

Digital Financial Services and Financial Inclusion in Nigeria

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**BEING A THESIS SUBMITTED TO THE DEPARTMENT OF FINANCE
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JANUARY, 2026

DECLARATION

I, **Napoleon UMUKORO** a Master of Science (M.Sc.) candidate of the Department of Finance, Faculty of Management Sciences, University of Benin, Benin City, Nigeria, do hereby declare that this Thesis is entirely my work and composition. The work embodied in this Thesis has not been submitted in candidature for any degree and it is not concurrently being submitted for any other degree. All references from other works have been duly acknowledged.

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CERTIFICATION

We certify that this thesis written by **Napoleon UMUKORO** is adequate in scope and quality in partial fulfilment of the requirements for the award of the degree of Master of Science (M.Sc) Degree in Finance.

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CERTIFICATION OF THESIS/DISSERTATION ON PLAGIARISM

We the undersigned attest and declare that the Thesis of Napoleon UMUKORO, titled: Digital Financial Services and Financial Inclusion in Nigeria, has successfully passed the anti-plagiarism test and does not violate any copyright regulations based on Turnitin anti-plagiarism similarity index.

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We the under listed hereby attest that Napoleon UMUKORO has effected and done all the necessary and required corrections as recommended by the external examiner and internal examiner in this thesis titled: “Digital Financial Services and Financial Inclusion in Nigeria”.

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DEDICATION

I dedicate this thesis to God Almighty and family ,Hon. Mrs Faith B Umukoro

Erhuvwu Ariakpoyenri

Corm. Oghenetejiri Ariakpoyenri

Oghenetega Ariakpoyenri

Oghenevowero Ariakpoyenri

Uvietobore Ariakpoyenri

Oghenerioborue Ariakpoyenri providing strength, guidance, and inspiration throughout my journey.

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ABSTRACT

This study examined the relationship between digital financial services and financial inclusion in Nigeria. The study, anchored on the vulnerable group theory, adopted the ex-post facto research design hence data were collected from secondary sources. Data for the study were obtained from the Statistical Bulletin of Central Bank of Nigeria for the period of 2010-2023. The Ordinary Least Square (OLS) was used to run the regression analysis after carrying out several diagnostic checks such as variance inflation factor, cointegration tests, and unit root tests.

Findings of the study showed that agency banking, Automated Teller Machine transactions, and mobile banking have a significant positive relationship with financial inclusion in Nigeria. The study also established a negative but not significant relationship between web payments, unstructured supplementary service data (USSD) transactions and financial inclusion in Nigeria. The study concluded that digital financial services positively contributed to the level of financial inclusion in Nigeria. The study recommends amongst others that banks should increase the Automated Teller Machine points to reach out to the interior villages and rural areas that are excluded from the financial services.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Scholars, policymakers, and managers of Nigeria's economy have continued to debate the significance of bringing millions of unbanked Nigerians into the financial ecosystem and the potential for increased access to financial services and products. Financial inclusion refers to the procedures involved in broadening the range of social groups within a community that have access to and utilise official financial services like credit, savings accounts, insurance, and remittances (Greta *et al.*, 2024). In this twenty-first century, providing financial services and products to underprivileged and low-income groups of society at reasonable costs is a widely acknowledged global issue. (CGAP, 2024), providing financial services and products to underprivileged and low-income groups of society at reasonable costs is a widely acknowledged global issue. Traditionally, Nigeria's financial services; including banking, insurance, pension, and credit facilities have been accessed and enjoyed exclusively by the educated, connected, wealthy, and metropolitan based residents and businesses in the formal sector. Inclusive financing looks at numerous methods by which the uneducated, poor, and rural based inhabitants can also have access to and enjoy banking and other financial services.

The introduction of policy frameworks for financial inclusion by the Central Bank of Nigeria in 2012 has made the Nigerian banking industry undergo (and still undergoing) operational, legislative and technological changes (EFiNA, 2023). Banking business as defined in Banks and Other Financial Institutions Act (BOFIA, 2004) entails the acceptance of deposits, withdrawals, and granting of loan facilities, and has always been done within the halls of the bank. In response to the financial inclusion policy framework, there has been a gradual eccentricity from the customary day to day deposits, withdrawal, cash payments, and other bank transactions carried out inside the banking hall to have considerably reduced to a more

digitized banking system where agency banking and automated teller equipment have been deployed. In contemporary banking practices, enquiries, transfers, lodgments, and issuing loan facilities are consummated outside the banking halls with the platforms provided by digital banking (EFiNA, 2021; Ehiedu *et al.*, 2023; Gbalam & Dumani, 2020).

Digital financial services, on the other hand, consist of a broad range of banking services accessed and delivered through systems-enabled channels such as personal computers, mobile handsets, encrypted cards, and the Internet linked to a dependable secured platform for processing transactions (Ukoh, 2019). Digital financial services ranges from cash payments, withdrawals, customer inquiries, withdrawals, e-statements, deposits and credits, remittances, to funds transfers, balance enquiry, call credit top-ups, and even loan facilities transactions. Digital banking, according to Olubukola *et al.* (2023), basically refers to the digitization (or moving online) of all the traditional banking activities and programs that historically were only available to customers when physically inside of a bank hall.

The Nigerian banking sector has put in place a number of policies to help achieve the goals set forth in the National Financial Inclusion Strategy (NFIS), including know-your-customer (KYC) requirements, agency banking guidelines, mobile payment systems, credit enhancement schemes, and a national financial literacy framework (David-West *et al.*, 2018; Iwedi *et al.*, 2022). With the development and usage of digital banking devices, NFISs are determined attempts to promote inclusive financing as a larger share of the payment system around the world is being driven by digital banking services. In addition to standard bill payment and money transfer, digital banking services now include credit, savings, cross-border remittances, bulk disbursements, and other value-added services like pay-as-you-go energy bills (Taiwo & Agwu, 2017). As noted by Uduak and Ekong (2022), the twenty first century bankers and bankable individuals are young and tech- savvy individuals, with preference for digital banking services like use of USSD or mobile apps to check account

balance on a smartphone instead of visiting a bank branch or automated teller machines many miles away. According to the Global Finance (2021), the biggest drivers of digital banking are the young and tech savvy people who reside in the rural areas. The implication is that individuals in possession of GSM gadgets or any internet enabled device are able to have access to banking services without physical presence in the banking hall.

In Nigeria, the absence or lack of financial institutions in the villages or rural areas is considered as one of the major impediments frustrating the attainment of financial inclusion. However, Ozili (2021) stated that the introduction of agency banking system has made it possible for individuals to enjoy banking services at their fingertips. Digital banking services have now made it convenient for any individual in the city to send money to a relative in the village at any given time and such money is received within the shortest possible time owing to the platform provided by agency banking.

Also, opening of new accounts which hitherto had been so cumbersome with all the protocols and procedures has been eased off due to application of the mobile banking system. Ahmad et al. (2020) reviewed African experiences on mobile money transactions and financial inclusion in relation to Sub-Saharan African development and observed that application for credits have been conventionally done within the halls of the bank. But as of late, the unstructured supplementary service data (USSD) has become available, giving consumers a way to register an account and receive credits just by calling a code. The individual does not have to wait long to receive an account number after dialing the USSD code. The fact that more individuals—including those living in rural areas—are using mobile phones has made it easier for consumers to use the USSD , web banking, and POS banking platform.

In spite of the recorded gains in digital financing and electronic banking services, the World Economic Forum (2023) stated that over 1.7 billion individuals are still underbanked, and about 2.3 billion adults are financially excluded, with small- and medium-sized businesses

(SMEs) facing unprecedented challenges connecting with the financial system. Rhyne (2020) argued further that finance users still encounter difficulties in accessing financial services, and, even when they are able to, those services may not be high quality, suitable or affordable. These scenarios might be especially concerning for developing economies, whose structural design and social and economic nature have exacerbated social and economic inequality and driven poverty in these areas to unimaginably high levels.

According to reports by Global Finance in 2023, Nigeria is one of the developing countries with a high rate of unbanked populace. It is estimated that over 60% of Nigeria's over 200 million population is omitted from the banking system (Global Finance, 2023). Between 2018 and 2022, the amount of money outside the banking system increased by more than 50%, from 1.46 trillion to 2.3 trillion naira. As a result, the growth rate increased annually from 12% in 2018 to 25% in 2022. According to the Central Bank of Nigeria (CBN) (2022), a significant number of Nigerians have further strayed from financial inclusion services as a result of currency depreciation which are reflected in growing inflation.

Therefore, the quest for digital financial services has become imperative and a drive towards redesigning the financial system that is inclusive and people friendly. As Yuhelson *et al.* (2020) opined, the utilization of digital financial services has the capacity of widening the entrance and capacity for individuals in financially included activities across boundaries. It is against this background that this study examined the relationship between digital financial services and financial inclusion in Nigeria.

1.2 Statement of the Research Problem

The National Financial Inclusion Strategy (NFIS) was one of the financial reforms instituted by the Central Bank of Nigeria in response to the global financial crisis. The NFIS is aimed at mitigating financial exclusion. After the launch of the strategy, Nigeria's apex bank, with other stake holding groups, also introduced agent banking, mobile money, and cashless

policy, to expand financial inclusion in the country. Aside, financial inclusion, the NFIS initiative also sought to promote wealth redistribution, economic development, and financial stability in Nigeria. However, available report from the Global Finance (2023) indicate that Nigeria still has a very low financial inclusion rate. According to the Global Finance (2023) report, Nigeria is one of the developing countries in Sub-Saharan Africa with a 60% unbanked population which is considered unreasonably high. This is alarming economically when contrasted with other developing countries like Brazil, India and Indonesia. For example, the Global Finance report showed that Brazil has 30% unbanked population, with India having about 20% unbanked population and Indonesia with 51% unbanked population. In view of the aforementioned, it is evident that a lot is still lacking in deepening financial inclusion in Nigeria and investigation into the role of digital financial services in promoting financial inclusion is more than ripped. Incidentally, empirical studies on the relationship between digital finances and financial inclusion is rather recent and also scanty, more so, for developing economies such as Nigeria.

There are three key motivations for this investigation. First, financial inclusion is now recognised as an instrument for sustainable development on a global scale. Financial inclusion is recognised as a driving force behind the achievement of seven of the seventeen sustainable development objectives that are widely acknowledged as the blueprint for a more prosperous and sustainable future (World Bank, 2022). It's interesting to note that Goal 9, which addresses sustainable concerns in infrastructure, innovation, and industry, identified vital infrastructure investment as a crucial enabler for development in the future. This is where financial innovation in digital financing may be leveraged to accelerate financial inclusion and address current global concerns such as social inclusion, justice, and security, in addition to fair wealth distribution for shared prosperity.

Second, Nigeria still has a high rate of financial exclusion which undermines the quality of life of Nigerians and hold the nations' economy back. It has been proven that economies with low financial inclusion produce declining growth. More so, SMEs that are financially excluded find it challenging to make timely business plans and productions to meet the market demand. It becomes imperative therefore, that for Nigeria economy to grow faster, there is need for its citizens to have access to financial services.

Third, even with all the potential advantages of digital financial services and electronic banking, the literature is still far from reaching a consensus on how it promotes financial inclusion especially as regards to a developing economy like Nigeria. Numerous empirical studies have examined the purported relationship between digital financing and financial inclusion, financial stability, and banking efficiency nevertheless, the findings of these studies are contradictory and uneven. Prior studies such as (Amos et al., 2020; Gbanador, 2023; Nwakoby et al., 2018; Otuya et al., 2022) on banking operations and performance; (Ahmad et al., 2020; David-West et al., 2018; Ene et al., 2019; Soriano, 2017; Uduak & Ekong, 2022) on financial inclusion; (Banna & Alam, 2021; Iwedi et al., 2023; Olubukola et al., 2023; Risal, 2018) on economic growth and development; and Olusegun et al. (2021) on financial system stability have produced mixed results. The lack of agreement regarding the relationship between digital financial services and financial inclusion necessitates this kind of research using current information on the relevant variables.

It is also worth mentioning that the operationalisation of digital financial services has been a subject of debate in prior studies. The extent to which digital financial services measures such as the agency banking, web payments, unstructured supplementary service data (USSD), and Automated Teller Machine (ATM) transactions have been deployed and how they influence financial inclusion is still unclear in the literature. It has therefore become imperative to conduct a study that will make a comprehensive assessment of all the digital financing

measures as well as integrating how financial literacy or awareness could influence these measures as regards financial inclusion in the context of a developing economy like Nigeria.

1.3 Research Questions

Attempts were made to address the following questions in this research effort.

1. What is the link between agency banking and financial inclusion in Nigeria?
2. What is the relationship between web transactions and financial inclusion in Nigeria?
3. How does unstructured supplementary service data (USSD) transactions influence financial inclusion in Nigeria?
4. What is the nexus between Automated Teller Machines (ATM) Transactions and financial inclusion in Nigeria?
5. How does mobile banking affect financial inclusion in Nigeria?

1.4 Objectives of the Study

The broad objective of this study is to examine the relationship between digital financial services and financial inclusion in Nigeria. The specific objectives are to:

1. investigate the link between agency banking and financial inclusion in Nigeria;
2. examine the relationship between web transactions and financial inclusion in Nigeria;
3. ascertain to what extent unstructured supplementary service data (USSD) transactions influence financial inclusion in Nigeria;
4. investigate the relationship between Automated Teller Machines (ATM) Transactions and financial inclusion in Nigeria; and
5. examine the link between mobile banking and financial inclusion in Nigeria.

1.5 Research Hypotheses

From the statement of the problem and the objectives of this study, the following hypotheses are formulated and stated in null form:

H₀₁: There is no significant relationship between agency banking and financial inclusion in Nigeria.

H₀₂: There is no significant relationship between web transactions and financial inclusion in Nigeria.

H₀₃: There is no significant relationship between unstructured supplementary service data (USSD) transactions and financial inclusion in Nigeria.

H₀₄: There is no significant relationship between Automated Teller Machines (ATM) transactions and financial inclusion in Nigeria.

H₀₅: There is no significant relationship between mobile banking and financial inclusion in Nigeria.

1.6 Significance of the Study

The main objective of this study is to examine the relationship between digital financial services and financial inclusion in Nigeria. The findings of the study will be of great importance to the following stakeholders:

Policy Makers: The results of this study will help policy makers by providing them with information and updates that will help them prioritise policies that impact financial inclusion and suggest methods for improving financial inclusion's efficiency. Additionally, the study will aid in the creation of policies that will support the growth of the financial industry.

Investors and Investment Analyst: The results of this study will be of benefit to investors and investment analyst in assessing the effectiveness of financial inclusion thereby evaluating the financial alternatives available (long-term, short-term, non-debt financial capital) which makes investors avoid over dependence on debt financing. It also serves as an area of interest for social impact investors who aim at impacting the lives of the financially marginalised population.

Financial institutions: The findings of the study will help financial institution operators to comprehend the changes in financial policies thereby equipping them to participate in a more sustainable manner in the financial system.

Researchers: The study will be of benefit to researchers, individuals and groups who desire to study the impact of digital financial services on financial inclusion as it will provide solutions on how digital financing can be made more effective as this will add to extant empirical studies in the Nigerian context.

1.7 Scope of the Study

The study aims to examine the link between digital financial services and financial inclusion. This study is country specific with Nigeria being the country of concentration. The study also covers the years 2010 to 2023. The period was chosen due to various banking evolutions and innovations that occurred during this period ranging from the informal mode of banking to traditional banking methods and now having the leverage to access banking services at the comfort of your home. Also the National Financial Inclusion Strategy was launched in 2012 to reduce the financially excluded to 20% by 2020 hence the scope was chosen to ascertain their progress so far in achieving this goal. The study mainly covers the influence of digital financial services on financial inclusion in Nigeria. Variables of interest include – agency banking, web transactions, USSD transactions, ATM transactions, and mobile banking as explanatory variables. The study also uses financial inclusion as dependent variable.

1.8 Limitations of the Study

The study addressed this limitation by ensuring that recently validated data from the CBN statistical bulletin was used for analysis. The study also performed some diagnostics to ensure that the data is useful for the regression analysis. Data were collected from secondary sources hence we placed our reliance on the authenticity of the data. Also, the study covered a period of 14 years. However, the limitation of this study is not likely to affect the quality of its

outcomes, because 14 years data, and five digital financing measures are considered large enough to produce a result that can be used to generalize digital financial and financial inclusion research. Also, the model of the study is considered robust because it encompasses the major digital financial services channels which have been adopted in both developed and developing economies are considered potentially influence financial inclusion.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is concerned with the review of extant literatures related to the study. It provides the conceptualization of the key variables of the study, highlights various theories related to the study, reviews previous empirical studies and provides the summary and gaps in literature review.

2.2 Conceptual Review

Conceptualization should necessarily precede a study where concepts and variables have diverse use and they connote different ideas used in a study. The following concepts and variables as used are defined, described and discussed.

2.2.1 Financial Inclusion

The utilisation of official financial services is referred to as financial inclusion. One definition of financial inclusion provided by Sahay *et al.* (2015) is the ease with which all members of the economy can access, make use of, and be part of the formal financial system. Ozili (2018) defined financial inclusion as the process of providing people with accessible financial services. The concept of financial inclusion entails that every household and individual operates a bank account which is considered as the first step towards achieving financial inclusion. This is because having access to formal financial services can empower underprivileged people and their households, bolster self-confidence, and encourage social inclusion. According to Mbutor and Uba (2016), financial inclusion is the provision of cost-effective financial services, such as credit, insurance, and savings accounts, to underprivileged and low-income groups in society. An alternative definition of it would be a circumstance or procedure that facilitates economic agents' availability and use of the formal financial system. It outlines a procedure whereby all participants in the economy can easily

create bank accounts, afford loans, and regularly and easily use financial products and facilities.

As per Ozili (2020), the attainment of financial inclusion goals frequently involves a blend of initiatives, regulations, and schemes aimed at catering to the needs of the unbanked populace. When implemented properly, financial inclusion can help pull the impoverished out of poverty. When done improperly, nevertheless, it can put the underprivileged at risk within the official financial system, especially when it comes to the risks involved in using financial services and goods. When these risks come to pass, they can impair the wellbeing of the most vulnerable, widen the gap in income, and perhaps result in social exclusion—all of which are undesirable outcomes.

Four factors can be used to quantify inclusive financing: impact, consumption, quality, and accessibility, as noted by Hannig and Jansen (2010). They defined usage as being concerned with the breadth and depth of financial services, whereas access is the capacity to use financial services and products that are offered by approved institutions. Quality, on the other hand, involves the need and importance of the financial services to the consumers tastes and preferences, while impact serves as a measure of changes in the lives of users attributable to the usage of a financial device or service. Data regarding these aspects of financial inclusion can be obtained from the supply side (i.e., financial institution level), the demand side (i.e., individual, household, or firm level), or from a combination of the two.

According to the World Bank, financial inclusion is defined as giving people and businesses access to reasonably priced financial goods and services that are carried out in an intentional, ethical, and sustainable way to satisfy their financial requirements. Financial inclusion, as described by Nguyen (2021), is the process of making sure that individuals, particularly those from financially disadvantaged backgrounds, have simple access to and usage of financial services from the formal financial system in a timely, adequate, and inexpensive manner. In

order to improve financial access equality for everyone and lessen economic disparity across regions, all forms of financial inclusion attempt to promote access for everyone in a nation or region.

Conversely, financial exclusion is often understood to mean that some groups within society are unable to obtain appropriate, reasonably priced, equitable, and secure financial services and products from mainstream providers (Scott & Davis, 2015). Therefore, ensuring that each person has access to a variety of suitable financial services and that they are able to comprehend and utilise such services constitutes the fundamental component of financial inclusion. In addition to standard financial intermediation, these could include a simple, no-frills bank account for sending and receiving money, a savings plan tailored to a low-income household's cash flow pattern, money transfer services, small loans and overdrafts for personal, business, and other uses, life and non-life insurance, etc. However, there have also been some worries expressed about the wealthy and powerful individuals benefiting more from changes to the financial system (Haber, 2004). This phenomenon is present in the early stages of financial development as the economy grows faster and more people join the formal financial system and take advantage of its many benefits, which contribute to a stable distribution of income among the population.

2.2.1.1 Overview of Global Financial Inclusion

Different countries have implemented varying policies to promote financial inclusion taking into consideration the peculiarities of the economy and local population characteristics. Some countries have promoted vigorously, alternative financial institutions such as micro finance institutions and Self Help Groups, among others, in order to ensure financial services reach the excluded, while others simplified existing products to overcome the difficulties in accessing such services.

In the developed economies, specific legal and policy pronouncements have been made to encourage actions (particularly by banks) that ensure continuous broadening and sustained financial inclusion. The United Kingdom was one of the first countries to realize the importance of financial inclusion. It published its strategy of financial inclusion “Promoting Financial Inclusion” alongside the Pre-Budget Report of 2004. Treasury (2004), indicated that the government identified the need for financial literacy and basic understanding of financial concepts as a critical success factor in the efforts at ensuring increased financial inclusion. To achieve this, government worked with potential providers to develop proposals for delivering a significant increase in free face-to-face money advice, targeted in areas of high financial exclusion. Specifically, the government took active part in the process of midwifing models of money advice outreach aimed at reaching those who do not normally present themselves to debt advisers. Also, a Financial Inclusion Fund of £120 million was set up to help bring about expansion of access to financial services, while a Financial Inclusion Taskforce was formally launched in February 2005 to monitor progress on financial inclusion and make suitable recommendations. Working and consulting with stakeholders (including community development finance institutions, and home credit companies), the government implemented policies, including community investment tax relief scheme to deliberately promote the informal sector (Olusegun *et al.*, 2021).

Srinivasan (2009) claims that in 1996, the German Bankers' Association unveiled a voluntary Code that allowed for "everyman" banking operations. This ensured that financial institutions made access to banking services easy and less cumbersome for the benefit of every member of the community. In Sweden, Belgium and France legislations recognized the right to open account and so prevent banks from refusing to open account for intending customers (World Bank, 2015). According to Mohan (2006), there are two laws in France and Belgium that provide minimum requirements for basic bank accounts and specify the minimum number of

free in-person transactions. The "Law on Exclusion" of July 1998 in France reiterates the right to an account first outlined in the 1984 law and has since made the process of exercising the right simpler.

In the US, the Community Reinvestment Act (1997) forbids banks from focusing only on affluent neighborhoods and forces them to offer credit throughout their entire area of operation. Similarly, the flagship legislation to promote financial inclusion required regulatory authorities to rate banks based on their efforts at serving rural-low income communities (Srinivasan, 2009).

Canada enacted "Access to Banking Services Regulation in 2003" requiring all banks/financial institutions to provide/open personal accounts without minimum opening balances irrespective of the employment or credit history and with minimum requirements. There was also a financial consumer agency established to monitor whether financial institutions adhere to their public commitments. The Canadian Bankers Association and the Canadian Foundation for Economic Education (CFEE) were involved in promoting financial education, extending beyond credit counseling to awareness about macroeconomic environment (Mehrotra *et al*, 2009).

In summary, the strategy and policy responses by central banks and monetary authorities in most developed economies have therefore been a combination of codes of practice and specific legislations. Effective access to financial services has assumed the status of fundamental human rights in most of the emerging market economies as it is considered as one of the main driving forces of economic equality in this contemporary age. While the high income OECD countries have as low as 8.0 per cent, the exclusion rate ranges from 49.0 per cent in Central Asia and Eastern Europe to 58.0 per cent in South Asia and 65.0 per cent in Latin America. Attempts to grow financial inclusion have been largely focused on either support for microfinance network (subsidy, co-financing, technical assistance etc.) or

provision of environment and regulation that promotes access to financial services (World Bank, 2020).

A World Bank sponsored study by Pearce (2018) reviewed progress of financial inclusion policy in the Middle East and North Africa (MENA) region. The report found that in most of the MENA nations, deficiencies in financial infrastructures and regulatory framework had made expansion of access to finance costly and risky for banks. Ardic (2018) found that the proportion of banked household stood at 42 per cent of the entire household in the MENA region. While the number of loans and deposits per head may be relatively low, (below the average in sub-Saharan Africa), the average size of loans and deposits relative to GDP remain high, suggesting high propensity to save in the region. Even though having greater financial depth (measured in term of private deposit as a proportion of GDP) than other regions, only 21.3 per cent of adults in MENA were having a loan account and only about 20 per cent had access to deposit accounts. MENA lagged behind other regions on the indicators for bank deposit and loan accounts per population. To address this, Pearce (2018) found that financial inclusion become a policy focus of several MENA countries and eventually became a priority alongside stability for many MENA countries' regulators and ministry of finance. MENA countries have so far adopted a roadmap towards fostering increased financial inclusion. Some of the steps adopted include release of charters and codes of practice, adoption of shared public and private sectors goals, use of government payments as stimulus for financial inclusion, improved data availability for financial inclusion, increased variety of financial services through increased number of branches as well as implementation of branchless banking and aggressive use of direct sales agents.

As regards financial inclusion indices in Africa, Andrianaivo and Kpodar (2021) found evidence that, in Africa, large share of the population are financially excluded and therefore resort to the use of informal financial services. They also found a relatively high propensity to

save, but financial expansion and deepening was constrained by lack of access to financial services and absence of depth of financial instruments. The problem is apparently accentuated by insufficient financial infrastructures; coupled with the fact that the number of ATMs and bank branches are low in this region. Evidences from the study not only revealed that the interaction between mobile phone penetration and financial inclusion is positive and significant in the growth regression, but also that people in Africa consider investment in mobile technology as a necessity as it constitutes a large portion of their earnings. It therefore means that mobile financial service platform could be the answer to bridge the gap in financial infrastructure. The protracted economic challenge of African countries has been explained in some studies as a consequence of the low level of financial services in Africa, despite efforts by countries to reform and develop financial services sectors in the continent. Largade (2021) posited that innovative solutions to foster financial sector development could spur the much needed growth, particularly in Africa.

Table 2.1. World Most Unbanked Countries

Country	Total population (Mill)	Unbanked population (%)	Cash trans. (%)	Card Trans. (%)	Internet penetra. (%)	No. of ATMs per 100,000 adults
Morocco	37	71	41	21	62	28.6
Egypt	102	67	55	27	45	20
Nigeria	208	60	24	27	70	16.9
Peru	33	57	22	62	126	49
Columbia	50	54	15	55	41	62
Argentina	45	51	18	45	60	76
Mexico	129	63	21	44	66	61.5
Vietnam	97	68	35	35	66	25.9
Philippines	109	66	37	22	60	30
Indonesia	278	51	13	34	55	53.3
S. Africa	59	31	11	43	65	56
Kenya	54	34	40	25	83	7.7
Brazil	212	30	18	62	57	101.7

Source(s): Extracted from Global Finance (2023)

Table shows extracts from Global finance index in 2023 for the first twelve most unbanked countries in the world. The statistics shows that Morocco has the highest percentage of unbanked in the world with 71 percent. Although when contrasted with a population of barely 37 million population it can then be observed that their position is not as bad as others within the population range. The lowest unbanked is the Brazil with 212 million population and thirty one percent unbanked rate as a percentage of total population. Curiously, Nigeria has a population of over 200 million people with an unbanked rate of 60 percent. When compared with countries like Brazil, and Indonesia with populations of 212 and 278 million respective which is similar to Nigeria population, then the statistics becomes worrisome. This is because while Brazil has 30 percent unbanked rate, Indonesia has 51. The summary of the table indicates therefore that Nigeria is still far from attaining the financial inclusion target.

2.2.1.2 Overview of Financial Inclusion in Nigeria

Nigeria has been a prime example of financial exclusion, with the majority of the country's money remaining outside of the banking system (World Economic Forum, 2024; World Bank, 2024). Hence, throughout the past forty years, the topic of financial inclusion has drawn the attention of numerous governments as a significant economic challenge. Before the present measures to enhance financial inclusion, the Nigerian economy was primarily cash-based, with a significant portion of the narrow money stock existing outside the banking system in the form of currency (Nguyen, 2021). Despite a downward trend from 61.1 percent in the 1960s to 44.3 percent in the 1970s which later fell to 40.9 percent in the eighties, the average ratio of the currency outside the banking sector to the narrow money supply (M) remained high in nominal terms, especially given the increase in the amount of narrow money in the economy.

A number of factors contributed to the ratio's fall, including rising literacy and government initiatives to support the expansion of the financial industry according to Olubukola *et al.* (2023).

In order to encourage Nigerians to use financial institutions and products more, the CBN launched the rural banking programme during this time, ordering banks to open branches in rural regions. The public's trust in the banking sector was damaged by the crisis that occurred in the 1990s. The issue was made worse by the political class's extravagant spending, which raised the amount of money outside the banking system. By the end of the 1990s, the percentage of currency outside the banking system had increased to 47.7%. In an effort to prevent the negative effects of the banking industry crisis in the 1990s, the government enacted a number of policies. These included measures that deepened the financial sector and included economic reforms aimed at improving the general well-being of the population in terms of employment and income earning capacity. One such measure was the bank consolidation programme of 2004. The percentage of money outside the banking system decreased to 38.2 percent at the end of 2005 as a result of the financial services' increased use.

The inclusion of financial inclusion as one of the primary goals of the Nigerian Financial System Strategies 2020 (FSS, 2020) was one of the crucial steps in this approach. In order to transform Nigeria's financial sector into a growth engine and help the country rank among the top 20 economies by 2020, a comprehensive and strategic road map and framework known as FSS 2020 was developed. Within the financial industry, six stakeholders were highlighted by the Financial System Strategy (FSS, 2020). These companies supplied financial services, which are thought of as suppliers in the financial inclusion value chain. Important actors in the financial inclusion process, including as insurance companies, pension funds, capital market participants, banking and non-bank financial institutions, technology suppliers, and regulatory agencies, were represented in the group. Four of the six measures enacted to

bolster the home financial sector specifically deal with financial inclusion. These initiatives include:

- Development of varied financial products;
- Enhancement of payment processes;
- Development of credit system; and
- Encouragement of a savings culture

The plan emphasized the goals of financial inclusion, which is defined as a situation in which individuals (those over the age of 18) have official, simple access to a wide choice of financial products that are suitable, offered at a reasonable cost, and treated with dignity. To make it simple for the unbanked to contact and be contacted at any time, and to conduct business in a way that makes the institution and its services accessible to anybody who wants them. Making sure the processes for using financial institutions' services were clear-cut and easy was the first step.

However, the data that was available in 2023 indicates that there are 206 million people in Nigeria, of which 99.6 million are classified as adults (EFInA, 2023). Records as indicated in Table 2.2 also show that in 2010, 39.2 million persons, or 46.3% of the adult population, lacked access to official financial services and products. The rate of exclusion from banking and financial products fell to 41.6% in 2014, meaning that 40.1 million persons were removed from the system. In 2018, the rate of exclusion increased to 36.8%, meaning that 36.6 million adult Nigerians were left out of the system.

According to EFFInA (2023), the percentage of adult Nigerians with access to any other formal channel, such as insurance companies or microfinance institutions, was 12.3% (11.5 million) in 2014, 10.3% (10.0 million) in 2016, and 9.8% (8.9 million) in 2018. Similarly, in 2010, 10.5% (9.2 million) of Nigerian adults had access to these channels. In addition, the proportion of adult Nigerians with informal financial services access was 17.4% (14.8 million)

in 2010, 17.3% (15.2 million) in 2012, 11.9% (11.3 million) in 2014, 9.8% (9.4 million) in 2016, and 14.6% (14.6 million) in 2018. In contrast, the percentage of adult Nigerians without access to formal financial services decreased slightly from 39.7% (34.9 million) in 2012 to 39.5% (36.9 million) in 2014.

Overall, from 34.9 million in 2012 to 40.1 million in 2016, Nigerian adults who were financially excluded increased (CBN 2018). Nonetheless, the understanding that significant portions of the public and corporate sector remain uninitiated in financial services notwithstanding advancements is what spurs attention (Olusegun *et al.*, 2021). As per the World Bank (2021), there exist significant disparities in the accessibility, utilisation, and calibre of savings accounts offered by financial institutions, as well as in the provision of credit and insurance products across various economic categories.

According to new estimates, 37% of Nigeria's poorest people do not have accounts, and 35% of small businesses have trouble obtaining formal financial services (EFInA 2023). As table 2.2 shows, there are significant disparities in access to financial services in Nigeria between the affluent and the poor, as well as between males and women and those who live in urban and rural areas.

Table 2.2 Score Sheet on National Financial Inclusion

	Focus Areas	2010	2012	2014	2016	2018	2020	2022
% of Total Adult Population	Payment	22	20	24	38	40	70	73
	Savings	24	25	32	38	24	60	61
	Credit	2	2	3	3	2	40	38
	Insurance	1	3	1	2	2	40	41
	Pension	5	2	3	7	8	40	40
	Financial Exclusion Rate	46	39	38	42	39	20	26

Source: EFInA Survey, (2023)

2.2.1.3 Suggestions towards Achieving Adequate Financial Inclusion in Nigeria

Many recommendations on how to close the gap between the rural poor and financial inclusion have been in the extant literature. Some of these recommendations, which were made in the form of models, made an effort to precisely define the issues surrounding financial exclusion and the tactics that should be used to help the underprivileged and unbanked achieve financial inclusion. One of these models is the Sustainable Financial Model developed by Porteous (2014), which defined three fundamental propositions—a complaint ecosystem, a business case thesis, and a consumers' demands proposal for establishing a long-term, sustainable inclusion within the economy. Another model tagged Social Development model represents the society as a three-segment pyramid with the peak representing the financially included, the base unbanked bankable, and the middle unbanked bankable.

Based on the most pressing barriers and the guiding principles of the financial inclusion strategy, Kama and Adigun (2013) identified four priorities as most crucial to increasing financial inclusion in Nigeria:

1. Establish a setting that will support the distributed file system's growth: Distributed file systems can help achieve financial inclusion goals because they can overcome physical obstacles by utilising ubiquitous end-user technologies, such as mobile phones. Nigeria has a low acceptance of distributed file systems despite their inherent benefits. Improvements in financial inclusion will coexist with the advancement of distributed file systems through the use of the Memorandum of Understanding (MOU) between the National Communications Commission (NCC) and the Central Bank of Nigeria. This MOU ensures that banking and telecommunications stakeholders collaborate to improve the penetration of distributed file systems and their adoption among the underserved population.

2. Facilitate the quick expansion of agent networks with a national scope: Agents play a vital role in enabling financial inclusion by serving as the intermediary between cash and digital money, especially in the case of cash in cash out (CICO) agents. Agents have been essential in providing many low-income individuals with their first access to financial services all throughout the world. Agent networks also offer a chance to provide services to consumers in places without bank branches or other physical financial access points like ATMs. Thus, providing financial services to the unbanked requires a functioning agent network. The lack of permanent location agents has presented difficulties, though.

For example, in order to reach the 2030 financial inclusion target, there has to be 62 agents for every 100,000 adult Nigerians. There are currently just 28.2 agents for every 100,000 adult Nigerians according to Global Financial Index (2023). This disparity has been exacerbated by problems with agent fee structures, agent networks' profitability, and other environmental concerns. Stakeholders must make a concerted effort to resolve policy-related obstacles and quickly deploy agents. To facilitate the quick expansion across the country, the Committee of Bank CEOs, Mobile Money Operators, Super Agents, and the CBN can take advantage of the existing Shared Agent Network Expansion Facility (SANEF) plan.

3. Lower Know Your Customer (KYC) barriers to opening and using a bank account: Verifiable identification is a requirement for using formal financial services, but 60 million adults in Nigeria lack a government-issued ID. To lower the KYC barriers to inclusion, the following guidelines should be followed: (a) Standardise KYC requirements for each activity, irrespective of the provider; (b) Make sure that KYC requirements are appropriate for the risk being managed, without requiring more than is necessary; (c) Create a national ID system that is universally covered and accessible; and (d) Plan enrollment for scalability and inclusivity.

To guarantee that universal coverage is achievable as quickly as feasible, the enrollment mechanism needs to be financially sustainable (both in terms of setup and enrolment expenses). (f) Guarantee data privacy and security. The data that is supplied needs to be safe. Identity databases need to be safeguarded as they are a public resource. In order to prevent inclusion initiatives from concentrating just on the "lowest hanging fruit" (and thereby increasing inequality), create an atmosphere that is favourable to serving the most marginalised.

4. Encourage the use of cashless payment methods, especially for person-to-person and government-to-government transactions, in order to: (a) Create trust by setting an exemplary example; and (b) Provide a significant enough load volume to support the development and expansion of distribution networks. Put in place a forcing mechanism to include large numbers of un-served and underserved people.

2.2.1.4 Measurement of Financial Inclusion

The literature on the measurement and operationalization of financial inclusion is inconclusive across countries and research studies. Ozili (2021) contended that more apprehensions for the dimension of financial inclusion are countries and regional-specific characteristics that make for uneven financial inclusion index across regions. For instance in some developing economies in Sub-Saharan Africa, cultural considerations, security challenges and information disclosure policies continue to pose measurement challenges to financial inclusion.

In an attempt to develop a complete financial inclusion or exclusion directory for countries around the world, The Global Financial Inclusion (Global Findex) database was inaugurated in 2011. The Global Findex data provides data for over one hundred and forty eight countries constructed with survey data from interviews with more than 150,000 national representatives and randomly selected adults age 15 and above in 2011 (Demirguc-Kunt & Klapper, 2012).

Also, the Alliance of Financial Inclusion (AFI), a conglomerate of financial sector regulators that had been in operation since 2008 provide also a set of measurement indices that bothers around financial system inclusiveness from time to time. These indices are used as measures to gauge the level of financial inclusion or exclusion across national boundaries.

Nonetheless, Uduak and Ekong (2023) created an easy-to-measure financial inclusion index that specifically targets developing economies and takes data availability into account. The study derived formulas for determining the rate of financial inclusion (RFI) index, the rural financial inclusion rate (RFIR) index, the urban financial inclusion rate (UFIR) index, the financially included population rate, the financially excluded population rate, the financial access ratio, among others by using the ratio of deposit by bank accounts operations to real gross domestic product. In different study by Ozili (2022), six financial inclusion indicators were used to operationalise the rate of financial inclusiveness. The indicators were (i) account ownership, (ii) extent of borrowings from a formal financial institution, (iii) extent of borrowings from family and friends, (iv) credit card ownership, (v) debit card ownership, and (vi) savings in a formal financial institution.

Iwedi (2023) adopted the ratio of total deposit to gross domestic product to represent financial inclusion in Nigeria. Similarly, Ene *et al.* (2019) in a study determined financial inclusion using credit penetration as a proportion of total loans and advances to gross domestic product (GDP). As Yuhelson *et al.* (2020) demonstrated, financial inclusion as the dependent variable for their study was derived as the proportion of the bankable population with access to formal sector financial systems' products and services. Olusegun *et al.* (2021) used three dimensions to explain financial inclusion. These dimensions are: penetration of banking institutions; availability or access to banking services and, usage of such banking services. The number of deposit accounts held by commercial and microfinance banks per 1000 adults and the number of loan accounts held by commercial and microfinance banks per

1,000 adults was used to measure the penetration dimension; availability or access to banking services dimension was measured by the number of bank branches per 1,000km or per 0.1m adults and number of ATMs and PoS per 1,000km or per 0.1m adults. Even though the availability of access included such indicators as internet and mobile banking, these were excluded in this study due to non-availability of data. Considering the usage dimension, the average of the weighted index of the total outstanding deposit as a percentage of real GDP per capita, outstanding credit as a percentage of real GDP per capita and total payments using electronic channels such as internet, mobile payments, electronic billers and web based payment platforms as a ratio of real GDP per capita were used.

The IMF Financial Access Survey, adopted the following indicators of financial access and usage, as shown in Table 2.3.

Table 2.3: Indicators of Financial Inclusion by the IMF

Access Indicators	Usage Indicators
*Number of Commercial bank branches per 1000km ²	*Number of borrowers from commercial banks per 1000 adults
*Number of Commercial bank branches per 100,000 adults	*Outstanding loans from commercial banks (per cent of GDP)
*Number of ATMs per 1000 km ²	*Number of depositors with commercial banks per 1000 adults
*Number of ATMs per 100,000 adults	*Outstanding deposits with commercial banks (per cent of GDP)

Source: IMF Financial Access Survey, (2022).

From the literature it can be observed that financial inclusion has been measured in various ways. However, this study will adopt the measures utilized by Ozili (2022) and Uduak and Ekong (2021) for ease of calculation, availability of data and ability to explain the extent of banked individuals as a ratio of real gross domestic product of the country. This measure derived as deposit by bankable adults scaled by gross domestic product at the end of a fiscal year.

2.2.2 Digital Financial Services

Financial services that rely on digital technologies to be delivered and used by customers effectively are known as digital financial services. The conventional methods of delivering banking and financial services have been transformed by this array of services, products, business models, applications, and procedures (World Economic Forum, 2021). Although it may be argued that technical innovation in finance is nothing new, innovation is happening at an exponential rate, and investment in new technologies has expanded significantly in recent years. Customers can now use mobile technologies to communicate with the bank. A number of new instruments that were unavailable a few years ago are now available to customers for use in payments, money transfers, and investing purposes. Cloud computing, big data analytics, distributed ledger technology, artificial intelligence, social networks, machine learning, mobile applications, and cloud computing have all contributed to the development of new services and business models by both new and old financial institutions (Yuhelson *et al.*, 2020).

According to Risal (2018), the use of these technologies can help businesses and consumers by providing choicer, facilitating easier access to financial services, and boosting operational efficiency. Digital financial services, according to the Mobile Solutions Technical Assistance and Research (mSTAR, 2019), can also assist businesses in addressing liquidity concerns, which are crucial because of supply, demand, and financial shocks. With the use of digital financial services, people and businesses can communicate with financial service providers even when in-person meetings are not feasible and can quickly and easily access their current credit lines.

Once authorised, digital payments can be promptly applied to clients' accounts. In order to make up for a shortage of liquidity in conventional financial channels, DFS has also created alternative finance channels. The development of DFS has benefited greatly from other

auxiliary and associated technology advancements, and this will probably continue as DFS advances (Ugwuanyi et al., 2020).

The Economic and Social Commission for Asia and the Pacific (ESCAP, 2021) postulated that digitization can reduce frictions in each step along the financial service life cycle, from opening an account to conducting customer due diligence, authenticating transactions, and automating other, product-specific processes, for example assessing creditworthiness. Digital financial services are therefore characterized by low marginal costs per account or transaction and can bring efficiencies of scale and reduce costs. Philippon (2020) validated this position and stated that digital financial services also enhance transparency, since every transaction generates a data trail. The capacity of financial institutions to formally create a credit-scoring system for unofficial market participants is aided by this data trail.

2.2.3 Types of Digital Financial Services in Nigeria

Financial inclusion can be facilitated by technology, which makes it possible for people to participate in financial activities regardless of their social standing or physical location. This section looks at the various technological advancements made by Nigerian banks and other financial technology (FinTech) businesses order to promote financial inclusion.

Agency Banking

Indirect access to payment networks is provided by agency banking, in which agent banks serve as a middleman between a customer and a banking service. The platform for accessing a service that would otherwise be unavailable is provided by the agent bank. In the financial industry, agency banking is a tactic that employs licenced agents to provide financial services to clients that live far away from typical branch locations. Since building branches in outlying and underdeveloped areas entails expenditures that are too high in relation to the projected return, this was the best method that banks could find to service customers in rural areas, especially in emerging countries (Ozili, 2022).

According to Gbalam and Dumani (2020), agency banking is a form of branchless banking that has grown to be a significant opportunity for banks to expand their clientele and reach in developing nations in an economical and effective manner. They believe that banks can now more swiftly expand their operations into rural areas, providing underserved and unbanked communities with banking services. According to Okoye and Ezejiolor (2013), the agency banking model provides financial services through agent networks, as the name implies. Agent networks offer a low-cost, highly adaptable, and readily extensible distribution mechanism to new regions. Agents ensure both service compliance and security in addition to being an economical channel. Rural customers have trouble utilising technology, therefore offering them products like net banking is insufficient. Agents play a critical role in providing customer support by assisting with the explanation of banking products, digital registration and onboarding processes, and identity verification for security reasons.

Web Banking

Other names for web banking include internet banking, online banking, e-banking, and net banking. Web banking is a technique and approach where a network service provider connects a personal computer directly to a bank's host computer system so that customer service requests can be handled automatically without the assistance of customer service agents. The system has the ability to discern between customer care requests that can be fulfilled automatically and those that need to be handled by a customer service agent. The system is linked with the bank's host computer system, enabling remote banking users to access additional automated services (Mieseigha & Ogbodo, 2013).

Customers can utilise web banking, a service provided by banks and other financial institutions, to access banking services online (Otuya *et al.*, 2022). Customers can use web or internet banking to get small services without having to visit their bank's branch office. Iwedi *et al.* (2023) explain further that online banking, sometimes referred to as net banking or

internet banking, is an electronic platform run by banks that allows users to access both financial and non-financial services. Previously, even minor services required clients to visit the banks. But nearly every service and product is now available online thanks to the introduction of digital financial services. This banking method is safe in addition to being convenient. There are numerous advantages associated with web banking. For instance, web banking makes it possible for a customer to use computer to view account balances, request transfers between accounts, and pay bills electronically.

Mobile Apps

These are applications that have been developed by the banks to encourage online transactions. With these apps, consumers are expected to do most of their transactions online, meaning that they do not have to visit banks. It is anticipated that wherever customers live within the country, they should be able to access the mobile app and carry out transactions. Acceptance of technology in this area is just starting to grow and is dominantly for young people who are more tech-savvy (Ene *et al.*, 2019). Older consumers who still prefer actual currency over using an app to transfer money they cannot see are frequently left out of this. It is not ideal for the adoption of this technology that fewer people than expected have smartphones to download and use this application.

Additionally, there are restrictions on how many apps users can download and utilise due to the memory limits of smartphones and other smart devices. Customers who rely on their bank's mobile app for financial transactions face significant challenges due to Nigeria's limited internet connection. Although many do not have frequent enough internet connectivity to make utilising the app practical, consumers may be interested in using it but discouraged (Olubukola *et al.*, 2023).

Unstructured Supplementary Services Data (USSD)

The Unstructured Supplementary Service Data (USSD) is a digital banking system which allows users without a smartphone or data/internet connection to use mobile banking through the specified codes. USSD, sometimes referred to as ‘Quick Codes’ or ‘Feature codes’, is a digital service which enables a high-speed cooperating communication between subscribers and applications (in this case, banks) across a mobile telecommunication Network (Dabas & Dabas, 2009). Afam *et al.* (2021) list a number of applications for the USSD-based mobile banking, including fund transfers, account balance checks, and bank statement generation.

According to Atima (2020), USSD has emerged as a substitute method for facilitating financial transactions and financial inclusion in Nigeria due to the country's increasing population of Global System for Mobile Communications (GSM) users.

Customers in Nigeria can conduct financial transactions on their mobile phones thanks to unique codes that the banks have adopted. First Bank *894#, First City Monument Bank (FCMB) *389*214#, and Guaranty Trust Bank (GTB) *737# are a few instances of these codes. The main advantages of USSD are its lower cost compared to current techniques and its capacity for quick user-application communication, which provides real-time features to the system (Dabas & Dabas, 2009).

Additionally, as long as clients have credit and can access the internet on their phones, this technology is accessible around-the-clock. For many customers in rural areas who do not have access to banks or home internet, this offers a simple and handy option. Because USSD relies on GSM technology rather than the internet, it is a better option than mobile apps in nations with spotty internet access. This implies that people who have access to the GSM network on their phone but no internet can still make and receive calls and conduct financial transactions. Because they can rely on their GSM network, people in remote locations who

might not have access to internet facilities would also benefit from this. Customers who lack a smartphone or are unable to use one can now access financial services (Ozili, 2021).

But there is a problem with the fees the banks impose. There is a cost for using this service, which limits the users. Customers must pay a monthly fee to use the code, and there are questions about the rationale behind this expense. Customers believe that rather than charging them to access their money, banks need to invest in constructing branches closer to them. This viewpoint holds true even when technology is enabling consumers to perform transactions without banks, leading to a decrease in the number of banks building physical locations—including in Nigeria (Sallaudeen, 2018).

Automated Teller Machine (ATM)

An automated teller machine (ATM), sometimes known as an electronic machine, is a device that a bank customer activates to acquire cash withdrawals and other financial services. It is connected to a data system and associated equipment. Also known as a cash machine, a cash machine is defined by Lu et al. (2021) as an electronic computerised telecommunications device that enables clients of financial institutions to access their bank accounts, order or make cash withdrawals (or cash advances using a credit card), and check their account balances without the assistance of a human bank teller (or cashier) directly through a secure means of communication.

In addition to accepting cash or checks, many ATMs in today's banking operations also let users transfer funds between bank accounts, top off pre-paid mobile phone accounts, and even purchase postage stamps. The majority of contemporary ATMs require the user to authenticate themselves by inserting a plastic smartcard with an embedded account number or a plastic card with a magnetic stripe (Menza et al., 2024).

Otuya *et al.* (2022) claim that ATMs are a quick and easy way to complete individual transactions since they eliminate the requirement for a physical visit to the bank branch or the aid of a human teller or cashier for self-serviced transactions. Moreover, automated teller machines, or ATMs, may perform a wide range of tasks, including money transfers, deposits, and withdrawals. Despite the fact that cash withdrawals are the ATMs' main purpose, these extra features make them more useful.

Demirguc-Kunt and Klapper (2012) emphasised the usage of automated teller machines (ATMs), stating that all that is needed to conduct an ATM transaction is a credit or debit card, which a user can swipe or insert into the machine's card reader. Automated teller machines (ATMs) have become one of the most convenient ways to receive financial services without physically visiting a bank because of how easy they are to use. One of the factors the EFiNA uses to gauge financial inclusion in its surveys is ATM availability.

Mobile Banking Technology

Individuals and small business owners who have been approved by Nigerian financial service providers to conduct transactions on behalf of banks and other FinTech providers use mobile banking technology. Mobile banking, which is a distributed and more mobile approach of guaranteeing deeper financial inclusion for the unbanked, is another name for agency banking. (Akinpelu, 2018). This technology serves as a hub that brings the bank together with the customer through the assistance of a Mobile Money agent.

The term "mobile banking" describes a kind of financial transactions that are carried out using access devices that are made possible by mobile communication networks (CPSS, 2012). These transactions are frequently started and carried out via mobile communication protocols such as QR codes, Near Field Communications, mobile applications, Short Message Services, and mobile web browsers (Khiaonarong, 2014). The financial resources employed in mobile payment plans originate from associated accounts, which can be (i) bank

accounts paid by customers, or (ii) client stored-value funds held by mobile network operators (CPSS, 2012).

Thus, banks, telecommunications firms, and third-party software businesses are among the crucial stakeholders that govern the ecosystem for digital financial services (Castle *et al.*, 2016). The amount of mobile payments in Nigeria has increased significantly in recent years due to a variety of domestic, international, technological, and regulatory causes. According to data from the Nigeria Interbank Settlement System (NIBSS, 2023), there were 510 million mobile transactions in 2023 compared to 51 million in 2019, an increase of almost 703.9 percent. Similar to this, from N296.3 billion in 2019 to N828.1 billion in 2022, the value of mobile transactions grew significantly.

2.2.3.1 Challenges of Digital Financing

The advent of digital banking has been beset with numerous issues. Getting money on demand is one of the benefits of in-branch transactions. For example, it has been discovered that agency banking relies heavily on trial-and-error (Ogutu & Fatoki 2019). Some users of agency banking are able to successfully withdraw money utilising the withdrawal function, however other users' transactions are unsuccessful. The customer's capacity to obtain his money on demand is weakened when it takes weeks for the value to be refunded to his account. The majority of clients that run into this kind of issue are no longer able to use agency banking services, which undermines the goal of financial inclusion. Second, there are problems specific to using USSD services, such as opening accounts, evaluating credits, and transferring funds. It has been noted that these accounts have restrictions when they are first opened (Ogilvie, 2008).

As a result, the consumer is unable to access the account right away. The customer is frequently required to physically visit the bank with the necessary paperwork, depending on what the bank may require. Financial inclusion is hampered as a result, and living far from

bank branches becomes problematic for some people. Some users of the programme frequently quarrel with the bank on the quantity, terms, and interest associated with repaying credits. Some of these individuals frequently have accounts with overdrafts reported to them (Azeez & Akhtar, 2021)

There are problems with online hackers accessing consumer accounts while using web banking. Most of the time, the victim suffers while the offenders escape punishment. Litigation has frequently resulted from similar circumstances. Customers typically get dissatisfied as a result and refuse to use online banking services. Sometimes a customer stops using the bank account altogether, which makes the CBN financial inclusion push less effective (Apere & Uche, 2024).

2.3 Theoretical Review

Some theories relating to financial inclusion based studies are discussed below:

2.3.1 The Access Opportunity Frontier Theory

The financial inclusion or exclusion hypothesis was explained by the access opportunity frontier theory, which was developed by Beck and De la Torre (2006) and based on the theory of supply and demand. This theory states that the cost of financial services, such as the opening and maintenance of a bank account, the requirement for a minimum deposit, and high administrative expenses, either decreases or increases financial exclusion among financial users. Access to financial services is therefore contingent upon the financial cost of service delivery.

The variety of products that financial institutions offer has an impact on both the availability and utilisation of financial services. In this way, the availability of e-products and digital currencies offer unique financial solutions that promote or lessen financial exclusion.

Therefore, improving financial inclusion synthesis will involve streamlining the financial services product process (World Bank, 2009), cutting down on the time required to use financial services (Beck & Demirguc-Kunt, 2008), and removing obstacles to formal financial products (Claessens, 2006; Beck & De la Torre, 2004).

Guerineau and Jacolin (2014) also demonstrated that the frequent implementation of financial services similarly hinges on the thickness of banking organization. Beck et al. (2009) provided a proof that the physical location of financial facility wage-earners and other service points either growths or otherwise of customers looking for access to financial services. Batila-Ngouala-Kombo (2021) highlighted other economic causes that maintains financial inclusion amalgamation. These comprise, income, employment status, and debt of financial users income flows. As Batila-Ngouala-Kombo (2021) displayed, these influences can easily hasten up customer access to financial services and decrease providers postponement in the selection process of financial assistance

2.3.2 The Vulnerable Group Theory

The vulnerable group theory of financial inclusion was first postulated in Ozili (2020) and is one of the most relevant theories of financial inclusion. Vulnerability is defined as the quality of being vulnerable or showing openness or susceptibility to attack or harm (Arora *et al.* 2015). A vulnerable group is a group that is physically or emotionally disadvantaged by events or by the decisions of others such as government, institutions, or individuals. Vulnerability may arise from many sources. For instance, financial vulnerability affects one's capacity to raise funds to meet basic needs (Anderloni *et al.* 2012); health vulnerability affects one's capacity to maintain good health over an extended period of time (Kovats *et al.* 2003); economic vulnerability affects one's susceptibility to economic shocks and one's capacity to find worthwhile employment opportunities to earn a respectable living wage

(Briguglio *et al.* 2009; Cariolle 2011); mental/emotional vulnerability affects one's capacity. In theory, persons who lack formal accounts will be both financially excluded and vulnerable, which is why Ozili (2024) claims that financial vulnerability and financial inclusion are tightly related. Therefore, for those who are vulnerable, having a formal account could boost their financial inclusion and decrease their financial vulnerability.

The beneficiary theory of financial inclusion is another name for the vulnerable group theory. According to the theory, since they are the ones most impacted by financial difficulties and crises, programmes and initiatives aimed at promoting financial inclusion in a country should concentrate on the most vulnerable segments of the population, which should include the elderly, young, women, and impoverished. Since vulnerable people are frequently the ones who suffer the most from financial crises and economic downturns, it makes sense to include them in the formal financial system (Ozili, 2021).

Government-to-person (G2P) social cash transfers into vulnerable people's official accounts are one technique to do this. Paying G2P social cash transfer benefits into the formal accounts of the impoverished, women, and elderly may serve as a catalyst for other impoverished, women, and elderly individuals to enter the formal financial sector and open formal accounts in order to benefit from G2P social cash transfer benefits. This could lead to an increase in the percentage of vulnerable groups' financial inclusion (Anderloni *et al.* 2012). Also, when social cash transfer is working, and other tools for achieving financial inclusion are provided to vulnerable people in society, it can make vulnerable people feel that they are being compensated for the existing income inequality that affect them, which gives them an opportunity to catch up with other segments of society. The implication of theory is that it identifies some members of the population to be vulnerable, and suggest that financial inclusion efforts should be the targeted to the vulnerable people in society.

There are certain advantages to the vulnerable group hypothesis of financial inclusion. Initially, the theory aims to address the issue of financial exclusion by focusing on vulnerable populations and integrating them into the official financial sector. Second, this idea makes it simple to pinpoint the population's financially excluded individuals. The degree of vulnerability, as well as other demographic traits like age, gender, and income level, can be used to identify the population's most susceptible members. Third, compared to achieving financial inclusion for the entire population, it might be more affordable to focus on the most disadvantaged members of society (Oumarou & Celestin, 2021)..

There are certain drawbacks to the vulnerable group idea as well. First off, the theory does not place a high priority on financial inclusion for the entire populace. Second, it disregards those outside the official banking sector who are not vulnerable. Access to the official financial sector is necessary even for those who are not susceptible. Thirdly, it indicates that men are not a vulnerable category since it believes that women are. This concept is important because, in contemporary countries, women and men compete for the same possibilities. As a result, social and financial inclusion may be unintentionally harmed by categorising women as weak groups to be excluded from males. It might cause men to become resentful of women in society (Ozili, 2021). Finally, achieving financial inclusion by targeting vulnerable people may lead to increasing social inequality when social policies are designed to favor vulnerable people over others, and it may also lead to income inequality if vulnerable people receive better access to financial services than others (Oumarou & Celestin, 2021).

2.3.3 Technology Acceptance Model

The technology acceptance model is also known as TAM. The theory attempts to explain why people would choose to use a particular technology to better their life. The technology acceptance model says very little about the technology itself; rather, the focus is what we believe or what we perceive this technology to be. Whether the technology is actually useful

or actually easy to use is not a matter of the technology but a matter of our perceptions, and this may change obviously, so depending on how much experience an individual has, how old he is, what gender you he/she is, the perceptions of a particular piece of technology say mobile device or a tablet computer changes not because the technology is different but because individuals and personalities are different (Otuya et al., 2024).

Davis (1986) first proposed this model to explain the mindset that underlies the desire to use technology (Monyoncho, 2015). TAM contends that when new technical advancements are offered to customers, their decisions are influenced by their perceptions of ease of use (PEOU) and usefulness (PU), rather than the actual utilisation of the systems. TAM deals with 14 perceptions rather than real system utilisation (Lule *et al.*, 2012). People's degree of confidence in a system is known as perceived ease of use, and if they believe a new technology will benefit them in the short and long terms, they will be encouraged to utilise it.

Moreover, Perceived Usefulness is the degree to which a person believes a system will improve performance over the short- and long-terms (Mojtahed *et al.*, 2011). According to the TAM, each user's behavioural purpose for system usage determines the system's actual utilisation, which is influenced by each user's perception of the system. The idea also describes how a system's simplicity and functionality directly relate to how new technology is perceived (Lim & Ting, 2012). According to TAM, consumer intentions have an impact on the acceptability of technology and functionality and shape the customer's impression of the system.

According to the hypothesis, perceptions of or misgivings about advancements also play a role in enhancing the mental states that eventually influence how people use the system (Lim & Ting, 2012). TAM also looks into how people feel about a certain system. The TAM provides information, explains, and illustrates the rationale for clients' acceptance or rejection of a data architecture or innovation. TAM is significant as a proactive approach, taking into

account the goal of assessing the likelihood that persons and associations will be exposed to a particular invention (Mojtahed *et al.*, 2011). TAM can be used to explain the digital financial services which can be applied in clarifying the existence of variations in consumer behaviors especially when it comes to use of related digital financial services (Lim & Ting, 2012).

2.3.4 Theory of Financial Innovation

Silber (1983) introduced the theory of financial innovations, which is based on the notion that the main driver of financial inclusion is the extension of the benefits of foundations associated to money. According to the hypothesis, the main inspiration for new inventions comes from the financial industry's flaws, which mostly include erroneous data, office expenses, and currency rates (Błach, 2011). Financial innovations contribute to deeper financial inclusion by boosting the accessibility of developing prospects, ensuring that resources are allocated to places that lack them, and enhancing the liquidity of financial markets (Błach, 2011). According to the theory of financial innovations, companies can maximise revenues by pursuing certain limits, such as external handicaps (Li & Zeng, 2010). As a result, commercial banks use creative strategies to expand their customer base and increase profits. Particularly in many African nations, the cutting-edge financial inclusion models being developed through mobile and other digital financial services are helping to bridge the financial instrument gap in these nations (Omwansa & Waema, 2014).through more effective distribution, increased efficiency, and a decrease in administrative and financial expenses (Sekhar, 2013).

As per Ionescu (2012), financial innovations can be either novel or conventional in nature, offering the most recent advancements in development while augmenting firms' liquidity and increasing the number of new applicants based on their suitability for the role. The theory holds that financial innovation is a vital source of energy for the financial system, improving economic advantage from frequent and novel changes as well as economic competence

(Sekhar, 2013). Financial innovations are characterised by the development of new technology solutions, new manufacturing methods, and higher return rates, all of which help to strengthen the nation's economy overall. According to the hypothesis, a company's innovativeness increases its competitive advantage and increases investor earnings (Błach, 2011). The entire additional load may be managed, solved, and transferred with the help of innovation. Through better allocation, increased efficiency, and a decrease in financial and administrative costs, the use of innovations fosters the growth of financial firms (Sekhar, 2013).

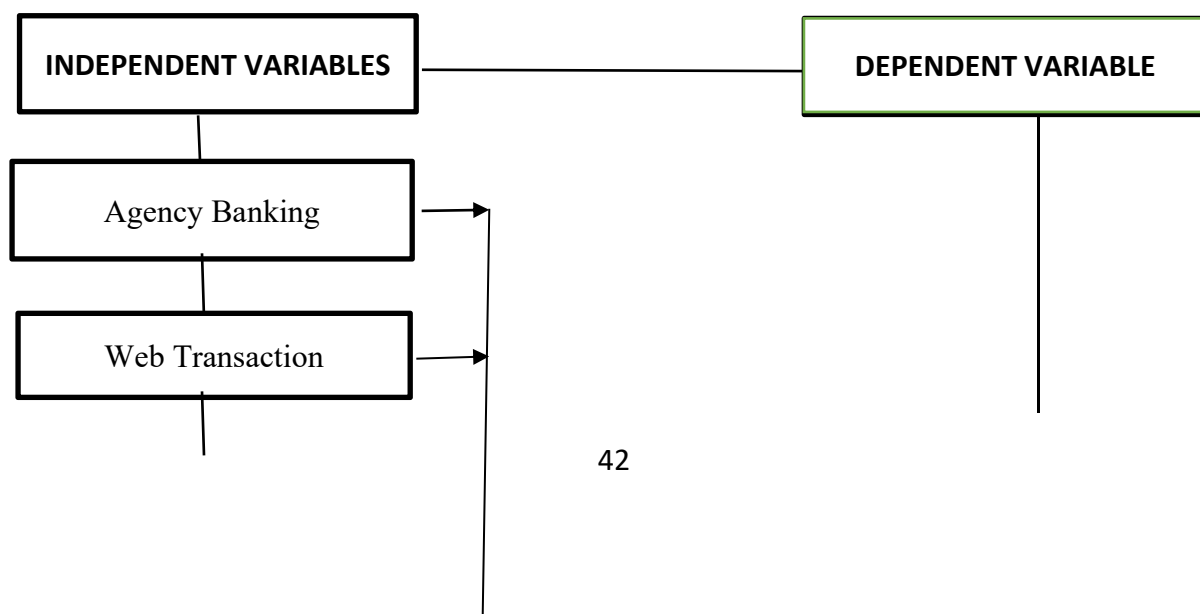
2.3.5 Theory Anchorage and Theoretical Framework

As discussed in the preceding passages, the four core theories – The Access Opportunity Frontier Theory, Vulnerable Group Theory, Technology Acceptance Model, and Financial Innovation Theory - underpinning digital financial services and financial inclusion approaches are pertinent to the study. While it is imperative to note that each of the distinctive theory has its own merits and alternative rationale, this study focusses predominantly on digital financial services and its components on the extent to which they affect financial inclusion. Essentially, applying the vulnerable group theory, it can be contended that since vulnerable people are frequently the ones who suffer the most from financial crises and economic downturns, it makes sense to include them in the formal financial system. The vulnerable group theory of financial inclusion is indeed a remarkable theory due to its merits.

It is considered the most suitable for this study because the theory seeks to reduce the financial exclusion problem in society. It does so by targeting vulnerable people who are excluded from the formal financial sector or targeting vulnerable people who are at risk of financial exclusion. The theory argues that financial inclusion efforts should be directed at vulnerable groups in society so that vulnerable people will not be left behind in society.

Another important justification of the vulnerable group theory of financial inclusion is that it is easy to identify the vulnerable people in society who are excluded from the formal financial system. They can be easily identified by their gender, age, freedom status, and other demographic characteristics. The theory is also considered most appropriate for the study because the vulnerable group theory of financial inclusion relates to cost effectiveness. It is cost-effective and cheaper to target only the vulnerable groups in society for financial inclusion compared to achieving financial inclusion for the entire population. Directing financial inclusion efforts to vulnerable groups will require the use of fewer public financial resources and/or fewer private resources compared to directing financial inclusion efforts to every member of the population, which would cost a lot of money to achieve. Hence, all these provide an appropriate ground to embrace the vulnerable group theory as the fundamental theory for this study.

Based on the above theoretical framework and the hypotheses, the following conceptual framework can be proposed:



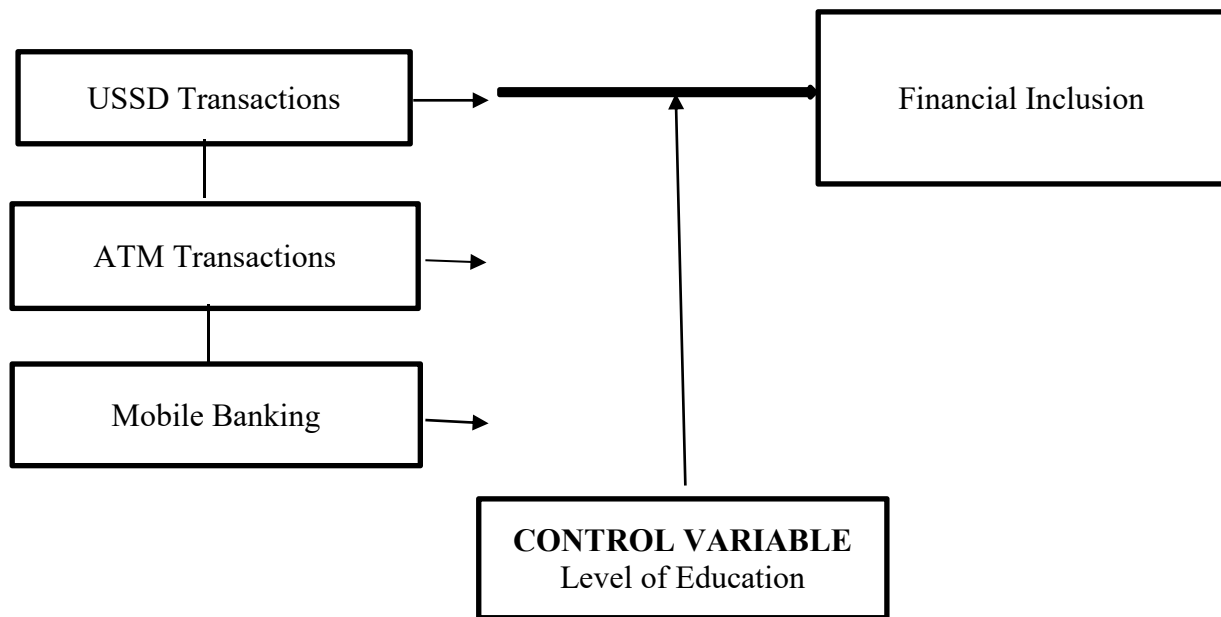


Fig. 2.1 Conceptual Framework for the Study

The above framework conceptualizes graphically the interaction between variables studied in this work. The study adopts five digital financial services measures as predictors of financial inclusion namely: agency banking, web transactions, USSD transactions, ATM transactions, and mobile banking as independent variables. The level of adult education is used as the control variable while financial inclusion measured as bank deposits scaled by gross domestic product is the dependent variable for the study. The level of education is used as a control variable because it influences individuals' ability to understand and adopt digital financial services.

2.4 Empirical Review

There is a growing debate on how digital financial services could impact financial inclusion in an economy. For instance, in an empirical study, Greta *et al.* (2024) looked at how the Covid 19 outbreak and FinTech development combined to affect the cross-country Digital

Financial Divide (DFD), as well as how social and digital infrastructure factors affected developed European regions. A two-stage least squares (2SLS) model was used in the study to address any endogeneity problems. In econometric research, this strategy is commonly employed when there is a possibility that some of the explanatory variables could be endogenous. Implementing the 2SLS model is done in two steps. Every endogenous explanatory variable in the model is first regressed on all exogenous variables, including the instrumental variables (IVs) and the exogenous variables of interest.

The anticipated values from the first stage are used to replace the endogenous variables in the original model during the second stage of estimation. The study provided empirical evidence for how various analysis dimensions may help or impede the realisation of customer-side "digitalization" of financial services. In particular, it was discovered that a high degree of FinTech growth lowers a nation's DFD, enhances e-banking service uptake, and boosts financial inclusion in Europe. The complexity of digital financial goods and the expansion of e-banking services offered via FinTech development and Covid-19 interact to raise DFD.

In a related study, Amnas and Satyanarayana (2024) investigated how financial technology (FinTech) may advance financial inclusion. By considering the moderating influence of perceived regulatory support and the mediating role of digital financial literacy, this study aimed to understand why consumers use FinTech and how it influences their access to financial services. This study collected data from 608 FinTech users in India and tested the research model using partial least squares structural equation modelling (PLS-SEM). The findings demonstrated the importance of perceived security, trust, and high-quality services in encouraging the use of FinTech services. Additionally, this study showed how FinTech promotes financial inclusion by facilitating people's access to formal financial services. Digital financial literacy has also come to light as a key intermediary between the usage of

FinTech and financial inclusion. The study also demonstrated that the association between FinTech and financial inclusion is significantly moderated by perceived regulatory support.

Tan *et al.* (2024) used panel data from 30 Chinese provinces between 2011 and 2020 to experimentally investigate the effects of digital inclusive finance on multi-dimensional food security. According to the study, China's multi-dimensional food security level from 2011 to 2020 demonstrated a steady but upward trend, with each location's spatial pattern largely matching the overall trend. From 2011 to 2020, China's multi-dimensional food security index exhibited an increasing tendency. Multifaceted food security can be aided by digitally inclusive financing. While the degree of digitalization has not had a promoting role, the breadth of coverage and depth of application of digital inclusive finance have a substantial positive impact on preserving multi-dimensional food security. In order to promote multidimensional food security, digital inclusive finance primarily uses two strategies: increasing marketization and encouraging urbanisation.

In a different study, Bu *et al.* (2024) methodically examined the connection between the financing constraints faced by small and medium-sized businesses (SMEs) and digital inclusive finance. Using two-way fixed effects and a mediation effect model, the study conducted an empirical test and extrapolated the influence model between them from the standpoint of economic theory. The findings indicate that: (1) SMEs' funding constraints are much lessened by digital inclusive finance; (2) The impact of deep adoption of digital inclusive finance is more pronounced than that of coverage breadth; (3) Digital inclusive finance has a heterogeneous alleviating effect. It can address the geographic, field, and attribute mismatches of traditional financial lending services; (4) By lowering financing costs and regulating leverage levels, digital inclusive finance increases internal sources of enterprise funds and eases the financing limitations faced by SMEs. This study was important in that it helped to advance digital inclusive finance, which helped to reduce the funding

challenges faced by SMEs in China. It also offers other nations helpful ways to lessen the "Macmillan Gap" impact.

A study by Johri *et al.* (2024) sought to determine the factors that influence digital financial inclusion (DFI) and how easy it is for microenterprises to conduct business. The research was conducted using data from 998 micro-enterprises from the World Bank's Enterprises Survey of Micro Firms (ESM) 2022. From the data are extracted the factors that quantify the use and accessibility of digital finance. For the purpose of explaining digital financial inclusion, two sets of independent variables are considered: companies' and owners' characteristics and digital resource competence.

To compare the perceived business barriers faced by microenterprises with and without access to and usage of digital finance, analysis of variance (ANOVA) was utilised. To further examine the DFI drivers, a logistic regression model was created. The study's conclusions demonstrated how digital financial inclusion can be used to manage market externalities and overcome barriers related to company regulation. Furthermore, it appears from estimates of the logistic regression model and marginal effects that owner experience, education, and internet access play a key role in digital financial inclusion among microenterprises.

The asymmetric effects of information and communication technology (ICT), financial inclusion, primary energy consumption, employment to population ratio, and human development index on CO₂ emissions in oil-producing nations (UAE, Nigeria, Russia, Saudi Arabia, Norway, Kazakhstan, Kuwait, Iraq, USA, and Canada) were investigated by Alam *et al.* (2024). Annual panel data covering the years 1990–2021 are used in the study. This study also examined the validity of the Environmental Kuznets Curve (EKC) trend throughout the whole sample, accounting for population and energy consumption impacts to examine how financial inclusion affects environmental deterioration. The data did not follow a normal distribution, according to preliminary results, which highlights the necessity of using quantile

regression (QR). This method works well for identifying structural alterations, outliers, and non-normal data. The quantile regression analysis results show that ICT consistently lowers CO2 emissions across the board in all quantiles (from the first to the ninth quantile). Similarly, the employment to population ratio and financial inclusion limit CO2 emissions at every quantile. Conversely, it was discovered that CO2 emissions increased in every quantile (1st to 9th) in relation to primary energy consumption and the Human Development Index.

Al Khub and Ali (2024) investigated how digital financial inclusion might help reduce poverty and promote economic prosperity in poor countries in the COVID-19 pandemic. It focused on Jordan and used a non-linear probit regression model to analyse data from 260 people in order to uncover important determinants of financial access. The study found that adult males and females in Jordan differed significantly in terms of financial inclusion, which might be attributed to variations in wealth, employment, income levels, and education. These results highlight the need to prioritise financial accessibility for underserved populations, including women, the elderly, and lower-income individuals, in order to successfully battle poverty and promote economic growth and sustainable development in emerging economies.

Using quarterly data covering 2009Q1–2021Q4, Apere and Uche (2024) investigated the impact of financial inclusion on economic performance in Nigeria by selecting ARDL as their analysis technique. The results showed that while the amount of POS, ATM, and USSD transactions raised GDP, the effect was not statistically significant, indicating that these factors had little bearing on the state of the economy. Likewise, loans to the private sector had a negative GDP impact, although this result was not statistically significant. The study therefore concludes that throughout the research period, Nigeria's economic performance was not significantly impacted by the factors that indicate financial inclusion and to better understand the underlying causes and dynamics of the link between financial inclusion and economic success in Nigeria, the study does, however, suggest more research. It is important

for policy makers and regulators to ensure that banks are exerting enough effort to adhere to the policies, rules, and laws that oversee their business operations.

An investigation into the impact of financial technology (Fintech) on financial inclusion in Ethiopia in the context of a digital economy was undertaken by Menza *et al.* (2024). Secondary data was gathered for this purpose from 2015 to 2020 from nine panel units of commercial banks. Following the testing of all model assumptions and based on the findings of the Hausman test, the random effect model was used to estimate the impact of explanatory factors on the interest variable. The results showed that agent banking, POS, ATMs, and mobile banking all had a statistically significant positive impact on financial inclusion. The authors proposed that expanding the use of digital financial technology (Fintechs) in both urban and rural areas will support policymakers' and bankers' initiatives for promoting financial inclusion.

The study conducted by Ubah *et al.* (2023) investigated the impact of digital banking on financial inclusion in Nigeria. The study was motivated by the CBN's inability to actualize its financial inclusion vision, even with the introduction and widespread use of digital banking instruments. Specifically, the study aimed to investigate the effects of agency banking, web banking, and USSD banking on financial inclusion in Nigeria, using technological acceptance theory as its foundation. The study used POS values as a stand-in for agency banking, financial deepening values as a proxy for measuring financial inclusion, and web banking and USSD banking values were also maintained. Relevant data from 2010 to 2021 was obtained from the CBN payment system database.

It was suggested that government should promote financial education and work to reduce the cost of data since POS and Web banking primarily depend on data availability. The data were analysed using the ordinary least square regression of Eviews (version 12, University edition). The results showed that POS and USSD banking has a significant effect on financial

inclusion while there is no significant relationship between web banking and financial inclusion.

In a different study, Iwedi (2023) conducted an empirical test to see how the digital banking paradigm affected financial inclusion in Nigeria. The Central Bank of Nigeria Statistical Bulletin (2021) provided the secondary data, which were taken from the study using the financial time series methodology throughout a twelve-year period (2009–2021). The independent variables in this analysis are the volume of transactions made in Nigeria on automatic teller machines (ATMs), point of sale (POS) terminals, web banking technology (WBT), and mobile banking technology (MBT) on a quarterly basis. Simultaneously, the gross domestic product to total deposit ratio served as a stand-in for financial inclusion in Nigeria. The data were analysed using the paired Granger causality test estimation approach. Since it has shown to be effective in determining if a one-time series is useful in forecasting another, the pairwise Granger causality test was employed.

The study discovered that Nigeria's financial inclusion is heavily and crucially impacted by the digital banking model. Thus, it can be inferred that even with the obstacles encountered by Nigerian banks, there exists ample opportunity to enhance financial inclusion in the nation by introducing further mobile and internet-based banking services into the banking infrastructure.

Iwedi et al. (2023) investigated the impact of mobile payment technology on reducing poverty in Nigeria through a survey study employing primary data. The Nigerian state of Rivers hosted the study. The individuals who resided in Nigeria's Rivers State made up the study population. For the purpose of the study, a sample size of 223 respondents was obtained using both multistage and purposive sampling procedures. The primary tool for gathering data for the study was a structured questionnaire. The study also evaluated the validity and reliability of the research instrument. The field survey data were first shown

using basic descriptive statistics, including tables, frequencies, graphs, and percentages. Using SPSS software version 25.0, a basic regression model was applied to test the data. The results demonstrated a positive and substantial relationship between mobile payment technology and the consumer expenditures of the respondents in the Nigerian state of Rivers. Based on the results, the study came to the conclusion that adopting digital technology, especially in developing nations like Nigeria, is a significant instrument for reducing poverty.

In a different study, Gbanador (2023) examined the effects of e-banking, or electronic banking, on the functions of deposit money banks (DMBs) in Nigeria. Using an ex-post facto research design, the study used secondary data taken from the Central Bank of Nigeria's statistical bulletin. Monthly time series data covering the period from 2019 to 2021 were used in the study. The study found that e-banking systems had no discernible short-term impact on Nigerian DMB performance. However, the long-term analysis concluded that, in Nigeria, mobile banking has a significant and beneficial impact on DMB performance, whereas ATM and POS have a favourable but insignificant impact.

Olubukola *et al.* (2023) analysis of Nigerian deposit money banks (DMBs) looked into the effects of digital financial services on the country's economy. A regressive analysis of ex-post facto data was conducted on the independent variables of digital financial services, namely the volume of transactions made through ATMs, POS machines, WEBPAY transactions, and mobile banking, with the GDP as the dependent variable. These were acquired through the use of ordinary least square regression (OLS) with the 2017 Central Bank of Nigeria (CBN) Statistical Bulletin. The study's conclusions showed that while the volume of web services has a negative effect on Nigeria's gross domestic product, the volume of mobile banking, point of sale, and automatic teller machine transactions all have a positive impact on the country's economy. Of these, the volume of transactions from automatic teller machines has the greatest impact on the country's GDP as a proxy for economic growth.

To investigate how the e-payment system (EPS) affected Nigerian banks' efficacy, Ehiedu *et al.* (2023) collected data from the Central Bank of Nigeria (CBN) for the years 2012 to 2016. Both a linear regression analysis and SPSS were used in the investigation. With a P-Value significance of 0.333, the analysis shows that the efficiency of Nigeria's banking sector is not significantly impacted by EPS. Uzor (2022) did a study on the effectiveness of deposit money banks and information and communications technology (ICT) in Nigeria between 2006 and 2020. The influence of transaction volume on ATMs, mobile and internet banking, and point-of-sale terminals was evaluated in relation to the efficacy of deposit money banks.

The Granger Causality test result showed that the efficiency of deposit money banks in Nigeria is not significantly impacted by information and communications technology channels such as automated teller machines (ATMs), mobile banking, online banking, and point of sale (POS) terminals. There exists a weak inverse relationship between the efficiency of deposit money banks and the volume of transactions processed by mobile banking, ATMs, and point-of-sale terminals. On the other hand, a weak but unfavourable association was shown between the volume of transactions conducted via internet banking and the performance of deposit money institutions in Nigeria. The little effect of ATM transactions emphasises how important it is for Nigerian deposit money banks to ensure that money is always available in the ATMs.

Otuya *et al.* (2022) looked at the influence of ICT adoption on the operational efficacy of Deposit Money Banks in Nigeria. The technological acceptance theory provided the study's theoretical framework, and the ex post facto research design was employed. All DMBs reported in Nigeria make up the study's population. Time series data from the CBN Statistical Bulletin and DMB annual reports for the years 2012 through 2021 were used in the study. The study's findings show that the adoption of ICT for web payments, ATMs, and point-of-

sale transactions has a favourable but not statistically significant influence on the operational efficiency of the sampled DMBs.

An investigation into the impact of digital banking services on Nigeria's economy was conducted by Iwedi *et al.* in 2022. It was specifically intended to determine whether the adoption of online pay and mobile pay, two types of digital banking services, had an impact on Nigeria's economy. For this study, the Central Bank of Nigeria Statistical Bulletin's 12-year aggregate annual data on digital banking services was utilised. Nigerian economic performance was examined in connection to digital banking service channels using a multiple regression approach to assess the significance of the association. The outcome demonstrated a considerable positive correlation between Nigeria's economic growth and WEB Pay and Mobile Pay. This suggests that there is a strong and significant correlation between Nigeria's economic growth and the digitalization of banking service channels.

The goal of Uduak and Ekong (2022) was to objectively examine how the growth of digital currencies, or digital finance, affected financial inclusion in Nigeria during that time. In a weighted stepwise forward regression, the study produced high-frequency quarterly data for the analysis spanning from 2006:1 to 2020:4. The results indicated that (1) a rise in the number of units that citizens spontaneously used automated teller machines to increase financial inclusion in a quarter in Nigeria by 0.012 units was statistically significant; (2) a rise in the percentage that citizens used point of sale transactions to increase financial inclusion in Nigeria by roughly 1% was also statistically significant; (3) a percentage increase in web payment services lowers financial inclusion by 22% in Nigeria; a percentage increase in mobile payment users will increase financial inclusion by at least 0.4% in Nigeria; and a cumulative positive effect of digital finances on financial inclusion was roughly 7%.

Madugba *et al.* (2021) employed an ex-post facto study approach to investigate the impact of electronic banking on the financial performance of deposit money banks in Nigeria.

According to the study's findings, Nigerian deposit money institutions' financial performance is considerably impacted by electronic banking. Banna and Alam (2021) examined, using a panel data set of 574 banks, the impact of digital currency development on the banking stability of seven Asian nations and the consequent influence on growth and development between 2011 and 2018. Malaysia, Pakistan, Indonesia, China, Thailand, India, and the Philippines were among the nations that were covered in the study. By using the panel-corrected standard errors (PCSE) and panel two-stage least-squares instrumental variables (2SLS-IV) methods, their findings show that the development of digital currencies can improve the stability of banks and create an integrated digital financial system among the emerging Asian banks, as well as provide a long-term path for the region's overall economic growth.

Equally, Risman *et al.* (2021) considered the associated risk involved in financial stability in the pursuit of digital finance for financial inclusion for 10 year period (2010–2019) in a panel framework for the Indonesian economy. In their study, over 120 sample data were collected from the Indonesian banking system for the risk assessment. They discovered convincing evidence that market risk can, in fact, reduce the influence of digital finance on financial stability by relying on the strength of what they called Moderating Regression Analysis under the Multiple Linear Regression technique. According to this, digital finance for financial inclusion will decrease if systemic banking risk rises and vice versa. Over time, this will have an impact on the overall stability of the financial system. When digital finance is considered independently, it finally improves the stability of the financial system by 18%; however, the relationship is inverse when risk is taken into account.

Oumarou and Celestin (2021) examined the variables influencing financial inclusion in eight countries that are members of the West African Economic and Monetary Union (WAEMU) between 2004 and 2017. The study included a number of restrictions related to digital

finances, including interbank credit transfers and the use of mobile phones. On the chosen variables, they applied panel conventional least squares and generalised least squares methods. Results indicated that mobile money transfers, a measure of digital finances, expressively and favourably boosted financial inclusion in the WAEMU member states. The research went on to say that in just ten years, from 2005 to 2015, the region's financial inclusion increased by more than 50%, demonstrating the impact of this development. This feature offered a window of opportunity to access digital funding for the region's growth after the year 2021.

Lu *et al.* (2021) showed that digital finances can affect the development of small and Mediumscale enterprises. They examined how the use of digital currency will affect small- and mediumscale businesses in their quest for financial inclusion in China from 2010 to 2017. In their study, they obtain data for SMEs constraint on financial inclusion and rural bank branches effect and SMEs financial inclusion index. Employing generalized methods of moments (GMM) technique on the collected variables, they provide empirical evidence of local bank branches and digital financial inclusion having a substitution effect on alleviating SMEs' financial constraints. Thus, SMEs sustainability trade-off has to be decided by small firms in China between using local bank branches and financial inclusion. Their study revealed how digital finance technologies could influence traditional SME-bank relationships for sustainability.

Azeez and Akhtar (2021) identified a preliminary impediment to digital currency usage for financial inclusion in rural communities. In their study of the determinants of digital financial literacy, they showed that inability to use digital finance is a result of limited skills, awareness and the knowledge and attitude of users. They demonstrated this for the rural inhabitant of the Indian community using the socio-economic data of the respondents. Applying multiple regression analysis on the generated variables, they found that financial

literacy is a major factor in digital currency for financial inclusion. In their conclusion, they argued that digital financial education should be the first and necessary step to consider in the digital currency– financial inclusion relationship for rural communities of India. This should be generally considered for not only the rural dwellers, but also for the urban dwellers as well.

Indian consumers' experiences with digital payment options were studied by Shree et al. (2021), who mostly relied on online survey-based datasets for their study. 640 respondents from 20 Indian states, the majority of whom are institutional workers employed by the government or the private sector, took part in the survey. The idea was that citizens' perceptions of digital currency for financial inclusion could be weakened by fraudulent digital transactions. By using the multinomial logistic estimate technique on the variables, they were able to demonstrate that a person's choice for digital payment solutions is mostly determined by how they view these solutions, not by how much they believe in the payments system as a whole. It goes without saying that if someone has previously been the victim of fraud involving digital financial services, their confidence in the payment method will probably decline, and given the state of the local economy, they will probably choose to pay with cash.

Olusegun *et al.* (2021) used panel data covering the 2014Q1–2018Q4 period to empirically investigate the relationship between financial inclusion and financial stability in Nigeria. To take usage, availability, and penetration into account, an indicator of financial inclusion was created. Higher levels of financial inclusion should result in stronger financial stability, according to the findings presented in the article, which showed a positive relationship between financial inclusion and stability. Dimensionally, utilisation was found to have a negative association with financial stability, although penetration and availability showed a positive link. This suggests that decision-makers must weigh the pros and cons of concentrating on changes that would advance financial access, innovation, and inclusion vs.

concentrating on enhancing financial stability. Therefore, in order to encourage financial inclusion and stabilise the financial sector, the study suggests creating more aggressive regulations targeted at improving credit risk management systems.

Nwezeaku (2020) also looked at the connection between the performance of Nigerian banks and e-banking. The value of Point-of-Sale transactions was used as a stand-in for electronic banking, and customer deposits were used to gauge the success of the banking system. In order to assess the data for the 2009–2013 sample period, the Engle–Granger cointegration model was utilised. The results show a stronger correlation between demand deposits and point-of-sale systems than between savings and time deposits. Amos et al. (2020) assess how Nigerian banks perform in relation to electronic banking. For the study, secondary data from the audited annual financial statements of the deposit money banks listed between 2008 and 2017 on the Nigerian Stock Exchange were used. The outcomes of the multiple regression analysis techniques demonstrated that there is no appreciable relationship between e-banking and the performance of Nigerian banks as measured by earnings per share (EPS), return on equity (ROE), and return on assets (ROA).

In regard to Sub-Saharan African development, Ahmad *et al.* (2020) examined African experiences with mobile money transactions and financial inclusion. Their study assessed the amount of data accessible in Sub-Saharan Africa on digital financial inclusion and the effects of mobile technology on the region's financial inclusion and economic development using taxonomic, descriptive, and analytical methodologies. Their analyses showed that the expansion of shared wealth was aided by the emergence of mobile money for both consumers and corporations. The M-pesa technology reduced company losses, shared risk with financial investors, and improved financial inclusion in the Sub-Saharan area in Kenya, which was an extremely outstanding experience.

Ugwuanyi *et al.* (2020) examined the impact of digital financing on the movement of money supply in Nigeria from 2009 to 2018. Their study included variables such as web payment systems, automated teller machine payment systems and point of sales payments as digital finance captures to affect money supply growth. Utilizing autoregressive distributed lag technique on the variables, they present positive evidence of digital finances on money supply growth in Nigeria from 2009 to 2018 from web payment and point of sales systems and a declining impact of automated teller machines on money supply growth.

Oyelami *et al.* (2020) investigated the impact of digital finance on consumer spending behavior in Lagos state Nigeria using a combination of data collected from primary and secondary sources. The sample data for the study were 405 commercial banks customers from the Lagos region. Utilizing autoregressive distributed lag framework on the variables, they found that digital finance penetration in Nigeria increases consumer spending behavior due to convenience and cost-effectiveness associated with digital currency. They thus recommended that government should deepen digital currency to boost aggregate demand and investment ultimately in the economy.

Gbalam and Dumani (2020) examined the impact of cashless payment systems on financial inclusion in Nigeria. This was aimed at ascertaining the level of financial inclusion caused by the cashless policy. The study was hinged on the theories of technology acceptance and diffusion of innovation. Thus, primary data was sourced and collated via structured questionnaires administered to 117 respondents and analyzed using simple percentages and presented using graphs. The data was further estimated using the ordered probit regression technique. The results indicate that nearness of financial products and service outlets to rural settlements, ease of digital financial transactions and reduced visits to banking halls aided by access to cashless payment mediums has enhanced financial inclusion in Nigeria. It also emerged that efficiency of cashless payment channels does not significantly reduce the use of

financial products and services, hence financial inclusion. Furthermore, the results indicate that the desire to own bank account and excessive digital payment charges has a positive but insignificant influence on financial inclusion in Nigeria. The study concludes that cashless payment channels have enhanced equal access and use of financial products and services in Nigeria. The study recommended that the adoption of advanced financial technology (Fintech) that integrate all the attributes of the user groups would enhance user friendliness and further accelerate the penetration and use of bank financial products and services to rural settlements.

In their study, Roussou *et al.* (2019) developed a research model that integrates the Technology Acceptance Model (TAM) and the Innovation Decision Process Model (IDPM), possibly to address the perception issues in digital currency transactions technically. The model integrates the perception of security and examines the factors influencing the actual use of digital currencies in Greece. They discovered strong statistical evidence of security perception and the requirement for managers to integrate security policies into transactions in digital currencies for strong commercialization. They based their analysis on data gathered from 254 online respondents in 2018 and subjected to structural equation modelling (SEM). Additionally, the study demonstrated that in order to foster trust in the use of digital currencies, financial and cybercrime education ought to be a crucial component of their growth.

Ogbeide (2019) used ordinary least square technique to examine the impact of cashless transactions on financial inclusion in Nigeria. The specific objectives of the study was to ascertain the effect of volume of automated teller machine transactions, volume of point of sales transactions, web based transactions on financial inclusion. To achieve this, time series data spanning 2007 to 2016 was collated and estimated. The results revealed that; the volume of ATM and POS transactions has a significant positive effect on financial inclusion in city

centres to rural areas, while web based transactions exerted an insignificant impact on financial inclusion.

In a related study, Ene *et al.* (2019) aimed to examine the impact of electronic banking on inclusive funding in Nigeria. The percentage of banked adults in Nigeria relative to all bankable adults in the country used as a proxy for financial inclusion, and the total number of ATMs and point-of-sale devices in the country served as a proxy for e-banking. The study employed ex-post facto and correlational research designs with the assistance of multivariate regression analysis. It was discovered that whereas POS devices have a major impact on financial inclusion in Nigeria, ATMs have no discernible effect. In a different study, David-West *et al.* (2018) examined the percentages of male and female banked and underbanked using a survey design. The study's factors include the quantity of ATMs, POS terminals, and bank branches. Frequencies and percentages were employed as data analysis techniques.

They came to the conclusion that financial inclusion promotes economic growth. Additionally, they noted that although Nigeria has made progress in increasing the proportion of its population that is banked or underbanked, a sizable portion still do not have access to formal financial services and are not yet considered banked. Another finding is that the target demographics of underbanked and unbanked people have very little to no knowledge of or use of digital banking services. Ailemen, *et al.* (2018) examined the influence electronic banking on cashless economy in Nigeria. Time series data spanning 2006 to 2015 was collated from the central bank and the Nigeria Interbank Settlement System database and estimated using the ordinary least square technique. The results indicate that ATM, POS, webTrans and mobile transactions, which are the components of electronic banking does not have significant positive impact on cash in circulation.

Additionally, Risal (2018) looked at how the activities of digital currencies affected the growth of Nepal's economy. In order to gather primary data about digital inclusion in the

Nepali economy from more than 100 respondents, the study used an exploratory research methodology. According to the findings, Nepal's economy lags behind in terms of digital financial inclusion. Digital penetration in the Nepalese economy was a fantasy since people there were either uninformed that there were digital financial goods in the country or that the government regulatory bodies were legally impeding their existence. The study found that initiatives like these are impeding the push for financial inclusion in developing economies, including Nepal.

Lema (2017) looked into the variables affecting the unbanked population's use of mobile financial services. 250 respondents were gathered through the use of structured questionnaires and a cross-sectional study methodology. The study's primary factors include cost, risk, social influence, utility, simplicity of use, and trust. The multiple regression technique was used to build and estimate a structural equation model. According to the estimates, explanatory variables significantly affect mobile financial services.

The significance of digital finance in financial inclusion was examined by Soriano (2017) from the standpoint of emerging financial technology businesses catering to the underbanked globally and insights for developing unbanked in two significant regions of the world: Africa and Asia. Approximately 7,370 data points were gathered for the study on 63 distinct fintech companies that were active in business starts before to 2017, particularly between 2004 and 2017. Applying multi-variate regression and binomial logit techniques on the primary data collected for the purpose, showed that fintech startups with long years of experience in financial services, the degree of customer centrality to the business location and startup and the strategic collaboration of fintech firms with other financial institutions and e-commerce enterprises exerted a strong, significant and positive correlation with financial inclusion and by extension financial performance. The study thus argued that digital technologies such as mobile phones, cloud computing, data analytics and block chain are necessary ingredients of

financial inclusion to make the economically underserved and unserved population financially active.

In a related development, Agyekum *et al.* (2016) used Ghana as a case study in Africa to examine the relationship between financial inclusion and the use of digital money in lower-income nations between 2011 and 2014. The study's sample data comprised both bank-based and non-bank-based clients. The study demonstrated that there are significant positive effects for digital currency usage and financial inclusion for non-bank-based digital finance users and a negative correlative effect for bank-based digital currency users in financial inclusion. This was achieved by combining both ordinary least squares regression and logistic regression analysis on both the macro and micro datasets, respectively, between the difference in difference positions. The argument put up was that in order to promote an inclusive financial system in Ghana, the government should coordinate technical advancements.

In order to investigate how Nigeria's cashless policy affected financial inclusion, Bayero (2015) employed a cross-sectional survey design. The precise goals are to ascertain how Nigerian financial inclusion is affected by the explanatory variables of company model, awareness, customer value, and infrastructure. 230 respondents from a representative group of working-age individuals provided primary data. Using the multiple ordinary least squares method, the data were approximated. The study discovered that infrastructure, customer value, company strategy, and awareness all significantly affect financial inclusion in Nigeria.

2.5 Gap in Literature

The literature on digital financial services, e-banking, and financial inclusion is indeed diverse and has been a subject of intense research in finance and management for a long time in both developed (Bu *et al.*, 2024; EFINA, 2023; Lu *et al.*, 2021; Roussou *et al.*, 2019) and developing nations (EFInA, 2022; Global Finance, 2023; Risal, 2018; Oumarou & Celestin,

2021; Soriano; 2017). A number of studies have been conducted in Nigeria too (Apere & Uche, 2024; Bayero, 2015; David-West *et al.*, 2018; Ene *et al.*, 2019; Gbalam & Dumani, 2020; Otuya *et al.*, 2022). Studies on international comparison also abound (Ahmad *et al.*, 2020; Alam *et al.*, 2024; Banna & Alam; 2021; Oumarou & Celestin; 2021; Soriano, 2017). However, a review of the literature brings up a few questions considered as likely gaps to research on digital financial services and financial inclusion in Nigeria.

First, available empirical evidence regarding digital financial services as determinants of financial inclusion provides an unclear picture. Numerous empirical studies have examined the purported relationship between digital financing and financial inclusion, the findings of these studies are contradictory and uneven. Prior studies such as (Amos *et al.*, 2020; Gbanador, 2023; Nwakoby *et al.*, 2018; Otuya *et al.*, 2022) on financial system stability have produced mixed results. The lack of agreement regarding the relationship between digital financial services and financial inclusion necessitates this kind of research using current information on the relevant variables.

Second, the discussion on digital financial services in the context of electronic and digital banking characteristics and its relation to financial inclusion is still lacking in developing countries like Nigeria. Therefore, this study covers main digital financial services characteristics of agency banking, USSD Transactions, mobile banking, ATM transactions, and web banking which have been rarely examined together in a single study.

Finally, very little is known on whether the level of education of the bankable populace may have an impact on the adoption and use of digital financing services in relation to financial inclusion. Prior research have focused more on the digital financing component without controlling for the effect of level of awareness by the teaming populace on digital financial services provided by banks. This study makes a clear departure from prior studies by including the level of education of the bankable populace as a control variable.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study evaluates the impact of digital financial services on financial inclusion in Nigeria.

This chapter reviews the research methods adopted for the study. It discusses the research design, and techniques used in data collection. The chapter also highlights the models specification, variables operationalization, and data analytical methods.

3.2 Research Design

The study adopted an ex-post facto research design given that it is a discourse on documented outcomes for the purpose of drawing conclusions and inferences. The choice of this research design is based on the fact that this work is an after-the-fact research which employed variables that the researcher cannot manipulate. In this study the ex-post factor is buttressed by the empirical or analytical form of research given the quantitative form of the study.

3.3 Sources of Data

All the data utilized are time series, quantitative and sourced from secondary sources basically, the Statistical Bulletin of Central Bank of Nigeria for the period of 2010-2023.

They are time series data because they are ordered following a natural frequency (Brooks, 2014). This means that time series data are characterized by their sequential ordering at regular intervals, are arranged in a chronological order, reflecting changes or patterns over time.

3.4 Method of Data Analysis

The basic steps followed were standard tests and regression analyses. The standard tests served as preliminary tests to ascertain the data behavior and their goodness towards employing them for model estimation. These tests include basic descriptive statistics such as the mean, median, mode, variance, standard deviation, skewness, kurtosis and normality. Stationarity implies that the ‘mean’ and ‘variance’ are constant over time and the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not the actual time at which the covariance is computed. In this study therefore, the Augmented Dickey Fuller Unit Root Test was employed to test for the presence or otherwise of the unit root (stationarity). In this work, the Ordinary Least Square was used to run the regression analysis.

3.5 Model Specification

To examine the impact of digital financial services on financial inclusion in Nigeria, the study developed a model similar to the one used by Apere and Uche (2024) and Demir et al. (2020) which expresses financial inclusion as a function of digital financial services thus:

Financial inclusion f (digital financial services) model I

The general form of the model is expressed as follows:

$FINC = f(AGCY, WEBB, USSD, ATMB, MOBB)$ model II

Integrating the control variable of level of education that may cause variation in the dependent variable of financial inclusion, equation II is modified as:

$FINC = f(AGNT, WEBT, USSD, ATMT, MOBB, EDUC)$ model III

Expressing equation III in econometric form and considering the time series nature of the regression data, equation IV is transformed as:

$$FINC_t = \beta_0 + \beta_1 AGNT_t + \beta_2 WEBT_t + \beta_3 USSD_t + \beta_4 ATMT_t + \beta_5 MOBB_t + \beta_6 EDUC_t + \epsilon_{it}$$

.....equation I

Where:

FINC represents Financial Inclusion; AGNT used to measure Agency Banking; WEBT used for Web Transactions; USSD represents USSD transactions; ATMT represents ATM Transactions; MOBB refers to Mobile Banking; and EDUC is used to stand for Level of Adult Education

β_1 to β_6 are the unknown coefficient of the variables; while $t =$ time dimension (1,2, 3,13).

Presumptively, we expect that Agency Banking, Web Transactions; USSD transactions; ATM Transactions; and Mobile Banking to have a positive relationship with financial inclusion which signifies that the digital banking services improves financial inclusion. Our a priori expectation also presume that level of education will have a bearing on these relationship as it is expected that higher level of education will connote improved usage of these digital financial services platforms.

3.6 Operationalisation of Variables

Table 3.1. Operationalisation of Variables

SN	Variable	Acronym	Measurement	Source	A Priori Expectation
1	Financial Inclusion	FINC	Financial inclusion determined using a proportion of total customer deposit to gross domestic product (GDP)	Ozili (2024) Iwedi et al. (2023)	
2	Agency banking	AGNT	Agency banking determined using natural log of the total number of agents offering agency-	Uduak and Ekong (2022) Olubukola et al (2023)	+

			banking services		
3	Web Banking	WEBT	Web banking determined through natural log of total internet banking transactions	Alam et al. (2024) Iwedi et al. (2023)	+
4	USSD Transactions	USSD	USSD transactions is determined using the total volume of USSD transaction in a given financial year	Apere and Uche (2024) Olubukola et al (2023)	+
5	ATM transactions	ATMT	Volume of ATM transactions in the country in the given financial year	Otuya et al. (2022) Uduak and Ekong (2022)	+
6	Mobile Banking	MOBB	Mobile banking determined using natural log of total mobile banking transactions	Olubukola et al. (2023) Otuya et al. (2022)	+
7	Level of Education	EDUC	Educated adult population (Secondary Education and above)	Ozili (2022) Global Findex (2022)	+

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.1 Introduction

The presentation, analysis, and interpretation of the data gathered for this this are all included in this chapter. As a result, it requires the use of both statistical and mathematical methodologies to establish the foundation for testing the research hypotheses. The model highlighted in the preceding chapter is empirically tested. The study's focus is to examine the relationship between digital financial services and financial inclusion in Nigeria.

4.2 Data Presentation

First, we conduct the preliminary analysis of the whole data using descriptive statistics followed by an examination of the relationship features of the data by using the correlation matrix and the variance inflation factor. Finally, the OLS regression analysis is used as the fundamental technique for analysis. With the estimates acquired, the empirical assessments of the results are carried out

using a variety of economic 'a priori' expectation criteria. This led to the identification of legitimate policy implications and the drawing of conclusions. The results are presented and analyzed thus:

Table 4.1: Descriptive Statistics of the Variables

	FINC	AGNT	WEBT	USSD	ATMT	MOBB	EDUC
Mean	23.26786	2829.894	293.6136	2578.318	9108.486	2037.433	73.57143
Median	23.11500	1084.405	158.4800	929.4500	5711.415	928.1300	73.78000
Maximum	28.10000	11860.80	732.2300	9073.260	20957.34	8895.640	78.24000
Minimum	19.80000	12.72000	25.05000	6.650000	399.7100	6.650000	68.11000
Std. Dev.	2.344598	3685.854	268.7621	3046.610	7482.549	2678.809	3.493180
Skewness	0.611943	1.338251	0.424056	0.860988	0.402516	1.480164	-0.178068
Kurtosis	3.019285	3.687003	1.478726	2.361496	1.549813	4.155233	1.723308
Jarque-Bera	0.873990	4.454120	1.769581	1.967517	1.604819	5.890563	1.024785
Probability	0.645975	0.107845	0.412801	0.373903	0.448248	0.052587	0.599060
Sum	325.7500	39618.52	4110.590	36096.45	127518.8	28524.06	1030.000
Sum Sq. Dev.	71.46284	1.77E+08	939029.6	1.21E+08	7.28E+08	93288245	158.6300
Observations	14	14	14	14	14	14	14

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

The table 4.1 displays the descriptive statistics for the data. As observed, financial inclusion (FINC) has a mean value of 23.26 for the time examined. The maximum and minimum values for financial inclusion rate for the fourteen year period are 28.1 and 19.8 respectively. The standard deviation measuring the spread of distribution stood at 2.344 indicating no considerable variation in the data series. The positive Jarque-Bera statistics of 0.873 and the probability value of 0.6459 indicates that the data series satisfies normality criterion and is suitable for further analysis. Similarly, agency banking (AGNT) has a mean value of 2829.8 for the period examined. The maximum and minimum amount of AGNT for the period was 11860 and 12.7 respectively. The standard deviation measuring the spread of the distribution stood at 3685 which is large and indicates a considerable dispersion among the samples and that the distribution is with years with significant variations in their agency banking structure.

Further, the descriptive statistics result from the table on (WEBT) and (USSD) point to the fact that while the country had an average of about 293.6 for the period under consideration

(2010-2023); the USSD usage within the same period under consideration stood at an average of about 2578.3 billion. The descriptive statistics also shows that during the period the maximum proportion for WEBT was 732.2 with the lowest being 25.05. The USSD also recorded the maximum value of 9073 and minimum value of 6.3 during the period. The standard deviation of 268.7 for the WEBT and 3046 for USSD shows that there is a wider dispersion in terms of USSD but no significant dispersion for WEBT among sampled years.

In addition, the descriptive statistics result from the table on ATMT and MOBB point to the fact that while the country had an average of about 9108 for the period under consideration; the MOBB usage within the same period under consideration stood at an average of about 2037 billion. The descriptive statistics also shows that during the period the maximum proportion for ATMT was 20957 with the lowest being 399. The MOBB also recorded the maximum value of 8895 and minimum value of 6.65 during the period. The standard deviation of 7842 for the ATMT and 2678 for MOBB shows that there is a wider dispersion in terms of ATMT but no significant dispersion for MOBB among sampled years.

Finally, the mean value for EDUC is 73.57 with maximum and minimum values of 78 and 68 per cent respectively. The standard deviation which stood at 3.49 indicates the nonexistence of clustering of the percentage of the sample around the sample means hence no much gap in distribution.

Table 4.2: Pearson’s Correlation Matrix of all Variables

	FINC	AGNT	WEBT	USSD	ATMT	MOBB	EDUC
FINC	1.000000						
AGNT	0.330245	1.000000					
WEBT	0.411953	0.310310	1.000000				
USSD	0.177549	0.466500	0.416753	1.000000			
ATMT	0.046891	0.405058	0.627909	0.753289	1.000000		
MOBB	0.530241	0.484838	0.770858	0.654001	0.296496	1.000000	
EDUC	0.107060	0.427742	0.580714	0.781618	0.653226	0.318674	1.000000

Source: Researcher’s compilation (2024) from EVIEW Software (Version 11)

A correlation matrix, shown in Table 4.2, was used to assess the degree of association among the explanatory aspects on the one hand and the explained variables on the other. FINC and AGNT, WEBT, USSD, ATMT, MOBB, and EDUC have a positive association, according to the correlation statistics ($r=0.330245$), ($r=0.411953$), ($r=0.177549$), ($r=0.046891$), ($r=0.530241$), and ($r=0.107060$) respectively. Additionally, the connection demonstrates a positive association between AGNT and WEBT ($r=0.310310$), USSD ($r=0.466500$), ATMT ($r=0.405058$), MOBB ($r=0.484838$), and EDUC ($r=0.427742$). Additionally, the matrix shows that WEBT has a positive correlation with USSD ($r=0.416753$), ATMT ($r=0.627909$), MOBB ($r=0.770858$), and EDUC ($r=0.580714$).

Additionally, the correlation matrix reveals a positive association between USSD and ATMT ($r=0.753289$), MOBB ($r=0.654001$) and EDUC ($r=0.781618$). Furthermore, a positive correlation ($r=0.296496$), ($r=0.653226$), between ATMT and MOBB, EDUC respectively is found. Finally, a positive correlation is found between MOBB ($r=0.318674$) and EDUC.

As shown in Table 4.2, none of the variables is strongly correlated with each other ($r>0.8$). Thus, a model of predictor variables (agency banking, web banking, USSD application, ATM transactions, mobile banking) could be used as digital financial services in forecasting financial inclusion in Nigeria.

4.2 Diagnostics Checks

In order to ascertain the fitness of the models specified in this study, the data obtained for the entire variables were further subjected to diagnostic tests for Normality, Autocorrelation, Multicollinearity, and Homoscedasticity. The results of the necessary diagnostic tests carried out in this study are discussed in the following sections:

4.2.1 Normality Tests

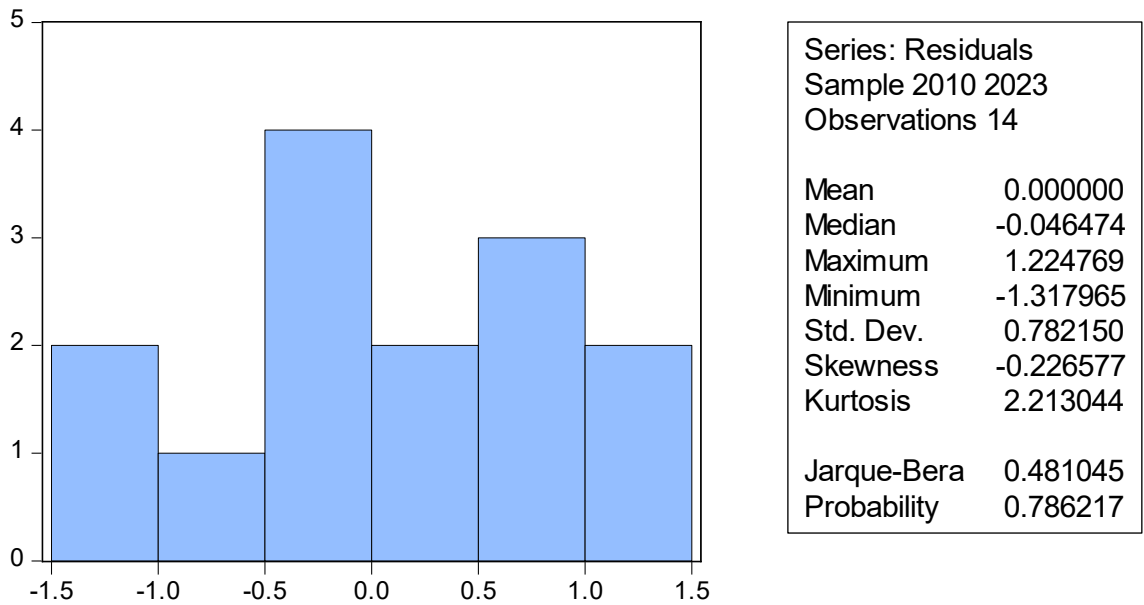


Figure 4.1: Normality Statistics
 Source: Researcher’s compilation (2024) from EVIEW Software (Version 11)

Figure 4.1 is a Normality test diagram that is used to test for normality of the data series. It was conducted using the Jarque-Bera statistics. As observed in the analysis of the normality statistics in figure 4.1, the variables did satisfy the normality criterion as the Jarque-Bera was significant and the p-values higher than the 5% significant level. Normality is all about the distribution of a series around its central mean and because the variables displayed normality in their distribution pattern, this study concludes that one of the basic assumptions of linear regression which allows only normally distributed series has not been violated which necessitated the use of OLS regression technique. Green (2003) argues that time series data regression analysis may produce a disingenuous results if the data are not normally distributed.

4.2.2 Serial Correlation Tests

Table 4.3: Serial Correlation LM Test

F-statistic	6.292193	Prob. F(2,5)	0.1431
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Obs*R-squared 10.01920 Prob. Chi-Square(2) 0.1067

The Breusch-Godfrey Serial Correlation LM Test was used to check for first-order serial correlation. The sufficient condition for the existence of serial autocorrelation is when there is a correlation between consecutive observations in a time series which could lead to spurious results. The results from the test in table 4.3 show Prob. F(2,5) 0.1431 which implies that there is no serial correlation in the model.

4.2.3 Multicollinearity Tests

Table 4.4: VIF Test Results

	Collinearity Tolerance	Statistics VIF
AGNT	4.54E-07	6.33589
WEBT	8.01E-05	1.1385
USSD	1.94E-06	4.8577
ATMT	4.77E-08	2.51332
MOBB	1.57E-06	8.3456
EDUC	0.000106	4.667961

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

The results of the multicollinearity test using the variance inflation factor (VIF) measure are reported in table 4.4. Multicollinearity problems occur where two or more independent variables in a regression are strongly correlated. The problem is typically assessed using the VIF. The results show that each of the independent variables has a VIF value of less than 10. Overall, the mean VIF obtained suggests the absence of multicollinearity among the

independent variables. Therefore, the results of the VIF test indicate that the regression model does not have the problem of multicollinearity.

4.2.4 Heteroscedasticity Test

Table 4.5: The Breusch-Pagan Godfrey Test Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.051769	Prob. F(6,7)	0.4672
Obs*R-squared	6.637453	Prob. Chi-Square(6)	0.3557
Scaled explained SS	1.006440	Prob. Chi-Square(6)	0.9854

The study further employs the Breusch-Pagan Godfrey test to ascertain the presence or absence of heteroscedasticity in the regression result. It is used to test heteroscedasticity in a linear regression model and assumes that residuals are distributed with equal variance at each level of the predictor variable known as homoscedasticity. If the probability value is less than 0.05, the null hypothesis is rejected and concluded that heteroscedasticity is present in the regression. From the table 4.5, our Breusch-Pagan Godfrey test shows Prob. F(6,7) 0.4672 which implies the homoscedastic behaviour is present.

4.2.5 Unit Root Test

The key notion in time series analysis, is to ascertain stationarity of data. The stationarity test is used to confirm that a time series' statistical characteristics do not alter over time. The statistical tests created to test the null hypothesis that a unit root is present in an autoregressive model of the given time series, indicating that the process is not stationary, is the Augmented Dickey-Fuller test (Arellano & Bond, 1991). The results of the stationarity tests performed on the variables are shown in Table 4.6. To avoid spurious regressions which may arise as a result of carrying out regressions on time series data, variables data were subjected to stationarity test, using the Augmented Dickey Fuller (ADF) tests.

Table 4.6: Stationarity Test Results

Variables	Critical values			Order of integration
	1%	5%	10%	
FINC	-4.200056 (0.037)*	3.175352 (0.037)*	-2.728985 (0.037)*	1(1)
AGNT	--4.297073(0.974)	-3.212696 (0.974)	-2.747676 (0.974)	1(O)
WEBT	--4.121990(0.001) *	--3.144920 (0.001)*	--2.713751 (0.001)*	1(1)
USSD	-4.121990 (0.013) *	-3.144920 (0.013)*	-2.713751 (0.013)*	1(1)
ATMT	-4.121990 (0.003) *	--3.144920 (0.000)*	-2.627420(0.002)*	1(1)
MOBB	-4.297073 (0.003) *	-3.212696 (0.000)*	2.747676 (0.002)*	1(1)
EDUC	-4.297073(0.0 02) *	-3.212696 (0.000)*	2.747676 (0.002)*	1(1)

*probability level.

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

The unit root test result presented table 4.6 shows that at various levels of significance (1%, 5% and 10%), the variables were stationary. From the stationarity tests results, all the variables under consideration have first-order integration with their respective p-values less than 0.05 except agency banking which has a probability value higher than 0.05. This implies that, all the parameters used in this study were stationary at first difference I(1); thus, the series estimations exhibit a common unit root process. Meanwhile having established stationarity, co-integration analysis was conducted in other to determine if there is a relationship between the variables under consideration. The Johanson co-integration test was used in this study as shown in Table 4.7.

4.2.6 Tests for Co-integration

To determine whether there is a long-term association between different time series, a co-integration test is utilised. The results of co integration tests reveal situations in which two or more non-stationary time series are combined such that they are unable to depart from equilibrium over the long term. The co-integration method developed by Johansen Fisher is

used in this work. The Co-integration for the study is conducted based on the test proposed by Johansen in 1988.

Table 4.7: Co - integration Test Results

Eigen value	Trace Statistic	5% critical value	Prob.	Hypothesis of CE(s)
0.954367	160.6205	69.81889	0.0000	None *
0.888666	89.61676	47.85613	0.0000	At most 1 *
0.652556	39.12674	29.79707	0.0002	At most 2 *
0.316169	14.81224	15.49471	0.0000	At most 3*
0.232000	6.071222	3.841466	0.1370	At most 4
0.246321	5.347443	4.676758	0.0023	At most 5*

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

The co-integration result for the economic parameters as evidenced in table 4.7 indicates the presence of a co-integrating relationship among the parameters as revealed by the significance of the Fisher Ratio from Trace test and that from Max-Tobin's Eigen test. The probability result indicates that five parameters used in the study are all significant at the five per cent significant levels and one no co-integration at the five per cent significant level. Therefore, the results from the co-integration test are in agreement with procedure for assessment in this study. The implication of this result is that there exist a long-run equilibrium relationship between digital financing systems and financial inclusion in Nigeria.

Table 4.8: OLS Regression Results

Variable	Coefficient	Prob.
AGNT	0.000542	0.0043
WEBT	-0.002498	0.7873
USSD	-0.000122	0.9320
ATMT	5.99E-05	0.0008
MOBB	0.000131	0.0195
EDUC	0.313595	0.0000
R ²	0.807765	
ADJ R ²	0.687618	
F-Stat	13.73767	
P(f-stat)	0.000000	

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

Table 4.8 shows the result for the model, which examines the relationship between digital financing services and level of financial inclusion in Nigeria. As observed, the regression estimation shows an R^2 value of 0.807 which suggests a 80.7% explanatory ability of the model for the systematic variations in the dependent variable with an adjusted value of 0.687. The regression estimates from table 4.8 serve as basis for testing of hypotheses in the following subsections.

4.4 Hypotheses Testing

In discussing the results, the regression estimates are utilized to examine the relationship between the dependent variable financial inclusion and the independent variables measured as agency banking, web banking, USSD transactions, ATM transactions, and mobile banking. For emphasis, the hypotheses are restated first before explaining the results. The decision rule is to reject the null hypothesis of no significant association if the probability value is less than 5% and accept the alternative.

4.3.1 Hypothesis 1

H_{01} : There is no significant relationship between agency banking and financial inclusion in Nigeria.

Table 4.9: OLS Regression Results for Hypothesis One

Variable	Coefficient	t-Statistic	P-value
AGNT	0.000542	0.804676	0.0043

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

Hypothesis one examines the association between agency banking and financial inclusion in Nigeria. As observed, the regression estimates in (Table 4.9) reveal a positive coefficient and statistically significant at 5% level of significance FINC and AGNT ($\beta_{1AGNT}t = 0.000542$, $p=0.0043 < 0.05$). The positive coefficient suggests that an increase in agency banking

outlets will lead to higher financial inclusion in Nigeria. We, therefore have enough evidence to reject the null hypothesis as the results suggest that there is significant positive relationship between agency banking and level of financial inclusion in Nigeria.

4.3.2 Hypothesis 2

H₀₂: There is no significant relationship between web transactions and financial inclusion in Nigeria.

Table 4.10: OLS Regression Results for Hypothesis Two

Variable	Coefficient	t-Statistic	P-value
WEBT	-0.002498	-0.279060	0.7873

Source: Researcher’s compilation (2024) from EVIEW Software (Version 11)

The relationship between web transactions and financial inclusion was subjected to an empirical test in hypothesis two. To test this hypothesis, we read off the regression statistics from Table 4.9 for the model. It can be seen that the coefficient is negative but not statistically significant. The negative coefficient suggests that web transactions do not influence financial inclusion in Nigeria ($\beta_3WEBTt=-0.002498, p=0.7873, p>0.05$). Therefore hypothesis of no significant relationship between web transactions and financial inclusion in Nigeria is supported. By implication, an increase in web transaction decreases the financial inclusion level but not a major determinant. We, therefore, have enough evidence to accept the null hypothesis and conclude that there is no significant relationship between web transactions and level of financial inclusion in Nigeria.

4.3.3 Hypothesis 3

H₀₃: There is no significant relationship between USSD transactions and financial inclusion in Nigeria.

Table 4.11: OLS Regression Results for Hypothesis Three

Variable	Coefficient	t-Statistic	P-value
USSD	-0.000122	-0.088033	0.9320

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

This hypothesis examines the link between USSD transactions and financial inclusion in Nigeria. The model estimate found at table 4.9 would serve as the backdrop for testing this hypothesis. The model results show that the interaction between USSD transactions and financial inclusion is negative but not significant ($\beta_4 \text{USSDt} = -0.000122, p=0.9320$). Therefore, this study is able to accept the null hypothesis and thus states that there is no significant relationship between USSD transactions and the level of financial inclusion in Nigeria.

4.3.4 Hypothesis 4

H₀₄: There is no significant relationship between ATM transactions and financial inclusion in Nigeria.

Table 4.12: OLS Regression Results for Hypothesis Four

Variable	Coefficient	t-Statistic	P-value
ATMT	5.99E-05	0.274364	0.0008

Source: Researcher's compilation (2024) from EVIEW Software (Version 11)

This hypothesis examines the link between ATM transactions and financial inclusion in Nigeria. The model estimate in table 4.9 would serve as the backdrop for testing this hypothesis. The model results show that the interaction between ATM transactions and financial inclusion is positive and significant ($\beta_4 \text{ATMTt} = 5.99\text{E-}05, p=0.0008$). Therefore, this study is able to reject the null hypothesis and accept the alternative, which thus states that

there is a significant positive relationship between ATM transactions and financial inclusion in Nigeria.

4.3.5 Hypothesis 5

H₀₅: There is no significant relationship between mobile banking and financial inclusion in Nigeria.

Table 4.13: OLS Regression Results for Hypothesis Five

Variable	Coefficient	t-Statistic	P-value
MOBB	0.000131	0.104251	0.0195

Source: Researcher’s compilation (2024) from EVIEW Software (Version 11)

The estimated co-efficient of the effect of mobile banking on financial inclusion in Table 4.9 would serve as the backdrop for testing this hypothesis. To achieve this aim, we read off the regression result in the model in Table 4.9 which reveals a positive coefficient between mobile banking and financial inclusion. ($\beta_5MOBB_t = 0.000131$, $p = 0.00195$, $P < 0.05$). The coefficient is found to be positive and statistically significant at the 5 percent level ($0.0000 < 0.05$). We, therefore, have a statistical evidence to reject the above-stated hypothesis and we conclude that mobile banking significantly affects the level of financial inclusion in Nigeria during the period of study.

4.5 Discussion of Findings

This study aims to examine the relationship between digital financial services and financial inclusion in Nigeria. An empirical examination of some variables was conducted to determine to what extent they influence the level of financial inclusion in Nigeria. The findings of the study are discussed below:

4.5.1 Relationship between Agency Banking and Financial Inclusion

First, the regression estimates on the relationship between agency banking and financial inclusion revealed a positive and significant association. The result implies that the higher the volume of agency banking, the higher the level of financial inclusion in Nigeria for the period under investigation. The result meets our *a priori* expectation. We anticipated that better patronage to agency banking mechanism will improve access to financial services and enhance better financial inclusion in the country. This result is consistent with prior studies such as Bu et al. (2024), Risal (2018), Ubah et al. (2023), and Iwedi (2023) in which agency banking in form of POS operations was found to positively impact on financial inclusion. This result however does not agree with some studies (Greta et al., 2024; Risal, 2018), in which agency banking was found to be positive but not significant.

4.5.2 Relationship between Web Transactions and Financial Inclusion

As regards web transactions, findings from regression estimates indicate that a negative but not significant association exists between web payments and financial inclusion in Nigeria. This result implies that web transactions do not significantly influence the level of financial inclusion in Nigeria. The finding did not meet our *a priori* expectation. Previous studies such as Risman *et al.* (2021) and Johri *et al.* (2024) report similar conclusion.

4.5.3 Relationship between USSD transactions and Financial Inclusion

As regards the third hypothesis, regression result on the link between USSD transactions and level of financial inclusion has been observed to be negative but not statistically significant. This implies that higher percentage of USSD transactions reduces level of financial inclusion in Nigeria. This result did not meet our *a priori* expectations as we expected that increase in USSD financing activities will enhance financial access, and by implication the financial

inclusion. The finding of this study as regards USSD transactions is in congruence with Amnas and Satyanarayana (2024), Gbalam and Dumani (2020), and Ene *et al.* (2019) who found that USSD contributes to financial inclusion but very insignificantly.

4.4.4 Relationship between ATM Transactions and Financial Inclusion

In addition, the regression estimates on the association between ATM transactions and level of financial inclusion reveals a positive and significant association in Nigeria. The result implies that the higher the volume of ATM usage by the public will improve financial inclusion in Nigeria for the period under investigation. The result meets our *a priori* expectation and is validated by the technology acceptance hypothesis. We anticipated that high proportion of ATM transactions will improve public access to money and funding which will in turn increase the rate of financial inclusion. This result is consistent with prior studies such as Olubukola *et al.* (2023), Ehiedu *et al.* (2023), Uzor (2022), and Otuya *et al.* (2022) in which electronic and digital banking services have been found to be positively correlated with financial inclusion. However, studies by Alam *et al.* (2024) and Gbanador (2023) reported a non-significant positive effect.

4.5.5 Relationship between Mobile Banking and Financial Inclusion

As to whether mobile banking affects financial inclusion in Nigeria, the results from the regression estimates indicate a positive effect of mobile banking on financial inclusion in Nigeria. This result connotes that higher deployment of mobile banking applications and systems will enhance the level of financial inclusion. This result meets our *a priori* expectation because we envisaged that higher use of mobile apps has influenced the level of financial inclusion and access to finance in Nigeria. This result is consistent with prior studies by Tan *et al.* (2024), Bu *et al.* (2024), Al Khub and Ali (2024), Ubah *et al.* (2023), and Iwedi (2023).

4.5.6 Relationship between Financial Literacy (Control Variable) and Financial Inclusion

As regards the control variable of financial literacy, the study found a positive and significant relationship between financial literacy and financial inclusion in Nigeria. The implication is that higher level of education has a positive and significant influence on the use and adoption of financial services which in turn enhances financial inclusion. Prior studies such as Otuya *et al.* (2024), and Iwedi (2023) support this finding.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the research in terms of the work done and empirical findings, conclusion and recommendations. It also discusses areas of opportunity for subsequent research as well as contribution of the study to knowledge.

5.2 Summary of Findings

In line with the study hypotheses, the following findings were made:

1. There is a positive and significant relationship between agency banking and financial inclusion in Nigeria.

2. There is a negative but not significant relationship between web banking and financial inclusion in Nigeria.
3. There is a negative and non-significant relationship between USSD transactions and financial inclusion in Nigeria.
4. There is a positive and significant relationship between ATM transactions and financial inclusion in Nigeria.
5. There is a positive and significant relationship between mobile banking transactions and financial inclusion in Nigeria.

5.3 Conclusion

There has been a plethora of empirical work in the literature on electronic banking, use of information and communication technology and digital financial services and how they affect financial inclusion. The literature on electronic banking, digital financial services and the resulting effect on financial inclusion is indeed diverse and has been a subject of intense research in finance, accounting, and management in recent times in both developed and developing nations. However, a review of the literature brings up some research gaps in finance and economics management practices as they relate to financial inclusion. First, available empirical evidence regarding the relationship between different measures of digital financial services provides an unclear picture with some studies showing different patterns of digital financial services or electronic banking as having a positive effect on financial inclusion while others provide divergent and conflicting results.

Against this backdrop, this study extends the existing literature on the relationship between digital financial services using listed data in Nigeria. To achieve the study's aim, a quantitative research design research was adopted. The study's data were collected from content analysis of annual reports and statistical bulletin of the Central Bank of Nigeria. The

originality of our analysis comes from its disaggregation of exploratory variables into several variants based on the analysis of data from the CBN for the years 2010 to 2023. We conducted some simple descriptive statistics and piloted some correlation and diagnostic tests. The OLS regression model was used to verify whether the studied variables impact the level of financial inclusion in Nigeria.

The study, using results of the statistics and exploratory variables in an OLS regression model show that agency banking, ATM transactions, and mobile banking have a significant positive relationship with financial inclusion in Nigeria. The study also establishes a negative but not significant relationship between web payments and USSD transactions and financial inclusion in Nigeria. The study, therefore, concludes that digital financial services positively contributes to the level of financial inclusion in Nigeria.

5.4 Recommendations

In line with the findings of this study, the following recommendations are proffered:

First, agency banking is found to have a positive link with financial inclusion in Nigeria. In view of this, it is recommended that the regulatory authorities and the banking sector should reduce the fees for obtaining and maintaining POS machines in the country. This will further enhance the level of financial inclusion in Nigeria.

Second, the study's finding also show that web transactions do not significantly improve the level of financial inclusion. Against this backdrop, this study recommends that concerted efforts should be put to sensitize the public on the use of internet banking as this would go a

long way to increase the access of individuals to funding without going to the bank thereby contributing to financial inclusion.

Third, the study has shown that USSD transaction have a negative effect on financial inclusion. In order to mitigate this negative effect it is therefore recommended that banks should improve on their USSD services while also imploring the network services providers to improve on network connectivity.

Fourth, the study found that ATM transactions positively and significantly affects the level of financial inclusion in Nigeria. It is also recommended that banks should increase the ATM spread to reach out to the interior villages and rural areas that are naturally excluded from the banking services. This will go a long way to improve financial inclusion in Nigeria.

Fifth, given the dynamics of mobile banking and as component of digital financial services as seen in this study, and the resultant effect on financial inclusion which is positive and significant, it is recommended that more mobile banking facilities be established by the deposit money banks. This should also be extended to the microfinancing institutions in Nigeria to reach a wider financial audience.

5.4 Suggestions for Further Studies

While the findings of this study are shown to be robust, however, like all other research studies, this study is not exempted from limitations, which warrants future research recommendations. First, this study's focus is on digital financial services offered by financial institutions. The findings may not fully capture behavioural aspects of banking practices and inclusion strategies of informal financial institutions. There is a need to expand the scope of this study in future research using primary data to cover informal financial institutions like thrift and saving, societies, and even micro finance banks in order to broaden the frontier of knowledge.

Secondly, this study applies a country level-specific drivers in the context of financial inclusion data and information about Nigeria. Future studies may adopt panel data drivers in comparative studies among countries such as West, East or Sub-Saharan Africa.

5.6 Contribution to Knowledge

This study contributes to knowledge through a methodological advancement by proposing and applying, for the first time, a comprehensive analysis covering five digital financial services variables that have been rarely undertaken in prior studies. This study provides empirical evidence on the positive impact of digital financing on financial inclusion in Nigeria, contributing to the existing literature on digital finance and financial inclusion. By focusing on Nigeria, a key emerging market, the study offers context-specific insights for policymakers and practitioners seeking to enhance financial inclusion. The findings suggest that promoting digital financing initiatives can be an effective strategy for increasing financial access and usage, informing policy decisions and interventions aimed at bridging the financial inclusion gap in Nigeria.

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APPENDICES

Null Hypothesis: FINC has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.743027	0.8014
Test critical values: 1% level	-4.057910	

5% level -3.119910
 10% level -2.701103

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FINC)

Method: Least Squares

Date: 12/02/24 Time: 04:20

Sample (adjusted): 2011 2023

Included observations: 13 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FINC(-1)	-0.175995	0.236862	-0.743027	0.4730
C	4.651919	5.441633	0.854876	0.4109
R-squared	0.047791	Mean dependent var	0.622308	
Adjusted R-squared	-0.038773	S.D. dependent var	1.581635	
S.E. of regression	1.612006	Akaike info criterion	3.933474	
Sum squared resid	28.58419	Schwarz criterion	4.020389	
Log likelihood	-23.56758	Hannan-Quinn criter.	3.915609	
F-statistic	0.552089	Durbin-Watson stat	1.982303	
Prob(F-statistic)	0.473036			

Null Hypothesis: D(FINC) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.368129	0.0370
Test critical values: 1% level	-4.200056	
5% level	-3.175352	
10% level	-2.728985	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(FINC,2)

Method: Least Squares

Date: 12/02/24 Time: 04:22

Sample (adjusted): 2013 2023

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FINC(-1))	-1.968310	0.584393	-3.368129	0.0098
D(FINC(-1),2)	0.748044	0.439041	1.703814	0.1268
C	0.961150	0.548794	1.751385	0.1180
R-squared	0.678770	Mean dependent var	-0.071818	
Adjusted R-squared	0.598462	S.D. dependent var	2.533783	
S.E. of regression	1.605582	Akaike info criterion	4.011851	
Sum squared resid	20.62316	Schwarz criterion	4.120368	
Log likelihood	-19.06518	Hannan-Quinn criter.	3.943446	
F-statistic	8.452130	Durbin-Watson stat	1.920969	
Prob(F-statistic)	0.010648			

Null Hypothesis: D(AGNT) has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.462084	0.974
Test critical values: 1% level	-4.297073	
5% level	-3.212696	
10% level	-2.747676	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(AGNT,2)

Method: Least Squares

Date: 12/02/24 Time: 04:24

Sample (adjusted): 2014 2023

Included observations: 10 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AGNT(-1))	0.295808	0.640162	0.462084	0.6603
D(AGNT(-1),2)	-2.696646	0.616866	-4.371528	0.0047
D(AGNT(-2),2)	-2.940708	0.627366	-4.687391	0.0034
C	751.6675	479.6465	1.567128	0.1681
R-squared	0.901910	Mean dependent var	310.9820	
Adjusted R-squared	0.852866	S.D. dependent var	2412.080	
S.E. of regression	925.2281	Akaike info criterion	16.78713	
Sum squared resid	5136282.	Schwarz criterion	16.90817	
Log likelihood	-79.93566	Hannan-Quinn criter.	16.65436	
F-statistic	18.38953	Durbin-Watson stat	1.660858	
Prob(F-statistic)	0.001987			

Null Hypothesis: D(WEBT) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.701737	0.0019
Test critical values: 1% level	-4.121990	
5% level	-3.144920	
10% level	-2.713751	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(WEBT,2)

Method: Least Squares

Date: 12/02/24 Time: 04:25

Sample (adjusted): 2012 2023

Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(WEBT(-1))	-0.836397	0.309577	-2.701737	0.0222
C	46.75680	38.75136	1.206585	0.2554
R-squared	0.421945	Mean dependent var	16.19417	
Adjusted R-squared	0.364139	S.D. dependent var	161.0111	
S.E. of regression	128.3917	Akaike info criterion	12.69906	
Sum squared resid	164844.2	Schwarz criterion	12.77988	
Log likelihood	-74.19436	Hannan-Quinn criter.	12.66914	
F-statistic	7.299382	Durbin-Watson stat	1.850853	
Prob(F-statistic)	0.022247			

Null Hypothesis: D(USSD) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.311223	0.0136
Test critical values: 1% level	-4.121990	
5% level	-3.144920	
10% level	-2.713751	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(USSD,2)

Method: Least Squares

Date: 12/02/24 Time: 04:26

Sample (adjusted): 2012 2023

Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(USSD(-1))	-0.793446	0.343301	-2.311223	0.0434
C	637.2119	362.7147	1.756785	0.1095
R-squared	0.348184	Mean dependent var	186.5775	
Adjusted R-squared	0.283002	S.D. dependent var	1251.251	
S.E. of regression	1059.506	Akaike info criterion	16.92000	
Sum squared resid	11225530	Schwarz criterion	17.00082	
Log likelihood	-99.52003	Hannan-Quinn criter.	16.89008	
F-statistic	5.341751	Durbin-Watson stat	1.811998	
Prob(F-statistic)	0.043417			

Null Hypothesis: D(ATMT) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.351814	0.0357
Test critical values: 1% level	-4.121990	
5% level	-3.144920	
10% level	-2.713751	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(ATMT,2)

Method: Least Squares

Date: 12/02/24 Time: 04:27

Sample (adjusted): 2012 2023

Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ATMT(-1))	-1.055791	0.314991	-3.351814	0.0073
C	1705.398	721.9848	2.362097	0.0398
R-squared	0.529072	Mean dependent var	19.29667	
Adjusted R-squared	0.481979	S.D. dependent var	2492.616	
S.E. of regression	1794.028	Akaike info criterion	17.97333	
Sum squared resid	32185353	Schwarz criterion	18.05414	
Log likelihood	-105.8400	Hannan-Quinn criter.	17.94340	
F-statistic	11.23466	Durbin-Watson stat	1.985258	
Prob(F-statistic)	0.007343			

Null Hypothesis: D(MOBB) has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	5.238412	1.0000
Test critical values: 1% level	-4.297073	
5% level	-3.212696	
10% level	-2.747676	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MOBB,2)

Method: Least Squares

Date: 12/02/24 Time: 04:28

Sample (adjusted): 2014 2023

Included observations: 10 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MOBB(-1))	1.279674	0.244287	5.238412	0.0019
D(MOBB(-1),2)	-1.850226	0.514792	-3.594125	0.0114
D(MOBB(-2),2)	-1.275261	0.458029	-2.784236	0.0318
C	-17.20842	75.25048	-0.228682	0.8267
R-squared	0.868529	Mean dependent var	270.9010	
Adjusted R-squared	0.802794	S.D. dependent var	353.7133	
S.E. of regression	157.0767	Akaike info criterion	13.24052	
Sum squared resid	148038.6	Schwarz criterion	13.36155	
Log likelihood	-62.20260	Hannan-Quinn criter.	13.10775	
F-statistic	13.21249	Durbin-Watson stat	2.499683	
Prob(F-statistic)	0.004719			

Null Hypothesis: D(EDUC) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=2)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.680364	0.0207
Test critical values: 1% level	-4.121990	
5% level	-3.144920	
10% level	-2.713751	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(EDUC,2)

Method: Least Squares

Date: 12/02/24 Time: 04:28

Sample (adjusted): 2012 2023

Included observations: 12 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EDUC(-1))	-1.081068	0.293740	-3.680364	0.0042
C	0.887197	0.254106	3.491446	0.0058
R-squared	0.575283	Mean dependent var	0.013333	
Adjusted R-squared	0.532811	S.D. dependent var	0.458720	
S.E. of regression	0.313541	Akaike info criterion	0.669238	
Sum squared resid	0.983079	Schwarz criterion	0.750055	
Log likelihood	-2.015426	Hannan-Quinn criter.	0.639316	
F-statistic	13.54508	Durbin-Watson stat	0.786170	
Prob(F-statistic)	0.004244			

Dependent Variable: FINC

Method: Least Squares

Date: 12/01/24 Time: 10:51

Sample: 2010 2023

Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGNT	0.000542	0.000674	0.804676	0.0043

WEBT	-0.002498	0.008952	-0.279060	0.7873
USSD	-0.000122	0.001391	-0.088033	0.9320
ATMT	5.99E-05	0.000218	0.274364	0.0008
MOBB	0.000131	0.001253	0.104251	0.0195
EDUC	0.313595	0.010274	30.52254	0.0000
<hr/>				
R-squared	0.807765	Mean dependent var	23.26786	
Adjusted R-squared	0.687618	S.D. dependent var	2.344598	
S.E. of regression	1.310423	Akaike info criterion	3.676105	
Sum squared resid	13.73767	Schwarz criterion	3.949986	
Log likelihood	-19.73273	Hannan-Quinn criter.	3.650752	
Durbin-Watson stat	1.548507			

APPENDIX II

RAW FINANCIAL DATA

Year	FINC (%)	AGNT (N'B)	WEBT (N'B)	USSD (N'B)	ATMT (N'B)	MOBB (N'B)	EDUC (%)
2010	20.01	12.72	84.15	6.65	399.71	6.65	68.11
2011	19.8	31.02	25.05	18.98	1,561.74	18.98	68.38

2012	21.35	48.01	59.61	31.51	1,984.66	31.51	69.84
2013	23.16	161.02	31.57	142.80	2,828.94	142.80	70.71
2014	22.65	312.07	47.32	346.47	3,679.88	346.47	71.57
2015	21.94	448.51	74.04	442.35	3,970.25	442.35	72.44
2016	23.65	759.00	132.36	756.90	4985.85	756.24	73.30
2017	24.90	1,409.81	184.60	1,102.00	6436.98	1100.02	74.26
2018	23.07	2,383.11	404.60	1,974.25	12837.54	1435.65	75.08
2019	23.52	3,204.75	732.23	5,080.96	13633.13	1975.75	75.89
2020	23.36	5,894.32	609.51	5,118.42	15714.24	3075.1	76.75
2021	22.90	4,455.41	545.04	5,179.90	18964.80	4221.56	77.62
2022	27.34	8,637.97	522.64	6,822.00	19563.75	6075.34	77.81
2023	28.10	11,860.8	657.87	9,073.26	20957.34	8895.64	78.24

Sources: Statistical Bulletins of the Central Bank of Nigeria, World Bank Reports, Bureau of Statistics (2010-2023).