Impact of Mobile Payments on Financial Inclusion in Nigeria

Ofure Josephine CHIEJINA
Department of Accounting, Business Administration and Economics,
Admiralty University of Nigeria, Ibusa, Delta State
Email: josypel2000@yahoo.com
ofurechiejina@gmail.com

Romanus Chukwumah IKE
Department of Accounting, Business Administration and Economics,
Admiralty University of Nigeria, Ibusa, Delta State
Email: ikeromanus406@gmail.com

Abstract

The research analysed the influence of mobile payments (MPs) on financial inclusion (FI) in Nigeria from 2001 to 2023 (23 years). This was conducted about mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW), and their influence on FI, as indicated by total rural deposits (TRD) in Nigeria. This study employed secondary data gathering methods, utilising time series data from the CBN Bank Supervisory Annual Report, CBN Statistical Bulletin, and Nigeria Deposit Insurance Corporation NDIC) Annual Reports covering the period from 2001 to 2023. The study employed several statistical techniques, including descriptive statistics, correlation analysis, and further diagnostic tests. Based on the hypothesis established for this research, the selected method of data analysis was ordinary least squares (OLS) regression analysis, utilising the software E-VIEWS 9.0. The results indicated that MB and USSD exert a positive significant influence on TRD in Nigeria, whereas EW has a negative negligible effect on TRD in Nigeria. The study revealed that MPs significantly influence FI in Nigeria. The study recommended that financial institutions should expand the reach of mobile banking and USSD services by improving network infrastructure in rural areas and reducing transaction costs. Governments and stakeholders should implement educational campaigns to enhance the understanding and trust of rural populations in mobile payment systems, including e-wallets.

Keywords: Mobile, Payments, Financial, Inclusion, Banking and E-Wallets

Introduction

The advent of MPs has been heralded as a transformative development in the global financial ecosystem, with significant implications for enhancing FI. Mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW) have emerged as pivotal conduits for bridging the gap between formal financial services and unbanked or underbanked populations. FI, often measured through proxies such as total rural deposits (TRD), reflects the extent to which individuals and businesses in remote or underserved areas can access and utilize affordable, convenient, and secure financial services. In Nigeria, a country with a substantial rural population and pervasive financial exclusion challenges, the nexus between mobile payment systems and FI merits a detailed examination.

Mobile banking, defined as the use of mobile devices to access financial services, has seen rapid adoption globally, including in sub-Saharan Africa. Nigeria, with its burgeoning mobile phone penetration rate, has experienced an increase in mobile banking adoption, which has been facilitated by regulatory frameworks and collaborations between financial institutions and mobile network operators. According to recent data, mobile banking transactions in Nigeria accounted for over a quarter of all electronic payments in 2022, indicating a growing reliance on digital platforms for financial activities (Central Bank of Nigeria [CBN], 2022). This growth has been propelled by the ability of mobile banking to offer real-time account management, fund transfers, and bill payments, which are crucial for rural populations who face logistical and infrastructural barriers to accessing physical bank branches (Okafor et al., 2021).

Similarly, USSD technology has emerged as a cost-effective and user-friendly platform for FI. USSD, a communication protocol used on GSM networks, enables users to perform financial transactions without the need for internet connectivity or sophisticated mobile devices. This feature makes USSD particularly relevant for Nigeria's rural and low-income demographics, where smartphone penetration remains relatively low. Studies have highlighted that USSD-based financial services significantly lower transaction costs and enhance accessibility, thereby incentivizing greater participation in the formal financial system (Adelakun et al., 2020; Kikulwe et al., 2021). Moreover, the Nigerian Inter-Bank Settlement System (NIBSS) reported a 35% increase in USSD transaction volume in 2021, underscoring its growing role in the country's financial landscape (NIBSS, 2021).

E-wallets, another critical component of mobile payment systems, have gained prominence as digital tools that allow users to store, transfer, and receive money electronically. The flexibility and convenience offered by e-wallets have made them a popular choice among Nigeria's youth and entrepreneurial population, particularly in rural areas where traditional banking services are scarce. The proliferation of fintech companies in Nigeria has further accelerated the adoption of e-wallets, with platforms such as Paga, Opay, and PalmPay becoming household names. Research indicates that e-wallets contribute to FI by fostering savings habits and enabling micro-

transactions, which are essential for the economic empowerment of rural communities (Akinola & Olayemi, 2022; Owolabi et al., 2021).

The linkage between mobile payment systems and FI is intricately tied to their capacity to mobilize savings and deposits, as captured by TRD. Rural deposits serve as a barometer for FI, reflecting the extent to which rural populations engage with formal financial institutions. In Nigeria, where over 40% of the population resides in rural areas, the mobilization of rural deposits is critical for achieving sustainable development and poverty alleviation goals (World Bank, 2022). Mobile payment systems have demonstrated a significant impact on rural deposit mobilization by reducing the cost and complexity of financial transactions. For instance, USSD platforms allow farmers and small-scale traders to deposit money directly into their accounts, thereby promoting a culture of savings and financial discipline (Eze et al., 2021).

Despite these advancements, the interplay between mobile payment systems and FI in Nigeria is not without challenges. Issues such as inadequate digital literacy, cybersecurity risks, and infrastructural deficits continue to hinder the full realization of MPs' potential. Digital literacy, or the ability to effectively use digital tools and platforms, remains a critical barrier, particularly among older and less educated segments of the rural population. According to a recent survey, only 25% of rural Nigerians possess basic digital skills, which limits their ability to utilize mobile banking, USSD, and e-wallet services effectively (National Bureau of Statistics [NBS], 2021). To address this gap, stakeholders have initiated financial literacy campaigns and partnered with community-based organizations to promote digital inclusion (Ademola et al., 2022).

Cybersecurity risks also pose a significant threat to the adoption and effectiveness of mobile payment systems. The rise in digital transactions has been accompanied by an increase in fraud and cyberattacks, which erode trust in mobile payment platforms. In Nigeria, cybercrime-related losses in the financial sector amounted to over $500 million in 2021, highlighting the urgent need for robust cybersecurity measures (CBN, 2021). Regulatory bodies, such as the Central Bank of Nigeria, have introduced guidelines to enhance the security of electronic payment systems, including the implementation of multi-factor authentication and real-time fraud detection mechanisms (Olaoye & Alade, 2021).

Furthermore, infrastructural deficits, including unreliable electricity supply and limited network coverage, continue to impede the expansion of mobile payment systems in rural Nigeria. Many rural areas lack the necessary infrastructure to support seamless digital transactions, resulting in frequent service disruptions and transaction failures. Addressing these challenges requires concerted efforts from both the public and private sectors, including investments in telecommunications infrastructure and the deployment of alternative energy solutions to power digital platforms (Okeke et al., 2021).

The role of government policy and regulation in shaping the trajectory of mobile payment systems and FI in Nigeria cannot be overstated. The Central Bank of Nigeria has implemented several initiatives aimed at promoting cashless transactions and enhancing FI. For example, the National

FI Strategy (NFIS), launched in 2012, sets ambitious targets for increasing the percentage of Nigerian adults with access to formal financial services. As of 2022, the NFIS has facilitated the onboarding of millions of previously unbanked individuals through mobile banking and e-wallet platforms (CBN, 2022). Additionally, regulatory frameworks, such as the Payment Service Bank (PSB) license, have encouraged the entry of non-traditional players into the financial sector, thereby fostering innovation and competition (Adejumo et al., 2022). Private sector initiatives have also played a crucial role in driving the adoption of mobile payment systems in Nigeria. Fintech companies, in particular, have leveraged technology and data analytics to develop user-centric solutions that cater to the unique needs of rural and underserved populations. For instance, fintech platforms that integrate USSD functionality with e-wallet services have enabled users to perform a wide range of financial transactions, from bill payments to loan applications, without requiring internet access. Such innovations have not only enhanced convenience but also reduced the cost of financial services, making them more accessible to low-income earners (Oluwaseun & Fadeyi, 2021).

The impact of mobile payment systems on FI extends beyond economic considerations to social and developmental outcomes. By facilitating access to formal financial services, mobile banking, USSD, and e-wallets empower individuals and communities to participate more actively in the economy. This, in turn, contributes to poverty reduction, gender equality, and improved livelihoods. Studies have shown that women, who constitute a significant proportion of the financially excluded population in Nigeria, are increasingly adopting mobile payment platforms to access credit and savings products, thereby enhancing their economic independence and social status (Adeoye et al., 2022; Bolarinwa et al., 2021). Hence, MPs, as proxied by mobile banking, USSD, and e-wallets, have demonstrated significant potential in enhancing FI in Nigeria, as evidenced by their impact on total rural deposits. While substantial progress has been made, addressing the persisting challenges of digital literacy, cybersecurity, and infrastructural deficits is crucial for maximizing the benefits of these platforms. The collaborative efforts of government, private sector players, and community stakeholders are essential for creating an enabling environment that fosters innovation, trust, and inclusivity in the financial ecosystem. As Nigeria continues its journey toward achieving comprehensive FI, the role of mobile payment systems will remain central to this transformative agenda.

Statement of the Problem

Despite the widespread adoption of mobile payment systems, including mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW), significant gaps remain in achieving comprehensive FI in Nigeria, particularly in rural areas. Prior studies have highlighted the potential of these technologies to bridge the financial divide by enhancing accessibility and reducing transaction costs. However, the direct relationship between these mobile payment platforms and FI, as proxied by total rural deposits (TRD), remains underexplored. Existing research often focuses on adoption rates, user behavior, or general financial access but fails to adequately investigate the extent to which these platforms contribute to mobilizing rural savings

and fostering sustainable financial engagement. Additionally, while studies acknowledge challenges such as digital literacy deficits, infrastructural limitations, and cybersecurity concerns, they provide limited empirical insights into how these barriers moderate the impact of mobile payment systems on FI. For instance, digital literacy remains a critical issue among rural populations, yet its influence on the effectiveness of mobile banking and USSD in driving rural deposits is not well-documented. Similarly, while e-wallets are increasingly popular, their role in cultivating savings behavior and formal financial engagement in underserved areas is insufficiently addressed.

A significant variable gap in existing studies lies in the limited focus on how mobile payment platforms—mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW)—specifically influence total rural deposits (TRD), a key proxy for FI. While previous research emphasizes adoption and usage patterns of these technologies (Ademola, Adebayo, & Ogundele, 2022; Oluwaseun & Fadeyi, 2021), few studies connect these platforms directly to measurable financial outcomes such as rural deposit mobilization. Additionally, variables such as digital literacy, infrastructural readiness, and trust in financial systems are often discussed qualitatively but not incorporated quantitatively to assess their moderating or mediating effects on the relationship between mobile payment systems and FI (Akinola & Olayemi, 2022; National Bureau of Statistics [NBS], 2021). This creates a gap in understanding how these factors collectively shape the financial behaviors of rural populations.Although the impact of mobile payment systems on FI has been widely studied, there is a lack of consistent findings regarding their effectiveness in rural contexts. For example, some studies suggest that mobile banking has a transformative effect on savings and deposits (Okafor, Eze, & Chukwuma, 2021), while others highlight that infrastructural and literacy challenges significantly limit its reach (Okeke, Udeh, & Nnamani, 2021). Similarly, while USSD platforms are hailed for their accessibility, their actual impact on rural deposit mobilization remains inconclusive, with some studies showing minimal change due to persistent distrust of digital systems (Adelakun, Olusegun, & Adeyemi, 2020). In the case of e-wallets, findings are fragmented, with some researchers emphasizing their role in promoting savings culture (Owolabi, Adetunji, & Olamide, 2021) while others point to the limited adoption among older and less tech-savvy demographics in rural areas (Adeoye, Oladele, & Balogun, 2022). These inconsistencies suggest a need for more robust, context-specific analyses that clarify the nuanced impacts of mobile payment systems on rural FI.

These gaps underscore the need for a comprehensive analysis that integrates these variables and evaluates their interplay to provide actionable insights for enhancing FI in Nigeria's rural sectors. Hence, this study examine the effect of MPs as proxied by mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW), on FI, as proxied by total rural deposits (TRD) in Nigeria.

Objectives of the Study

The main objective of this study is to examine the impact of MPs on FI in Nigeria. The specific objectives are:

1. To evaluate the impact of mobile banking (MB) on total rural deposits (TRD) in Nigeria.

2. To assess the influence of unstructured supplementary service data (USSD) platforms on total rural deposits (TRD) in Nigeria.

3. To determine the role of e-wallets (EW) in fostering savings and total rural deposits (TRD) in Nigeria.

Research Hypotheses

$H0_1$: Mobile banking (MB) has a significant positive effect on total rural deposits (TRD) in Nigeria.

$H0_2$: Unstructured supplementary service data (USSD) platforms significantly influence the total rural deposits (TRD) in Nigeria.

$H0_3$: E-wallets (EW) have a significant positive effect on total rural deposits (TRD) in Nigeria.

Literature Review

Conceptual Review

MPs, characterized by the integration of mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW), represent a technological innovation that has reshaped financial systems globally. In the Nigerian context, these digital payment systems have emerged as critical tools for enhancing FI, particularly in rural areas where access to traditional banking infrastructure remains limited. FI, often proxied by metrics like total rural deposits (TRD), is pivotal for sustainable development, poverty reduction, and economic growth (World Bank, 2022). This review explores the conceptual linkages between MPs and FI in rural Nigeria, drawing on recent empirical and theoretical perspectives.

Mobile Banking (MB) and FI

Mobile banking (MB) involves using mobile devices to access financial services such as account management, fund transfers, and bill payments. It eliminates the need for physical bank visits, thus reducing costs and logistical barriers for rural users. Studies indicate that MB facilitates FI by

providing real-time, accessible, and secure financial services (Okafor, Eze, & Chukwuma, 2021). The Central Bank of Nigeria (CBN) has reported a steady increase in mobile banking adoption, with transaction volumes reaching unprecedented levels between 2020 and 2022, reflecting a growing trust in digital platforms (CBN, 2022). However, rural adoption of MB faces challenges such as low smartphone penetration and limited internet access. To mitigate these challenges, partnerships between financial institutions and telecommunications providers have enabled MB innovations that operate efficiently even on low-bandwidth networks (Akinola & Olayemi, 2022). For instance, mobile banking services integrated with voice-assisted technology have been deployed to cater to non-literate users in rural areas. Yet, gaps remain in understanding how MB directly impacts TRD in these regions, especially concerning the frequency and volume of deposits.

Unstructured Supplementary Service Data (USSD) and Financial Accessibility

Unstructured supplementary service data (USSD) is a mobile communication technology that does not require internet connectivity, making it particularly suited to rural environments where such infrastructure is scarce. USSD enables users to perform banking operations, such as transferring funds and checking account balances, using basic feature phones. Its simplicity and cost-effectiveness have made it a popular tool for driving FI in Nigeria (Adelakun, Olusegun, & Adeyemi, 2020). Studies reveal that USSD has significantly improved rural financial transactions by reducing both time and financial costs associated with accessing banking services (Oluwaseun & Fadeyi, 2021). Furthermore, the interoperability of USSD platforms across banks and mobile network operators has enhanced their utility for rural users, contributing to increased deposit mobilization. However, challenges such as transaction failures and user interface complexity for older populations continue to limit its effectiveness. Additionally, while USSD usage is positively associated with increased rural savings, there is limited empirical evidence linking it directly to measurable improvements in TRD.

E-Wallets and Digital Savings Culture

E-wallets, digital applications that allow users to store, transfer, and receive money, have gained traction in Nigeria due to their flexibility and convenience. Platforms such as Paga, OPay, and PalmPay have expanded their reach to rural communities, offering services that range from savings to microloans (Adeoye, Oladele, & Balogun, 2022). E-wallets have been particularly effective in promoting a savings culture among rural users, enabling small and frequent deposits that were previously impractical due to high transaction costs in traditional banking. The adoption of e-wallets has also been facilitated by government initiatives, such as social intervention programs that use digital wallets for cash transfers to low-income households. These programs have not only increased e-wallet adoption but have also provided empirical evidence of their impact on TRD (Ademola, Adebayo, & Ogundele, 2022). Nevertheless, the lack of financial literacy and concerns over cybersecurity risks pose significant barriers to e-wallet adoption in rural areas. Future

research should explore how e-wallets can be further optimized to address these barriers while sustaining their positive impact on deposit mobilization.

Total Rural Deposits (TRD) as a Measure of FI

Total rural deposits (TRD) serve as a critical proxy for assessing the effectiveness of FI initiatives. TRD reflects the extent to which rural populations engage with formal financial systems through savings and deposits. MPs, by lowering the cost of accessing banking services, have been identified as a key driver of TRD growth in Nigeria (Eze, Nwankwo, & Umeh, 2021). However, the extent of this impact varies across different mobile payment platforms, highlighting the need for disaggregated analyses. Empirical studies have shown that rural users who adopt MPs tend to exhibit a higher propensity to save, contributing positively to TRD (Owolabi, Adetunji, & Olamide, 2021). However, gaps remain in quantifying the relative contributions of MB, USSD, and EW to TRD growth. For instance, while MB is associated with higher transaction volumes, USSD demonstrates broader accessibility, and e-wallets offer targeted savings products. These distinctions underscore the need for a comprehensive framework that integrates these platforms into a unified model of FI.

Challenges and Policy Implications

Despite the potential of MPs to enhance FI, several challenges hinder their full realization in rural Nigeria. Digital literacy remains a critical barrier, with a significant proportion of rural users lacking the skills to navigate mobile payment platforms effectively (National Bureau of Statistics [NBS], 2021). Additionally, cybersecurity risks have eroded trust in digital financial systems, particularly among older and less tech-savvy populations (CBN, 2022). Policy interventions aimed at addressing these challenges include financial literacy campaigns, the promotion of user-friendly platform designs, and the implementation of robust cybersecurity frameworks (Okeke, Udeh, & Nnamani, 2021). Furthermore, targeted infrastructure investments, such as expanding mobile network coverage and ensuring reliable electricity supply, are essential for sustaining the growth of mobile payment adoption in rural areas.

Theoretical Review

Technological Advance Model

The technological advance model, rooted in the innovation-diffusion theory by Rogers (1962) and the technology acceptance model (TAM) by Davis (1989), provides a framework for understanding how new technologies are adopted and integrated into societal systems. This model emphasizes the interaction between technological innovation, user acceptance, and the societal context, which collectively drive adoption and utilization. Over the years, advancements in digital technologies have significantly influenced financial systems, with MPs emerging as a

transformative innovation, particularly in developing economies like Nigeria (Okeke, Udeh, & Nnamani, 2021).

MPs, encompassing mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW), exemplify the practical application of the technological advance model. These innovations enable financial transactions through digital platforms, reducing dependence on physical banking infrastructure and addressing barriers such as geographical isolation and high transaction costs. In rural Nigeria, where financial exclusion has historically been prevalent, these technologies offer pathways to economic empowerment by facilitating savings, enhancing accessibility to financial services, and increasing total rural deposits (TRD) (Adelakun, Olusegun, & Adeyemi, 2020).

Mobile banking, leveraging smartphone technology, enables users to conduct banking operations remotely, thus aligning with the model's focus on user-friendly technological interfaces. Similarly, USSD technology caters to rural populations by providing financial services through basic mobile phones without requiring internet access, highlighting the model's adaptability to infrastructural constraints (Kikulwe, Okello, & Wambugu, 2021). E-wallets, as digital storage solutions for monetary transactions, promote a savings culture and facilitate cashless transactions, aligning with the model's emphasis on efficiency and innovation (Adeoye, Oladele, & Balogun, 2022).

Together, these mobile payment technologies illustrate the practical relevance of the technological advance model in addressing FI gaps, as evidenced by their role in mobilizing rural savings and increasing TRD in Nigeria. This alignment underscores the need for further exploration of their impact and optimization in achieving sustainable FI (Eze, Nwankwo, & Umeh, 2021)

Empirical Review

The study by Akinmoladun (2022) investigates the effect of mobile banking (MB) on FI, specifically its influence on rural deposit growth (TRD) in Nigeria. Using a descriptive and explanatory research design, the study collected primary data through surveys conducted in rural Nigerian households, complemented by secondary data from Nigerian banks and mobile network operators. The scope of the study covers rural areas in southwestern Nigeria over a 5-year period (2017–2021). Regression analysis was applied to explore the relationship between mobile banking usage and rural deposit increases. The findings suggest that mobile banking significantly contributes to increasing rural deposits, thereby improving FI. The study concludes that mobile banking services are pivotal for FI in rural Nigeria. It recommends further investments in mobile banking infrastructure and educational programs to boost mobile banking use in rural areas.

Opara and Eze (2020) examine the role of unstructured supplementary service data (USSD) in enhancing FI, particularly focusing on rural deposit growth in Nigeria. The study employs a cross-sectional design, using primary data collected through structured interviews from 200 rural

Nigerian residents. The data covers rural regions in southeastern Nigeria where USSD is commonly used for MPs. The data was analyzed using correlation analysis to assess the effect of USSD adoption on rural deposit mobilization. The findings show a positive correlation between USSD adoption and increased rural deposits, indicating that USSD can play a vital role in advancing FI in underserved areas. The study concludes that USSD services are an effective tool for overcoming barriers to FI, especially for populations without smartphones. The authors recommend promoting USSD-based MPs and raising financial literacy in rural communities.

Adewumi (2018) investigates how MPs (through mobile banking and USSD services) affect FI, particularly focusing on rural deposit behavior in Nigeria. The study uses survey data collected from 350 rural Nigerian respondents and secondary data from Nigerian financial institutions and mobile operators. The scope of the study focuses on rural northern Nigeria, where mobile payment adoption has been increasing. Multiple regression analysis was used to examine the relationship between mobile payment adoption and rural deposits. The findings reveal that MPs, particularly mobile banking and USSD services, have a significant positive effect on rural deposits, thus improving FI. The study concludes that MPs are crucial for enhancing FI in rural Nigeria. The recommendations include expanding mobile payment services and improving mobile network coverage in rural regions to enhance FI.

Okeke and Alabi (2023) assess the impact of e-wallet services on FI, particularly analyzing their effect on rural deposit growth in Nigeria. The study employs a mixed-method approach, collecting survey data from 400 rural respondents in Lagos and Ogun states. The data spans from 2016 to 2022. Descriptive statistics and thematic analysis were used to analyze the data. The findings indicate that e-wallet services have a positive impact on rural deposits, demonstrating that they improve financial access and increase savings among rural populations. The study concludes that e-wallets are instrumental in advancing FI in rural Nigeria. The authors recommend further investments in e-wallet infrastructure and increased collaboration between fintech companies and traditional banks to reach more rural customers.

Rauf and Olorunfemi (2019) analyze the role of mobile banking in FI, with a particular focus on rural deposit mobilization in Nigeria. The study uses primary survey data collected from 300 rural mobile banking users and secondary data from the Central Bank of Nigeria. The scope of the study covers rural areas across Nigeria, with a focus on southeastern and southwestern regions. Logistic regression analysis was applied to evaluate the effect of mobile banking on rural deposits. The findings suggest that mobile banking significantly increases rural deposits, thereby improving access to financial services in rural areas. The study concludes that mobile banking is a key driver of FI in rural Nigeria. It recommends that financial institutions and government agencies should invest in mobile banking infrastructure and promote mobile banking adoption in rural areas.

Adedeji (2021) explores the impact of MPs, including mobile banking and e-wallets, on FI and rural deposits in Nigeria. The study adopts a mixed-method approach, collecting both survey data

from 350 rural Nigerian residents and secondary data from Nigerian financial institutions. The scope of the study focuses on southwestern Nigeria, where MPs have been increasingly adopted. The data was analyzed using factor analysis and correlation analysis. The study found that both mobile banking and e-wallets positively impacted rural deposits, especially among previously unbanked individuals. The conclusion of the study is that MPs, including e-wallets, are effective tools for enhancing FI, particularly in rural areas. The recommendations include promoting mobile payment services and increasing mobile network infrastructure to reach unbanked populations.

Iwuala and Eze (2019) investigate the role of MPs (mobile banking, USSD, and e-wallets) in improving FI, focusing on rural deposits in Nigeria. The study uses a cross-sectional survey design to collect data from 400 rural mobile payment users, supplemented by secondary data from Nigerian banks and telecom companies. The scope of the study spans rural areas in Nigeria, including the northern and southwestern regions. The data was analyzed using Structural Equation Modeling (SEM) to test the hypotheses. The study finds that MPs have a positive impact on rural deposit growth, demonstrating a significant contribution to FI in rural Nigeria. The study concludes that MPs are crucial for enhancing FI in rural areas. The recommendations include expanding mobile payment infrastructure and promoting mobile payment adoption among rural populations.

Ihenacho and Olaniyi (2022) assess the relationship between mobile banking adoption and FI, particularly focusing on rural deposits in Nigeria. The study uses a quantitative survey design, collecting data from 300 rural mobile banking users. The secondary data from Nigerian banks covers the period 2015–2021, focusing on rural regions in southeastern and southwestern Nigeria. Multiple regression models were used to analyze the data. The findings suggest a strong positive relationship between mobile banking adoption and rural deposit growth. The study concludes that mobile banking plays a critical role in improving FI by increasing rural deposit volumes. The recommendations include expanding mobile banking services to underserved rural areas and improving financial literacy to encourage further adoption.

Akinmoladun and Adebanjo (2020) examine how mobile payment methods such as USSD, mobile banking, and e-wallets influence rural deposit growth and FI in Nigeria. The study uses a survey design, collecting data from 250 rural Nigerian households and secondary data from the Central Bank of Nigeria. The study focuses on rural areas in southwestern Nigeria, where MPs have become increasingly common. Correlation and regression analysis were applied to assess the relationship between mobile payment adoption and rural deposits. The study finds that MPs, including USSD, mobile banking, and e-wallets, significantly contribute to increasing rural deposits and enhancing FI. The study concludes that MPs have a substantial role in improving FI in rural Nigeria. The recommendations emphasize expanding mobile payment services in rural areas and promoting financial education to maximize adoption.

Fola Adebayo (2021) investigates the role of MPs, including mobile banking, USSD, and e-wallets, in enhancing FI in Nigeria, with a specific focus on rural deposits. The study uses a cross-

sectional survey design, collecting data from 350 rural respondents and secondary data from the Central Bank of Nigeria. The study spans rural areas across Nigeria, with a focus on mobile payment users. Descriptive statistics and correlation analysis were used to examine the relationship between mobile payment adoption and rural deposits. The findings reveal a positive effect of MPs on rural deposit growth, demonstrating their importance in promoting FI. The study concludes that MPs are vital for improving FI and increasing rural deposits in Nigeria. The recommendations highlight the need for further investment in mobile payment infrastructure and the promotion of mobile payment solutions in rural communities.

Research Methodology

This study's research technique was based on an ex-post facto research approach. Ex-post facto research design involves analysing how prior influences have impacted a current occurrence or incident. This study employs secondary data gathering methods, utilising time series data from the CBN Statistical Bulletin, CBN Annual Report, CBN Bank Supervisory Annual Report, and Nigeria Deposit Insurance Corporation (NDIC) Annual Reports covering the period from 2001 to 2023. The CBN statistical bulletin, CBN bank supervisory annual report, and NDIC annual report were chosen as data gathering sources due to their reliability and accuracy for the study. The study employed multiple statistical techniques, including descriptive statistics, correlation analysis, and further diagnostic tests. Considering the hypothesis established for this research, the selected method of data analysis was ordinary least squares (OLS) regression analysis, utilising the program E-VIEWS 9.0. These are the suitable measures implemented to analyse data pertaining to the study in question.

The model which specifies that FI, as proxied by total rural deposits (TRD) is significantly influenced by the MPs as proxied by mobile banking (MB), unstructured supplementary service data (USSD), and e-wallets (EW) was formulated as follows,

TRD = f(MB, USSD, EW)

$$LogTRD = \beta_0 + Log\beta_1 MB + Log\beta_2 USSD + Log\beta_3 EW + U$$

Where:
TRD = Total rural deposits
β_0 = Constant Term
β_1 = Coefficient of Mobile banking
MB = Mobile banking
β_2 = Coefficient of Unstructured supplementary service data
USSD = Unstructured supplementary service data
β_3 = Coefficient of E-wallets
EW = E-wallets
U = Disturbance Term (other variable not mentions in the model)
The a priori expectation is $\beta_1, \beta_2, \beta_3, > 0$

Results and Discussion

The descriptive statistics was conducted, as presented in Table 4.1 below;

Table 4.1:   **Descriptive Statistics**

	LOGTRD	LOGMB	LOGUSSD	LOGEW
Mean	1.274213	2.608411	1.709696	1.391272
Maximum	1.778658	3.813755	3.505794	3.705946
Minimum	0.568636	0.733999	0.322219	0.004321
Std. Dev.	0.480064	1.047317	1.022068	1.384808
Kurtosis	2.960592	1.804989	1.710175	1.492760
Observations	23	23	23	23

Source: EVIEW, 9.0 Outputs, 2024.

Table 4.1 above presents the descriptive statistics. The mean value for the TRD was 1.2742, with a standard deviation of 0.4801. MB exhibited a mean of 2.6084 with a standard deviation of 1.0473, USSD demonstrated a mean of 1.7097 with a standard deviation of 1.0221, and EW presented an average value of 1.3913 with a standard deviation of 1.3848. As the standard deviations for all variables are less than their respective means, this indicates that the data are not widely dispersed. The normal distribution possesses a kurtosis of three, signifying that the distribution exhibits neither fat nor skinny tails. Therefore, if an observed distribution exhibits a kurtosis exceeding three, it possesses heavy tails relative to the normal distribution. All kurtosis coefficients in Table 4.1 are below 3, indicating that TRD, MB, USSD, and EW exhibit thinner tails relative to the normal distribution.

Multicollinearity Test

Given that the study utilises annual time series data, a multicollinearity test was performed to determine the presence of multicollinearity, as illustrated in table 4.2 below;

Table 4.2: Variance Inflation Factors (VIF) Test

Variable	Coefficient Variance	Centered VIF
C	0.389769	NA
LOGMB	0.054263	4.936432
LOGUSSD	0.864456	7.895244
LOGEW	0.314960	5.094101

Source: EVIEW, 9.0 Outputs, 2024.

Multicollinearity arises in a dataset when two or more independent variables in multiple regression models exhibit a high degree of correlation. To validate the outcomes of this investigation, the VIF

is calculated as demonstrated in Table 4.4.1. Moreover, the CVIF statistics for all independent variables continuously range from 4.9364 to 7.8952 for MB, and from 5.0941 for USSD and EW, respectively. This signifies the lack of multicollinearity issues among the examined variables, as the threshold value of VIF is 10. VIF values beyond 10 are commonly considered indicative of multicollinearity.

Data Validity Test

Given that the data included time series spanning from 2001 to 2023 (23 years), the Ramsey RESET Test was employed to evaluate the validity of the data for analysis. This is illustrated in Table 4.3 below; **Table 4.3: Data Validity Test**

Table 4.3a: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.528691	Prob. F(2,14)	0.2509
Obs*R-squared	3.764061	Prob. Chi-Square(2)	0.1523

Source: E-VIEW, 9.0 Outputs, 2024.

Before estimating the models, the residuals of the variables were evaluated to determine the existence of serial correlation. The serial correlation LM test was employed for this purpose. The serial correlation LM test in Table 4.3a indicates the absence of serial correlation in the models, as the p-values of the f-statistics are inconsequential at the 5% significance level.

Table 4.3b: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	33.36858	Prob. F(4,16)	0.7373
Obs*R-squared	29.53950	Prob. Chi-Square(4)	0.8497
Scaled explained SS	28.54540	Prob. Chi-Square(4)	0.6310

Source: E-VIEW, 9.0 Outputs, 2024.

Table 4.3b illustrates that when the variability of one variable is inconsistent over the range of values of a second predictive variable, it results in the issue of heteroskedasticity. A heteroskedasticity test using the Breusch-Pagan-Godfrey method was conducted to confirm homoscedasticity in the model estimation. The results indicate an absence of heteroskedasticity in the models, as the p-values of the F-statistics are inconsequential at the 5% significance level.

Table 4.3c: Ramsey RESET Test

	Value	Df	Probability
t-statistic	1.399614	15	0.1820
F-statistic	1.958918	(1, 15)	0.1820

Likelihood ratio	2.577616	1	0.1084

Source: E-VIEW, 9.0 Outputs, 2024

Table 4.3c above reveals that the Durbin-Watson statistic indicates our data exhibits no characteristics of autocorrelation. Indicates that the model is homoscedastic, as the p-values of three parameters above the 0.05 significance level. The Ramsey test results indicate that our model is appropriately described and stable.

Augmented Dickey-Fuller (ADF) Unit Root Test

Examining the presence of unit roots is a fundamental issue in the analysis of time series models and co-integration. The purpose of this test is to mitigate the issue of spurious regression frequently linked to time series data. The existence of a unit root indicates that the examined time-series data is non-stationary, whereas the lack of a unit root signifies that the stochastic process is stationary. The unit root test was performed via the ADF Unit Root Test, as illustrated in Table 4.4 below:

Table 4.4: **Augmented Dickey-Fuller Unit root Test**

Test Variables	ADF Test Statistic Value	Mackinnon Critical Value @ 5%	Order of Integration	P-Value	Decision
TRD	-5.078997	-3.040391	1(1)	0.0008	**Stationary**
MB	-3.839179	-3.029970	1(1)	0.0416	**Stationary**
USSD	-3.598352	-3.029970	1(1)	0.0440	**Stationary**
EW	-3.509324	-3.029970	1(1)	0.0289	**Stationary**

Source: E-VIEW, 9.0 Outputs, 2024.

The summary of the ADF unit root test output in Table 4.4 indicates that all variables examined, namely TRD, MB, USSD, and EW, exhibit a unit root at their initial difference, denoted as 1(1). Their individual ADF statistics exceed the crucial value of 5%, providing evidence of this. Furthermore, supplementary evidence of stationary series is evident from the p-value for all variables, which is below the 5% significance level, indicating a confidence level above 95%. All achieved stationarity at the first difference, or order one. Given that all variables are integrated of order one, we can proceed with the Johansen cointegration test. Table 4.5 below presents a summary of the cointegration test:

Table 4.5: Summary of Johansen Cointegration Test Output

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.956060	123.5776	69.81889	0.0000	59.37385	33.87687	0.0000
At most 1 *	0.832813	64.20372	47.85613	0.0007	33.98417	27.58434	0.0066
At most 2 *	0.519489	30.21955	29.79707	0.0447	23.92519	21.13162	0.0112
At most 3	0.413783	16.29437	15.49471	0.0378	16.14723	14.26460	0.0024
At most 4	0.276412	6.147136	3.841466	0.0132	6.147136	3.841466	0.0132

Researcher's Computation Based E-views 9.0 Output, 2024.

Table 4.5 indicates that the multivariate cointegration test conducted using the Johansen and Juselius technique demonstrates two cointegration relationships (at None and at most 1), as both the trace statistic and the Maximum Eigenvalue statistic exceed their respective critical values at the 5% significance level. This outcome supports the presence of a robust long-term link between MPs and FI in Nigeria.

Table 4.6: Ordinary Least Squares Regression Analysis

Dependent Variable: LOGTRD
Method: Dynamics Ordinary Least Squares
Date: 12/12/24   Time: 14:07
Sample: 2001 2023
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.461835	0.624315	2.341503	0.0325
LOGMB	0.300682	0.132945	2.261702	0.0441
LOGUSSD	0.809235	0.329761	2.454005	0.0370
LOGEW	-0.413697	0.561213	-0.737148	0.4717

R-squared	0.862914	Mean dependent var	1.274213
Adjusted R-squared	0.746358	S.D. dependent var	0.480064
F-statistic	20.78481	Durbin-Watson stat	2.429205
Prob(F-statistic)	0.005282		

Source: EVIEW, 9.0 Outputs, 2024.

The multiple regression findings presented in Table 4.6 indicate that the coefficient of MB is 0.3007, with a t-value of 2.2617 and a corresponding p-value of 0.0441. This indicates that MB

has a considerable favourable impact on TRD. This link is noteworthy as the p-value of 0.0441 is below than the 0.05 (5%) significance level. The coefficient of MB is 0.3007, indicating a positive correlation with TRD. A one percent (1%) change in MB will result in a 30.07% increase in TRD in Nigeria. Mobile banking and USSD platforms, owing to their simplicity and accessibility, especially for users in rural regions, seem to correspond closely with these constructions. The limited acceptance and trust in e-wallets in rural Nigeria may explain their negligible and adverse effects, perhaps indicating concerns regarding perceived utility and technological obstacles. This finding aligns with the theoretical framework of the TAM, which asserts that perceived usefulness and ease of use influence technology adoption. Empirical research supports the beneficial impact of mobile banking on FI. Akinmoladun (2022) shown that mobile banking substantially fosters rural deposit growth by improving access to financial services.

The multiple regression findings in Table 4.6 indicate that the coefficient for USSD is 0.8092, with a t-value of 2.4540 and a corresponding p-value of 0.0370. This indicates that USSD has a considerable favourable impact on TRD. This link is noteworthy as the p-value of 0.0370 is below than the 0.05 (5%) significance level. The coefficient of USSD is 0.8092, indicating a positive correlation with TRD. A one percent (1%) change in USSD will result in an 80.92% increase in TRD in Nigeria. This finding aligns with the theoretical framework of the TAM, which asserts that perceived usefulness and ease of use influence technology adoption. Opara and Eze (2020) emphasised the efficacy of USSD technology in addressing obstacles to FI, especially in areas with restricted internet access. The findings substantiate the assertion that mobile banking and USSD channels are appropriately aligned with the socio-economic conditions of rural Nigeria, characterised by low smartphone penetration and restricted financial awareness.

Finally, the multiple regression results in Table 4.6 above, the coefficient of EW is -0.4137 with a t-value of -0.7372 and an associated p-value (sig. value) of 0.4717. This indicates that EW has a negligible deleterious impact on TRD. This association is not significant, as the p-value of 0.4717 exceeds the 0.05 (5%) significance threshold. The coefficient of EW is -0.4137, indicating that EW exhibits a negative correlation with TRD. A one percent (1%) change in EW will result in a 41.37% reduction in TRD in Nigeria. This finding aligns with the theoretical framework of the TAM, which asserts that perceived usefulness and ease of use influence technology adoption. The negligible and inconsequential effect of e-wallets on TRD diverges from the conclusions of Okeke and Alabi (2023), who indicated a beneficial influence of e-wallets on rural saves in different circumstances. This difference may arise from infrastructural obstacles, a deficit of trust, and inadequate awareness in Nigeria's rural regions. The reliance of e-wallets on cellphones and internet access restricts their adoption among rural people, underscoring the necessity for tailored efforts to mitigate these obstacles.

Conclusion and Recommendations

This study concludes that mobile banking (MB) and USSD have significantly enhanced FI in Nigeria by positively influencing total rural deposits (TRD). These technologies bridge the gap between formal financial services and underserved rural populations. However, e-wallets (EW) have yet to demonstrate significant contributions to rural deposits, likely due to adoption barriers such as limited smartphone penetration and low digital literacy. These findings underscore the importance of tailoring financial technologies to the unique needs of rural communities. These recommendations aim to build on the findings of this study, fostering greater FI in rural Nigeria through enhanced mobile payment systems:

1. Financial institutions should expand the reach of mobile banking and USSD services by improving network infrastructure in rural areas and reducing transaction costs.

2. Governments and stakeholders should implement educational campaigns to enhance the understanding and trust of rural populations in mobile payment systems, including e-wallets.

3. Policymakers should collaborate with fintech companies to provide incentives, such as subsidies or promotions, to encourage the use of e-wallets in rural communities.

4. Investments in mobile network coverage and internet penetration in rural areas are essential to support the adoption of all mobile payment platforms.

Contribution to Knowledge

This study contributes to the growing body of literature on the role of MPs in FI, particularly in rural contexts. It highlights the differential impacts of mobile banking, USSD, and e-wallets on rural deposit mobilization in Nigeria, providing empirical evidence to inform policy and practice. Additionally, the study emphasizes the relevance of the TAM in understanding the adoption of financial technologies in developing economies.

Suggestions for Further Studies

Future research could explore the following areas:

Barriers to E-Wallet Adoption: Investigate the specific challenges hindering e-wallet usage in rural Nigeria, focusing on trust, infrastructure, and user experience.

Comparative Analysis Across Regions: Conduct comparative studies to assess the impact of mobile payment technologies on FI across different regions of Nigeria.

Longitudinal Analysis: Examine the long-term effects of MPs on FI metrics, such as rural deposits and credit access, to understand sustained impacts.

References

Adebayo, F. (2021). Mobile payment services and financial inclusion in rural Nigeria. *Journal of Financial Inclusion, 14*(4), 256-269.

Adedeji, M. (2021). The role of mobile payments in promoting financial inclusion in rural Nigeria. *Journal of Financial Services, 16*(2), 98-111.

Adejumo, B., Fashola, T., & Oyewole, S. (2022). Payment service banks and their role in driving financial inclusion in Nigeria. *African Review of Banking and Finance*, *14*(2), 18-30.

Adelakun, O., Olusegun, A., & Adeyemi, K. (2020). The role of USSD in enhancing financial inclusion in sub-Saharan Africa. *African Journal of Financial Technology*, *12*(3), 45-62.

Ademola, T., Adebayo, R., & Ogundele, M. (2022). Promoting digital literacy for financial inclusion: Evidence from rural Nigeria. *Journal of Digital Economy and Innovation*, *8*(1), 24-39.

Adeoye, J., Oladele, F., & Balogun, A. (2022). Gender equality and financial inclusion through mobile payment platforms in Nigeria. *Journal of Development Economics and Policy Studies*, *10*(3), 72-89.

Adewumi, T. (2018). The impact of mobile payments on rural deposit behavior and financial inclusion in northern Nigeria. *African Journal of Mobile Banking, 12*(3), 210-226.

Akinmoladun, O., & Adebanjo, B. (2020). The impact of mobile payment systems on rural deposit growth and financial inclusion in Nigeria. *International Journal of Mobile Banking and Payments, 6*(2), 104-118.

Akinmoladun, S. O. (2022). The effect of mobile banking on rural deposit growth and financial inclusion in Nigeria. *Journal of Financial Inclusion, 15*(2), 134-148.

Akinola, J., & Olayemi, T. (2022). E-wallet adoption and financial inclusion in rural Nigeria: A case study. *Journal of Emerging Markets and Digital Transformation*, *9*(4), 56-78.

Bolarinwa, K., Adegbite, S., & Ojo, R. (2021). Women\u2019s financial empowerment through mobile wallets: Evidence from Nigeria. *International Journal of Gender and Development Studies*, *7*(2), 34-49.

Central Bank of Nigeria (CBN). (2021). Annual report on electronic payments and financial stability. Abuja, Nigeria: Central Bank of Nigeria. Retrieved from https://www.cbn.gov.ng

Central Bank of Nigeria (CBN). (2022). Mobile payment adoption and its implications for financial inclusion: A statistical analysis. Abuja, Nigeria: Central Bank of Nigeria.

Central Bank of Nigeria. (2021). Cybersecurity trends in Nigeria's financial sector. *CBN Economic Report*. Retrieved from https://www.cbn.gov.ng

Central Bank of Nigeria. (2022). Annual report on mobile payment adoption and financial inclusion in Nigeria. Retrieved from https://www.cbn.gov.ng

Eze, C., Nwankwo, A., & Umeh, P. (2021). Mobile banking and rural deposit mobilization: A Nigerian perspective. *Journal of Rural Finance and Development*, *6*(1), 15-32.

Ihenacho, C., & Olaniyi, O. (2022). Mobile banking adoption and financial inclusion: A study on rural deposits in Nigeria. *Journal of African Economic Development, 17*(1), 22-36.

Iwuala, N., & Eze, C. (2019). Mobile payments and rural deposit growth: A pathway to financial inclusion in Nigeria. *International Journal of Financial Technology, 5*(3), 233-247.

Kikulwe, E., Fischer, E., & Qaim, M. (2021). Mobile payments as a tool for financial inclusion: Trends and challenges. *Development in Practice*, *31*(4), 612-625.

National Bureau of Statistics. (2021). Digital literacy levels in rural Nigeria: Insights from a nationwide survey. Retrieved from https://www.nigerianstat.gov.ng

Nigerian Inter-Bank Settlement System. (2021). Annual report on electronic payments. Retrieved from https://www.nibss-plc.com.ng

Okafor, L., Eze, S., & Chukwuma, T. (2021). The impact of mobile banking on financial inclusion in Nigeria. *Journal of Banking and Financial Innovation*, *14*(3), 98-114.

Okeke, E., Udeh, J., & Nnamani, C. (2021). Addressing infrastructural deficits to improve financial inclusion in rural Nigeria. *Journal of Infrastructure Development and Policy Research*, *12*(1), 39-58.

Okeke, K., & Alabi, B. (2023). The influence of e-wallet services on rural deposit growth and financial inclusion in Nigeria. *Financial Technology Review, 9*(1), 77-91.

Olaoye, B., & Alade, M. (2021). Enhancing trust in mobile payment platforms: The role of cybersecurity measures. *African Journal of Information Security*, *5*(2), 45-62.

Oluwaseun, A., & Fadeyi, O. (2021). Fintech and financial inclusion: A case study of USSD and e-wallets in Nigeria. *Journal of Fintech Innovation*, *11*(2), 50-68.

Opara, C., & Eze, S. (2020). The role of unstructured supplementary service data (USSD) in advancing financial inclusion in Nigeria. *International Journal of Mobile Payments, 7*(1), 45-58.

Owolabi, M., Adetunji, R., & Olamide, A. (2021). The role of e-wallets in promoting savings culture in Nigeria\u2019s rural economy. *Journal of Digital Banking*, *15*(3), 28-44.

Rauf, A., & Olorunfemi, T. (2019). Mobile banking and rural deposit mobilization in Nigeria: A catalyst for financial inclusion. *Nigerian Journal of Finance, 8*(4), 54-69.

World Bank. (2022). Rural development and financial inclusion in sub-Saharan Africa: Insights and implications. Retrieved from https://www.worldbank.org