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email: ijemss@futminna.edu.ng

Impact of Technological Innovation on Rural Financing in South East Nigeria

[1]UGWUANYI Wilfred N.J.; [2]ADAM Sa'adatu Balarabe; [3]AGU Fortune Nneka; [4]ISRAEL-COOKEY Stowell Ozioma
[1,2,3,4]Department of Financial Studies, Faculty of Management Sciences, National Open University of Nigeria, Abuja.
fagu@noun.edu.ng. 07062701424

Abstract

This study examined the impact of technological innovation on rural financing in South East Nigeria, with a focus on mobile banking, Automated Teller Machines (ATMs), and Point-of-Sale (POS) systems. Rural communities in South East Nigeria have long faced challenges in accessing formal financial services, resulting in a reliance on informal lending practices and financial exclusion. Technological innovations offer potential solutions to bridge this gap by enhancing financial accessibility, promoting financial inclusion, and fostering economic growth in underserved regions. The research employs a survey design to examine how these technologies have affected access to financial services, the barriers to their adoption, and the broader socio-economic implications for rural development. Data were collected from 500 respondents across five states using questionnaires, interviews, and document reviews. The study's findings reveal strong positive correlations between the use of mobile banking, ATMs, and POS services, and financial inclusion in rural areas. However, challenges such as low digital literacy, inadequate infrastructure, and security concerns hinder the full adoption of these technologies. The study concludes that while technological innovations significantly contribute to improving financial inclusion, addressing these barriers is essential for realizing their full potential. Recommendations include enhancing digital infrastructure, promoting financial literacy programs, and implementing stronger security measures to encourage widespread adoption.

1. Introduction

Rural financing is a critical factor in promoting economic growth, particularly in regions where agriculture and small-scale enterprises form the backbone of the economy. It involves the provision of financial services such as loans, savings accounts, insurance, and other investment opportunities, specifically tailored to support the agricultural sector, small businesses, and households in rural areas (Agbakwuru, 2019). Effective rural financing is instrumental in reducing poverty, empowering communities, and facilitating economic development by enabling access to capital and investment in underserved regions. In South East Nigeria, however, rural communities face significant financial challenges, including limited availability of formal financial services, low levels of financial literacy, and a reliance on informal lending practices (Okeke et al., 2021). These challenges hinder economic growth, exacerbate poverty, and contribute to a high level of income inequality.

Despite the importance of rural financing, many rural areas in South East Nigeria remain financially underserved, with a scarcity of formal banking institutions. The traditional banking infrastructure has struggled to penetrate these areas due to high operational costs, poor infrastructure, and a lack of tailored financial products that meet the unique needs of rural populations (Okeke et al., 2021). This financial exclusion has perpetuated a cycle of poverty and limited economic opportunities for millions of people, leading to the urgent need to explore innovative solutions that can bridge the financial access gap in these regions (World Bank, 2008).

Technological innovation has emerged as a transformative tool for addressing these challenges (Chiemeke et al 2020). Technological advancements such as mobile banking, Automated Teller Machines (ATMs), Point-of-Sale (POS) systems, and digital payment platforms are reshaping the financial landscape in South East Nigeria. These innovations have the potential to overcome barriers such as physical distance, high transaction costs, and bureaucratic inefficiencies, providing more accessible and efficient financial services to rural communities (Rogers, 2003). By leveraging mobile phones, internet connectivity, and digital platforms, financial services can be extended to areas previously considered too remote or economically unviable for traditional banking institutions.

While technological innovations like mobile banking, ATMs, and POS systems have begun to gain traction in urban areas, their adoption in rural regions remains limited. This limitation is largely due to inadequate digital infrastructure, including unreliable internet access, poor network coverage, and unstable electricity supply (Lawal et al 2024). In addition, socio-cultural factors such as low digital literacy and mistrust of digital systems continue to hinder widespread adoption (Lui, 2025). These persistent barriers highlight the need for further research into how technological innovation can promote rural financing, particularly within South East Nigeria (Sam-Abugu, 2025).

This study seeks to address these gaps by exploring the impact of mobile banking, ATMs, and POS services on financial inclusion in rural communities in South East Nigeria. The study will analyze how these technologies have improved access to financial services, the barriers to their full adoption, and the broader socio-economic implications for rural development. By examining these factors, the study aims to contribute valuable insights into the potential of technological innovation as a means to promote financial inclusion and sustainable economic growth in rural areas.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature, Section 3 presents the research methodology, Section 4 discusses the analysis and results, and Section 5 offers conclusions and policy recommendations.

2. Review of Literature

Technological Innovation

Technological innovation could be seen as the introduction or application of new technologies or the improvement of existing ones to enhance efficiency, productivity, and accessibility in various sectors (Schumpeter, 1942). It encompasses the use of groundbreaking tools and methodologies that address existing challenges and create new opportunities. According to Thairu & Wahome (2016), technological innovations are opening up new markets for service providers such as telecoms and a wide range of retail stores, as well as new consumers which might include millions of unbanked cell phone owners. Angko (2013) stated that cost savings for both banks and clients are a benefit of technological advancements in banking. This implies that in order to draw in and satisfy clients, banks must make sure that cutting-edge goods and services are fairly priced. In the financial sector, technological innovation includes advancements such as mobile banking, digital payment platforms, blockchain, artificial intelligence, and fintech solutions, which aim to revolutionize traditional financial services by making them more inclusive and accessible (Chukwu & Nnamdi, 2020). Technological advancements in the banking sector include online account opening, ATM deposits and withdrawals, internet banking, mobile banking, and electronic money transfers. These innovations significantly contribute to expanding a bank's customer base, capital, and profitability, ultimately enhancing its overall financial performance (Hill, 2009). Hilal (2015) asserts that introducing new technologies and fostering innovation are the best ways to increase bank productivity. For instance, mobile banking platforms such as Paga and Opay have

empowered millions of unbanked people in South East Nigeria to carry out transactions without relying on physical bank branches (Eze & Nnamani, 2021). Similarly, agricultural fintech platforms such as FarmCrowdy offer credit facilities, input supply chains, and market linkage services tailored to rural farmers, thereby driving financial inclusion and productivity.

Furthermore, innovations like blockchain provide secure and transparent transaction frameworks, which are particularly useful in addressing fraud and enhancing trust in financial systems. Conversely, artificial intelligence enables financial institutions to analyze data patterns, predict customer needs, and customize financial products, making them more accessible to rural populations. These technological advancements not only reduce operational costs but also expand the reach of financial services to underserved regions. Technological innovations are broadly acknowledged as key factors that drive economic growth and improve prosperity in both advanced and emerging economies. Enhanced technological innovation has the potential to foster sustainable economic development by boosting productivity and fostering creativity (Gwani, 2023). However, the successful implementation of these innovations in South East Nigeria is often hindered by infrastructural deficits, such as poor internet penetration and irregular power supply, as well as socio-economic factors, including digital illiteracy and gender disparities (Ogbu & Ukpere, 2023). Addressing these barriers requires a concerted effort from stakeholders to invest in digital infrastructure, promote capacity building, and create an enabling regulatory environment.

Rural Financing

Rural financing involves offering specialized financial services like loans, savings, insurance, and payment options, to rural populations to support their agricultural activities, small-scale enterprises, and household needs. Rural financing includes formal, informal, and semiformal systems designed to tackle the specific financial challenges encountered by rural communities (World Bank, 2004). Kofi et al. (2018) emphasize that rural financing is crucial for empowering rural households, driving economic development, and alleviating poverty by facilitating access to vital capital for both productive use and consumption. These services enable rural populations to mitigate risks, invest in education and health, and enhance income stability. Rural financial systems involve diverse stakeholders, including microfinance institutions, cooperative societies, and informal savings groups. Nonetheless, access to formal financial services in rural areas continues to be restricted because of poor infrastructure, high transaction expenses, and the intricate nature of rural economic activities (Echebiri & Nwosu, 2020). This gap often compels rural dwellers to rely on informal financial arrangements, which may not always meet their needs effectively. Agboola and Fadeyi (2019) emphasize the critical need for inclusive financial services to address these barriers and promote economic sustainability in rural areas. In addition, rural financing supports not just agricultural ventures but also non-farm activities that contribute to rural development, such as small businesses and social enterprises. Adewole et al. (2021) highlight that effective rural financing must include innovative financial products like microinsurance, digital payment platforms, and leasing services, which cater specifically to the diverse and often underserved needs of rural populations. Incorporating technology into rural financing has demonstrated considerable promise in addressing traditional obstacles like restricted access to physical bank branches and low levels of financial literacy (Ifeanyi & Olu, 2022). For sustainable rural financial systems, collaborative efforts are essential among governments, financial institutions, and development agencies. Policy stability, infrastructure investment, and financial literacy programs are crucial to ensuring that rural communities can access and utilize financial services effectively (Chukwuma & Umeadi, 2020). Expanding rural financing through these means is critical to fostering inclusive economic growth, enhancing resilience, and addressing the persistent challenges of poverty and inequality in rural regions.

Mobile Banking

The banking sector is vital to national economies, particularly in emerging markets. Over time, it has evolved from conventional banking methods to incorporate electronic banking (e-banking) and, more recently, mobile banking (m-banking) (Shobhit, 2016). Mobile banking, or m-banking, is a significant technological innovation that allows customers to manage their financial activities anytime and anywhere using their mobile phones. Essentially, m-banking provides clients with a 24/7 bank at their fingertips through dedicated mobile applications offered by financial institutions. Many customers are drawn to mobile banking because of its simplicity, enabling them to create accounts, transfer money, pay bills, make purchases, and more using mobile devices. Significantly, many American and Chinese banks that adopted mobile banking for their full range of services saw a substantial increase in demand (Narteh et al 2022). Mobile banking combines the banking and telecommunications industries, enabling customers to use banking services through smartphones and tablets (Meghna, 2022). This innovation has revolutionized how individuals and businesses manage their finances, leveraging the convenience and accessibility of mobile technology. By providing convenient, accessible, and secure banking solutions, mobile banking has reshaped the financial services landscape on a global scale. With ongoing technological progress, mobile banking is anticipated to become increasingly important in promoting financial inclusion and shaping the future landscape of digital finance. Despite substantial investments in mobile banking and its numerous benefits, its adoption remains underrepresented in rural areas. The rate of uptake has not reached the anticipated levels. Low literacy and limited knowledge act as significant barriers, as many individuals face challenges in operating advanced technologies like smartphones and personal digital assistants (PDAs).

Automated Teller Machine (ATM)

An Automated Teller Machine (ATM) is a self-operated device that allows customers to carry out a range of financial transactions; such as withdrawing cash, checking account balances, transferring funds, and making deposits without needing assistance from bank personnel. Ohazulike (2022) defined an ATM as a machine that disburses the amount of money a customer requests and highlighted its role in improving operational efficiency for banks and convenience for clients. ATMs help declutter banking halls, reduce workloads for employees, and enhance customer experience by allowing transactions outside traditional banking hours and locations. Beyond convenience, the quality of ATM services is a significant determinant of customer satisfaction, influenced by factors such as transaction speed, accessibility, and reliability. According to Ohazulike (2022), demographic factors such as age, education level, and income influence the relationship between ATM services and customer satisfaction. Okafor and Adebayo (2020) emphasized that ATMs are a key factor in driving customer loyalty in banking, particularly when combined with user-friendly interfaces and efficient service delivery. However, ATMs also pose challenges, including the risks of skimming, hacking, and fraud, which necessitate ongoing technological advancements and stringent security measures (Adebisi & Emmanuel, 2019). The integration of biometric authentication and real-time fraud detection systems has further strengthened ATM security, fostering greater trust among users (Kalu & Nnamdi, 2021). ATMs continue to be a vital component of contemporary banking, connecting traditional and digital banking services and promoting financial inclusion for underserved communities in remote locations. Olorunfemi (2020) emphasized that ATMs play a key role in advancing financial inclusion in rural areas with limited access to physical bank branches.

Point of Sale (POS)

The Point of Sale (POS), also known as Point of Purchase (POP), is a system that enables electronic payment for goods and services using methods like debit cards, credit cards, or

mobile payment platforms. A POS system typically includes a terminal, software, and other tools that enable sales transactions and generate receipts. Chitokwindo (2014) noted that POS systems manage the selling process efficiently, allowing for the printing of receipts and accurate tracking of sales for business and tax purposes. POS systems are essential for retailers and marketers as they often influence purchasing decisions, especially for high-margin products and services. Modern POS systems have advanced to include features like inventory management, customer relationship management (CRM), and data analytics. These innovations enable businesses to optimize sales processes, improve customer service, and gain insights into consumer behavior. Bala et al. (2021) highlighted that POS systems are integral to the transition towards cashless economies, particularly in developing countries where they bridge gaps in financial inclusion. POS systems are increasingly mobile, allowing businesses to operate outside traditional store locations and accept payments at pop-up shops, events, and delivery points, thus enhancing convenience for both retailers and customers (Akindele & Johnson, 2020). However, as Chitokwindo (2014) pointed out, POS systems are sometimes misused to fabricate records and evade taxes through illicit software, known as "zappers." This underscores the importance of regulatory oversight and the adoption of secure, tamper-proof technologies to ensure the integrity of POS operations. By integrating AI and blockchain technologies, POS systems are becoming more robust, offering enhanced security, fraud detection, and transaction transparency (Nguyen & Dao, 2022). The ongoing development of POS systems is essential in accelerating the adoption of cashless payment methods, supporting financial inclusion, and improving operational efficiency for businesses worldwide.

Illiteracy

Being illiterate is defined as not being able to read, write or use technical tools like mobile banking, ATMs, or point of sale systems to transfer money. The concept of functional illiteracy refers to individuals who, despite having basic reading, writing, and math skills, struggle to apply these abilities effectively in real-life situations that require informed decision-making and active participation in everyday activities (Cree et al 2023). As to the definition provided by UNESCO, illiteracy is determined through the evaluation of an individual's reading, writing and mathematics skills in several financial categories that impact their identity and integration into society (Cree et al 2023).

Financial Inclusion

Babajide, Adegboye, and Omankhanlen (2015) describe financial inclusion as the effort to make suitable financial services accessible to every group within society particularly the economically vulnerable through regulated institutions that offer these services in an affordable, fair, and transparent manner. According to Demirgüç-Kunt et al (2015), financial inclusion involves delivering a broad array of quality financial products, such as savings, credit, insurance, payments, and pensions, tailored to the needs of all adults, with a special focus on those with low incomes. The importance of financial inclusion has gained global recognition among policymakers, researchers, and development organizations. Its significance is anchored in its capacity to promote economic development by reducing poverty, generating employment, creating wealth, and improving overall welfare and living standards. According to a 2017 World Bank report, around two billion adults of working age, more than half of the global adult population remain excluded from formal financial services. To close this gap, financial inclusion initiatives are designed to provide households and businesses across all income levels with the ability to access and make effective use of essential financial tools, thereby improving their overall well-being (EFInA, 2016). Around the world, financial inclusion has become a central focus for policymakers, regulators, and development organizations. The World Bank Group views it as a key driver in the fight against extreme poverty and in promoting shared prosperity. Reflecting this belief, the organization has committed to the ambitious objective of achieving universal financial inclusion. By expanding access to financial services and

encouraging their practical use, financial inclusion supports sustainable economic growth and helps create more equitable development outcomes (Allen et al 2016).

Theoretical Framework

This study is grounded in three key theoretical frameworks that link technological innovation to rural financing: the Diffusion of Innovation (DOI) Theory, Financial Intermediation Theory, and Technology Acceptance Model (TAM). The DOI Theory by Rogers (1962), explains how new technologies, such as mobile banking, ATMs, and POS systems, are adopted within a social system, emphasizing factors like perceived benefits, compatibility with existing practices, and ease of use, which are crucial for overcoming barriers to financial access in rural areas. The Financial Intermediation propounded by Gurley & Shaw (1960) highlights the role of financial intermediaries, like microfinance institutions and rural banks, in providing credit and financial services to underserved populations, and how technological innovations lower transaction costs and expand the reach of these services to rural communities (Ajakaiye & Fakiyesi, 2019). Finally, the Technology Acceptance Model (TAM) by Davis (1989), posits that the likelihood of technology adoption increases when users perceive a technology as both useful and easy to use, which is essential for the acceptance of mobile banking and POS systems in rural areas. Together, these theories explain how technological innovations can improve rural financing by enhancing financial access, reducing transaction costs, and promoting the adoption of digital financial services, thus fostering financial inclusion and economic growth in rural communities.

Empirical Review

Ogunleye et al. (2020) explored the influence of mobile banking on financial inclusion within rural areas of Nigeria. Utilizing a quantitative research design, the study gathered data through structured questionnaires administered to rural banking clients. The collected information was analyzed using both descriptive and inferential statistics to examine the relationship between mobile banking adoption and levels of financial inclusion. The findings revealed that mobile banking has significantly improved access to financial services among rural populations, with notable benefits for women and small-scale entrepreneurs. The study highlighted that mobile money platforms have enhanced the ability of rural users to obtain micro-loans, transfer and receive remittances, and save funds securely.

Ugwuanyi et al (2020) investigated the impact of digital finance on money supply in Nigeria over the period from 2008 to 2019. The study utilized the Auto-Regressive Distributed Lag (ARDL) model to analyze the data and derive conclusions. A unit root test was conducted as a diagnostic measure, indicating that the variables were integrated at levels I(0) and first difference I(1), thus justifying the use of the ARDL technique. The results of the ARDL analysis showed that digital finance, particularly deficit financing, had a positive and statistically significant effect on the money supply in Nigeria.

Dzogbenuku et al. (2021) examined the impact of digital payment systems on financial well-being in rural Ghana, with particular attention to variations across gender and age groups. The study found that security, ease of use, and convenience significantly influenced customer satisfaction. Females prioritized security, while males valued ease of use; younger users focused on convenience, whereas older users emphasized security. Customer satisfaction mediated trust and digital payment experiences, with females showing stronger trust linked to positive experiences. The findings underscore the importance of tailoring digital payment systems to meet diverse user needs based on demographic factors.

In a related study, Ajayi and Olufemi (2021) assessed the effect of Point of Sale (POS) systems on financial transactions in rural Nigeria. Employing a mixed-methods approach, the researchers combined qualitative interviews with rural bank managers and POS users,

alongside quantitative data gathered through questionnaires distributed to rural consumers. The study revealed that POS systems have significantly enhanced access to financial services in rural communities. By facilitating cashless transactions and minimizing the need for long-distance travel to bank branches, POS terminals have contributed to greater financial inclusion and convenience for rural dwellers.

Furthermore, Onuoha and Ugochukwu (2022) investigated the role of mobile banking and financial technology (FinTech) in improving rural development in Nigeria. The authors used a quantitative research design, distributing structured questionnaires to rural residents and business owners in Nigeria. Their study concluded that FinTech solutions have contributed to increasing financial inclusion, particularly among low-income and underserved rural populations. By offering digital loans, savings accounts, and remittance services, mobile banking platforms have helped rural Nigerians manage financial risks and access capital for small-scale businesses.

Ekechukwu and Mbah (2019) carried out a study to assess the influence of electronic banking on Nigeria's economic growth over the period from 2008 to 2018. The study used Mobile Transfers, Point-of-Sale (POS) systems, and Automated Teller Machines (ATM) as independent variables, while Real Gross Domestic Product (RGDP) served as the measure of economic growth. A range of econometric tools including the Augmented Dickey-Fuller (ADF) test, error correction mechanism, Breusch-Pagan-Godfrey test for heteroscedasticity, and the Durbin-Watson test were employed to analyze the data. The results revealed that Mobile Transfers and POS systems had varying effects on RGDP, showing both positive and negative relationships at different times. However, ATM usage consistently demonstrated a significant and positive impact on Nigeria's economic growth throughout the study period.

Gap in the Literature Review

Existing literature on technological innovation in rural financing largely focuses on urban areas, leaving rural regions, particularly in South East Nigeria, underexplored. Key gaps include a lack of research on the specific impact of mobile banking, ATMs, and POS systems in rural economies, and how these technologies foster financial inclusion in areas with limited banking services. Additionally, socio-cultural barriers such as low digital literacy, mistrust of digital systems, and gender disparities in technology adoption have been insufficiently addressed. Moreover, studies rarely examine the long-term economic and social impacts of these technologies, such as their effects on household income, small business growth, and agricultural productivity in rural areas. This study aims to fill these gaps by focusing on how technological innovations can improve financial access and promote rural economic development, while also considering the socio-cultural barriers to adoption.

3. Methodology

The study utilized a survey research design, which, as defined by Isangedighi et al (2004), involves collecting data that accurately reflects real-world conditions and behaviors. Data were gathered using a range of instruments, including questionnaires, interview guides, direct observations, and document reviews. The research was conducted across the five states in Nigeria's South East geopolitical zone: Enugu, Anambra, Abia, Imo, and Ebonyi. The study population consisted of 1,250 adults (which comprises of 250 adults from the North senatorial district of each state) within the age range of 20 to 50 years (The age range of 20 to 50 years was selected as it represents the economically active population most likely to engage with financial technologies like mobile banking, ATMs, and POS systems). A simple random sampling technique was employed to ensure that every member of the population had an equal chance of being selected. Despite the larger population, a final sample of 500 participants was

used for the analysis. The sample size for this study is determined using Taro Yamane's formula for sample size calculation, which is commonly used in social sciences research.
The formula is:

$$n = \frac{N}{1+N(e)2n}$$

Where:

n is the sample size
N is the total population of adults in rural South East Nigeria
e is the margin of error (0.05)

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Data were processed and analyzed using the Statistical Package for Social Sciences (SPSS). Quantitative responses were coded into a spreadsheet, and Pearson's product-moment correlation coefficient was used to evaluate the relationship between independent and dependent variables. A 0.01 significance level was set, with p-values above this threshold indicating no statistically significant relationship. Results were presented in tabular form, with mean (x^-\bar{x}x^-) scores and standard deviations (SD) used to summarize the data. In addition, qualitative data from interviews and document analysis were compared against questionnaire responses, providing a basis for confirming or challenging the quantitative outcomes.

4.0 Data Analysis and Interpretation of Results

4.1 Analysis of the First Objective

To assess this objective, responses from participants were analyzed using mean scores and standard deviations. The focus was on understanding how mobile banking influences access to and usage of financial services across the South East region of Nigeria.

Table 4.1: Mean and standard deviation responses of respondents on the impact of mobile banking on financial inclusion in South East Nigeria.

Issues Raised (SA=5, A=4...)	Mean	SDev	Remark
Mobile banking has made financial services more accessible to people in rural areas.	4.0380	1.31606	Agree
The use of mobile banking has significantly reduced the need to visit physical bank branches.	3.7520	1.23999	Agree
Mobile banking provides an affordable means of accessing financial services.	3.8180	1.43002	Agree
Mobile banking has enhanced savings among low-income earners in South East Nigeria.	3.7560	1.37267	Agree
Awareness of mobile banking services has improved financial literacy in the region.	3.9160	1.32531	Agree
Overall mean	**3.8560**		**Agree**

Source: Researcher's Computation, 2025

Table 4.1 presents the mean and standard deviation responses of the participants regarding the impact of mobile banking on financial inclusion in South East Nigeria. The responses indicated general agreement with all the items, as each recorded mean scores above 3.0. The highest mean score was recorded for the item "Mobile banking has made financial services more accessible to people in rural areas" (Mean = 4.0380, SDev = 1.31606). This reflects a strong

consensus among the respondents that mobile banking significantly improved access to financial services in rural communities. This result aligns with the findings of Adebisi and Emmanuel (2019), who asserted that mobile banking serves as a powerful instrument for promoting financial inclusion, particularly in underserved rural areas where access to traditional banking infrastructure is limited. The item "Awareness of mobile banking services has improved financial literacy in the region" also received a high mean score (Mean = 3.9160, SDev = 1.32531), suggesting that mobile banking not only facilitates access to financial services but also plays a role in enhancing financial knowledge in the region. This supports the argument by Afolabi (2021), who highlighted the importance of mobile banking in raising awareness and improving financial literacy among the Nigerian populace. "Mobile banking provides an affordable means of accessing financial services" (Mean = 3.8180, SDev = 1.43002) and "Mobile banking has enhanced savings among low-income earners in South East Nigeria" (Mean = 3.7560, SDev = 1.37267) also received significant agreement. This indicated that mobile banking reduces costs and encourages savings, particularly among low-income earners. These findings are consistent with studies by Smith and Akinwale (2022), who identified mobile banking as a key enabler for increasing savings, especially among financially underserved populations. The item *"The use of mobile banking has significantly reduced the need to visit physical bank branches"* recorded a slightly lower mean score (Mean = 3.7520, SDev = 1.23999), indicating that while mobile banking has reduced the need for physical visits to bank branches, the reduction is not as pronounced compared to other areas. However, it still reflects agreement among the respondents. This finding is similar to the work of Opara (2015), who found that while mobile banking reduces the dependency on physical banks, some users still prefer in-person transactions for certain services. The overall mean score of 3.8560 indicated a general agreement that mobile banking has a positive impact on financial inclusion in South East Nigeria. This finding is consistent with existing literature, notably the study by Kofi et al (2018), which identified mobile banking as a key driver of financial inclusion in Nigeria. Their research highlighted that mobile banking plays a particularly important role in rural regions, where limited access to traditional banking infrastructure presents a significant barrier.

4.2 Analysis of the Second Objective

To determine the impact of Automated Teller Machine on financial inclusion in South East Nigeria.

Table 4.2: Mean and standard deviation responses of respondents on the impact of Automated Teller Machine on financial inclusion in South East Nigeria.

Issues Raised (SA=5, A=4...)	Mean	SDev	Remark
The availability of ATMs has increased access to cash in rural areas.	3.9100	1.38771	Agree
ATMs have made banking services faster and more convenient for users.	3.7360	1.24153	Agree
The introduction of ATMs has reduced queues in bank branches in South East Nigeria.	3.8740	1.31970	Agree
ATMs enable users to perform transactions at any time, promoting financial inclusivity.	3.7940	1.21264	Agree
Security concerns with ATMs discourage people from fully utilizing their services.	3.5400	1.50763	Agree
Overall mean	**3.7712**		**Agree**

Source: Researcher's Computation, 2025

Table 4.2 presented the mean and standard deviation responses of participants on the impact of ATMs on financial inclusion in South East Nigeria. The responses indicated agreement with all items, as all mean scores were above 3.0. The highest mean score was recorded for the item "The availability of ATMs has increased access to cash in rural areas" (Mean = 3.9100, SDev = 1.38771), highlighting the significant role of ATMs in enhancing cash accessibility in underserved rural locations. This aligns with the findings of Eze and Ugwu (2022), who emphasized that ATMs bridge the gap between rural populations and banking services by providing easier access to cash. Similarly, the item "The introduction of ATMs has reduced queues in bank branches in South East Nigeria" (Mean = 3.8740, SDev = 1.31970) confirms the assertion by Ohazulike (2022) that ATMs minimize overcrowding in banks, thus improving the efficiency of financial service delivery. "ATMs enable users to perform transactions at any time, promoting financial inclusivity" (Mean = 3.7940, SDev = 1.21264) and "ATMs have made banking services faster and more convenient for users" (Mean = 3.7360, SDev = 1.24153) further demonstrate that ATMs enhance convenience and round-the-clock access to financial services. These findings corroborate the study by Umar and Lawal (2019), which revealed that ATMs play a crucial role in improving the convenience and timeliness of banking services in rural areas, thereby fostering financial inclusion. However, the item "Security concerns with ATMs discourage people from fully utilizing their services" (Mean = 3.5400, SDev = 1.50763) highlighted the challenges associated with ATM usage, particularly in rural settings. This aligns with the observations of Afolabi and Osakwe (2022), who noted that security concerns, such as fraud and ATM theft, remain significant barriers to the full adoption of ATM services in some regions. The overall mean of 3.7712 confirmed a general consensus that ATMs positively impact financial inclusion in South East Nigeria, particularly in rural areas. This finding is consistent with existing literature, such as Nwachukwu and Ugochukwu (2020), who identified ATMs as an effective tool for expanding financial inclusion by reducing physical and transactional barriers in rural areas.

4.3 Analysis of the Third Objective

To assess the impact of Point-of-Sale services on financial inclusion in South East Nigeria.

Table 4.3: Mean and standard deviation responses of respondents on the impact of Point-of-Sale services on financial inclusion in South East Nigeria.

Issues Raised (SA=5, A=4...)	Mean	SDev	Remark
Point-of-Sale (POS) services have brought banking closer to people in remote areas.	4.0000	1.27564	Agree
The availability of POS services has increased financial transactions in small-scale businesses.	3.7140	1.25193	Agree
POS services provide a reliable alternative to bank ATMs.	3.8240	1.37579	Agree
The use of POS services has reduced the reliance on physical cash in the region.	3.9240	1.35864	Agree
High transaction fees on POS services discourage their full utilization.	3.6520	1.31847	Agree
Overall mean	**3.8227**		**Agree**

Source: Researcher's Computation, 2025

Table 4.3 presents the mean and standard deviation responses of participants on the impact of Point-of-Sale (POS) services on financial inclusion in South East Nigeria. All items recorded mean scores above 3.0, indicating general agreement among respondents that POS services positively influence financial inclusion. The highest mean score was recorded for the item "The

use of POS services has reduced the reliance on physical cash in the region" (Mean = 3.9240, SDev = 1.35864), highlighting the significant role of POS services in promoting cashless transactions. This supports the findings of Okeke and Udeh (2022), who emphasized the role of POS services in reducing dependency on cash and enhancing financial inclusivity in underserved areas. The item "Point-of-Sale (POS) services have brought banking closer to people in remote areas" (Mean = 4.0000, SDev = 1.27564) reflects the ability of POS services to extend banking services to rural and remote areas, aligning with the study by Ifeanyi and Olu (2022), which identified POS services as a tool for bridging the gap between rural communities and formal financial services. Other items, such as "POS services provide a reliable alternative to bank ATMs" (Mean = 3.8240, SDev = 1.37579) and "The availability of POS services has increased financial transactions in small-scale businesses" (Mean = 3.7140, SDev = 1.25193), further underscore the positive impact of POS services. These findings align with Gwani (2023), who noted that POS services not only improve accessibility but also drive economic activities in small businesses. However, the item "High transaction fees on POS services discourage their full utilization" (Mean = 3.6520, SDev = 1.31847) highlights a notable limitation, as high transaction costs could reduce the adoption of POS services in some areas. This finding corresponds to the observations of Eze and Ugwu (2022), who identified high service charges as a barrier to the widespread use of POS services. The overall mean of 3.8227 indicates a general agreement that POS services significantly contribute to financial inclusion in South East Nigeria. These results support existing literature work of Hilal (2015) who highlighted the importance of POS services in promoting cashless policies and increasing financial awareness in rural areas.

Table 4.4: Pearson product moment Correlation Analysis of Mobile Banking, ATM, POS, and Financial Inclusion in South East Nigeria

	Correlations	Mobile Banking	ATM	Pos	Financial Inclusion
Mobile Banking	Pearson Correlation	1	.994**	.995**	.990**
	Sig. (2-tailed)		.000	.000	.000
	N	500	500	500	500
ATM	Pearson Correlation	.994**	1	.995**	.994**
	Sig. (2-tailed)	.000		.000	.000
	N	500	500	500	500
Pos	Pearson Correlation	.995**	.995**	1	.992**
	Sig. (2-tailed)	.000	.000		.000
	N	500	500	500	500
Financial Inclusion	Pearson Correlation	.990**	.994**	.992**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	500	500	500	500

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Researcher's Computation, 2025

The Pearson correlation coefficient results presented in Table 4.4 indicate very strong and statistically significant positive relationships between mobile banking, ATM usage, POS services, and financial inclusion in rural areas of South East Nigeria. These relationships were tested at the 0.01 level of significance, confirming the reliability of the findings. Notably, a near-perfect positive correlation was found between mobile banking and financial inclusion (r = 0.990), suggesting that as mobile banking adoption increases, access to financial services in rural communities also rises substantially. Similarly, ATM usage demonstrated a strong positive correlation with financial inclusion (r = 0.994), indicating that greater availability and use of ATMs significantly contribute to expanding financial access in these areas. There was an equally positive correlation between POS services and financial inclusion (r = 0.992), which indicates that as the availability of POS terminals increases, there will be a corresponding increase in financial inclusion in rural South East Nigeria. The he relationships among the independent variables; mobile banking, ATM usage, and POS services also showed very strong positive correlations. Mobile banking and ATM usage are highly complementary (r = 0.994), suggesting that the expansion of one service likely supports the growth of the other. Likewise, mobile banking and POS services (r = 0.995) are closely related, with the growth of mobile banking likely driving increased POS usage. The correlation between ATM and POS usage (r = 0.995) confirmed that these two technologies are intertwined in facilitating financial transactions, further enhancing financial inclusion in rural areas. The analysis of the Pearson correlation results implied that mobile banking, ATMs, and POS services are critical tools for financial transactions in South East Nigeria, significantly contributing to the improvement of financial inclusion in rural communities.

5. Conclusion and Recommendation

This study examined the impact of technological innovations specifically mobile banking, ATMs, and POS systems on financial inclusion in rural South East Nigeria. The analysis was carried out using Pearson's Product-Moment Correlation to assess the relationships between the usage of these technologies and financial inclusion. The results indicated strong and statistically significant positive correlations between the use of mobile banking, ATMs, POS services, and financial inclusion, confirming that these technologies significantly enhance access to financial services in rural areas. The study also highlighted that while mobile banking, ATMs, and POS systems have been instrumental in improving financial inclusion, there are barriers such as poor internet connectivity, low digital literacy, and security concerns that limit the full potential of these technologies. The findings suggest that these technological innovations are interrelated and work synergistically, with mobile banking supporting the growth of ATM usage and POS services. Despite the positive outcomes, it was clear that additional efforts are needed to improve infrastructure and address the challenges that still impede adoption. The analysis technique employed, Pearson’s correlation, confirmed that mobile banking, ATMs, and POS services are critical enablers of financial inclusion in rural South East Nigeria, but further efforts in addressing barriers and enhancing adoption are needed to fully harness their potential.

To enhance the impact of technological innovations on rural financing and financial inclusion, the following recommendations are proposed:

First, there is a need for improvements in digital infrastructure: reliable internet connectivity and consistent electricity supply are crucial to ensuring that mobile banking, ATMs, and POS systems function effectively in rural communities. These improvements will increase the efficiency and reliability of digital financial services, making them more accessible to rural populations.

Second, financial literacy and digital skills programs should be introduced at the community level: These programs would help bridge the digital divide by training individuals in rural areas to use mobile banking apps, ATMs, and POS systems effectively. Training initiatives should be carried out by local organizations, microfinance institutions, and community centers to ensure that rural residents are equipped with the necessary skills to engage with digital financial services. Importantly, governments and NGOs could provide financial support for such initiatives, ensuring widespread access to training across different rural areas.

Third, security measures should be enhanced to address concerns related to fraud and cybercrime: Financial institutions and technology providers should work together to implement robust security protocols, such as biometric verification and real-time fraud detection systems. These measures will help to build trust and encourage the widespread adoption of digital financial services.

Fourth, the government should create policies that promote rural financing: the government should ensure that financial institutions and digital service providers are incentivized to expand their operations into rural areas. Policy interventions could include subsidizing internet services for rural communities, offering tax incentives to businesses providing POS systems, and ensuring subsidized access to mobile banking platforms. Additionally, the government should engage in public-private partnerships to create programs that incentivize digital financial service providers to offer affordable services in rural regions.

Fifth, the government should address the challenges of training private operators in the rural areas: to address the challenge of training private operators of POS systems in rural areas, the government should partner with local financial institutions and mobile network providers to establish training hubs. These hubs could be set up at the community level to provide free or subsidized training programs for POS operators, ensuring that rural small-scale businesses can leverage digital payment systems effectively.

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