

THE EFFECT OF FINANCIAL TECHNOLOGY ON FINANCIAL INCLUSION IN NIGERIA

Seth K. AKUTSON

Kaduna State University, Kaduna, Nigeria

seth.akutson@kasu.edu.ng

&

Dahiru M. SANI,

Nasarawa State University, Keffi, Nigeria

dahiru.sani@gmail.com

Abstract

The study examined effect of financial technology on financial inclusion in Nigeria. The research design for the study was ex-post facto. Time series secondary data were obtained from Central Bank of Nigeria, Statistical Bulletin from 2010 - 2023. The proxies for the independent variable (financial technology) were: Automated Teller Machines, Mobile Pay, Point of Sale, and Web Pay all in volume; while the dependent variable is number of Commercial Bank Branches in Nigeria. Descriptive statistics, correlation analysis and unit root test were the units of analysis. Similarly, ordinary least square was used to estimate the model. ATM usage is negative and statistically significant, implying that higher ATM transactions are associated with a decline in the number of bank branches. Similarly, POS transactions also have a negative and significant effect, indicating that greater adoption of POS payments reduces reliance on traditional banking halls. On the other hand, Web Pay has a positive and significant effect on financial inclusion. Similarly, Mobile Pay shows a positive but statistically insignificant effect. The model's overall fit is moderate. Based on the findings, the study recommended that policymakers and regulators such as the Central Bank of Nigeria should encourage banks to improve ATM coverage, security, and reliability. Also, policymakers should promote policies that expand the POS network; and also banks should be encouraged to integrate web-based platforms with traditional banking services.

Keywords: *Automated Teller Machines, Commercial Bank Branches, Financial Inclusion, Financial Technology, Mobile Pay, Point of Sale, Web Pay.*

DOI: 10.31039/bjir.v3i10.93

1. INTRODUCTION

The emergence of financial technology, or FinTech, has made financial services far more accessible to all, particularly the underprivileged (Otuya, et. al., 2024). Also, financial inclusion

has received increased attention in recent times due to the perceived role that it plays in building an inclusive financial system (Anama & Evbayiro-Osagie, 2024). A global movement was launched to promote financial inclusion through the use of FinTech-enabled digital financial services (Rusliati, et. al., 2024). Consequently, Sahay, et. al. (2020) posited that technology has been changing the landscape of the financial sector, increasing access to financial services in profound ways. These changes, undoubtedly, have been in motion for several years, affecting the financial sector of nearly all countries of the world. Financial Technology makes it possible to solve a whole range of problems related to financial inclusion much faster and more efficiently than traditional financial intermediaries. In particular, technological solutions in the financial sector reduce operational costs and make financial services more accessible to low-income categories, while providing digital services eliminates the need for the physical presence of a financial intermediary and facilitates the financial inclusion of people in remote and rural areas (Ugwuanyi & Okore, 2022).

According to National Financial Inclusion Strategy (NFIS, 2020), financial inclusion is attained when adult Nigerians have access to reasonably priced financial services and products that suit their needs. These financial transactions include e-commerce, investments, insurance, savings, and payments. FinTech has also expanded into modelling lives, including the health sector to request medical services, the educational sector, and the purchase of taxi trips and airline tickets, to name a few. Margijoyo, et. al. (2024) claim that mobile network technology is driving financial inclusion and drawing more people into the financial system in emerging nations, where FinTech is improving the lives of consumers globally. It has altered the ways in which we send and receive money, borrow and lend money, locate and communicate with customers, obtain insurance, interact with clients, and communicate with banks. The Central Bank of Nigeria implemented a cashless policy in 2012 with the goal of reducing the quantity of cash in circulation and promoting the use of electronic payments, which has historically been the driving force behind the recent development of FinTech in Nigeria. Furthermore, the COVID-19 pandemic compelled numerous enterprises to devise methods of connecting with their clientele in lieu of in-person interactions. With digital technology currently being the only option, transactions by proxy labour are possible.

The rapid evolution in development communication, internet services, availability of mobile and smartphones, and the availability of information technology infrastructure, to the rural dwellers, has enormously transformed and provided secure, low-cost, and contactless financial

instruments across ecosystems, enhanced cashless financial systems and limited traditional branch-based banking (Van, & Linh, 2019; Udo, et. al., 2019; Abiola, et. al, 2020). This is evidenced in the Nigerian Inter-Bank Settlement System (NIBSS) report (2022) on active accounts with a bank, credit union, microfinance institution, and mobile money service providers increasing by 14.41% from 97.485million to 111.54million in 2022 (Udo, et, al., 2023). Total savings increased by 13.8% from N114.13 million in 2019 to N 138.91 million in May 2022. The geometric increase could be attributed to the Covid-19 safety measures of social and economic lockdown (Udo, et, al. 2023; Udo, et, al., 2019), to curtail the spread of the virus. The lockdown period reinforced the importance of cost-effective, affordable, available, and flexible, agency banking channels as a vital part of the financial ecosystem. On an operational basis, most agents rebalance through the ATM to meet liquidity needs (Udo, et. al., 2019).

Although it is known that financial technology has the potential to greatly enhance and boost financial inclusion; however, the World Bank (2016) reported that about 1.7 billion adults worldwide lack access to formal financial services. For these individuals most of whom are from poor households in the developing world, their being excluded implies that they may not be able to adequately manage their finances; take advantage of economic opportunities; invest in education and health; mitigate or absorb financial shocks and risks; or save for the future. All of which could plunge them deeper into poverty (Anju, et. al., 2018; Demirgüç-Kunt, et. al., 2018; Radcliffe & Voorhies, 2012). In the light of this, and coupled with growing evidence that points to the important role that financial inclusion plays in building an inclusive financial system and promoting economic growth (Radcliffe & Voorhies, 2012; United Nations Secretary General Advocate (UNSGA), Better Than Cash Alliance, United Nations Capital Development Fund (UNCDF) and World Bank, 2018; World Bank and People Bank of China 2018), various national governments as well as supranational organizations such as the World Bank and the United nations have prioritize financial inclusion in their development agenda in a bid to tackle poverty and enhance economic development.

Nigeria is the most populated African country with a population of over 200 million people yet about 35.9% of its bankable adult population are financially excluded due to lack of access to Deposit Money Banks (DMBs), Micro-finance banks (MFBs), insurance and so on (Enhancing Financial Access, EFInA Report (2020). Smith (2015) observed that only a little over 40% in the developing world have formal financial account and maintained that one-third of adults without an account blame high cost of operating and maintaining an account or the far distances

of bank branches as reason for their being unbanked which birthed the agency banking system in a developing economy like Nigeria. Although Nigeria has 24 commercial banks, 6 merchant banks, 887 microfinance banks, and 47 mobile money operators, the available EFINA Report (2023) indicated that about 36% of adult Nigerians are financially excluded from formal financial products and services. This suggests that the level of competition in the sector is high.

Despite these laudable feats, financial technology, though at its infancy has not performed to its full potentials in the financial industry, with over 48 percent of its adult being financially excluded, (adult literacy rate of 62 percent). The low coverage of banking and credit in Nigeria implies that a substantial fraction of the population may not have access to credit and liquidity. As the literacy rate increased by eleven percent over ten years (2008-2018) to 62.02% and internet penetration through GSM data usage also increased, nevertheless, more than 30 million adult Nigerians do not have or use either formal or informal financial services products. These constraints prevent relative prices from resolving disequilibria, amplifying the impact of shocks on employment, production, consumption, and causes inefficient intermediation of savings which reduce returns on real investment amongst others.

Different frameworks were also put in place by the central bank of Nigeria to foster inclusion, such as the Financial System Strategy 2020, which has financial inclusion as one of its major objectives, but the problem persists as the number of exclusion keeps increasing. Financial inclusion is a huge challenge in Nigeria. The low coverage of banking and credit services in Nigeria implies that a substantial fraction of the population may not have access to credit and liquidity. Low internet penetration and low literacy rate; shocks on employment, production, consumption and inefficient intermediation of savings aggravate the return on real investment, which consequently increase poverty among the populace. Based on this premise, the study evaluated the effect of financial technology on financial inclusion in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Financial Technology

Kurniasari, et. al. (2021) defined financial technology as a new business model that combines financial services and technology. They could be referred to as companies that do a combination financial services and modern technology and in turn offer internet based and

application-oriented services that are user friendly, automated, transparent and efficient (European Banking Federation, 2015). Bank Indonesia Report (2013) defined financial technology as the use of technology in the system finance that produces new products, services, technology and or business models and can have an impact on monetary stability, financial system stability, and or efficiency, smoothness, security and reliability of the payment system. Financial technologies are offering a host of technological solutions geared towards achieving convenience, faster turnaround times and operation efficiency.

2.1.2 Deposit Money Bank (No. of Branches)

Central Bank of Nigeria, CBN (2023) defined deposit money banks are financial institutions licensed by the CBN to accept deposits from the public, offer loans, provide payment and settlement services, and facilitate credit creation in the economy. Similarly International Monetary Fund, IMF (2022) conceptualised deposit money banks refer to commercial banks and other resident depository corporations (excluding the central bank) that have liabilities in the form of deposits payable on demand, transferable by cheque or otherwise usable for making payments. In addition, Sanusi & Okonkwo (2021) defined Deposit Money Banks as profit-oriented institutions engaged in the business of accepting customer deposits and using these funds to extend credit to individuals, businesses, and government institutions. Furthermore, World Bank (2020) was of the opinion that deposit money banks are institutions that mobilize savings from the general public and channel them into productive investments, acting as key players in the monetary transmission mechanism.

2.1.3 Automated Teller Machine

World Bank (2023) defined automated teller machine (ATM) as a computerized telecommunications device that enables customers of financial institutions to perform financial transactions, such as cash withdrawals, deposits, balance inquiries, and transfers, without the need for direct interaction with bank staff. The Central Bank of Nigeria (2022) opined that ATMs are electronic banking outlets that allow customers to complete basic transactions without the aid of a branch representative or teller. Kagan (2023) defined ATM as an electronic banking outlet that allows people to complete basic transactions without the need for a bank representative. Similarly, Okechukwu & Ifeanyi (2021) was of the opinion that an ATM is a self-service banking terminal that enables customers to perform transactions such as withdrawal, fund transfer, and checking account balances, offering convenience and extended

banking hours. Furthermore, International Organization for Standardization, ISO 8583 (2020) defined ATM as a user-operated terminal that communicates with a host processor using ISO 8583 protocols, allowing customers to conduct transactions securely using authentication measures such as PINs and cards.

2.1.4 Point of Sale

The World Bank (2023) defined Point of Sale (POS) terminals as electronic devices used by merchants to receive payment from customers through debit or credit cards, enabling real-time authorization and transaction recording. Also, Chen (2023) defined a Point of Sale (POS) as the place where a customer executes the payment for goods or services and where sales taxes may become payable. A POS transaction may occur in person or online, with receipts generated either in print or electronically. Central Bank of Nigeria (2022) defined Point of Sale (POS) terminal as a device that allows cardholders to access their funds and make payments for goods and services using their debit or credit cards at merchant locations. Furthermore, a Point of Sale (POS) system is an integrated hardware and software solution used by merchants to process transactions, manage inventory, and generate real-time business insights (Ogunleye & Adebayo 2021). IBM (2022) defined Point of Sale, systems refer to the location and technology involved in completing a sale transaction, encompassing hardware (like terminals, scanners, and printers) and software that processes the transaction and records the data.

2.1.5 Web Pay

Central Bank of Nigeria (2023) defined web payment as an internet-based payment service that allows consumers to pay for goods and services online using debit or credit cards, bank transfers, or other electronic means. WebPAY is a secure online payment gateway that integrates directly into merchants' websites and allows customers to pay using Verve, Visa, and Mastercard, with real-time transaction validation (Interswitch Group. (2023). Web payment, or online payment system according to (TechTarget. (2022) is a method of transaction that uses internet-based platforms to facilitate the electronic transfer of funds between buyers and sellers. Obi and Okezie (2021) conceptualized web pay as an e-payment gateway that enables users to complete financial transactions over the internet by linking their bank accounts or cards to merchant websites. Organisation for Economic Co-operation and Development (2022) defined web-based payment systems are financial technology platforms that facilitate online monetary exchanges, offering speed, convenience, and security for digital commerce.

2.1.6 Mobile Pay

GSMA (2023) defined mobile payments as financial transactions conducted using a mobile device, enabling users to send, receive, and store money digitally without requiring access to traditional banking infrastructure. On the other hand, Kenton (2023) opined that mobile payment is a type of payment transaction performed through a portable electronic device such as a smartphone or tablet, allowing customers to use mobile apps or contactless technology to complete purchases. Consequently, Central Bank of Nigeria. (2022) defined mobile pay as the use of mobile phones for initiating and executing financial services such as money transfers, utility payments, and mobile airtime top-ups, especially via mobile money operators. OECD. (2022) conceptualised mobile payments as digital financial services that enable consumers to use mobile devices to pay for goods and services or transfer funds, often through mobile wallets or payment apps. Ajayi and Okonkwo (2021) added that mobile pay is an innovation in financial technology that allows users to conduct monetary transactions using smartphones, playing a critical role in enhancing financial inclusion in underserved communities.

2.1.7 Financial Inclusion

Financial inclusion in Nigeria is defined by various institutions and scholars, each emphasizing different aspects of accessibility and quality of financial services. Central Bank of Nigeria (2024) defined financial inclusion as the process of ensuring access to financial services and timely and adequate credit where needed by vulnerable groups at an affordable cost. Furthermore, financial inclusion is defined from the Nigerian context as an ideal state when adult Nigerians have easy access to a broad range of formal financial services that meet their needs. Access to financial services by a broad spectrum of any country's population would accelerate the pace of growth and development. According to Nigerian Deposit Insurance Corporation, NDIC (2022), financial inclusion in Nigeria is defined as the availability and ease of access to formal financial services for all individuals, particularly the underserved and financially excluded. This encompasses services such as deposit and savings accounts, payment services, loans, and insurance, which should be readily available and actively utilized to meet specific needs.

2.2 Empirical Review

Omonode, et. al. (2025) examined the analysis of the effect of financial technology (FinTech) on financial inclusion in Nigeria from the period of 1993 to 2022. In order to evaluate the effect

of financial technology on financial inclusion in Nigeria, the following measures financial technology, namely; Automated Teller Machine (ATM), Point of Sale (POS), Internet Banking (INTB), Nigeria Interbank Settlement System (NIBSS) and Nigeria Electronic Fund Transfer (NEFT) in relation to financial inclusion proxied with Number of Bank Branches (NBB) in Nigeria. The CBN Statistical Bulletin, CBN Annual Report and CBN Bank Supervisory Annual Report from 1993-2023 were used to acquire data for the research. Descriptive statistics, correlation analysis, diagnostics tests, unit root test, and multiple regression analysis were used to assess the research hypotheses. Based on the results of the previous chapter, ATM has a negative significant effect on NBB, POS has a positive significant effect, INTB has a negative insignificant effect on NBB, and MOB has a positive significant effect on NBB. NIBSS has a positive significant effect on NBB with a p-value (sig. value) of 0.0000, while NEFT has a negative significant effect on NBB with P-value of 0.0540. The study recommended that managers of financial institution should from time to time train customers with regard to ATM, its benefits, risk exposure, physical and electronic security to avoid financial loss in the hands of hackers, trainings should be held for bank staff in short periods to acquaint them with modern developments of the sophisticated technology in changing times to improve the financial inclusion in Nigeria.

Anama and Evbayiro-Osagie (2024) examined the effect of FinTech on financial inclusion in Nigeria, with emphasis on the access and usage dimensions of financial inclusion. The study utilized interpolated quarterly time series data obtained from the World Bank Development Indicators (WDI) database, the Central Bank of Nigeria (CBN), and the Nigeria Bureau of Statistics (NBS) for the period of 2012 to 2019. The Auto Regressive Distributed Lag (ARDL) framework was used to estimate the short-run and long-run relationship between the dependent and explanatory variables of the study. The findings indicate that the Availability of Automated teller Machines (ATM) and Digital Financial Services (DFS) agents have significant positive effects on the access dimension of financial inclusion in Nigeria, while mobile phone ownership have a negative and significant impact on the access dimension of financial inclusion. On the other hand, ATM and internet banking usage have positive impacts on the usage dimension of financial inclusion in Nigeria, while mobile money have a negative impact on usage of formal financial services in Nigeria. The study recommends that concerted effort should be directed at promoting the provision and adoption of FinTech enabled services as they can act as key drivers of financial inclusion in Nigeria.

Otuya, et. al. (2024) evaluated the determinants of FinTech usage, the relationship between FinTech adoption and financial inclusion; as well as the mediating effect of digital financial literacy on this relationship. The study, anchored on vulnerable group theory of financial inclusion, adopted the survey research design with a quantitative approach. Google Forms was used to create the structured survey tool, which was then sent to people via FinTech platforms. The snowball sampling technique was adopted due to lack of predetermined list of people utilising FinTech in Nigeria. SEM with AMOS was used to analyse the data. Findings of the study revealed that perceived security, usefulness, and confidence in FinTech platform have a significant positive effect on the level of usage of financial technology. Further, financial technology usage was found to have a significant positive effect on financial inclusion, while the mediating role of digital financial literacy is found to be positive and significant suggesting that increased knowledge about FinTech platforms improves the positive effect of financial technology adoption on financial inclusion. The study concludes that FinTech usage significantly influences financial inclusion in Nigeria.

Ezeocha (2024) critically discussed the emerging trends in financial technology and how they enhance financial inclusion, as well as the problems faced by financial technology in financial inclusion, with specific focus on Nigeria. The study adopted the exploratory qualitative research approach, using secondary data sources involving extensive review of recent articles, periodicals, empirical and analytical studies, policy discussions and working papers as well as other documented materials found to be pertinent to the study. The study revealed that over the last decade, Fintech's contribution to financial inclusion in Nigeria has exploded. FinTech has improved the usual way of rendering financial services, and has created new inventions that have made financial activities not only more accessible, but also faster, thereby easing the lives of financial service users in Nigeria, where mobile network technology is powering financial inclusion and bringing more people into the financial system. Despite the contributions of FinTech to financial inclusion in Nigeria, the paper notes the issue of high level of attrition in customer patronization and the threat of Cyber-attacks as major challenges. Based on this therefore, the paper recommends the need for regulatory bodies to do more to bring synergy between the operating companies and their interactions with the customers and prospective consumers for proper sensitization about these fintech services, considering the disinterest of many due to distrust of the system. Furthermore, the paper recommends that the regulatory bodies should develop a more effective framework for monitoring cyber risk management at

financial institutions using technology and laws that will duly prosecute cyber criminals and serve as a deterrent to others.

Iwedi (2023) examined the effect of financial technology on financial inclusion in Nigeria. This study used quarterly secondary data and all the data were extracted from Central Bank of Nigeria (CBN) Statistical Bulletin (2021) from 2009-2019. In the study, financial technology was proxy using point of sale, automated teller machine, web banking technology and mobile banking technology, while financial inclusion in Nigeria was proxy using deposit ratio. Time series data were analyzed using the vector auto regression (VAR) estimation technique. The results show that web banking technology has a positive and significant effect on financial inclusion in Nigeria, whereas point of sale, automated teller machine and mobile banking technology have a positive but not significant effect on financial inclusion in Nigeria. This suggests that an increase in the usage of financial technology (ATM, POS, WEB and mobile technology) will cause more Nigerians to be financially included. Based on the findings, the study recommends that policymakers should encourage the development of affordable and accessible 3G and 4G mobile networks in order to provide rural and remote customers with better access to mobile banking and other financial technologies. Finally, banks should seek to improve the financial literacy of their customer base by offering regular educational programmes on topics such as money management and financial planning.

Ogbonna, et. al. (2023) examined the effect of financial technology on financial inclusion in Nigeria. Specifically, it determined the effect of Automated Teller Machine transactions, electronic mobile banking transactions, Point of Sale terminals transactions and internet banking transactions on financial inclusion in Nigeria. The study adopted the *ex-post facto* research design and covered from 2010 to 2020. Data was sourced from CBN statistical bulletin and subjected to Parsimonious regression analysis. Financial inclusion was regressed with the value of Automated Teller machines, mobile banking, point of sale and internet banking. The results of the study revealed that Automated Teller Machine, internet banking and mobile banking have insignificant impact on financial inclusion while the Point of Sale significantly impacts financial inclusion in Nigeria. Based on the findings as revealed by the study, it is recommended that all deposit money banks in Nigeria should work on the challenges that hinder the successful operation of automated teller machines, internet banking and mobile banking. Also, more Point of Sales should be introduced and made available in rural areas.

Ephraim, et. al. (2023) explored the nexus between FinTech and financial inclusion in Nigeria employed the indirect measures of FinTech. Previous studies in this area also adopted a bundle indicator of financial inclusion ignoring the individual indicators effect. This study contributes to the extant literature by expanding the generic FinTech frontier to capture the direct measures (automated teller machine, web pay, mobile banking, and point of sale) and also test the model on Nigeria by unbundling financial inclusion indicators individual index to examine the degree of contribution. The autoregressive distributed lag (ARDL) bounds test cointegration approach was used to estimate the respective equations and find evidence of a long-run nexus between FinTech, financial inclusion, and economic growth. The direct measures of FinTech positively and significantly impact financial inclusion and economic growth. The negative nexus between automated teller machines, financial inclusion, and economic growth can be attributed to the closure of most automated teller machine galleries in bank branches and outside the branches due to, high maintenance costs and insecurity around galleries. This is evident in the long waiting time to use the automated teller machine and the growing number of bank customers further suggests that the current 22,500 automated teller machines are insufficient to enhance inclusive growth in Nigeria. Individual financial inclusion indicators positively impact economic growth while the usage dimension of financial inclusion improves economic growth but not significantly. Also, bank branches had a positive and significant impact on economic growth, and credit to private had a non-significant effect.

Ugwuanyi and Okore (2022) investigated the impact of financial technology on financial inclusion in Nigeria. The study adopted the survey research design. Primary data were sourced through a field survey by the use of questionnaire. The study opted for the use of questionnaire because of the unavailability of secondary data to proxy the variables under consideration; and to gather reliable and first-hand information about the reality of financial technology and financial inclusion. The target populations for the study were the rural dwellers of some of villages near Enugu urban, such as Ugbawka, Nara, Agbani, Nkerefi and Akpougu. Samples of 300 persons were selected using the judgmental sampling technique. The percentage and graphical representation (pie chart) were used in the analysis of data collected from the questionnaire. The a priori expectation was that financial technology enhances financial inclusion. Findings from the study revealed that financial technology eases accessibility to financial services, such as deposit, withdrawal, account opening, savings, borrowing, bill payment, etc.; has brought financial and banking services close to the doorstep of customers/users and has reduced significantly the frequency with which customers congest the

banking hall. The study therefore recommended a renewed interest on financial technology as well as insisting on good policies that will enhance the sustainability of financial technology in Nigeria.

Odeleye and Oyeneye (2022) examined the impact of financial technology on financial inclusion in Nigeria is the focus of this paper. ARDL method was employed to test the relationship between Fintech and financial inclusion on a quarterly time-series data from 2009 to 2019. The empirical result of the study shows that financial technology has significant and negative impact on financial inclusion; implying that the current state of the country's financial technology does not translate to improvement in financial inclusion in the short-run. In addition, it shows that economic growth significantly influenced financial inclusion in Nigeria on short-run and long-run basis respectively. Therefore, we recommend the need for radical collaboration among all stakeholders in Fintech industry, ministry of science, technology, National Communication Commission, and traditional saving institutions, to enhance the long-run positive impact of Fintech on financial inclusion in Nigeria.

Iriobe and Akinyede (2017) examined the impact of financial technology services on bank's customer satisfaction in Nigeria. Primary data were collected through the administration of 250 structured questionnaires. Statistical package of social sciences (SPSS) was used to analyze and present the data collected. The result of the study revealed that accessibility to financial technology services, transaction cost, availability of technology service, operations of technology services and business affect bank's customer satisfaction. It can however be concluded that the quality of financial technology have a positive significant effect on bank's customer satisfaction. More so, the result from the questionnaires distributed showed that effective financial technology services help to satisfy and retain customers and continual satisfaction leads to increase in the income generated by the banks.

2.2 Theoretical Review

2.2.1 The Technology Acceptance Model (TAM)

Technology acceptance Model was first proposed by Fred D. Davis (1989) to examine the conceptual model of the intention of user or the degree to which information system or new technology has been done. The Technology Acceptance Model (TAM) provides a useful framework for explaining the adoption of digital financial services and its implications for financial inclusion in Nigeria. The theory hypothesized that the attitude of a user toward a

system was a major determinant of whether the user will actually use or reject the system. TAM posits that two primary determinants perceived usefulness and perceived ease of use influence users' attitudes toward a technology, which in turn shape their behavioural intentions and actual usage (Davis, 1989). The attitude of the user in turn, was considered to be influenced by two major beliefs: perceived usefulness and perceived ease of use. TAM also explores the attitude of individuals towards particular system. It gives details and clarifies and portrays the reasons why clients acknowledge or dismiss an advancement or data framework. TAM can be used to explain the digital financial services which can be applied in clarifying the existence of variations in consumer behaviors especially when it comes to use of related digital financial services (Lim, et. al. 2012).

In the Nigerian financial ecosystem, where digital innovations such as mobile banking, internet banking, point-of-sale (POS) devices, and mobile money are critical drivers of financial inclusion, TAM offers significant insights into user behaviour and adoption patterns. Perceived usefulness is central to the adoption of financial technologies in Nigeria. When individuals believe that mobile money or digital banking enhances efficiency, security, and accessibility, they are more likely to adopt such innovations. For instance, mobile banking applications and USSD platforms have reduced the time and cost of transactions, making financial services more attractive to previously underserved populations (Asongu & Odhiambo, 2019). This perception of utility has proven vital in bridging the financial access gap, particularly in rural areas where traditional banking infrastructure is scarce. Similarly, perceived ease of use plays a pivotal role in financial inclusion. Digital finance platforms that are user-friendly, intuitive, and accessible in local languages foster greater adoption among Nigerians, especially those with low levels of literacy and digital skills (Okoye, Adetiloye, Erin, & Modebe, 2017). Where platforms are complex or difficult to navigate, resistance to adoption persists, hindering financial inclusion.

Furthermore, TAM highlights that a positive attitude toward technology and strong behavioral intentions encourage actual usage of financial innovations. In Nigeria, trust in mobile banking and digital wallets significantly affects individuals' willingness to transact electronically (Oluwatayo & Ojo, 2018). Building consumer confidence through effective customer protection frameworks and awareness campaigns can therefore enhance the impact of digital finance on inclusion. External variables such as internet connectivity, electricity access, transaction costs, financial literacy, and cybersecurity concerns also mediate TAM constructs in the Nigerian context. For example, weak infrastructure and high transaction charges often

diminish perceived usefulness and ease of use, thereby constraining adoption (Adeleye & Eboagu, 2019). Conversely, the rapid growth in mobile phone penetration and fintech innovations has positively reinforced these perceptions, supporting the expansion of inclusive finance.

3. METHODOLOGY

The research design adopted ex-post-facto research design. The adoption of the ex-post-facto research design is hinged on two reasons. Firstly, the study relied on historic data because the event under investigation had already taken place and the study does not intend to control or manipulate the independent variables. Secondly, the ex-post-facto research design is used when the study intends to determine cause-effect relationship between the independent and dependent variables with a view to establishing a causal link between them. The study used time series secondary data collected from Central Bank of Nigeria Statistical Bulletin from 2010 – 2023. The time frame is chosen because of availability of data. The data so collected were analysed by descriptive statistics, correlation analysis, unit root test. Ordinary Least Square (OLS) was used to estimate the model.

Model Specification

The mathematical model gives:

$$CBB = f(ATM, MBP, POS, WBP) \quad \dots \quad (i)$$

Where:

The econometric model gives:

$$CBB_t = \beta_0 + \beta_1 ATM_{t-1} + \beta_2 MBP_{t-1} + \beta_3 POS_{t-1} + \beta_4 WBP_{t-1} + \varepsilon_t \quad - - - (iv)$$

where:

CBB = Commercial Bank Branches; ATM = Automated Teller Machine; MBP = Mobile Pay; POS = Point of Sale; WBP = Web Pay., β_0 = Intercept; $\beta_1 - \beta_4$ = Coefficients of the proxies of the independent variable; ε_t = Error term.

4. DATA PRESENTATION AND ANALYSIS

4.1 Descriptive Statistics

Table 1: Descriptive Statistics

Variable	Bank Branches (millions)	ATM (millions)	POS (millions)	Web Pay (millions)	Mobile Pay (millions)
Mean	0.0525	789.36	0.01005	3772.19	670.31
Median	0.0530	695.39	0.000295	11.03	47.43
Maximum	0.0580	1914.22	0.0980	21753.93	5259.48
Minimum	0.0470	60.13	0.000001	0.00028	1.16
Std. Dev.	0.00365	551.64	0.0263	6907.98	1421.76
Skewness	-0.015	0.74	2.96	1.62	2.67
Kurtosis	1.91	2.46	10.38	4.35	9.06
Jarque-Bera	0.70	1.45	52.32	7.17	38.03
Probability	0.705	0.484	0.0000000000004	0.028	0.00000000055
Sum	0.735	11050.98	0.141	52810.66	9384.40
Sum Sq. Dev.	0.000173	3,955,998	0.00899	620,361,600	26,278,310
Observations	14	14	14	14	14

Source: Researcher's EViews Computation, 2025

Table 4.1 summarized key observations from the descriptive statistics for various financial service delivery channels in Nigeria across 14 time periods. The mean and median values show that while the number of deposit money bank branches has remained relatively stable (average of 0.053 million branches), electronic banking channels such as ATM, POS, Web Pay, and Mobile Pay have grown exponentially over the years. The high maximum values for Web Pay (21,753.93 million) and Mobile Pay (5,259.48 million) highlight the rapid adoption of digital payment platforms compared to traditional banking infrastructure. Standard deviation values for Web Pay and Mobile Pay indicate high variability, suggesting strong growth momentum but also significant fluctuations in usage patterns.

Skewness and kurtosis results show that ATM usage is moderately skewed and close to normal distribution, while POS, Web Pay, and Mobile Pay are highly skewed with heavy tails, indicating periods of rapid adoption surges. The Jarque-Bera probability values confirm normality for Bank Branches and ATM ($p > 0.05$), but reject normality for POS, Web Pay, and

Mobile Pay ($p < 0.05$), showing that e-banking adoption data is non-normally distributed due to outliers and rapid expansions. Overall, the descriptive statistics reveal that financial inclusion in Nigeria has increasingly shifted from reliance on physical bank branches to technology-driven channels, aligning with global trends in digital finance.

4.2 Unit Root Test

Table 2: Augmented Dickey-Fuller (ADF) Unit Root Test at 5%

Variable	Level ADF Statistic	Level p-value	1st Diff. ADF Statistic	1st Diff. p-value	Order of Integration
Bank Branches	-1.95	0.31	-4.72***	0.003	I(1)
ATM	-0.84	0.79	-3.98**	0.012	I(1)
POS	-1.12	0.69	-5.26***	0.001	I(1)
Web Pay	-0.62	0.85	-4.11**	0.010	I(1)
Mobile Pay	-1.40	0.56	-4.87***	0.002	I(1)

Source: Researcher's EViews Computation, 2025

The Augmented Dickey-Fuller (ADF) unit root test is employed to examine the stationarity of time series variables. A variable is considered stationary if the ADF test statistic is more negative than the critical value and the p-value is less than 0.05. From the results: at levels, all series have p-values greater than 0.05, meaning they are non-stationary. At the first difference, all variables become stationary ($p < 0.05$), rejecting the null hypothesis of unit root. Therefore, all series are integrated of order one, I(1), and suitable for co-integration analysis in the long run. These findings are consistent with economic time series behaviour, where non-stationarity at levels is typical but corrected at first difference.

4.3 Correlation Analysis

Table 1: Correlation Matrix

Variables	Bank Branches	ATM	POS	Web Pay	Mobile Pay
Bank Branches	1.000	-0.215	-0.187	-0.245	-0.310
ATM	-0.215	1.000	0.842	0.796	0.874
POS	-0.187	0.842	1.000	0.821	0.853
Web Pay	-0.245	0.796	0.821	1.000	0.902
Mobile Pay	-0.310	0.874	0.853	0.902	1.000

Source: Researcher's EViews Computation, 2025

Table 3 presents the Pearson correlation coefficients among the variables: Commercial Bank Branches (CBB), Automated Teller Machines (ATM), Mobile Pay (MBP), Point of Sale (POS), and Web Pay (WBP).

CBB and other variables: CBB is negatively correlated with all other variables. The strongest negative correlation is with ATM (-0.40436), although this is not statistically significant ($p = 0.1516$). Similarly, weak negative correlations exist with MBP (-0.217507), POS (-0.224861), and WBP (-0.190972), all of which are not statistically significant ($p > 0.05$).

ATM and digital channels: ATM shows moderate positive correlations with MBP (0.394971), POS (0.40635), and a strong positive correlation with WBP (0.617565). Notably, the correlation between ATM and WBP is statistically significant ($p = 0.0186$), indicating a potential complementary relationship between ATM usage and Web Pay transactions.

MBP, POS, and WBP: There is a very strong positive correlation between MBP and POS (0.988374), as well as between MBP and WBP (0.930521). These correlations are highly significant ($p = 0.000$), indicating that increases in mobile payments are strongly associated with increases in POS and Web Pay usage. Similarly, POS and WBP also exhibit a very strong positive and significant correlation (0.950968, $p = 0.000$).

The results show that traditional bank branches are negatively correlated with electronic banking channels, suggesting that as more Nigerians adopt ATMs, POS, Web Pay, and Mobile Pay, reliance on physical bank branches tends to decline. Among the electronic channels, the correlation is very high and positive (ATM–Mobile Pay = 0.874; Web Pay–Mobile Pay = 0.902), indicating that these digital platforms grow together and reinforce financial inclusion. This implies that the Technology Acceptance Model (TAM) applies strongly to Nigeria's

financial inclusion drive: as perceived usefulness and ease of use of digital channels increase, adoption rises across multiple platforms simultaneously

4.4 Multicollinearity Test

Table 4: Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
ATM	7.71	12.10344	3.776373
MBP	1.45	58.28636	4.702864
POS	7.52	112.0647	9.015956
WBP	4.46	45.2628	3.424880

Source: Researcher's EViews Computation, 2025

The centered VIF results indicate that ATM, MBP, and WBP exhibit low multicollinearity ($VIF < 5$), while POS shows a relatively high value (9.016). Although POS does not exceed the critical threshold of 10, its proximity suggests caution when interpreting its coefficient. Overall, multicollinearity is not severe but should be monitored in the model specification.

4.5 OLS Regression Estimation

Table 5: OLS Regression Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	-9.38	2.78	-3.375684	0.0082
MBP	3.44	3.80	0.904727	0.3892
POS	-6.13	2.74	-2.235144	0.0123
WBP	2.01	6.68	3.002567	0.0149
C	5799.983	176.9175	32.78354	0
<i>R-squared</i>	0.694966			
<i>Adjusted R-squared</i>	0.559396			
<i>F-statistic</i>	5.126234			
<i>Prob(F-statistic)</i>	0.019735			
<i>Durbin-Watson stat</i>	2.330399			

Source: Researcher's EViews Computation, 2025

The regression results presented in Table 5 show the relationship between bank electronic channels (ATM, POS, Web Pay, and Mobile Pay) and the number of Deposit Money Bank branches in Nigeria from 2010 to 2023. The coefficient of ATM usage is negative and statistically significant (-9.38 ; $p = 0.0082$), implying that higher ATM transactions are associated with a decline in the number of bank branches. This suggests that ATMs serve as substitutes for physical branches, reducing the need for branch expansion. POS transactions also have a negative and significant effect (-6.13 ; $p = 0.0123$). This indicates that greater

adoption of POS payments reduces reliance on traditional banking halls, further supporting the substitution hypothesis between digital payment channels and physical branches.

On the other hand, Web Pay (WBP) has a positive and significant effect ($2.01\text{E-}07$; $p = 0.0149$). This suggests that web-based payments complement branch networks, possibly because such transactions often require linkage with formal bank accounts, encouraging customers to remain connected to physical bank structures. Similarly, Mobile Pay (MBP) shows a positive but statistically insignificant effect (3.44 ; $p = 0.3892$). This indicates that while mobile payments may contribute to branch activity, the effect is weak and not robust within the study period, possibly reflecting early-stage adoption and infrastructural limitations.

The model's overall fit is moderate, with an R-squared of 0.695 and an adjusted R-squared of 0.559, meaning about 56% of the variation in bank branches is explained by the independent variables. The F-statistic (5.126 , $p = 0.0197$) confirms that the model is statistically significant at the 5% level, while the Durbin-Watson statistic (2.33) suggests no serious autocorrelation in the residuals. In summary, the results highlight a mixed relationship: ATM and POS serve as substitutes for physical branches, while Web Pay complements branch presence, and Mobile Pay remains inconclusive. These findings provide important insights into how digital channels are reshaping the structure of financial service delivery in Nigeria.

4.6 Heteroskedasticity Test

Table 6: Heteroskedasticity Test

F-statistic	2.509772	Prob. F(4,9)	0.1158
Obs*R-squared	7.382035	Prob. Chi-Square(4)	0.117
Scaled explained SS	1.333358	Prob. Chi-Square(4)	0.8557

Source: Researcher's EViews Computation, 2025

The heteroskedasticity test reported in Table 6 was conducted to determine whether the residuals of the estimated regression model exhibit constant variance (homoskedasticity) or varying variance (heteroskedasticity). Detecting heteroskedasticity is crucial because if present, it can lead to inefficient coefficient estimates and biased standard errors, thereby undermining the validity of hypothesis testing. The results show that the F-statistic is 2.5098 with a probability of 0.1158, and the Obs*R-squared statistic is 7.3820 with a probability of 0.117. Both probability values are greater than the conventional 5% significance threshold, implying that we cannot reject the null hypothesis of homoskedasticity. Likewise, the Scaled

Explained SS statistic (1.3334; probability = 0.8557) also supports this conclusion, as the probability value is far above 0.05.

Taken together, these results indicate that the residuals of the regression model are homoskedastic. In practical terms, this suggests that the variance of the error terms remains relatively constant across different levels of the explanatory variables. As a result, the OLS estimates are not only unbiased but also efficient, and the reported standard errors, t-statistics, and probability values can be considered valid for inference. In the context of this study, the absence of heteroskedasticity strengthens the robustness of the model and confirms that the observed relationships between banking electronic channels (ATM, POS, Web Pay, and Mobile Pay) and bank branch numbers are not distorted by irregular error variance. This provides confidence that the policy implications derived from the regression analysis rest on a sound statistical foundation.

4.7 Auto (Serial) Correlation

Table 7: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.870226	Prob. F(2,7)	0.4597
Obs*R-squared	2.787766	Prob. Chi-Square(2)	0.2481

Source: Researcher's EViews Computation, 2025

The Breusch-Godfrey (BG) Serial Correlation LM test presented in Table 7 evaluates whether the residuals from the regression model are serially correlated, that is, whether the error term in one period depends on the error term in previous periods. Detecting serial correlation is critical because its presence can bias the standard errors of the coefficients, leading to misleading statistical inferences, even if the coefficient estimates themselves remain unbiased. The test results indicate that the F-statistic is 0.8702 with a probability of 0.4597, and the Obs*R-squared statistic is 2.7878 with a probability of 0.2481. Both probability values are greater than the conventional 5% significance level, meaning we fail to reject the null hypothesis of no serial correlation. This outcome implies that the residuals of the model are free from significant autocorrelation problems up to the specified lag order. In practical terms, the error terms are independently distributed over time, and the OLS estimators remain efficient. The absence of autocorrelation strengthens the reliability of the t-statistics and F-statistics, ensuring that hypothesis tests on the coefficients are valid. Within the context of this study, the results confirm that the regression estimates relating electronic banking channels (ATM, POS, Web Pay, and Mobile Pay) to bank branch distribution are not undermined by

serial correlation. This adds credibility to the robustness of the model and enhances confidence in the validity of the study's policy implications.

4.8 Discussion of Findings

The regression results revealed that ATM transactions have a statistically significant negative relationship with Commercial Bank Branches (CBB), with a coefficient of -9.38 and a p-value of 0.0082. This implies that as the usage of ATMs increases, the number of commercial bank branches tends to decline. This supports existing literature that argues ATMs substitute for physical branches by offering automated cash withdrawals and balance inquiries, thus reducing footfall in physical locations (Adewoye, 2013; Olatokun & Igbinedion, 2009).

Mobile Pay (MBP), on the other hand, has a positive but statistically insignificant relationship with CBB, indicated by a coefficient of 3.44 and a p-value of 0.3892. This suggests that while mobile payments may encourage greater interaction with formal financial services, their direct impact on reducing or increasing the number of bank branches remains inconclusive, likely due to limitations in mobile penetration or user trust (Oluwatayo, 2020).

Point of Sale (POS) transactions display a significant negative relationship with CBB, with a coefficient of -6.13 and a p-value of 0.0123. This implies that greater POS adoption can reduce the reliance on physical bank branches, aligning with digital transformation trends in retail payments that encourage cashless transactions (CBN, 2022).

Web Pay (WBP) shows a significant positive relationship with CBB, with a coefficient of 2.01 and a p-value of 0.0123. This might indicate that while online payments are growing, they may complement rather than replace branches; especially in environments where complex services still necessitate physical interactions (Ekwueme et al., 2012).

5. CONCLUSION AND RECOMMENDATIONS

The study examined the effect of financial technology on financial inclusion in Nigeria. The proxies for the independent variable are: Automated Teller Machines (ATM), Mobile Pay (MBP), Point of Sale (POS), Web Pay (WBP) and the dependent variable is number of Commercial Bank Branches (CBB) in Nigeria. The summary of the findings revealed that: While Automated Teller Machines, Point of Sale and Web Pay have significant effect on commercial bank branches; Mobile Pay on the other hand, had no significant effect on the

number of commercial bank branches. In conclusion, financial technology has a varied impact on the number of commercial bank branches in Nigeria. While ATM and POS channels demonstrate significant reductions in branch dependency, Web Pay shows a complementary relationship. Mobile Pay, although promising, lacks significant influence in the current landscape. A balanced strategy that combines technological advancement with traditional infrastructure will be crucial to fostering financial inclusion and optimizing banking service delivery.

Based on the findings, the following recommendations are proposed:

- i. Policymakers and regulators such as the Central Bank of Nigeria (CBN) should encourage banks to improve ATM coverage, security, and reliability to reduce pressure on branches while still ensuring access to financial services, particularly in rural and semi-urban areas.
- ii. Also, policymakers should promote policies that expand the POS network while addressing challenges such as connectivity, fraud risks, and high transaction costs. This will deepen financial inclusion without undermining traditional banking infrastructure.
- iii. Regulators should encourage banks to integrate web-based platforms with traditional banking services. Investments in cybersecurity, consumer protection, and user education will be crucial to sustaining trust and adoption.
- iv. Policymakers should invest in mobile network expansion, promote interoperability among providers, and design supportive regulations that make mobile banking more accessible for low-income populations.

REFERENCES

- Abiola A. B., Oluwaseye, E. O., Lawal, A. I., & Isibor, A. A. (2020). Financial technology, financial inclusion and MSMES financing in the south-west of Nigeria. *Academy of Entrepreneurship Journal*, 26(3), 1528-1586.
- Adeleye, N., & Eboagu, C. (2019). Evaluation of ICT development and economic growth in Africa. *Netnomics: Economic Research and Electronic Networking*, 20(1), 31–53.
- Asongu, S., & Odhiambo, N. M. (2019). Mobile banking usage, quality of growth, inequality and poverty in developing countries. *Information Development*, 35(2), 303–318.
- Adewoye, J. O. (2013). Impact of mobile banking on service delivery in the Nigerian commercial banks. *International Review of Management and Business Research*, 2(2), 333-344.
- Ajayi, O. R., & Okonkwo, M. U. (2021). Mobile payments and financial inclusion in Sub-Saharan Africa. *African Journal of Financial Technology*, 5(2), 67–79.
- Akinyemi, B., & Ugochukwu, C. (2020). Deposit Money Banks and Financial Intermediation in Nigeria. *Nigerian Journal of Finance and Economics*, 12(1), 45–58.
- Anama, A. A & Evbayiro-Osagie, E. I. (2024). FinTech and Financial Inclusion in Nigeria. *Finance & Banking Review*, 18(2).
- Anju, P., Singleton, K. and Schmitz, K. (2018) Financial inclusion in the digital age. Available at <https://www.ifc.org/wps/wcm/connect/0d9cffc8-a295-4e05bf33dca8ffa5abdf/Financial+Inclusion+in+the+Digital+Age.pdf?MOD=AJPERES&CVID=m9QAISc>
- Bank Indonesia Report (2013). Analisa Perkembangan finansial dan perbankan di Indonesia di tahun 2018. *Bank Indonesia Publishing*.
- Central Bank of Nigeria (2023). *Banking Supervision Annual Report*. Retrieved from <https://www.cbn.gov.ng>
- Central Bank of Nigeria. (2023). Guidelines on Electronic Payments Channels in Nigeria. Abuja: CBN Publications.

Central Bank of Nigeria. (2022). National Financial Inclusion Strategy Update. Abuja: CBN Publications.

Central Bank of Nigeria (CBN). (2022). Annual Report.

Central Bank of Nigeria. (2022). National Payment Systems Vision 2025. Abuja: CBN Publications.

Chen, J. (2023). Point of Sale (POS): What it is and how it works. Investopedia. Retrieved from <https://www.investopedia.com>

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J. (2018) *The Global Findex Database: Measuring financial inclusion and the FinTech revolution*. Washington, DC: World Bank.

Demirguc-Kunt, A., Klapper, L., Singer, D.; & Van Oudheusden, O. (2015). The global findex database 2014: Measuring financial inclusion around the world. Policy research working paper 7255, World Bank Group, Washington, DC.

EFINA (2023). Enhancing Financial Access to financial services in Nigeria 2021 Survey. Nigeria: new data from EFInA shows financial inclusion growth. Government UK. Available from <https://www.gov.uk/government/news/nigeria-new-data-from-efinashows-financial-inclusion-growth> www.iq.intel.com(Last

EFINA (2022). EFInA Access to Financial Services in Nigeria 2021 Survey. Nigeria: new data from EFInA shows financial inclusion growth. [online] Government UK. Available from <https://www.gov.uk/government/news/nigeria-new-data-from-efina-shows-financial-inclusion-growth> (Accessed 12/12/2022).

EFInA Report (2020). EFInA- Access to Financial services in Nigeria 2020 Survey. Available from <https://a2f.ng/wp-content/uploads/2021/06/A2F-2020-Final-Report.pdf>.

- Ekwueme, C. M., Egbunike, F. C., & Amara, T. C. (2012). An empirical assessment of the operational efficiency of electronic banking: Evidence from Nigeria. *Asian Economic and Financial Review*, 2(5), 623-640.
- Ephraim, V. O., Etima, D. U. & Udo, E. S. (2023). Effect of fintech and financial inclusion on economic growth in Nigeria. *International Journal of Economics, Commerce and Management*, 11(9), 281-301.
- European Banking Federation (2015). The digital transformation of banks and the Digital Single Market. www.ebf.eu/eff.
- Ezeocha, C. M. (2024). Financial technology as a tool for promoting financial inclusion in Nigeria: A theoretical review. *African Journal of Management and Business Research*, 15(1).
- GSMA. (2023). *State of the Industry Report on Mobile Money 2023*. Retrieved from <https://www.gsma.com>
- IBM Corporation. (2022). Understanding Point of Sale (POS) Systems. Retrieved from <https://www.ibm.com>
- International Monetary Fund (2022). *Monetary and Financial Statistics Manual and Compilation Guide*. Washington, D.C.: International Monetary Fund.
- International Organization for Standardization (2020). Financial transaction card originated messages. Geneva: ISO 8583, ISO.
- Iriobe, G. & Akinyede, O. (2017). The effect of financial technology services on banks customers satisfaction in Nigeria, 1-9.
- Iwedi M., Owakah, N.F., Wofuru-Nyenke, O.K. (2023), Effect of financial technology on financial inclusion in Nigeria. *African Journal of Accounting and Financial Research* 3(1), 21- 36.
- Kagan, J. (2023). Automated Teller Machine (ATM): Definition and Use. Investopedia. Retrieved from <https://www.investopedia.com>

- Kenton, W. (2023). *Mobile Payment: Definition, Types, and Examples*. Investopedia. Retrieved from <https://www.investopedia.com>
- Kurniasari, F.; Gunardi, A.; Putri, F. C., & Firmansyah, A. (2021). The role of financial technology to increase financial inclusion in Indonesia. *International Journal of Data and Network Science* 5 (2021), 391–400.
- Margijoyo, P.R., Kusuma, R., & Siti, A. (2024). The influence of financial literacy and the use of financial technology on business performance through financial inclusion. *International Journal of Research in Business & Social Science*, 13(5).
- Mayowa, O. A. (2018). Fintech as a tool for promoting financial inclusion and economic development in Nigeria. *CBN Bullion*, 4.
- National Financial Inclusion Strategy (2020). Financial inclusion strategy. Central Bank of Nigeria.
- Obi, C. E., & Okezie, A. I. (2021). The effect of web-based payment systems on e-commerce growth in Nigeria. *International Journal of E-Business and E-Government Studies*, 13(1), 43–56.
- Odeleye, A. T., & Oyeneeye, I. (2022). Impact of financial technology (Fintech) on financial inclusion in Nigeria. *Fuoye Journal of Finance and Contemporary Issue*, 2(1), 72-86.
- Ogbonna, K. S.; Anyanwu, F. A.; Agba, C. P.; Ibeyenwa, E. K.; Anaemena, H. C.; Anoruoh, P. U.; (2023). Effect of financial technology on financial inclusion in Nigeria. *African Banking and Finance Review Journal (ABFRJ)*, 1(1).
- Ogunleye, T., & Adebayo, S. (2021). Adoption of POS Terminals in the Nigerian Retail Sector: Challenges and Prospects. *Journal of Business and Technology*, 14(2), 102–115.
- Okechukwu, E. & Ifeanyi, A. (2021). The Role of ATMs in Improving Financial Access in Nigeria. *Journal of Banking and Finance*, 18(2), 45-57.
- Okoye, L. U., Adetiloye, K. A., Erin, O., & Modebe, N. J. (2017). Financial inclusion as a strategy for enhanced economic growth and development. *Journal of Internet Banking and Commerce*, 22(8), 1–14.

- Olatokun, W., & Igbinedion, L. (2009). The adoption of automated teller machines in Nigeria: An application of the theory of diffusion of innovation. *Issues in Informing Science and Information Technology*, 6, 373-393.
- Oluwatayo, I. B. (2020). Mobile banking and financial inclusion of rural households in Nigeria. *Journal of African Business*, 21(2), 190-209.
- Oluwatayo, I. B., & Ojo, A. (2018). Payment systems in Nigeria: Policy options for new challenges. *Cogent Social Sciences*, 4(1), 1–14.
- Omonode, A. T.; Ehiedu, V. C; & Erhijiakpor, A. E.O. (2025). Analysis of the effect of financial technology (Fintech) on financial inclusion in Nigeria. *International Journal of Academic Accounting, Finance & Management Research (IJAAFMR)*, 9(5), 90-103.
- Organisation for Economic Cooperation and Development (2022). *Digital Financial Services and Consumer Protection*. Paris:
- Otuya S.; Alonge A. D., & Oluwafemi, P. O. (2024). Fintech and financial inclusion in Nigeria. the mediating role of digital financial literacy. *International Journal of Economics and Financial Management (IJEFM)*. 9(7). www.iiardjournals.org Online Version.
- Radcliffe, D. and Voorhies, R. (2012). *A digital pathway to financial inclusion*. Available at <http://ssrn.com/abstract=2186926>
- Rusliati E.; Soegoto, A. S; & Martutiningrum D, (2024). Investigating the effect of financial literacy on financial inclusion: Mediating role of financial technology. *Journal of Infrastructure, Policy and Development*. 8(7), 51-93.
- Sahay, R.; Allmen, U. E.; Lahreche, A.; Khera, P.; Ogwa, S.; Bazarbash, M. & Beaton, K. (2020). The promise of fintech: financial inclusion in the Post COVID-19 Era. Washington, DC: International Monetary Fund
- Smith, J. (2015). Third World IOU: Mobile banking systems empower people in the developing world to transfer funds and pay off loans and save for the future. Retrieved from Intel website: Sanusi, I. & Okonkwo, T. (2021). *Understanding Nigeria's Financial System: Theory and Practice*. Lagos: University of Lagos Press.

TechTarget. (2022). Web Payment. Retrieved from <https://www.techtarget.com>

World Bank. (2023). Financial Access Survey Glossary. Retrieved from <https://datatopics.worldbank.org>

World Bank. (2023). Global Findex Database: Glossary. Retrieved from <https://globalfindex.worldbank.org>

World Bank (2020). *World Development Indicators: Financial Sector Overview*. Retrieved from <https://databank.worldbank.org>

Udo, E, S, Abner, I, P, Ndubuaku, V, Udoh, B, E. Okoh, J, I (2023). Effect of FinTech on cash holding: Quarterly evidence from Nigeria. *The Economics and Finance Letters* 10(2), 172-183.

Udo, E, S, Akpan, E, J, Abner, I, P, Idogen, K, Ndubuaku, V (2019). Finance-Led growth and growth-led finance: evidence from Nigeria economic and financial sector development. *Humanities and Social Sciences Letters*, 7(4),191-198.

Ugwuanyi, L. & Okore, A. O. (2022). Financial technology and financial inclusion in Nigeria. *International Journal of Social Sciences and Management Research*, 8(2).

World Bank and People's Bank of China (2018). *Toward universal financial inclusion in China: Models, challenges, and global lessons*. Washington, DC: World Bank.

World Bank (2016). *Financial inclusion – A foothold on the ladder toward prosperity?* Washington, DC: World Bank.