IMPACTS OF ELECTRONIC FRAUD ON FINANCIAL INCLUSION IN NIGERIA

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Abstract

Digital banking has brought financial inclusion to Nigeria, but also created many new opportunities for electronic fraud (e-fraud) attacks. This study examined the impacts of the specific electronic banking fraud channels on the rate of account enrolment of some selected deposit money banks in Nigeria. The study used secondary time-series and panel data sourced from regulatory agencies like the Central Bank of Nigeria (CBN) and the Nigeria Inter-Bank Settlement System (NIBSS) from 2016 to 2025 and regression analysis to assess the relationship between the various typologies of fraud and the new bank account creation trend. Key Findings revealed that ATM Banking Fraud has a significant negative impact on account enrollment – as regular ATM banking fraud undermines public's confidence in the use of physical and digital banking channels. Internet/Web Banking Fraud had a negative impact on account enrollment, suggesting that customers are wary and anxious about online/browser-based solutions. POS Terminal Fraud had a positive impact on account enrollment due to the importance of Point-of-Sale agents and localized agency banking in providing financial services to unbanked rural and urban populations, despite localized security concerns. While agentdriven POS infrastructure is helping to lead to deeper financial inclusion, electronic fraud is creating a formidable obstacle. The study suggests that deposit money banks and financial regulators should increase multi-factor authentication, expand real-time fraud monitoring and expand consumer cybersecurity education, to ensure user confidence is protected.

Keywords: Electronic Fraud, ATM Fraud, Internet/Web Banking Fraud, POS Terminal Fraud, Financial Inclusion.

1. Introduction.

With the advent of the digital revolution, the world's financial scene has changed significantly from cash payments to electronic payment systems. Nigeria has been a leader in this shift in Africa through Central Bank of Nigeria (CBN) 'Cashless Policy' that was adopted in 2012 (Monye, 2024). The transformation has been intended to improve financial and service efficiency, lower banking service costs and, above all, to advance financial inclusion and the availability of

low-cost, accessible and formal financial service offerings to under-banked and unbanked segments of society (Mavlutova et al., 2022).

Mobile banking, USSD codes, agency banking, and electronic wallets have brought millions of Nigerians who were formerly excluded from the formal financial sector into the formal financial system (Ezeocha, 2024). But this quick digital growth has brought electronic fraud (e-fraud) to the forefront of the financial world's vulnerability. With the increasing number of touch points, cybercriminals have taken advantage of the systems and a lack of consumer digital literacy to commit identity theft, phishing, business email compromise and unauthorized fund transfers (Pandey & Kapoor, 2025).

Financial inclusion is a pivotal component of the nation's economic development objective in Nigeria (Anthony-Orji et al., 2023). The country's goal is to lower poverty, promote entrepreneurship and economic growth at the macro level by offering vulnerable members of society financial services like savings, credit, Payments and insurance. The financial inclusion landscape has transformed in the past decade as a new generation of mobile telecommunications, Quick Response (QR) codes, and Point of Sale (POS) terminals come into existence, moving financial inclusion beyond the traditional bricksand-mortar branch banking model to dynamic digital financial services (DFS).

But this swift digital growth has revealed weaknesses in the financial system. E-fraud has gone exponential from the inception of phishing and business email compromise, SIM-swap fraud, automated teller machine (ATM) skimming and mobile application vulnerabilities (Nwosu et al., 2026). Reports from Nigeria Deposit Insurance Corporation (NDIC) and Nigeria Electronic Fraud Forum (NeFF) have revealed that cybercriminals have cost the country billions of Naira every year, both in the retail and institutional platforms (Abu, Sakanko & Haron, 2026).

The financial inclusion agenda is at risk of being undermined by the rising tide of e-fraud. Rural, lowincome or newly banked individuals who become victims of digital financial crimes lose their confidence in formal financial channels and are frequently pushed back to informal cash-based sources. Thus, it's essential to grasp the digital security and financial accessibility nexus (Ololade, Salawu, & Adekanmi, 2020). This study examines the socio-economic consequences of electronic fraud, and the implications of cyber security on marginalized population's access to digital banking, and the threat e-fraud poses to Nigeria's financial inclusion policy.

2. Literature Review

Conceptual Review

Malik, Asad, Azeem (2022) defined electronic fraud as any activity done by a person or organization that deceives, misrepresents or attempts to engage in information or financial gain without authorization and using electronic communication or devices. This is a catch-all phrase that refers to many different types of illegal activity, from the most basic email scams to the most sophisticated and coordinated cyber-attacks targeting multi-national banking systems. In essence, electronic fraud relies on two weaknesses: human psychology and systemic technical weaknesses (Mahida, Bhatt & Gambhava, 2025). Software bugs and unpatched servers offer opportunities for

the bad guys, but the most important is human error - it's the biggest cause of successful fraud campaigns.

According to Tawil and Tarawneh, (2025), electronic fraud (also referred to as digital or cyber fraud) is any attempt to defraud using digital technology, computers or the internet to gain financial or organizational advantage. In the digital world, electronic fraud is all too common. Deep fakes, AI, and automated bots are becoming more ubiquitous, and scammers will keep evolving their tactics to make it increasingly difficult to spot scams (Leong, Leong, and San Leong, 2024). Yet, electronic fraud is not an insurmountable issue.

Today the world's banking sector is a completely different place from what it was in the past. In today's digital age, the traditional banking model with physical branches, paper ledgers and face-toface interaction has been largely given up in favor of a dynamic, 24/7 digital banking ecosystem. Electronic banking, or e-banking, is a channel used heavily by financial institutions today and includes use of mobile applications, online portals, ATMs, and automated clearing houses (ACH) (Akpuri, Money & Iyoha, 2025). This digital transformation has brought about greater convenience, speed, and efficiency for banks and consumers, but it has also created an unprecedented level of systemic risk.

Concept of Financial Inclusion

Financial inclusion, the provision of affordable, suitable and timely access to formal financial services to everyone is a key element of sustainable economic development worldwide.

Financial Inclusion is measured by the total number of people in each environment who have an existing account in banks ir financial service institutions. It includes total number of adults that fall back into banked status.

Automated Teller Machine (**ATM) Fraud:** Offline transactions, skimming or stealing of PIN numbers made at a physical ATM.

Mobile Banking Fraud: Fraudulent access to a customer's bank account using a smartphone or USSD codes usually involving SIM swaps and/or a social engineering attack.

Point of Sale (POS) Fraud: Financial crime that takes place at merchant terminals and typically results from either a compromised card or fraudulent agent code.

Internet/Web Banking Fraud: Hacking, business email compromise and phishing crimes targeting web-based banking systems and platforms

Concept of Electronic Fraud and Financial Inclusion

Two forces—electronic fraud and financial inclusion—are so deeply connected and competitive in today's financial age that one cannot exist without the other. Digital financial services have proven to have an unprecedented ability to overcome historical socio-economic gaps, enabling millions of disenfranchised people to be safely included in a formal global economy for savings, investment and borrowing. But during this "expand at all costs" digitization, such corresponding populations have been the subject of advanced cybercrime campaigns that may erase lifetime savings in a matter of seconds. If e-fraud is not addressed, the loss of structure of trust and accompanying economic devastation can completely erode and reverse the gains of financial inclusion. Electronic fraud and financial inclusion are deeply conflicting. Financial inclusion

aims to widen the boundary of the formal economy, while e-fraud builds an imposing barrier—structural and psychological—that keeps those who are at risk in the informal and unmonitored modes of economic survival.

2.2. Theoretical Framework

This study employs a multi-layered theory approach in order to be able to analyze the relationship between electronic fraud and financial inclusion in Nigeria. It is based on the integration of technology adoption models and criminological and economic theories of trust.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is an influential model that was first developed by Fred Davis in 1989 to account for user acceptance and adoption of information systems. Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the two factors that influence an individual's behavioral intentions to use a new technology, according to TAM. Perceived Usefulness is the extent to which a user feels using a particular system will improve job performance/economic productivity. This refers to the ease with which the system is perceived to operate, in terms of mental or physical effort.

Routine Activity Theory (RAT)

This study takes a theoretical approach based on Routine Activity Theory (RAT) by Marcus Felson and Lawrence Cohen to explain development of electronic fraud today, in conjunction with the rise of fintechs. The RAT was originally created in 1979 to identify physical crime trends, and states that there are three minimal elements that need to align in time and space for a predatory crime to occur. A motivated offender, An appropriate target, and. Lack of a responsible guardian.

RAT's application to the digital world is an explanation of how structural changes such as Nigeria's cashless policy give rise to new patterns of crime. With the number of mobile banking apps, POS networks and internet portals growing rapidly, millions of newly banked citizens who are not digitally educated are there to become "suitable targets"—that is, victims of this fraud. Some of the "motivated offenders" consist of cybercriminals taking advantage of automated software vulnerabilities, social engineering and insider collusion to target these users.

System Trust Theory

The socio-economic basis for the assessment of the consequences of fraud on exclusion is provided by the theory of trust in the system of Niklas Luhmann. There are two types of trust: personal trust, which is directed towards other people, and system trust, which is directed towards abstract, functional systems such as the law, money, or digital banking networks. System trust is the way to defuse social complexity. It lets people participate in the economy without having to master the technology and institutional designs.

An essential component of the formal financial industry is this abstract trust. Users will trust that their money will be recorded, kept and transferred safely when the user deposits cash into a digital agent's terminal or wallet. But chronic electronic fraud undermines this system of trust. Trust in

the banking system is broken if consumers feel it is not providing the protection from bad actors that they expect. System Trust Theory is a theory that elucidates the systemic nature of e-fraud as an issue that directly attacks financial inclusion.

2.3 Review of recent and relevant literature

Current paper focuses on Odeleye and Oyeneye (2026) which studied effect of financial technology on financial inclusion in Nigeria. The study adopted a quarterly time series data from 2020 to 2025 for the relationship between Fintech and financial inclusion using ARDL method. The findings of the study in the empirical aspect indicates that financial technology has a significant and negative impact on financial inclusion, which means that the financial technology in status does not bring into improvement in financial inclusion in the short run. It also demonstrates that on short run and long run basis, Nigeria's economic growth significantly affected financial inclusion, respectively.

This paper by Abu, Sakanko and Haron (2026) investigates the long-term asymmetric effect of financial fraud (total amount lost to financial fraud and total amount of financial fraud) on financial inclusion (FI) as measured by a financial inclusion index (developed using two-stage Principal Component Analysis) in Nigeria between 1989 and 2023. The results depict that during long-term, the lower the value of FF, the higher the value of FI and vice versa. In addition, income growth, employment rate, money supply, inflation and interest rates, are long-term drivers of FI. In this study, alternative estimation approaches such as linear ARDL, DOLS, CCR and FMOLS are used and evidence found to support the negative relationship between the growth of FF and Nigeria's FI.

Garcia (2025) explored Digital Banking: Technological Innovation in Financial Inclusion in Peru. The sum of traditional banking and the internet that provides banking services via a website or mobile application is digital banking. The emergence of digital ecosystems and the integration of financial services is indeed a challenge for traditional banking and require adaptation to the new environment. Digital banking plays an important role in financial inclusion, as it allows access to innovative services to more Peruvians and boosts economic growth, there is a lot of digital fraud, where the money is misappropriated, or the financial user is blackmailed through phishing and the use of malware. Pearson's correlation coefficient was used to check the relationship between variables digital banking and financial inclusion and SPSS-IBM software was used to tabulate the results.

Adewale (2026) explored how employment in Nigeria will be affected by POS Business, POS Fraud and inflation between 2013 and 2024. It highlights the implications for job creation resulting from the recent expansion of POS terminals and services and considers the effects of the potential negative effects of POS fraud and macroeconomic uncertainty. A secondary data was used in the study because it was an ex-post-facto research design, which was based on the CBN Statistical Bulletin, Financial Institutions Training Centre (FITC) and World Bank Development Indicators. Descriptive statistics, correlation analysis and OLS regression were used to analyze the relationship between the variables. The results showed that the employment is significantly and highly positively affected by POS Business and employment increases as the number of POS Terminals increases particularly the employment of the small-scale entrepreneurs

and young people. The negative coefficients of POS Fraud and inflation are not statistically significant thus suggesting weak or indirect relationship to employment which means it can be counterbalanced by a swift growth of POS.

3. Methods

Ex-post-facto research method was utilized to compile the data for this study which is secondary sources form Central Bank of Nigeria (CBN) Statistical Bulletin edition, the National Bureau of Statistics (NBS) Annual abstract and Statistical Bulletin edition and World global databank Publications. These secondary data used in the study are collected from some selected banks annual report for the period 2016-2025. United Bank for Africa, Zenith Bank PLC, Guarantee Trust Holding Company PLC, First Bank of Nigeria Holdings, and Access Bank PLC are some of these banks. These banks, based on the Nigeria Stock Exchange (NSE) Market Capitalization are the top 5 banks in Nigeria. Three models of estimation were employed: Random Effect model, Fixed Effect model and Pooled OLS model

Model Specifications

There have been several studies that have linked digital financial fraud to financial exclusion in Nigeria. It is necessary to have an empirical basis to develop a model that represents the process of financial technology on the economy in an accurate way to ensure their relevance to our research. we propose to integrate the levels of financial technology and awareness of digital financial fraud, the volume and values of transactions through innovative financial technology services into a linear model. The model in an econometric form is defined as:

$$FIN_{it} = \beta_0 + \beta_1 ATMF_{it} + \beta_2 INWF_{it} + \beta_3 POSF_{it} + \mu_{it} \quad \text{(Equation 1)}$$

The equation (2) is converted to a logarithmic form with each variable having the same base:

$$Log\ (FIN_{it}) = \beta_0 + \beta_1\ Log\ (ATMF_{it}) + \beta_2\ Log\ (INWF_{it}) + \beta_3\ Log\ (POSF_{it}) + \mu_{it} \quad \text{(Equation 2)}$$

Where:

FIN_{it}	=	Number of account enrollment in selected banks i in year t (Proxy for Financial Inclusion).
$ATMF_{it}$	=	Value of Automated Teller Machine Fraud.
$INWF_{it}$	=	Value of Internet/Web Fraud.
$POSF_{it}$	=	Value of Point-of-Sale Fraud.
β_0	=	Constant intercept.
β_1 - β_3	=	Coefficients of the explanatory variables.
μ_{it}	=	Error term.

Table 3.1: Operationalizing the Variables

Variable Type	Variable Name	Indicator / Measurement	Expected Sign	Justification / Rationale

Dependent	Financial Inclusion (FIN)	The number of account enrollment in selected banks OR Composite Financial Inclusion Index (based on indicators such as access, availability, use of financial services).	N/A	This is the primary outcome variable being predicted or explained by the model.
Independent	ATM Fraud (ATMF)	The amount of money (or volume of transactions) that has been lost due to fraudulent transactions using the automated teller machine over the course of the year.	- *(Negative)*	Increased ATM fraud undermines trust in formal banking systems, which in turn decreases financial inclusion and people's use of ATMs.
Independent	Internet/Web Fraud (INWF)	The total dollar amount (or the number of transactions) lost due to unauthorized or fraudulent web-based and online banking transactions.	- *(Negative)*	Web fraud brings security concerns, hindering the uptake and active use of digital banking systems, especially for vulnerable groups.
Independent	POS Fraud (POSF)	The amount of money or goods that have been stolen from terminals during a checkout.	- *(Negative)*	High frequency of POS fraud can make it hard for merchants and customers to accept cashless payment options, forcing them to return to cash-based methods of payment.

Techniques of Data Analysis

Panel Regression Analysis was used in this study to assess the effect of electronic fraud on financial inclusion in Nigeria. Panel data is data collected on several cross-sectional units (e.g., Nigerian commercial banks, geopolitical zones, or certain demographic groups) at different time points. This technique is selected because it accounts for individual heterogeneity, decreases the level of collinearity among variables and offers increased degrees of freedom and efficiency when compared to using pure time series or cross section data.

4. Results and Discussion of Findings Descriptive Statistics

Table 4.1 shows number of observations, mean, standard deviation, minimum and maximum of the explained variable, and each of the explanatory variables and gives the descriptive statistics for all the variables in the model. The descriptive data of the chosen channels that comprise our sample are displayed in the table below.

Table 4.1: Descriptive Statistics

	LFIN	LATMF	LINWF	LPOSF

Mean	1.335040	2.451842	2.388998	2.452840
Median	1.397900	2.415700	2.383550	2.401550
Maximum	1.755900	2.992200	2.989500	2.964800
Minimum	0.903100	2.010300	2.117900	2.066300
Std. Dev.	0.259791	0.268846	0.217963	0.271391
Skewness	-0.268259	0.330425	0.695361	0.245460
Kurtosis	1.739392	1.966387	2.961210	2.034075
Jarque-Bera	3.910386	3.135577	4.032525	2.445859
Probability	0.141537	0.208506	0.133152	0.294367
Sum	66.75200	122.5921	119.4499	122.6420
Sum Sq. Dev.	3.307071	3.541624	2.327880	3.608997
Observations	50	50	50	50

Source: *E-Views 9.0 Software 2026*

Table 4.1 above indicates the descriptive statistics for each variable including Maximum, Minimum, Mean, Standard Deviation, Jarque-Bera value which show the normality of the data and nature of the data. The results provide some insight into the attributes of the selected listed financial sector in Nigeria used for the research. The goal of the descriptive statistics was to describe the general distributional features of the data and to identify any unusual observations and/or unusual patterns of observations that would present problems for further analyses. An initial analysis of the data was conducted using basic descriptive methods to describe and summarize the data which have been obtained for the study.

From to the study's goal, the descriptive statistics are provided in this part. Value of financial inclusion (FIN) was 1.76% while the minimum value was 0.90% in the review period. The relatively large differences in financial inclusion scores indicate that the components vary considerably between each other, which means that the banks are not uniform over the time span studied. The standard deviation was .26. The skewness was -0.27, indicating that the data were skewed to the left side, and thus the majority of the data values were to the left of the distribution. The kurtosis is 1.73 which is less than 3; thus the distribution will be termed platykurtic, and there may not be many outliers.

From table 4.1 above it is observed that the minimum value of automated teller machine fraud (ATMF) is 2.01% while the maximum value of it is 3.0%. The standard deviation was 0.27 meaning that the available resources or size of the listed banks in Nigeria were spread around the mean by about 2.01%. The ATMF was positively skewed with a value of 0.33 which indicated that the majority of the values in the ATMF were not concentrated to the mean. The Kurtosis for ATMF was 1.97% which is less than 3, indicating that it is platykurtic and is likely to contain very few outliers.

Internet/Web Fraud (INWF) was 2.39% of their average value. The mean value of INWF is 2.39% indicating that the average value of INWF of the listed banks studied was approximately 2%, which implies that the INWF was a quarter of profit. Standard deviation of 0.22% deduce that

there is high return on INWF amongst the selected banks, with a minimum and maximum value of about 2.99% and 2.11% respectively.

Graphical Representation of variables

The graphical behaviour distribution of the variables used in this study for the sampled period is presented across the cross-sectional units in this section. For Nigeria, visualizing the data suggest trend.

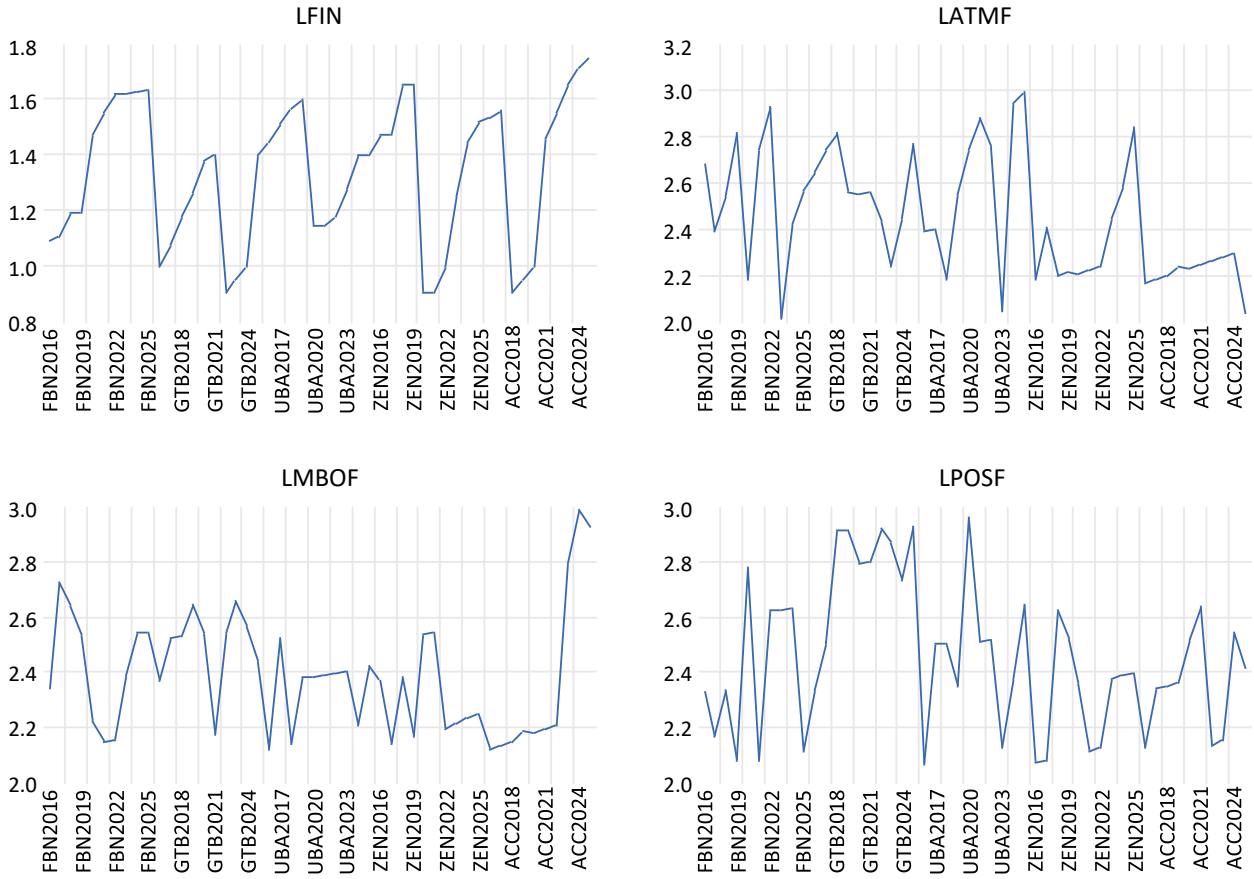


Figure 4.1: Graphical Illustration of variables *(Source: E-view 9.0, 2026)*

The following chart shows the total loss volume and value across different channels—ATMF, POSF, and INWF. On the chart, a clear trend of more and more mobile and POS-based electronic fraud incidents is evident, largely corresponding to the rapid growth in agent banking networks and fintech apps. ATM vulnerabilities are a plateauing or diminishing market share, whereas mobile channel vulnerabilities (e.g. USSD exploits & SIM swaps) are an exponential curve. Here, it's a parallel growth in the "fraud surface area" that mirrors directly financial access.

4.3. Augmented Dickey Fuller (ADF) Unit Root Test

The ADF test is a widely cited statistical test to check time series for stationarity. A time series is stationary if the statistical properties (such as the mean, variance, and autocorrelations) of the series are not influenced by time. When the data contains time and multiple cross-sections, then

a disadvantage of using individual ADF test for each entity is that it does not provide a holistic assessment of the overall data set. There are some statistical and practical arguments for the replacement of the traditional time-series ADF test with the panel unit-root test. The levels and initial differences of the time series data for the years 2016 to 2025 are displayed as the results of the ADF test statistics, respectively, in Table 4.2.

Table 4.2: Results of ADF Test Statistics

Variables	1%	5%	10%	ADF	Order of Integration
LOGFIN	-3.577723	-2.925169	-2.600658	-4.810081	1(0)
LOGATMF	-3.571310	-2.922449	-2.599224	-5.387179	1(0)
LOGINWF	-3.571310	-2.922449	-2.599224	-3.376720	1(0)
LOGPOSF	-3.571310	-2.922449	-2.599224	-5.165347	1(0)

Source: E-Views 9.0 Software, 2026

Therefore, since the following section relies on the presence of a stochastic trend, I(0) variables would be used to test for co-integration, and this would be the case in the presence of this stochastic trend. A co-integration test was employed to see whether or not there was a long-term relationship between the variables, using the Johansen test.

5. Recommendations and Conclusion Recommendations

The policy recommendations build on the study results on e-fraud and financial inclusion in Nigeria, and are organized by channel to ensure consumer trust is not undermined, and increase account enrolment:

1. Central Bank of Nigeria (CBN) and banks should introduce anti-skimming devices, enhanced CCTV surveillance, and adequately lit and secure enclosures in all ATM galleries. They should also require immediate SMS and push notification for every ATM cash withdrawal and PIN change to ensure that users can quickly identify and alert for any unauthorized transactions. They should also review the fast and provisional credit processes for fraud claims in the ATM arena and put them in place to regain nervous customers' confidence in using physical card terminals.
2. Dynamic risk-based authentication (e.g. biometric, hardware token, one-time password) is required for high value online transfers and Web portals used by financial institutions. Banks should conduct targeted and focused digital literacy campaigns (in local languages) to sensitise the internet banking users about phishing, fake URLs and social engineering traps.
3. Regulators should not inhibit the growth of agent networks in underbanked rural and semiurban markets, but formalise them, with local agents adequately vetted and

registered. They should use daily transaction limits, require biometric (PIN-pad) security on agent terminals and display fees to keep POS growth safe and trusted. Banks must also undertake compulsory antifraud and compliance training for super-agents/operators of the point of sale unit at the grassroots level to help them in the prevention of collusion and the use of fake cards.

Conclusion

The study adopted an empirical approach and the impact of electronic banking fraud on financial inclusion of DMBs in Nigeria was studied between 2016 and 2025. To gain a valid understanding and to help in addressing the problem of the study, it looked at the concepts of e-fraud and financial inclusion and contributed to the existing academic literature on the concepts. Similarly, the Technology Acceptance Model (TAM), Routine Activity Theory (RAT), and System Trust Theory were used as bases for the study. Beyond that, the study was conducted on the time series data of efraud channels for several years from 2016 to 2025 across three channels of ATMF, POSF and INWF. Furthermore, the indicators for financial inclusion were based on the number of accounts enrolled to selected banks. The sources of secondary data gathered were the Annual Reports of NDIC and NIBSS for the period of the study and the Panel Least Squares Regression technique was used as a tool of analysis.

To evaluate the effect of ATM related fraud on the expansion of financial inclusion in Nigeria was the first specific objective of the study. The coefficient value of financial fraud by (ATM) in the result of the estimation obtained is -0.00871 with a p-value of 0.00337. It was concluded that the number of accounts enrolled is negatively affected by the incidence of fraud through ATM channel in selected banks in Nigeria. The findings reveal that with higher ATMF, the number of customers who enroll in the selected banks decreases.

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