

# Effect of Technological Innovation on Financial Intermediation in Nigeria, 2005-2023

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**Abstract**— *The financial sector in Nigeria has seen a considerable transformation due to the integration of digital technology. Still up for debate is how much it has improved accessibility and involvement with financial services. Technology interference methods need a solid platform of stable and productive elements to guarantee that these services are affordable, safe, and easy to use. Through the Central Bank of Nigeria, the Nigerian government has tried to foster financial innovation as a crucial component of sustainable and equitable growth by developing policies that are anticipated to promote affordable financial services for the entire nation, especially for the less privileged and vulnerable groups. This study examined the impact of technological innovation on financial intermediation in Nigeria, utilizing data spanning from 2005 to 2023. The study set out to determine how points of sale affected Nigerian financial intermediation; it also looked at the influence of automated teller machines; and it evaluated the effect of Internet banking on Nigerian financial intermediation. An ex post facto research design and the OLS regression model were used to evaluate the data. The results indicated that, throughout the study period, internet banking had no significant impact on financial intermediation, Automated Tellers Machine had no significant impact and point of sale systems had a significant impact on financial intermediation in Nigeria. Accordingly, the study suggested that the Central Bank of Nigeria should improve point-of-sale accessibility for all Nigerian businesses; policymakers should devise a plan to increase the availability of Automated Teller Machines (ATMs) in both urban and rural areas; and the government should work with network providers to enhance the network for efficient use of Internet banking (IB).*

**Index Terms**— *Technological innovation, financial intermediation, Point of Sale, Internet banking and financial sector*

## I. INTRODUCTION

The Nigerian government, in conjunction with the Central Bank of Nigeria, has developed policies aimed at promoting affordable financial services for the entire country, with a particular focus on the most vulnerable and disadvantaged populations (Olatunji, 2015). This is an attempt to foster financial innovation as a critical component of sustainable and equitable growth. It is anticipated that citizen participation in the financial system will boost investment, job creation, and economic expansion. By increasing the number of individuals participating in the structured financial system, these policies and methods aim to decrease the number of individuals who are not part of the system. The application of technical advancements in the financial industry has been one of the most persistent initiatives to maintain and expand financial innovation. The process by which financial service providers such as banks receive deposits from the general public and convert them into loanable cash is known as financial intermediation (Dunami et al., 2017; Agbada & Osuji, 2013). It also refers to the state in which all societal segments receive fundamental financial services at a reasonable cost. According to these definitions, financial innovation is simply the process of including every resident of a country in official banking operations.

According to Shnaider (2023), financial technology is the application of software and technology in the financial services industry. This encompasses various companies offering financial products or services such as wealth

management, investments, loan processing, payments and money transfers, leveraging advanced technology. More precisely, financial technology encompasses all software and other modern technologies utilized by companies providing automated and improved financial service delivery. It is projected that the application of this technology to financial services will lower obstacles to banking, promote customer use of bank services and ultimately aid in the expansion of the domestic economy (Asian Development Bank, 2016). Banks now have new strategies to remain competitive in the digital world, thanks to financial innovations. Financial innovations have allowed banks to operate more efficiently, spend less money and offer better customer service. Financial technological breakthroughs like blockchain and artificial intelligence are also utilized by banks to provide their customers with safer and more personalized transaction processes. Moreover, according to the Asian Development Bank (ADB 2016), these advancements effectively function as viable avenues for fostering financial innovation by reducing the costs associated with delivering these services. Though it is arguable to what degree the advent of digital financial technology has improved accessibility and involvement in financial services activities, the Nigerian financial industry has unquestionably undergone significant transformation.

According to Kaffenberger and Zimmerman (2015), financial technology has made it easier for people with lower incomes who have fewer options for financial services to obtain them. Kolesova and Girzheva (2018), on the other

hand, stated that the rapid growth of financial technology lowers entry barriers in the financial market. This is achieved by eliminating traditional banking structures and enabling the provision of specialized services independently, often at a reduced cost compared to established incumbents. Consequently, this trend fosters the emergence of new entrepreneurial endeavors. As banks experience a decline in market share, they become less competitive. Additionally, the adoption of advanced algorithms and artificial intelligence further contributes to a reduction in job opportunities. Arenaza (2019) contended that the use of technology in financial services necessitates the involvement and communication of several parties as well as the regulatory environment's requirements, which provide challenges to each party and, as a result, diminish their contribution to financial innovation. The impact of financial technology on the financial innovation of informal financial institutions is limited by the barriers to its adoption and application in developing countries. The World Bank (2020) conducted a study to investigate the impact of financial technology on financial innovation in developing economies. The study found that technological interference mechanisms necessitate a stable and productive foundation to guarantee the cost-effective, secure, and user-friendly delivery of these services. Many developing economies lack this necessary stable and productive basis, which could potentially diminish the participation of citizens.

These pressing concerns prompted the initiation of the present study.

The major objective of the study was to examine the effect of technological innovation on financial intermediation in Nigeria: informal financial institutions, 2005–2023, while the specific objectives included to:

- i. ascertain the impact of point-of-sale banking on financial intermediation in Nigeria.
- ii. examine the effect of automated teller machines on financial intermediation in Nigeria.
- iii. assess the impact of internet banking on financial intermediation in Nigeria.

## II. HYPOTHESIS

The study tested the following hypotheses:

- i) Point of sale has no significant effect on financial intermediation in Nigeria.
- ii) Automated teller machines have no significant effect on financial intermediation in Nigeria.
- iii) Internet banking has no significant effect on financial intermediation in Nigeria.

## III. REVIEW OF LITERATURE

### Conceptual Review

#### Financial intermediation

Financial intermediation, according to Ene, Abba and Fatokun (2019), is the provision of basic banking services to all segments of society at a reasonable price, with a focus on

the large number of low-income and disadvantaged populations that are typically shut out of the conventional banking system. In order to effectively facilitate financial transactions, human and institutional factors, including outreach to the most marginalized communities, the affordability of goods and the sustainability of providers, must be taken into consideration. Therefore, financial intermediation can be described as providing everyone with fair, transparent and equitable access to finance and financial services at a reasonable cost.

#### Technological innovation

The greatest innovation to occur in the banking sector in the 21st century is technological innovation. It has enabled banking to take place outside the bank premises. Nowadays, banking may be done anywhere with a variety of electronic devices, including laptops, tablets, smart TVs, ATMs, mobile phones and point-of-sale systems. Today, a variety of banking activities, including the transfer and receipt of funds, checking one's balance, buying airtime, paying bills and opening an account, can be started or finished from websites outside of banks. Financial technology is the only technological breakthrough in the financial sector.

Scholars have viewed financial technology in many different ways. Financial technology, according to Zavolokina (2016), is the marriage of technology and finance, that is, the integration of information technology and finance, which has been fueled by digitalization in recent decades. Financial technology, according to Kagan (2020), is the broad range of technological interventions into personal and business finance as well as the improved and automated distribution and utilization of financial services distinguished by new technological approaches. Due to these definitions, the term "financial technology" can now be used broadly to describe the offering of banking services and products through electronic channels, such as automated teller machines, mobile phones, the internet and point-of-sale locations.

#### Automated Teller Machine (ATM)

An ATM is a device that allows users to deposit and withdraw money without entering the banking hall. In addition, it offers other rapid teller services like bill payment, airtime buying, money transfers, and balance inquiries. 1969 saw the release of the first ATM for general use at the Chemical Bank in Rockville Center, New York. Nigeria first saw the introduction of ATMs in 1989. The National Cash Registers (NCR) for the General Bank of Nigeria society installed it.

#### Point of Sale (POS)

The point of sale (POS), also known as the checkout or point of purchase (POP), is where payments are made for goods and services using credit cards and electronic devices. The selling process is managed by a POS terminal with an interface that salespeople can use. In Chitokwindo (2014), the

receipt can be created and printed using the same system. POS systems keep track of sales for tax and business purposes. Chitokwindo, however, pointed out that they are increasingly being used to fabricate these records using illicit software known as "zappers" in order to avoid paying taxes.

#### **Internet Banking**

Customers of a financial organization such as a credit union, retail or virtual bank, or society can transact money online via internet banking on a secure website managed by the institution. This service is also referred to as online banking. An increasing number of banks have transaction portals and websites where customers may execute a variety of tasks and check account balances, interest rates and currency rates.

### **IV. THEORETICAL REVIEW**

#### **Diffusion of Innovation Theory**

The Diffusion of Inventions (DOI) hypothesis was developed by Rogers (1995) to explain how inventions could spread across many users in a variety of ways over a particular period of time (Sarker & Sahay, 2004). The DOI hypothesis investigates how new ideas are passed down from one generation to the next. The DOI hypothesis states that discoveries are continuously shared among people who have similar social values through an array of channels (Echchab & Hassanuddeen, 2013). The dispersion of innovation hypothesis seeks to investigate the factors influencing the choice of new data innovation advancement by examining the pace, mode, and causes of new innovations' dissemination (Monyoncho, 2015). According to the theory of diffusion of inventions, inventors employ a normal distribution curve that may be divided into five parts: absolute benefit, companionability, simplicity, trial ability and ease of detection. These segments allow innovators to categorize customers based on their degree of innovativeness. These categories play a crucial role in deciding how well innovation is applied.

#### **Empirical Studies**

The following empirical studies by different authors as they relate to the objectives of the study were reviewed.

Iluno, Farouk, and Saheed (2018) investigated how customers' happiness was affected by electronic banking products and services. The analytical techniques employed were multiple regression analyses and frequency distribution tables. The findings demonstrated that in Kaduna State, Nigeria, electronic banking products and services (EBS and EBP) significantly raise customer satisfaction (CS).

In his research, Saidi (2018) examined the relationship between e-payment technologies and economic growth in emerging economies through the use of an ex post facto design using a random panel regression model. Economic growth, the study found, diverged from autoregressive and random walk processes, suggesting that investors should focus on available banking resources now rather than

worrying about economic growth in the past.

Afaha (2019) used monthly data from 2012 to 2017 to investigate the connection between electronic payment systems and economic growth. The analysis employed the Autoregressive Distributed Lag Regression (ADLR) method. The findings demonstrated a strong correlation between electronic payment systems and economic growth, especially in terms of real gross domestic product (GDP) growth.

In an attempt to identify the primary causes of this phenomenon, Ene, Abba, and Fatokun (2009) studied the effect of electronic banking on financial inclusion following the Central Bank of Nigeria's implementation of its cashless policy. They employed regression analysis using ordinary least squares for their data analysis. They emphasized the point of sale as the main driver of financial inclusion in Nigeria but countered by arguing that electronic banking had a considerable impact on financial inclusion. Although they concede that financial inclusion is partly to blame for the ineffectiveness of automated teller machines, they also point out that the machines' out-of-service notifications sometimes force customers to wait for services to be restored because of network problems.

Nedozi and Omoregie (2019) examined an empirical analysis of a number of Nigerian electronic payment systems. Percentages were employed in the data analysis. In terms of volume, ATMs dominated Nigeria's e-payment penetration from 2011 to the first quarter of 2019.

Mago and Chitokwindo (2021) examined the impact of financial technology on financial inclusion in Zimbabwe, with a particular focus on mobile banking in Masvingo province. Both a survey design and a qualitative research methodology were used in the study. They maintained that electronic banking had a major influence on Zimbabwe's financial inclusion. Low-income individuals are willing to use mobile banking, according to their research, which will increase financial inclusion.

Asare and Sakoe (2022) used a qualitative study approach to examine the impact of financial technology on financial services in Ghana. According to the report, Ghana's implementation of financial technology has sped up the provision of banking services and enhanced access to a wide range of banking products in order to meet the needs of both an expanding client base and those recommended by current clients. As a result, the study concluded that Ghanaian banking was significantly impacted by financial technology, which changed it from being a financial intermediary to a financial mall that provided a one-stop shop for a variety of financial services.

Using voluntary data collected over a five-year period, Monyoncho (2023) conducted a study to determine the association between e-banking and financial inclusion as adopted by Kenya's deposit money banks. The results of the study showed that clients' access to formal financial services was generally made easier by Mastercards and ATM enhancements. According to the study's findings, electronic

banking would improve financial inclusion in Kenya, and deposit money institutions should continue to provide funds for the creation of efficient ATMs.

The studies examined showed varied connections between electronic banking and either economic growth or financial services, influenced by factors such as geography, analytical methods and time frames. The inconsistent results underscored the need for more data on how technological innovation impacts financial intermediation in Nigeria.

## V. METHODOLOGY

Based on ex post facto research design, the study evaluated data from the Central Bank of Nigeria (CBN) statistical bulletin for the years 2005–2023 and the World Bank national accounts data (2023). The Ordinary Least Squares (OLS) regression model was also used to evaluate the data.

### Model Specification

The dependent variable in the model was financial intermediation, which was represented by cooperative loans. The independent variables were points of sale, automated teller machines and internet banking. The details of our three-predictor error-correcting model are as follows:

$$Y_t = \alpha_i + \sum_{i=1}^p \delta Y_{t-i} + \sum_{i=1}^q \beta_1 X_{t-1} + \sum_{i=1}^q \beta_2 X_{t-1} + \sum_{i=1}^q \beta_3 X_{t-1} + e_t \quad (3.1)$$

$\sum_{i=1}^p$  = speed of adjustment parameter Where;

Y = Dependent variable

X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> ... X<sub>n</sub> = the explanatory or independent variables

$\beta_1, \beta_2, \beta_3$  and  $\delta$  = the coefficient of the parameter estimate or the slope

e = Error or disturbance term t = Time

In relating this to the study;

$$CPL_t = \beta_0 + \sum_{i=1}^q \beta_{1i} CPL_{t-1} + \sum_{i=1}^q \beta_{2i} POS_{t-1} + \sum_{i=1}^q \beta_{3i} IB_{t-1} + \sum_{i=1}^q \beta_{4i} ATM_{t-1} + ECM_{t-1} + \epsilon \quad (3.2)$$

Relating to econometric form and the variables log linearised, it will appear thus;

$$CPL_t = \beta_0 + \sum_{i=1}^q \beta_{1i} \ln CPL_{t-1} + \sum_{i=1}^q \beta_{2i} \ln POS_{t-1} + \sum_{i=1}^q \beta_{3i} \ln IB_{t-1} + \sum_{i=1}^q \beta_{4i} \ln ATM_{t-1} + ECM_{t-1} + \epsilon \quad (3.3)$$

Where;

$\ln CPL$  = Cooperative loans  $\ln IB$  = Internet banking

$\ln ATM$  = Automated teller machine  $\ln POS$  = point of sales

$\beta_1, \beta_2, \beta_3$  and  $\delta$

$\beta_n$  = the coefficient of the parameter estimate or the slope

e = Error or disturbance term t = Time Point of Sales.

### Methods of Analysis

This paper used the below listed analytical technique:

1. Diagnostic Tests
2. Test for Stationarity
3. Regression Analysis

## VI. DATA ANALYSIS AND RESULTS

### Preliminary Tests

**Table 4.1** Descriptive Statistics

	LCPL	LATM	LIB	LPOS
Mean	5.867668	5.276927	2.821355	16.48265
Median	5.993719	5.062748	2.824944	16.63071
Maximum	6.303864	5.882765	2.943913	17.56919
Minimum	4.915518	4.775335	2.717340	14.52654
Std. Dev.	0.372682	0.395707	0.052661	0.881595
Skewness	-1.244037	0.320081	0.133906	-0.644956
Kurtosis	3.768303	1.437267	3.552117	2.690560
Jarque-Bera	5.085600	2.138958	0.282418	1.319720
Probability	0.078646	0.343187	0.868308	0.516924
Sum	105.6180	94.98468	50.78439	296.6877
Sum Sq. Dev.	2.361158	2.661922	0.047143	13.21257
Observations	19	19	19	19

Source: E-views 9 output, 2024

Descriptive statistics in Table 4.1 show that cooperative loans (LCPL) attained a mean of 5.867668 between 2005 and 2023, with the highest level at 6.303864 and the lowest at 4.915518. The automated teller machine (LATM) stood at a mean of 5.276927, a maximum of 5.882765, and a minimum of 4.775335 over the period. Point of sale (LPOS) attained a mean of 16.48265 with a maximum of 17.56919 and a minimum of 14.52654. Also, Internet banking gained a mean of 2.821355 with a maximum of 2.943913 and a minimum of 2.717340. We observed from the results that our variables are normally distributed ( $p > 0.05$ ) and are statistically different from zero. The normality in the variable description is based on the skewness of the variables: cooperative loans and point of sale were negatively skewed ( $S < 0$ ), while automated teller machines and Internet banking were positively skewed. The results in Tables 4.2 indicate that the probability value of the Jarque-Bera (J-B) statistics for Y is greater than the 5% conventional level of significance; hence, we cannot reject the null hypothesis that our variables are normally distributed.

### Unit Root Test

The Augmented Dickey Fuller (ADF) unit root test was employed to determine the stationarity of the data, as shown in Table 4.2.

**Table 4.2** Unit Root Test Result

#### Summary of unit root test

Variables	ADF-Stat	5% critical value	P-value	Inference
$\ln CPL$	-5.520326	-3.029970	0.0003	I(1)
$\ln POS$	-5.348141	-3.029970	0.0004	I(1)
$\ln ATM$	-6.114644	-3.020686	0.0001	I(1)
$\ln IB$	-4.843143	-3.658446	0.0051	I(1)
ECM	-4.763709	-3.029970	0.0014	I(0)

Source: Author's compilation 2024

The result of the unit root test in Table 4.2 reveals the presence of stationarity at the 5% critical level. In other words,

all the variables attained stationarity at first difference I(1) and at level I(0). In both instances, it is apparent that the calculated ADF value is less than critical values for all the variables tested, which confirms that our series has no unit root. Moreover, to confirm the reliability of this result, the p-value of the calculated ADF values for each of the variables is less than 5% at the level of significance.

### Test of Hypotheses

**Table 4.3 OLS regression Model Estimation Results**

Dependent Variable: LCPL

Method: Least Squares

Date: 03/07/24 Time: 23:09

Sample: 1 19

Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnIB	-0.013089	1.478853	-0.008851	0.9931
LnPOS	1.096922	0.169674	6.464868	0.0000
LnATM	0.159983	0.365528	0.437677	0.6679
C	-13.10533	4.978626	-2.632320	0.0188
R-squared	0.935341	Mean dependent var	5.829002	
Adjusted R-squared	0.922409	S.D. dependent var	1.049172	
S.E. of regression	0.292248	Akaike info criterion	0.562239	
Sum squared resid	1.281137	Schwarz criterion	0.761068	
Log likelihood	-1.341267	Hannan-Quinn criter.	0.595888	
F-statistic	72.32868	Durbin-Watson stat	1.679192	
Prob(F-statistic)	0.000000			

$$LCPL = -0.0130894973293 * LIB + 1.09692237896 * LPOS + 0.159983397552 * LATM - 13.1053338735$$

### Decision rule

The decision rule is based on a 5% probability value and is stated as follows:

$$H_0: \theta = \theta_0 \text{ versus } H_a: \theta \neq \theta_0$$

The above model presents the result derived from the OLS test; the value of the R squared is 0.935341, which means that 93% of the dependent variable CPL is explained by the independent variables in the model. The adjusted R squared is 92%, indicating a good fit for the model.

For a unit increase in automated teller machines (ATM), cooperative loans (CPL) in Nigeria will increase by 0.159%. For a unit increase in Internet banking (LIB), the cooperative loans of deposit (CPL) in Nigeria will increase by 0.0130%. With a unit increase in point of sale (LPOS), cooperative loans (CPL) in Nigeria will increase by 1.09%. The value of the constant is -13.10533; therefore, when the independent variables are equated to zero, CPL will increase by 13 percentage points. The F-value (72.32868), with a probability value of 0.000000 < 0.05, is indicative that the overall regression is significant. The Durbin Watson statistics (DW) approximate value of 1.679192 shows signs of no serial auto-correlation having a value greater than the R-squared.

### Discussion of Results

#### Objective one: Determine the effect of Point of Sales on the financial intermediation in Nigeria

Our estimation's findings showed that point of sale (LPOS) positively and significantly affects cooperative loans in Nigeria. The positive point-of-sale coefficient value (1.096922) and its related probability value (0.0000), both of which are less than 0.05 significant levels, provided an explanation for this.

#### Objective two: Ascertain the effect of Automated Teller Machine on financial intermediation in Nigeria

According to the findings of our investigation, automated teller machines (ATMs) have a positive but no significant effect on cooperative loans in Nigeria. The Automated Teller Machines (ATM) positive coefficient value (0.159983) and associated probability value (0.9931), both of which are more than 0.05 significant levels, provided an explanation for this.

#### Objective three: Examine the impact of internet banking on the financial intermediation in Nigeria

Our estimate's findings showed that Internet banking (LIB) has a negative and no significant effect on cooperative loans in Nigeria. Internet banking's positive coefficient value (-0.013089) and matching probability value (0.9931), both of which are more than 0.05 significant levels, provided an explanation for this.

### VII. CONCLUSION AND RECOMMENDATIONS

Achieving financial intermediation is the goal of every government, especially those in developing and impoverished nations. One of the main factors driving financial development and intermediation is technological innovation, which is why this research is an area of interest.

The following recommendations were made based on the outcome of the study;

Given the demonstrated significance of point-of-sale (POS) systems in advancing financial inclusion, the Central Bank of Nigeria ought to enhance their availability to all businesses functioning within the nation. It is recommended that policymakers devise a plan aimed at augmenting the accessibility of automated teller machines (ATMs) to both urban and rural regions. They should also focus on enhancing the networking capabilities of ATMs and their ability to dispense various denominations of the naira. The government, in collaboration with network providers, should strive to enhance networking infrastructure to facilitate the efficient utilization of Internet banking (IB). Banks should undertake campaigns to educate their customers on the utilization of these services.

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