FUDMA Journal of Accounting and Finance Research, 4(1). ISSN: 2992-4693 (Online); 2992-2704 (Print)

Banking sector innovations and manufacturing sector performance in Nigeria

Memoye Suotor[1]*, Marshal Simon Ekpete[2], Kingsley Simon Ekpete[3]
[1,3]*Ignatius Ajuru University of Education, Port Harcourt, Nigeria*
[2]*Nigerian British University, Asa, Abia State, Nigeria*
**Corresponding email : suotor.memoye@iaue.edu.ng*
https://doi.org/10.33003/fujafr-2026.v4i1.316.307-319

Abstract

Purpose: This study evaluates the influence of banking sector innovations on manufacturing performance in Nigeria from 2010 Q1 to 2023 Q4. The research examines how digital financial tools, specifically Automated Teller Machines (ATMs), Point-of-Sale (POS) terminals, Web Payments, and Real-Time Gross Settlement (RTGS) systems, affect manufacturing output.

Methodology: Utilizing an Autoregressive Distributed Lag (ARDL) model, the study analyses quarterly secondary data sourced from the Central Bank of Nigeria. Manufacturing output serves as the dependent variable, while various banking innovations represent the primary explanatory measures.

Results & conclusion: Empirical results reveal a complex, non-linear relationship. While current-period coefficients for ATMs, POS, and Web payments show a negative nexus with production, their first-period lagged values exhibit a positive effect. This suggests that the benefits of financial innovation are subject to a maturity period rather than being instantaneous. Conversely, RTGS systems demonstrate a persistent negative impact. The study concludes that banking innovations currently exert a weak, inconsistent influence on Nigeria's industrial sector due to delayed adoption benefits and systemic inefficiencies.

Implication of findings: Findings highlight that technological adoption without robust institutional support yields sub-optimal results. To foster an efficient ecosystem, policy efforts must prioritize resolving infrastructural bottlenecks, specifically electricity and internet unreliability. This research contributes to the Constraint-Induced Financial Innovation discourse by emphasizing the necessity of aligning fintech evolution with specific industrial needs to drive long-term economic expansion.

Keywords: ARDL model, Banking innovation, Financial technology, Manufacturing sector, Nigeria.

1. Introduction

In modern banking practice, financial innovation is categorized into process, product, and institutional innovation. The fundamental aspect of this paper is linked to process innovation as a categorization of financial sector digitalization which Tahir et al. (2018) referred to as the novel methods of doing business and integrating information technology, such automated teller machines, mobile banking, and internet banking. These forms of innovation enhance payment methods used in the borrowing and lending of cash, therefore facilitating a more efficient interaction in the manufacturing sector and the economy at large. According to Hameed and Nigam (2022), these payment mechanisms are essential for the effective functioning of the financial sector. In contemporary banking, successful payment system is characterized by rapid, secure, and reliable product and service exchanges, facilitating the prompt settlement of monetary transactions within and outside the economy.

For many years, it has been observed that real development of the economy is a function of a viable financial technology. An effective supply of finance is a key factor in catalyzing the innovations in the manufacturing industry. For instance, Claessens et al. (2018) reported that a viable route by which financial sector innovation might foster economic development is through the enhancement of efficiency and stability in financial markets. Similarly, De Nicolò et al. (2019), reported that a principal mechanism by which financial sector innovation fosters economic acceleration is the enhancement of access to credit, especially for small and medium-sized firms (SMEs) and other marginalized groups. Financial innovation fosters economic growth by enabling technical advancement; it also supports research and

development financing and provides essential funds for the commercialization of innovative technology. Bariviera et al. (2017) and Alimi and Olubusoye (2018) Theodossiou (2011), Chauhan et al. (2022), Chipeta and Muthinja (2018) among other scholars believed that sustained industrial growth needs efficient and effective financial sector.

Nevertheless, the financial sector in Nigeria with regards to the manufacturing sector is not free from challenges. Aladejubelo et al (2024) listed some of these challenges to include regulatory uncertainty and high compliance costs, poor infrastructure like unreliable internet and electricity, and a lack of skilled personnel to manage and develop these technologies. Other issues include the high initial cost of implementing technology, data security vulnerabilities, and a significant digital divide, where many small and medium-sized enterprises (SMEs) are lagging behind in the adoption of digital technology. The inadequacies in the use of financial-technology in the real sector have also led to structural imbalances and domain mismatches in serving the real economy, thus creating an insufficiency in meeting manufacturing-innovation needs. The application of financial technology in the manufacturing industry is expected to bridge important blind spots associated with the traditional financial services, reduce service costs and entry barriers, improve financing efficiency, and effectively support the real economy's development. The myriads of glitches facing manufacturing industries for instance in Nigeria and other parts of the world, according to De Nicolò et al. (2019), Chen et al (2023) could be resolve by fully integrating technology into the manufacturing process, Gita and Oriavwote (2025), Usman et al (2025) and Abdullahi (2025).

Studies regarding financial technology in various industries have been conducted, as is discussed in the literature review of this paper. However, the scarcity of studies that discuss the nexus between the manufacturing sector and banking sector process innovation-technology needs to be addressed. Novel evidence that considers technological innovativeness in the manufacturing industries in Nigeria is imperative. Therefore, this paper is billed to investigate the impact of financial technology on manufacturing sector in Nigeria. According to Sheng et al (2023), the need for this study emanated from the intensive nature of development and the huge contribution of the manufacturing sector in Nigeria's development equation. The rest of the paper is structured to include literature review, methodology, results, and conclusion.

2. Literature review

Theoretical foundation

The theoretical foundation for this study is built on the Constraint-Induced Financial Innovation Theory. The notion of constraint-induced financial innovation was formulated by William Silber in 1983. According to Silber (1983), the theory posits that the profit maximisation objective of financial institutions is the primary driver of financial innovation while overcoming limitations such as taxes, regulations, and high operating costs. According to Domeher et al (2023), the theory is built on the assumption that innovation is the key driver of profit. The theory further assumes that financial innovation improves liquidity, reduces cost of transactions and borrowing. Another assumption has it that the theory ensures stability and reduction in efficiency, making institutions modernize to cast constraints off.

The theory suggests that commercial banks operating in highly regulated markets are more motivated to adopt financial innovations that enhance their financial performance by reducing operational costs; conversely, banks that do not adopt such innovations are likely to fail. Sujud and Hashem (2017) and Chandio, Burfat, Abro, Naqvi (2017) are proponents of the constrained-induced financial innovation theory. These scholars are of the view that the theory is useful for financial sector innovation and

business growth. The theory was designed to help business organizations to deal with external and internal financial handicaps and bottle-necks that hinder organizational growth.

The theory has been criticized for concentrating heavily on innovation in the face of adversity which potentially overlooks innovations driven by competition and/or technology other than constraints. For instance, Piazza (2010) has reported that the theory discussed constrained-financial innovation from the microeconomics perspective, failing to demonstrate the phenomena of constraint-induced financial innovation from the increasing trend of liberal finance.

Review of related studies

Sheng et al (2023) investigated the influence of digital innovation on manufacturing technology-innovation (MTI), utilizing data from listed manufacturing firms in the Shanghai and Shenzhen A-share markets for the period 2011-2020. Using the fixed-effects model as well as a panel-threshold model, the results revealed that digital finance greatly accelerates manufacturing sector innovations significantly. Furthermore, digital finance improves technology modernization in manufacturing sector by alleviating financial-constraints. From the dual-threshold effect, tech innovation declines with the growing degree of competition in the market. Finally, digital finance enhances the tech innovation of private firms in the manufacturing sector. In terms of the type of factor-intensive, digital finance is effective in labour-capital intensive manufacturing enterprises with no effect on technology-intensive enterprises.

Suha et al (2022) studied how financial innovation and institutional quality affected financial growth in emerging markets. Data from 1990 to 2020 were utilized to choose 17 developing markets for the research. Information was retrieved from the database of the World Development Indicators. This study used panel unit root tests, totally modified ordinary least squares, and Pedroni integration tests for data processing. The investigation demonstrated a substantial and positive correlation between financial innovation and institutional quality and financial development. The research suggests that financial innovation enhances financial growth, but poor institutional quality in a developing country might impede financial development.

Oluwaseyi et al (2021) investigated the impact of financial innovation and banking rivalry on corporate value. The research used secondary data from the Central. The research used the sys-GMM estimate method using data from 26 commercial banks in Nigeria and Malaysia from 2009 to 2019, including a total of 286 observations. The study's data include return on assets (ROA), bank size, GDP growth, inflation rate, and company value. The study revealed that competition among banks and financial innovation negatively impact the value of Nigerian enterprises. In contrast, new financial innovations and increased competition among Malaysian banks both significantly boost company value in the country. Value of a company is highly correlated with ROA, size of the bank, GDP growth, and inflation rate. The value of firms in Nigeria and Malaysia has a positive and substantial correlation with the interaction effect. The research indicates that financial innovation significantly propels economic advancement, competitiveness, and development. The report advises policymakers to rectify the vulnerabilities shown by the financial crisis, which led to the establishment of contemporary financial regulatory frameworks designed to mitigate the risks associated with the financial innovation process.

Adamu et al (2020), analyzed the impact of financial innovation on the Nigerian economy using quarterly and monthly data from 2010 to 2020. The study used data produced by the Central Bank of Nigeria. The study used the ARDL and PDL MIDAS models, which denote autoregressive distributed lag and polynomial distributed lag, respectively. Although internet and point-of-sale transactions had a negligible adverse effect on the Nigerian economy in both the short and long run, the ARDL analysis

revealed that mobile payment systems had a significant and beneficial impact in both scenarios. The PDL MIDAS equation confirms that mobile payment transactions positively influence Nigeria's economic growth, but point-of-sale transactions have a negative effect. The study's results underscore the significance of financial innovation in Nigeria's banking industry for the nation's GDP.

John (2019) assessed the correlation between electronic payment system utilization and the advancement of the Nigerian economy using the Autoregressive Distributed Lag (ARDL) methodology. Between 2012 and 2017, the study examined data about the volume of transactions conducted via many online platforms, including web-based transactions (WBT), point-of-sale systems, automated teller machines (ATMs), mobile payment systems (MOPs), and interbank money transfer systems (INTERBANK). The results indicated that internet transactions, mobile payments, and ATMs adversely affected Nigeria's real GDP growth. The growth of the Nigerian economy is impeded by ATM, MOP, and WBT transactions. The results indicated that point-of-sale transactions positively influence economic growth in Nigeria, but interbank transactions had no significant impact. The research found that some financial innovations didn't significantly impact Nigeria's GDP growth.

Okafor et al (2019) emphasized the significance of online payment systems for Nigeria's economic progress. The study used data from the Central Bank's database on financial innovation, including the years 2009 to 2014. To examine the data, the researchers used the least squares approach, grounded on the vector autoregressive (VAR) system and Johansen cointegration. The Johansen cointegration test indicates a long-term relationship between financial technology innovation and economic progress in Nigeria. The regression analysis indicated that advances in financial technology via ATMs and online banking substantially enhance economic development in Nigeria, but innovations via point-of-sale (POS) payment channels have a detrimental impact. According to the research, monetary transactions performed at point-of-sale terminals have a negative impact on Nigeria's economic growth prospects, whereas those conducted at automated teller machines (ATMs) and online banking platforms have a positive effect.

In their 2019 study, Ozurumba and Charles used the Ordinary Least Square (OLS) method to look at how financial innovation affected Nigeria's GDP growth. The data for the research, spanning from 2012 to 2018, is sourced from the Nigeria Interbank Settlement System (NIBSS), including the volume of ATM transactions and the agent banking function. It encompasses economic expansion and the magnitude of financial transactions. The research used Ordinary Least Squares (OLS), the Autoregressive Distributed Lag (ARDL) bound test, and a cointegration approach. The regression analysis indicated that the monetary flow through NIBSS and Agent Banking platforms exerts a modest yet positive influence on Nigeria's GDP growth, while the outflow from ATMs has a substantial and negative effect on GDP growth, statistically significant at the 5% level. Research indicates that not all financial innovations in Nigeria enhance GDP development.

Chukwunulu (2019) examined the influence of emerging financial technologies on GDP growth in Nigeria. The research used data on GDP growth and the four major e-money transactions in Nigeria as indicators of financial innovation. This encompasses the volume of transactions conducted via ATMs, online platforms, point-of-sale systems, and mobile payment methods. The data was gathered from 2008 to 2017. Owing to the constrained timeframe, the research team used GMM, or Generalised Method of Moments. The data analysis indicated that the four primary categories of electronic money transactions in Nigeria—ATM transactions, internet transactions, point of sale transactions, and mobile payments—exerted a positive and statistically significant influence on the country's GDP growth. This proves that

between 2008 and 2017, financial innovation had a favourable effect on Nigeria's GDP growth. The research found that online transactions, mobile payments, and ATMs all contributed to real GDP growth in Nigeria.

Ngigi (2019) conducted study on the influence of innovation in the financial sector on the profitability of Kenya's commercial banks. The study used secondary data extracted from publications provided by the Central Bank of Kenya. The study used the Statistical Package for the Social Sciences (SPSS) and the F-test for data analysis. In the banking sector, particularly among commercial banks, the study indicated that financial innovation contributes to and is positively correlated with profitability. This is further corroborated by the significant adoption of more efficient financial systems in place of the less efficient old methods. The report advocates for the Kenyan banking industry to use further financial innovations to enhance actual sector performance.

Ravikumar et al (2019) and Suresha et al (2019) examined the impact of online payments on India's GDP growth. The research's primary data was sourced from the World Bank's statistical bulletin. The research used the Ordinary Least Squares (OLS), Autoregressive Distributed Lag (ARDL) cointegration method, and ARDL bounds testing methodologies for analysis. Digital payments were assessed using Real Time Gross Settlement (RTGS), the Clearing Corporation of India Ltd (CCIL) controlled system, paper clearing, retail electronic clearing, card transactions, and Prepaid Payment Instruments (PPIs). From 2011 to 2019, real GDP served as the metric for assessing economic growth. According to the OLS data, the only measure of digital payments that significantly influences real GDP is retail electronic payments. In the assessment of digital payments, all other variables are irrelevant to India's real GDP. The ARDL bound test indicated that digital payments do not substantially influence India's long-term economic growth. The study revealed that electronic payments influenced India's GDP growth.

With emphasis on return on equity, Simiyu et al. (2014) examined how financial innovations affect business market size. They utilized qualitative and quantitative data in a case study technique. From the population and the interview sessions, a sample of 200 respondents was chosen. According to their findings, financial innovations had a significant effect on banks' bottom lines. The study's findings indicated that bank advances (loans) influenced assets and, therefore, bank performance. The correlation study revealed no statistically significant association between the market and the various transaction channels. In contrast, Okafor et al (2019) established that certain market needs were substantially associated with the produced commodities. The research advocated for the use of more financial innovations to improve consumer happiness and value, ultimately leading to market expansion.

Drawing upon a review of existing empirical literature, this study tests the null hypothesis that no statistically significant relationship exists between the adoption of various electronic payment channels, specifically the transaction values of Automated Teller Machines, Point of Sale terminals, Digital platforms, and Web-based systems and the total Output of the Manufacturing sector**.**

3. Methodology

Performance of the manufacturing sector in Nigeria was measured by manufacturing sector output (dependent variable) while the explanatory factors considered for the study were value of automated teller machine, value of point of sales, digital payments, and web payments. The study utilized data from the Central Bank of Nigeria Statistical Bulletin (2023) for the period 2010Q1 to 2023Q4. This study's research approach is based on the work of Sheng et al (2023), who investigated the impact of digital finance on manufacturing technology innovation (MTI) using data relating to listed manufacturing

firms in the Shenzhen and Shanghai A-share markets from 2011 to 2020 to establish a fixed-effects model and a panel-threshold model for empirical analysis. The current study therefore modifies the work of Sheng et al (2023) by examining the effects of financial innovations on manufacturing sector output in Nigeria.

To implement the estimation process, use is made of the ARDL approach. The autoregressive distributive lag (ARDL) is a data estimation technique grounded on the general-to-specific modelling framework, introduced by Pesaran, Shin, and Smith (2001). This study employs the autoregressive distributive lag (ARDL) methodology, first formulated by Pesaran and Shin (1995), then refined by Pesaran et al. (2001), and subsequently modified by Narayan (2005) for small sample sizes (30-80 observations).

The ARDL methodology has certain advantageous statistical properties. It can accommodate variables that are stationary before the differencing (I(0)) and those that achieve stationarity after first differencing (I(1)), but it cannot accept variables that need second differencing to get stationarity (I(2)). This method's efficacy with I(0), I(1), and fractionally co-integrated variables provides an additional advantage, (Pesaran, 1997).

The fundamental structure of an ARDL model is:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \ldots\ldots + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_1 x_{t-2} + \ldots\ldots + \alpha_q x_{t-q} + \varepsilon_t \quad (1)$$

Where εt is the random disturbance term, which is serially independent and presumed to be stable or constant.

A detailed definition of the model concerning the research variables is offered below:

$$MOP = f(ATM, POS, DPS, WPAY) \quad (2)$$

$$\Delta MOP_t = \beta_0 + \sum_{i=0}^{q} \beta_1 \Delta ATM_{t-1} + \sum_{i=0}^{q} \beta_2 \Delta POS_{t-1} + \sum_{i=0}^{q} \beta_3 \Delta DPS_{t-1} + \sum_{i=0}^{q} \beta_4 \Delta WPAY_{t-1} + \mu_5 MOP_{t-1} + \mu_6 ATM_{t-1} + \mu_7 POS_{t-1} + \mu_8 DPS_{t-1} + \mu_9 WPAY_{t-1} + \mu_{10} ECM_{t-1} + \varepsilon_t \quad (3)$$

The error term is represented by εt, while Δ signifies the first difference operator. The objective of the test is to assess the existence of a long-term relationship among the variables by conducting an F-test for the combined significance of the coefficients of lagged variables. This study is built upon the research of Pesaran et al. (2001).

From the model, MOP = Manufacturing Sector Output, ATM = Value of automated teller machine, POS = Value of point of sales, DPS = Digital payments were measured using Real Time Gross Settlement (RTGS) and WPAY = Web payments. The Apriori Expectation and Description of Variables are explained in table 1.

Table 1: A priori expectation and description of variables

Variable Type	Variable Name	Proxy / Measurement Metric	Source of Data
Dependent	Manufacturing Sector Output (MOP)	The total monetary value of all goods and services produced by the Nigerian manufacturing sector within the period.	CBN Statistical Bulletin (2023)
Explanatory	Automated Teller Machine (ATM)	The total financial value of transactions processed through automated teller machines.	CBN Statistical Bulletin (2023)
Explanatory	Point of Sale (POS)	The total financial value of retail transactions completed via POS systems or computers.	CBN Statistical Bulletin (2023)
Explanatory	Digital Payments (DPS)	The total value of Real-Time Gross Settlement (RTGS) transactions, representing electronic transfers occurring in real-time.	CBN Statistical Bulletin (2023)
Explanatory	Web Payments (WPAY)	The total financial value of transactions conducted through online web-based payment platforms.	CBN Statistical Bulletin (2023)

A detailed description of the variables in terms of a priori expectation and measurements is thus: Manufacturing Sector Output (MOP): This serves as the primary indicator of the manufacturing industry's performance in Nigeria. It reflects the aggregate production levels and is expected to show a positive sign.

Automated Teller Machine (ATM): Measured by the volume and value of cash withdrawals and transfers made without visiting a human teller. The research treats the growth in ATM transaction value as a proxy for increased financial liquidity available to the real sector. The study expects automated teller machines to be positive to manufacturing sector output.

Point of Sale (POS): This variable measures the adoption of electronic purchase technology at the point of sale. The study quantifies this by the total value of transactions to determine its significance in modernizing manufacturing retail chains. The study expects point of sale to be positive to manufacturing sector output.

Digital Payments (DPS): Measured specifically through Real-Time Gross Settlement (RTGS). This metric is chosen because it represents high-value, time-critical electronic fund transfers between banks, which are essential for industrial-scale operations. The study expects digital payments to be positive to manufacturing sector output.

Web Payments (WPAY): These are measured by the total value of transactions facilitated through online platforms designed for frictionless web-based commerce. This variable test the impact of internet-based financial integration on manufacturing productivity. The study expects web payments to be positive to manufacturing sector output.

4. Results and discussion

Table 2: Result of ADF unit root

Levels			First Difference		
Variables	**ADF Statistics**	**Critical Value.**	**ADF Statistics**	**Critical Value.**	**Remarks**
MOP	-0.287	-1.947	-1.965	-1.947	I(1)
ATM	-0.739	-3.493	-3.544	-3.495	I(1)
POS	-2.310	-3.489	-4.920	-3.489	I(1)
DPS	-3.520	-1.947	-	-	I(0)
WPAY	-2.975	-3.489	-3.833	-3.489	I(1)

Source: Authors computation from Eviews 10.0

Table 2 presents the results of the stationarity test performed using the augmented Dickey-Fuller (ADF) test. Digital payments system was found to be stagnant at levels, according to the findings. Automated teller machines, point of sale systems, and online pay all failed the ADF test at levels, whereas agriculture, manufacturing, and service sector outputs all passed. After failing the levels test, we continued by using the ADF's first difference test on the variables, and this time we got stationarity. In conclusion, the ARDL model must be used for estimating purposes since all the variables exhibit mixed stationarity of I(0) and I(1).

Table 3: ARDL - Long run form and bound test

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.961107	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	54		Finite Sample: n=55	
		10%	2.345	3.28
		5%	2.763	3.813
		1%	3.738	4.947
			Finite Sample: n=50	
		10%	2.372	3.32
		5%	2.823	3.872
		1%	3.845	5.15

Table 3 presents the results of the limits cointegration test, used to ascertain the existence of a long-term relationship among the series in the manufacturing sector output model. The results indicate that the f-statistics of 5.961107 exceeds the critical threshold of 3.49 for the top limits. Consequently, we accept the alternative hypothesis and reject the null hypothesis, which posits the absence of a long-term relationship. The study's findings indicate that web payments, automated teller machines, digital

payment systems, and point of sale technologies significantly influence output in Nigeria's industrial sector over the long run. This indicates that the ARDL model needs to be used for estimation.

Table 4: ARDL- ECM result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MOP(-1))	1.069	0.057	18.65	0.000
D(ATM)	-1.265	0.238	-5.309	0.000
D(ATM(-1))	1.781	0.228	7.797	0.000
D(POS)	-0.952	0.578	-1.645	0.107
D(POS(-1))	0.957	0.442	2.162	0.036
D(DPS)	-0.011	0.420	-0.026	0.978
D(DPS(-1))	-2.482	0.499	-4.972	0.000
D(WPAY)	-2.179	0.823	-2.647	0.011
D(WPAY(-1))	3.584	0.856	4.185	0.000
CointEq(-1)*	-0.062	0.009	-6.352	0.000
R-squared	0.901	Mean dependent var		438.311
Adjusted R-squared	0.881	S.D. dependent var		475.401
S.E. of regression	163.8	Akaike info criterion		13.201
Sum squared resid	11810.	Schwarz criterion		13.5693
Log likelihood	-346.432	Hannan-Quinn criter.		13.343
Durbin-Watson stat	2.109			

Table 4 presents the error correction term and the cointegrating relationship as short-run representations. An R-Square score of 0.901399 indicates a strong match, while an adjusted R-Square value of 0.881231 demonstrates that the model accounts for 88% of the variance in manufacturing sector output. The residual 18% is ascribed to variables not included by the model. The Durbin-Watson value of 2.109044, being nearer to 2, suggests the absence of first-order autocorrelation in the residuals. The probability value of 0.0000, being less than 5%, indicates that the error correction term (-0.062) is very important at the 5% level. It was duly signed (-). Thus, in the near term, the previous imbalance will be corrected at a pace of 6.2 percent.

Parameter estimates showed that the manufacturing sector's production at the first lag, denoted as D(MOP (-1)), was positively correlated with and substantially aided manufacturing output growth in Nigeria. In other words, if everything else was kept constant, industrial production would rise in direct proportion to a one-year delay.

In terms of individual parameters, there was a statistically significant/negative correlation between the value of ATMs and production in Nigeria's manufacturing sector. That example, the Nigerian manufacturing sector benefited from the value of automated teller machines. It follows that the manufacturing sector in Nigeria would see a corresponding rise in production if the value of ATMs were to rise by a certain percentage. Additionally, the automated teller machine's value had a substantial positive impact on Nigeria's manufacturing industry at D(ATM(-1)).

Production in Nigeria's manufacturing sector was inversely connected to point-of-sale (POS) at a non-significant level. The manufacturing sector's production was favorably and considerably impacted by the point of sale (POS) value at D(POS(-1)). It follows that industrial production would rise in direct correlation to a 1% increase in POS value.

Digital payment systems, or DPS, had a negligible and unfavorable effect on production in Nigeria's industrial (manufacturing) sector. A decline in industrial production would result from a rise in the value of digital payments. The value of digital payments likewise became negative and became significantly related to manufacturing sector production at D(POS(-1)). This suggests that a rise in the value of digital payments would result in a more significant decrease in manufacturing sector production.

Finally, web payments which is otherwise referred to as WPAY was signed negative and significant to manufacturing sector output in Nigeria. At D(WPAY (-1), web payments contributed positively as well as insignificantly to production in the manufacturing sector.

Table 5: Diagnostic test result
ECM Diagnostic Tests.

Test	F-Statistic	Prob. Value
F-Heter.	0.095	0.092
Ramsey	0.953	0.335
Normality	1.122	0.570
Auto-correlation	0.476	0.346

Source: Authors computation from Eviews 10.0

The heteroskedasticity test for the error process in the model yields an F-statistic of 0.095 and a probability value of 0.093, indicating statistical insignificance. Consequently, the computed model is not affected by heteroskedasticity. Ramsey RESET test with a probability value of 0.335 and a reset value of 0.953 do not demonstrate statistical significance. This signifies that the computed model is linear and stable in nature. The normality test using the Jarque-Bera statistics of 1.122 and a probability value of 0.571 is not significant. This indicates that the series used in the model follows a normal distribution. The Breusch-Godfrey (LM) test for serial correlation yields an F-statistic of 0.476 and a p-value of 0.346, indicating a lack of statistical significance. The null hypothesis of no serial correlation in the residuals cannot be rejected in the analysis. The model is hence free from first-order serial correlation among subsequent error terms.

Discussion of findings

The empirical analysis pertaining to the relationship between banking sector innovations and the performance of Nigeria's manufacturing sector is complex and yields a mixture of positive and negative outcomes. The results suggest that the impact of these technologies is not instantaneous but follows a time-lagged maturity curve. For instance, while the current lagged value of automated teller machines (ATMs), exhibited a substantial negative impact on the manufacturing industry, the first-period lag (D(ATM(-1)) was positively signed and significantly aided output growth. Therefore, a 1% rise in automated teller machines would lead to about 178% increase in manufacturing output. This suggests that the initial costs or operational adjustments associated with ATM-based cash management eventually transition into a supportive mechanism for industrial activity. The findings of this study aligned with Chipeta and Muthinja (2018) who documented among other scholars that sustained industrial growth need efficient and effective financial sector.

With regard to the current lag of point-of-Sale (POS) Systems, there was a weak and negative association between POS value and manufacturing production. However, the first lagged value (D(POS(-1)) showed a significant positive impact, where a 1% rise in POS value leads to a 95.5 percent rise in industrial output.

This confirms with the findings of Theodossiou (2011) and Chauhan et al. (2022) that POS terminals have become a critical tool for manufacturers in facilitating online business transactions.

Digital payment systems (DPS) as measured by real time gross settlement (RTGS) had a devastating effect on manufacturing performance. Both immediate and current lagged values of DPS showed a negative relationship with sector output (manufacturing). This likely reflects the fact that many industrial customers have yet to fully integrate or trust these high-value digital tools for their day-to-day operations. This, however, negates the findings of Sheng, Chen, Tang and Obuobi (2023) who found that banking sector innovations spur production sector.

At its initial lag, web payments were signed negative and significant to manufacturing sector output in Nigeria. However, at the first lag (D(WPAY(-1)), it showed a positive and significant contribution to output of the manufacturing sector. This highlights the growing utility of web-based platforms in enhancing the efficiency of manufacturing sector. The outcome of this study is in tandem with Sheng, Chen, Tang and Obuobi (2023) who observed that digital finance improves business in the manufacturing sector. This further agrees with Bariviera et al. (2017) and Alimi and Olubusoye (2018) who reported that sustained industrial growth is a function of an innovative financial sector.

5. Conclusion

Based on the empirical evidence gathered from the ARDL model, this study concludes that banking sector innovations currently have a weak and inconsistent impact on the manufacturing sector's production in Nigeria. While these innovations are theoretically designed to reduce transaction costs and bridge the financial inclusion gap, their practical application within the Nigerian industrial landscape remains sub-optimal. The findings align with the Constraint-Induced Financial Innovation Theory, which posits that institutions innovate to overcome external limitations. However, the study proves that in the Nigerian context, the potential gains of these innovations are significantly undermined by structural glitches. Specifically, the lack of reliable internet facilities and electricity poses a major threat to the successful application of financial technology in the real sector. Ultimately, the transition toward a digitally-driven manufacturing economy in Nigeria is evident through the positive lagged effects of ATMs, POS, and Web payments. However, without a synchronized improvement in digital infrastructure and increased technological literacy among manufacturers, banking innovations will continue to yield only marginal benefits for the nation's industrial output.

Arising from the findings of the study, it is suggested that:

i. The government, through the Central Bank of Nigeria and other organizations, should promote the use of financial innovation technologies such as ATMs, point-of-sale systems, web payments, and digital payment systems in Nigeria's manufacturing sector, as lack of knowledge of these factors often impede growth of the sector.

ii. Lack of internet facility has posed a lot of threats to the success of the application of financial innovations and technology tools. The study therefore suggests that relevant authorities should ensure the availability of internet facilities in the rural and urban areas of the country in order to promote the use of digital payments and other online financial platforms such as POS, ATM, Web Pay.

iii. Policy efforts must be prioritized at resolving infrastructure glitches, specifically inadequate supply of electricity, which hinder digital tool efficacy within the Nigeria’s manufacturing industry.

References

Ahmed, A., Adamu, M.A., & Dauda, O.R. (2020). Financial innovation and economic growth: Empirical evidence from Nigeria. *Journal of Risk and Financial Management, 5(3) 33-52.*

Ajibade, P. (2016). Validating information sensing in a South African university as an impetus to improved information management practice and performances. *Journal of Social Sciences, 48(3), 225-238.*

Akhisar, I., Tunay, K., and Tunay, N. (2015). The effects of innovations on bank performance: The case of electronic banking services. *Social and Behavioral Sciences, 195*, 369–375.

Aladejubelo, O. S., Ishola, S. A. and Amisaye, P. (2024). Assessing the impact of regulatory approaches on financial technology (fintech) solutions in Nigeria. *Journal of Global Social Sciences*, 5(20), 65-75.

Alimi, R. S., & Olubusoye, O. E. (2018). Financial innovation and economic growth in Nigeria. *Economic Analysis and Policy* No. 60, 40-50.

Asongu, S. A., Folarin, O. E., and Biekpe, N. (2019). The long run stability of money demand in the proposed West African monetary union. *Research in International Business and Finance, 48*, 483–495.

Badi R.V. & Badi N.V. (2010). Values, beliefs and regional varieties in new firm formation rates. *Journal of Economic Psychology 18(2) 179-199.*

Bariviera, A. F., Guercio, M. B., Martinez, L., & Rosso, O. A. (2017). A comparative analysis of the financial innovation efficiency of developed countries. *Journal of Business Research*, 7(4), 263-269.

Chandio, F., Burfat, F., Abro, A., & Naqvi, H. (2017). Citizens' acceptance and usage of electronic-government services: A conceptual model of trust and technological factors. *Journal-SURJ (Science Series), 49(3), 665-668.*

Chauhan, S., Akhtar, A., and Gupta, A. (2022). Customer experience in digital banking: A review and future research directions. *International Journal of Quality and Service Sciences, 14*(2), 311–348.

Chauhan, V., Yadav, R., and Choudhary, V. (2022). Adoption of electronic banking services in India: An extension of UTAUT2 model. *Journal of Financial Services Marketing, 27*, 27–40.

Chernykh. L, & Theodossiou, A. K. (2011). Determinants of bank long-term lending behaviour: Evidence from Russia. Multinational finance Journal, 15(3-4). 193-216.

Chintalapati, N., & Daruri, V. S. K. (2017). Examining the use of you tube as a learning resource in higher education: Scale development and validation of TAM model. *Telematics and Informatics Journal, 34(6), 853-860.*

Chipeta, C., and Muthinja, M. M. (2018). Financial innovations and bank performance in Kenya: Evidence from branchless banking models. *South African Journal of Economic and Management Sciences, 21*(1), 1–11.

Claessens, S., Dell'Ariccia, G., Igan, D., & Laeven, L. (2018). Financial development and economic growth: A review of the literature. *Journal of Economic Literature, 56(2), 386-414.*

De Nicolò, G., Gamba, A., & Lucchetta, M. (2019). Financial innovation and risk management: Evidence from the US banking industry. *Journal of Financial Stability*, 41, 1-14.

Domeher, D., Konadu-Yiadom, E. and Aawaar, G. (2023). Financial innovations and economic growth: Do financial inclusion play a mediating role? *Cogent Business and Management,* 9(1).

Gujarati, D. N., and Porter, D. C. (2009). *Basic Econometrics* (5th Ed.). New York: McGraw Hill Inc.

Hameed, S. and Nigam, A. (2022) Exploring India's generation Z perspective on AI enabled internet banking services, *Foresight*,10.1108/FS-10-2021- 0213.

John, S. A. (2019). Electronic Payment Systems (E-payments) and Nigeria Economic Growth. *European Business & Management*, 5(6), 77-87.

Ngigi, C.N. (2019). Financial sector innovation and its effect on financial performance of commercial banks in Kenya. *African Journal of Social and Management Sciences, 9(8) 222-238.*

Okafor, I. G., Chijindu, E. H. & Chikezie, A. K. (2019). Does financial innovation drive growth? Empirical analysis of the Nigerian case. *British Journal of Economics, Management & Trade*, 16(3), 1-10.

Oluwaseyi, E.O., Marniati S.E.M., Aminu, I., Shafiqur, R. (2021). The effect of financial innovation and bank competition on firm value: A comparative study of Malaysian and Nigerian banks. *Journal of Asian Finance, Economics and Business, 8(6), 0245–0253.*

Ozurumba, O. C. & Charles, O. (2019). The impact of financial innovation on economic growth in Nigeria. *International Journal of Economics, Commerce and Management*, 7 (8), 1-14.

Piazza, R. (2010). Financial innovation and risk: The role of information. *Journal of Banking and Finance, 2(2), 37-51.*

Ravikumar, T., Suresha, B., Sriram, M. & Rajesh, R. (2019). Digital payments on economic growth: Evidence from India. *International Journal of Innovative Technology and Exploring Engineering*, 8 (12), 553-557.

Sheng, X., Chen, W., Tang, D. & Obuobi, B. (2023). Impact of digital finance on manufacturing technology innovation: Fixed-effects and panel-threshold approaches. *Sustainability*, 15, 11476.

Silber, W. (1983). The process of financial innovation. *American Economic Review, 73*(2), 89–95.

Simiyu, R. S., Ndiang'ui, P. N., & Ngugi, C. C. (2023), Effect of financial innovations and operationalization on market size in commercial banks: A case study of equity banks. *International Journal of Business & Social Science, 5(8), 227-249.*

Suha, M.W., Wajih, A. Rukhma, S. & Madeeha, S. (2022). Impact of financial innovation and institutional quality on financial development in emerging markets. *Journal of Risk and Financial Management, 5(3), 33-52.*

Sujud, H., & Hashem, B. (2017). Effect of bank innovations on profitability and return on assets of commercial banks in Lebanon. *International Journal of Economics and Finance,* 4(7) 35-50.