ACCESS TO FINANCIAL SERVICES AND MANUFACTURING SECTOR GROWTH IN NIGERIA: 2012Q1-2023Q4

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Abstract

The main objective of the study was to analyse the effects of financial accessibility—measured by private sector credit, Automated Teller Machine (ATM) transactions, and Point-of-Sale (POS) transactions—on the manufacturing sector's contribution to GDP. The study employed an ex post facto research design, utilizing secondary data from the Central Bank of Nigeria (CBN), and the Nigeria Inter-Bank Settlement System (NIBSS) for the period 2012Q1 to 2023Q4. The Auto Regressive Distributed Lag (ARDL) model was applied to analyse both short-term and long-term dynamics. Findings revealed that private sector credit had a positive and significant impact on manufacturing sector growth, indicating that increased credit availability enabled manufacturers to finance investments and boost productivity. ATM transactions also exhibited a significant positive effect, highlighting the role of financial infrastructure in improving liquidity and business operations. POS transactions had a similarly significant positive impact, signifying the growing importance of digital payment systems in enhancing operational efficiency for manufacturers. Based on these findings, the study recommended that the CBN and Bank of Industry (BOI) strengthen access to long-term, low-interest loans for manufacturers to support capital-intensive investments. The NIBSS and the Federal Ministry of Communications and Digital Economy were urged to expand ATM and digital infrastructure, particularly in underserved areas. Additionally, the CBN and NIBSS were advised to incentivize POS adoption by reducing transaction fees and improving network reliability through partnerships with the National Information Technology Development Agency (NITDA). These measures are critical to promotion of sustainable manufacturing sector growth and economic transformation in Nigeria.

Keywords: Private Sector Credit, Automated Teller Machine, Point-Of-Sale, Manufacturing Sector, Access to Credit.

Introduction

Access to financial services is a critical driver of economic development globally, facilitating business expansion, investment, and overall economic growth. The availability of financial resources

enhances productivity by ensuring that businesses and individuals have access to credit, banking infrastructure, and digital payment systems. In developed economies, financial inclusion is nearly universal, with high penetration of banking services, credit facilities, and digital payment solutions. According to the World Bank (2023), approximately 76% of adults globally had access to a financial institution or mobile money account in 2021, reflecting a steady increase due to advancements in financial technology (FinTech) and banking innovations. However, significant disparities remain, particularly in emerging economies, where financial exclusion continues to hinder business development and economic participation (Yakubu & Afful, 2023).

The Nigerian financial sector has expanded significantly over the past decade, driven by regulatory reforms and technological advancements. However, access to finance remains a bottleneck for businesses, particularly within the manufacturing sector. According to the Central Bank of Nigeria (CBN, 2022), private sector credit—an essential proxy for financial access—stood at approximately ₦39 trillion in 2022, reflecting a 17% increase from the previous year. While this suggests an improving credit environment, manufacturing firms still struggle with high borrowing costs and stringent lending conditions. ATMs and POS terminals have also proliferated across the country, with the Nigeria Inter-Bank Settlement System (NIBSS, 2022) reporting over 1.5 million POS terminals and 19,000 ATMs as of December 2022. Despite this expansion, financial infrastructure remains concentrated in urban areas, leaving many businesses in rural and semi-urban regions underserved. The financial constraints within Nigeria's private sector continue to limit investment in machinery, technology, and raw materials, impeding the growth of the manufacturing industry (Ezie *et al.,* 2023).

The manufacturing sector is widely regarded as a catalyst for economic transformation globally. It fosters industrialization, creates employment opportunities, and drives technological advancement (Osiobe, 2018). In high-income economies such as Germany, China, and the United States, manufacturing contributes significantly to GDP and economic diversification. China, for instance, has leveraged financial accessibility to propel its manufacturing sector, which accounted for approximately 27% of its GDP in 2022 (World Bank, 2023). The widespread availability of credit, advanced financial infrastructure, and government-backed industrial financing schemes have fueled China's rapid industrialization and global manufacturing dominance. Similarly, in European economies, accessible financial services facilitate capital investment, operational efficiency, and innovation, sustaining manufacturing competitiveness (Osiobe, 2021).

In Nigeria, however, the manufacturing sector has faced persistent structural challenges, limiting its contribution to economic growth. Historically, the sector has been constrained by inadequate financing, poor infrastructure, and inconsistent government policies. According to the National Bureau of Statistics (NBS, 2022), the manufacturing sector contributed approximately 10%

to Nigeria's GDP in 2022, a marginal increase from previous years but still significantly lower than in industrialized economies. The lack of adequate financial services, including access to private sector credit, digital banking infrastructure, and financial technology adoption, has hindered manufacturing growth. High borrowing costs, foreign exchange volatility, and inefficient financial intermediation exacerbate the sector's struggles. Despite recent improvements in financial technology adoption—exemplified by increased POS transactions and digital banking penetration—many manufacturing firms remain underfunded, limiting their expansion and productivity (Eze & Okonkwo, 2021).

The relationship between financial access and manufacturing sector growth is evident in Nigeria's economic nature. The availability of private sector credit facilitates investment in equipment, technology, and production capacity, enabling manufacturing firms to expand their operations. ATMs and POS terminals enhance transactional efficiency, reducing cash dependency and improving supply chain management.

The manufacturing sector's contribution to GDP in Nigeria has remained persistently low, hovering around 9% between 2015 and 2023, significantly below the average of 16% for emerging economies (Adegbite & Aluko, 2024). This underperformance is further evidenced by declining growth rate, which dropped from 13.26% in 2022 to 12.65% in 2023 according to the Manufacturing Association of Nigeria (MAN, 2023). The sector's employment generation capacity has also weakened, with manufacturing employment falling from 16.8% of total employment in 2014 to 12.3% in 2023 (National Bureau of Statistics [NBS], 2023).

In response to these challenges, Nigerian policymakers have implemented various interventions aimed at revitalizing the manufacturing sector. These include the implementation of the Nigerian Industrial Revolution Plan (NIRP), the Economic Recovery and Growth Plan (ERGP), and various fiscal incentives such as tax holidays, pioneer status incentives, and import duty waivers on machinery. The Central Bank of Nigeria has also introduced several funding initiatives, including the ₦1 trillion Manufacturing Intervention Fund and the Real Sector Support Facility (RSSF). Despite these policy interventions, the sector's contribution to export earnings has remained negligible at less than 3% of total exports, highlighting its weak competitive position in the global market. Furthermore, the number of manufacturing enterprises has decreased, with over 820 manufacturing companies shutting down or relocating between 2015 and 2023 (MAN, 2023).

This study thus aims to analyse the impact of access to financial services—measured by private sector credit, Automated Teller Machines (ATMs), and Point-of-Sale (POS) terminals—on the growth of Nigeria's manufacturing sector, proxied by its percentage contribution to GDP, over the period from the first quarter of 2012 (2012Q1) to the fourth quarter of 2023 (2023Q4).

The seminar addressed the following research questions and hypotheses:

i.   What impact does private sector credit has on manufacturing sector growth in Nigeria?

ii. How has Automated teller machine impacted on manufacturing sector growth in Nigeria?

iii. To what extent does point-of-sale impact on manufacturing sector growth in Nigeria?

H$_{01}$: Private sector credit has no significant impact on manufacturing sector growth in Nigeria

H$_{02}$: Automated teller machine has no significant impact on manufacturing sector growth in Nigeria

H$_{03}$: Point-of-sale has no significant impact on manufacturing sector growth in Nigeria

Access to Financial Services

Access to financial services is a fundamental driver of economic growth, enabling businesses and individuals to efficiently mobilize funds, make investments, and conduct transactions. In this context, key indicators of financial access include private sector credit, Automated Teller Machines (ATMs), and Point-of-Sale (POS) terminals, each of which plays a distinct role in financial intermediation and business operations.

Private sector credit is one of the most widely used indicators of financial access, reflecting the extent to which businesses can obtain funding for investment and operational needs. It refers to the total credit extended by financial institutions to businesses and households, excluding government borrowing. According to Beck et al. (2020), private sector credit serves as a critical channel for capital allocation, enabling firms to expand, invest in new technologies, and enhance productivity.

Another key measure of financial access is the availability of Automated Teller Machines (ATMs), which provide liquidity and facilitate financial transactions for businesses and individuals. ATMs are a critical component of banking infrastructure, allowing for cash withdrawals, fund transfers, and other financial transactions outside traditional banking hours. According to Ozili (2022), ATM availability is a strong indicator of financial inclusion, particularly in cash-driven economies where access to banking facilities is limited.

Point-of-Sale (POS) terminals represent another crucial indicator of financial access, particularly in the context of digital payments and electronic transactions. POS systems enable businesses to accept card payments, reducing reliance on cash transactions and enhancing financial efficiency. According to Kassi *et al.* (2021), the proliferation of POS terminals has been instrumental in advancing financial inclusion and reducing transaction costs in developing economies.

Manufacturing sector growth

Manufacturing sector growth, when measured by the percentage contribution of manufacturing to Gross Domestic Product (GDP), is a widely accepted indicator of industrial development and economic progress. According to Rodrik (2021), manufacturing sector growth represents the ability of an economy to expand its industrial base, enhance productivity, and transition from a resource-dependent structure to a more diversified and stable economic framework. This

growth is crucial for long-term economic development, as a higher manufacturing share in GDP is often associated with increased employment opportunities, technological advancement, and improved global competitiveness.

The percentage contribution of the manufacturing sector to GDP is also conceptualized as an indicator of industrialization and structural change. Adegbite and Aluko (2024) defines manufacturing sector growth as the process through which an economy shifts from agrarian or resource-based activities to more technologically sophisticated and capital-intensive manufacturing processes, leading to a higher share of manufacturing in GDP.

Theoretical Framework

The theoretical foundation of this study is rooted in the Financial Intermediation Theory, which provides a fundamental explanation of how financial institutions facilitate economic growth by efficiently channelling funds from surplus units (savers) to deficit units (borrowers). This theory was primarily developed by Gurley and Shaw (1960), who argued that financial intermediaries, such as banks and other financial institutions, play a crucial role in reducing transaction costs, improving capital allocation, and enhancing economic development. According to this theory, an efficient financial system promotes investment, accelerates industrialization, and ultimately contributes to economic growth by ensuring that productive sectors, including manufacturing, have access to necessary financial resources.

The Financial Intermediation Theory posits that financial institutions bridge the gap between savers and borrowers, thereby fostering economic activities. The theory emphasizes the role of banks and financial institutions in mobilizing savings, facilitating credit allocation, and providing financial services that enhance economic productivity. Schumpeter (1911), an earlier proponent of financial intermediation, highlighted the significance of financial institutions in economic development by arguing that they provide credit for entrepreneurs, stimulate innovation, and drive industrial expansion. The theory is particularly relevant in the context of this study, as access to financial services—measured by private sector credit, Automated Teller Machines (ATMs), and Point-of-Sale (POS) terminals—is a crucial determinant of manufacturing sector growth, measured by its percentage contribution to GDP.

Empirical Review

Empirical studies have extensively explored the relationship between access to financial services and manufacturing sector growth, particularly in developing economies where financial constraints often hinder industrial expansion. Various scholars have examined the role of private sector credit, digital banking infrastructure, and financial technology in facilitating manufacturing growth, using different methodologies, timeframes, and variable selections. While some studies have

focused on Nigeria, others have taken a comparative or regional approach to understanding how financial accessibility influences industrial performance. The following empirical reviews provide insights into the subject, highlighting key findings, methodologies, and limitations.

Adegbite and Aluko (2024), who analysed the impact of financial sector development on manufacturing sector growth in Nigeria between 1999 and 2020. The study employed a Vector Error Correction Model (VECM) to capture both short-run and long-run effects of private sector credit, ATM penetration, and POS adoption on manufacturing GDP contributions. The findings revealed that while private sector credit had a significant long-term impact, ATM usage was not a major determinant of manufacturing growth. The study emphasized that financial access alone was insufficient to drive manufacturing expansion without addressing underlying infrastructural and policy constraints. While the research provided a useful country-specific analysis, it did not incorporate firm-level data, which would have offered a more understanding of credit accessibility challenges faced by manufacturers in Nigeria. Additionally, the study did not control for structural breaks such as financial crises or policy shifts, which could have influenced the observed relationship between financial services and manufacturing growth.

A study by Yakubu and Afful (2023) examined the impact of financial sector deepening on manufacturing output in West African economies from 2000 to 2022. Using a dynamic panel data approach with the System Generalized Method of Moments (SGMM), the study found that private sector credit significantly influenced manufacturing sector growth, while WEB and POS usage had mixed effects. The findings suggested that financial development fosters industrialization by improving credit accessibility, but digital financial services alone were insufficient to drive manufacturing expansion without complementary infrastructure and policy support. While the study offered valuable regional insights, it did not account for country-specific differences in financial sector regulation and monetary policies, which could influence how financial access translates into manufacturing growth. Furthermore, the study did not control for external economic shocks such as inflation and exchange rate volatility, which are crucial determinants of industrial performance in West Africa.

A study by Adu, *et al.* (2022) examined the impact of financial development on manufacturing sector growth in sub-Saharan Africa. The study covered 30 African countries from 1995 to 2020 and employed a panel data approach using the Generalized Method of Moments (GMM) to address endogeneity concerns. The findings indicated that increased private sector credit significantly contributed to manufacturing value-added, while digital financial services such as ATM and POS transactions had a marginal effect. The study provided valuable insights into the role of financial development in Africa's industrialization process; however, it focused predominantly on financial

depth rather than financial inclusion. The exclusion of country-specific policy variations and institutional differences in financial sector performance limited the applicability of the findings to individual economies such as Nigeria, where financial constraints are more pronounced due to structural bottlenecks.

In another study, Ozili (2022) investigated how financial inclusion indicators, including access to credit and digital payment infrastructure, influenced manufacturing output in selected emerging economies between 2000 and 2021. The study utilized a panel cointegration and error correction model to analyze data from 20 emerging economies. The results revealed that while private sector credit had a long-run positive impact on manufacturing GDP contribution, the role of ATMs and POS transactions was more significant in economies with advanced digital financial infrastructure. The study highlighted the transformative role of digital payment systems in enhancing business transactions and reducing cash dependency in the manufacturing sector. However, the research did not consider the varying levels of financial regulation and institutional quality across the sampled economies, which could influence the extent to which financial access translates into manufacturing growth. Furthermore, the study did not account for informal sector activities, which play a crucial role in the manufacturing scope of many developing economies.

A study conducted by Eze and Okonkwo (2021) focused on Nigeria's manufacturing sector and examined the relationship between private sector credit and industrial output from 1990 to 2020. Using an Autoregressive Distributed Lag (ARDL) model, the study found that private sector credit had a significant positive impact on manufacturing GDP contributions in the long run but exhibited weak short-term effects. The study attributed the long-run positive impact to improved banking sector reforms, while the short-term fluctuations were linked to credit access volatility and high lending rates. Although the study provided useful insights into the Nigerian context, it relied heavily on secondary data without incorporating firm-level financial constraints, which could provide a more granular understanding of financial accessibility challenges within the manufacturing sector. Additionally, the study did not explore the impact of digital financial services, which have increasingly become integral to business operations in Nigeria.

Similarly, a study by Kassi, *et al.* (2021) assessed the role of digital financial services in promoting manufacturing sector performance in developing countries, focusing on the period from 2005 to 2019. The study employed a panel data fixed-effects model and examined 50 developing countries across Africa, Asia, and Latin America. The findings demonstrated that increased penetration of POS terminals and mobile banking services significantly boosted manufacturing sector performance by enhancing trade efficiency and reducing transaction costs. The study provided a novel perspective by emphasizing the role of financial technology in industrialization; however, it did not

differentiate between the impacts of traditional financial access (e.g., private sector credit) and digital financial services, making it difficult to ascertain the relative contribution of each financial access indicator. Moreover, the study did not control for macroeconomic shocks such as exchange rate fluctuations, which are critical in shaping manufacturing sector growth in developing economies.

A research paper by Mensah and Ofori (2021) assessed the relationship between financial access and manufacturing growth in Ghana, covering the period from 1995 to 2020. The study applied an ARDL model to examine both short-run and long-run effects of private sector credit, ATM usage, and POS transactions on manufacturing GDP contributions. The findings revealed that private sector credit had a long-term positive effect on manufacturing growth, while digital financial services contributed more significantly in the short run by facilitating business transactions. The study made an important contribution by distinguishing between short-term and long-term financial effects; however, it relied exclusively on time-series data, limiting its generalizability across different economies. The study also did not consider firm-level characteristics such as size, capital structure, or sector-specific constraints, which could affect the relationship between financial access and manufacturing growth.

Another significant study was carried out by Balchin and Calabrese (2020), who analysed the constraints to manufacturing growth in African economies, focusing on the role of financial access. The study utilized World Bank Enterprise Survey data from 2006 to 2019 across 25 African countries and employed a probit regression model to assess how financial access affected firm-level manufacturing growth. The findings revealed that firms with better access to private sector credit exhibited higher productivity levels, while those relying solely on informal financing sources struggled to scale their production. The study highlighted the importance of strengthening banking sector regulations to facilitate credit accessibility for manufacturing firms. However, the study's reliance on enterprise survey data, which captures only formal manufacturing firms, excluded a significant portion of the informal manufacturing sector, thereby limiting the comprehensiveness of the findings. Additionally, the study did not consider the role of digital financial services, which have increasingly played a crucial role in financial transactions for small and medium-sized enterprises in Africa.

Similarly, a study by Mahmood and Chaudhry (2020) explored the role of financial intermediation in driving industrial growth in South Asian economies from 1990 to 2019. Using a panel cointegration model, the study found that economies with higher levels of private sector credit and financial technology adoption experienced stronger manufacturing sector expansion. The results highlighted the importance of an efficient financial system in mobilizing resources for industrial investment. However, the study treated South Asia as a homogeneous region, without accounting for

significant differences in financial sector development, regulatory environments, and industrial policies across countries. Additionally, the study did not examine external factors such as foreign direct investment (FDI), which could also play a critical role in manufacturing sector growth.

Methodology

This study adopted an *ex post facto* research design, which is appropriate for analysing historical data and identifying causal relationships between financial access and manufacturing sector growth. *Ex post facto* research design involves examining pre-existing data without manipulating independent variables. This study utilized secondary data sourced primarily from the Central Bank of Nigeria (CBN) Statistical Bulletin, ensuring reliability and accuracy in economic analysis. Secondary data was appropriate given the study's focus on historical trends in financial access and manufacturing sector growth. The dataset covered key financial indicators, including private sector credit, Automated Teller Machine (ATM) deployment, and Point-of-Sale (POS) transactions, alongside manufacturing sector contributions to GDP. This study adopted and refined the model framework of Yakubu and Afful (2023), who investigated the effects of financial sector deepening on manufacturing sector growth in selected African countries. Their model is captured as:

$$MSO_{it} = \beta_0 + \beta_1 MSC_{it} + \beta_2 WEB_{it} + \beta_3 POS_{it} + u_{it} \qquad (1)$$

Where:

MSO = Manufacturing sector output; MSC = Manufacturing sector credit; WEB = Web usages

POS = Point of sale

β_0 = Autonomous parameter estimates; $\beta_1 - \beta_3$ = Coefficients of Manufacturing sector credit, Web usages and point of sale; u_t = error term.

The modified model for the study is captured as:

$$MSG_t = \psi_0 + \psi_1 PSC_t + \psi_2 ATM_t + \psi_3 POS_t + e_t \qquad (2)$$

Where:

MSG= Manufacturing sector growth (%of manufacturing contribution to GDP)

PSC= Private sector credit

ATM = Automated teller machine usages

POS = point of sale usages

ψ_0 = Autonomous parameter estimates

$\psi_1 - \psi_3$ = Coefficients of private sector credit, ATM and point of sale

e_t = error term.

Based on *a priori* expectations, the coefficient of private sector credit is expected to be positive $(\psi_1 > 0)$; For Automated Teller Machines (ATMs), the coefficient is also anticipated to be positive $(\psi_2 > 0)$.; Similarly, the coefficient of Point-of-Sale (POS) usage is expected to have a positive sign $(\psi_3 > 0)$. Increased fintech adoption promotes digital transactions, reduces cash dependency, and improves financial inclusion, which can enhance business efficiency and manufacturing sector performance.

The analysis begins with pre-estimation diagnostics focusing on unit root testing to examine the stationarity properties of the variables. This crucial preliminary step, as emphasized in econometric literature, helps prevent misleading regression results that could arise from using non-stationary time series data in the analysis (Dickey & Fuller, 1979). The stationarity testing is particularly important given the quarterly nature of our data spanning from 2012 to 2023.

Following the stationarity analysis, the study proceeds to investigate the existence of long-run relationships among the variables. This investigation is crucial because financial access indicators and manufacturing sector growth might exhibit equilibrium relationships over time, despite their individual non-stationary properties. The cointegration analysis helps identify such stable long-term associations between variables within a stationary framework, preserving valuable information that might be lost through simple differencing techniques (Engle & Granger, 1987).

To establish the presence of long-run relationships between financial access indicators (private sector credit, ATM penetration, and POS availability) and manufacturing sector growth in Nigeria, the study employs the Bounds cointegration approach within an Auto Regressive Distributive Lags (ARDL) framework. This methodology, developed by Pesaran *et al.* (2001), offers distinct advantages for our analysis. Its flexibility in handling variables integrated of different orders makes it particularly suitable for examining the relationship between financial access and manufacturing sector performance.

The ARDL framework allows us to incorporate both current and lag effects of changes in financial access on manufacturing sector growth, providing a more detail of these relationships. The unrestricted ARDL model for this study is specified as follows:

$$\Delta MSG_t = \psi_0 + \sum_{i=0}^{m-1} \psi_1 \Delta MSG_{t-i} + \sum_{i=0}^{n-1} \psi_2 \Delta PSC_{t-i} + \sum_{i=0}^{q-1} \psi_3 \Delta ATM_{t-i} + \sum_{i=0}^{p-1} \psi_4 \Delta POS_{t-i} + \psi_5 MSG_{t-1} +$$

$$\psi_6 PSC_{t-1} + \psi_7 ATM_{t-1} + \psi_8 POS + \upsilon_t \tag{3}$$

Δ denotes the first difference of the variables, capturing the short-run changes.

$\psi_1 - \psi_4$ are the short-run coefficients for the lagged differences of MSG, PSC, ATM, and POS respectively; while $\psi_5 - \psi_8$ are the long-run coefficients of MSG, PSC, ATM, and POS. Converting equation (3) in semi-log model (linear-log) to achieve uniformity in data measurement, and be able to interpret the parameter estimate in terms of their elasticity, we have:

$$\Delta MSG_t = \psi_0 + \sum_{i=0}^{m-1}\psi_1 \Delta MSG_{t-i} + \sum_{i=0}^{n-1}\psi_2 \Delta \log PSC_{t-i} + \sum_{i=0}^{q-1}\psi_3 \Delta \log ATM_{t-i} + \sum_{i=0}^{p-1}\psi_4 \Delta \log POS_{t-i} + \psi_5 MSG_{t-1} +$$

$$\psi_6 \log PSC_{t-1} + \psi_7 \log ATM_{t-1} + \psi_8 \log POS + \upsilon_t \tag{4}$$

Results and Discussions

Descriptive Statistics Results

Descriptive statistics serve as fundamental tools in quantitative analysis, providing a concise summary of data characteristics including central tendency, dispersion, and distribution shape. These statistics help researchers understand the basic features of variables and identify potential patterns or anomalies in the dataset.

Table 1: Descriptive Statistics

	MSG	PSC	ATM	POS
Mean	10.90995	26125.63	8585.555	7593.744
Std. Dev.	2.111151	11775.25	6926.845	10793.99
Skewness	0.382116	1.404470	1.568986	1.468158
Kurtosis	1.652862	4.686189	4.442166	3.781119
Jarque-Bera	4.797663	21.46676	23.85341	18.46420
Probability	0.090824	0.000022	0.000007	0.000098
Observations	48	48	48	48

Source: Researcher's Computation Using EViews-12 (2025)

The mean value of manufacturing sector growth (MSG) was 10.91%, indicating that, on average, the manufacturing sector contributed approximately 10.91% to Nigeria's GDP over the study period. The standard deviation of 2.11 suggests moderate fluctuations in the manufacturing sector's GDP contribution over time, implying relative stability compared to financial variables. The skewness value of 0.38 indicates a slight positive skew, meaning the distribution is moderately asymmetric, with more observations clustered towards the lower end. The kurtosis value of 1.65, which is below the normal value of 3, suggests a flatter distribution (platykurtic), indicating fewer extreme values. The Jarque-Bera statistic of 4.79, with a probability value of 0.09, suggests that MSG is approximately normally distributed at the 5% significance level.

Private sector credit (PSC) had a mean value of ₦26,125.63 billion, reflecting the average level of credit extended to the private sector over the study period. The standard deviation of ₦11,775.25 billion indicates significant variability in private sector credit, suggesting fluctuations in financial accessibility for businesses. The skewness value of 1.40 indicates a strong positive skew, meaning that there were more occurrences of lower credit levels, with a few extreme high values influencing the distribution. The kurtosis value of 4.69 suggests a leptokurtic distribution, meaning the data had heavier tails and more extreme values than a normal distribution. The Jarque-Bera test statistic of 21.47, with a probability value of 0.000022, confirms that PSC is not normally distributed, implying significant variations in financial credit trends.

The descriptive statistics for ATM transaction values show an average of ₦8,585.56 billion, suggesting substantial use of ATM services over the years. However, the standard deviation of ₦6,926.85 billion indicates high variability in ATM transactions, reflecting shifts in consumer behaviour, banking policies, and financial technology adoption. The skewness of 1.57 shows a strong positive skew, indicating that lower ATM transaction values were more frequent, with a few large values pulling the distribution to the right. The kurtosis value of 4.44, greater than 3, suggests a leptokurtic distribution, meaning more extreme values were present. The Jarque-Bera statistic of 23.85, with a probability of 0.000007, confirms that the ATM transaction data deviates significantly from a normal distribution.

Point-of-Sale (POS) transaction values had a mean of ₦7,593.74 billion, indicating substantial growth in digital payment adoption during the period. However, the standard deviation of ₦10,793.99 billion suggests considerable fluctuations in POS usage, possibly due to shifts in consumer preferences, economic conditions, and financial inclusion initiatives. The skewness value of 1.47 reveals a positive skew, meaning lower transaction values were more common, with occasional high values influencing the distribution. The kurtosis value of 3.78 suggests a moderate leptokurtic distribution, indicating the presence of some extreme values. The Jarque-Bera test statistic of 18.46, with a probability of 0.000098, indicates non-normality in the POS transaction data, reflecting rapid expansion in digital payment systems over the years.

Unit Root Test

This study employed the Augmented Dickey-Fuller (ADF) test to assess the stationarity of the variables.

Table 2: Summary of Unit Root Test Results

Variable	ADF Test Statistics	Critical ADF Test Statistics	Order of Integration
MSG	-3.690169	-3.510740**	I(0)
PSC	-4.850302	-4.170583*	I(1)
ATM	-6.903018	-4.170583*	I(1)
POS	-5.465517	-4.219126*	I(0)

Note: The tests include intercept with trend; * *and** significant at 1 and 5 percent.*

Source: Researcher's Computation Using EViews-12 (2025)

Manufacturing sector growth (MSG), measured as the percentage contribution of the manufacturing sector to GDP, was found to be stationary at level, I(0). The ADF test statistic of -3.690169 was more negative than the 5% critical value of -3.510740, indicating that the null hypothesis of a unit root was rejected at the 5% significance level.

Private sector credit (PSC) was found to be non-stationary at level but became stationary after first differencing, indicating it is integrated of order one, I(1). The ADF test statistic of -4.850302 exceeded the 1% critical value of -4.170583, confirming that PSC became stationary at the first difference;

Automated Teller Machine (ATM) transactions also exhibited non-stationarity at level but became stationary after first differencing, indicating an integration order of I(1). The ADF test statistic of -6.903018 was more negative than the 1% critical value of -4.170583, leading to the rejection of the null hypothesis of a unit root after first differencing.

Point-of-Sale (POS) transactions, on the other hand, were found to be stationary at level, I(0), with an ADF test statistic of -5.465517, which was more negative than the 1% critical value of -4.219126. This implies that POS transaction values did not exhibit long-term stochastic trends, and their fluctuations were temporary rather than permanent.

Co-integration Results

This study employed the Bounds test for cointegration, which is suitable for models where some variables are stationary at level [I(0)] while others become stationary after first differencing [I(1)]. The test evaluates whether the computed F-statistic exceeds the critical upper bound value (I(1)) at a given significance level, thereby confirming the presence of a long-run relationship.

Table 3: Bound Test-Co-integration Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	13.28820	10%	2.37	3.20
k	3	5%	2.79	3.67
		1%	3.65	4.66

Source: Researcher's Computation Using EViews-12 (2025)

At the 5% level of significance, the computed F-statistic of 13.28820 is significantly higher than the upper bound critical value (I(1)) of 3.67. Since the test statistic surpasses the upper bound, the null hypothesis of no long-run relationship is rejected, confirming that access to financial services—measured by private sector credit, Automated Teller Machines (ATM) transactions, and Point-of-Sale (POS) transactions—has a stable and meaningful relationship with manufacturing sector growth (MSG) over time.

ARDL (Short and Long Run) Estimates

Having confirmed the existence of a cointegrating relationship between access to financial services and manufacturing sector growth in Nigeria through the bounds test approach, the study moves forward to estimate both the error correction mechanism and long-run coefficients.

Table 4: ARDL-ECM and Long-run Result

Dependent Variable: MSG

ECM Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MSG(-1))	0.4177	0.0874	4.7808	0.0001
D(MSG(-2))	0.2948	0.1014	2.9082	0.0082
D(MSG(-3))	-0.1391	0.1452	-0.9583	0.3483
D(MSG(-4))	1.0535	0.1838	5.7312	0.0000
DLOG(PSC)	2.2905	0.2972	7.7064	0.0000
DLOG(PSC(-1))	-0.8828	0.3356	-2.6307	0.0153
DLOG(ATM)	-0.1310	0.0953	-1.3753	0.1829
DLOG(ATM(-1))	-0.4184	0.0964	-4.3403	0.0003
DLOG(ATM(-2))	-0.1208	0.0914	-1.3223	0.1997
DLOG(ATM(-3))	-0.2238	0.0916	-2.4436	0.0230
DLOG(ATM(-4))	0.9171	0.1054	8.7043	0.0000
DLOG(POS)	0.2554	0.0839	3.0423	0.0060
DLOG(POS(-1))	0.2581	0.0755	3.4198	0.0025
DLOG(POS(-2))	-0.0364	0.0764	-0.4759	0.6389
DLOG(POS(-3))	0.1190	0.0806	1.4771	0.1538
DLOG(POS(-4))	-0.8184	0.1026	-7.9780	0.0000
CointEq(-1)*	-0.1895	0.0214	-8.8612	0.0000
Long-Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(PSC)	4.1107	1.9613	2.0959	0.0478
LOG(ATM)	0.1075	0.0509	2.1112	0.0325
LOG(POS)	0.1022	0.0476	2.1456	0.0319
C	-32.8454	21.5372	-1.5251	0.1415
Reliability				
R-squared	0.9606			
Adjusted R-squared	0.9363			
Durbin-Watson stat	1.8457			

Source: Researcher's Computation Using EViews-12 (2025)

The error correction term, denoted as CointEq(-1), provides critical information about the speed of adjustment toward long-run equilibrium following short-term shocks. The coefficient of CointEq(-1) is -0.1895, and it is statistically significant at the 1% level, as indicated by the t-statistic of -8.8612 and the probability value of 0.0000. The negative sign and statistical significance confirm the presence of a valid long-run relationship among the variables in the model, as previously established by the cointegration test results.

From the long-run-estimates, the coefficient of private sector credit (LOG(PSC)) is 4.1107, with a t-statistic of 2.0959 and a probability value of 0.0478, which is statistically significant at the 5% level. This suggests that a 1% increase in private sector credit leads to an approximately 4.11% increase in the manufacturing sector's contribution to GDP.

For ATM transactions (LOG(ATM)), the coefficient is 0.1075, with a t-statistic of 2.1112 and a probability value of 0.0325, also significant at the 5% level. This indicates that a 1% increase in ATM transaction values is associated with a 0.11% increase in manufacturing GDP contributions. Point-of-Sale (POS) transactions (LOG(POS)) have a coefficient of 0.1022, with a t-statistic of 2.1456 and a probability value of 0.0319, confirming statistical significance at the 5% level. This implies that a 1% increase in POS transaction values results in a 0.10% increase in the manufacturing sector's GDP contribution.

Discussion of Findings

Findings from the study revealed that private sector credit (PSC) has a positive and significant impact on manufacturing sector growth in Nigeria. This suggests that increased availability of credit enables manufacturers to finance capital-intensive investments in machinery, technology, and raw materials, thereby enhancing productivity and driving industrial growth. This outcome aligns with the findings of Adu, *et al.* (2022), who noted that private sector credit significantly contributes to manufacturing sector expansion in sub-Saharan Africa by improving firms' access to finance. Similarly, Eze and Okonkwo (2021) also found that PSC positively impacts the manufacturing sector in Nigeria, particularly in the long run, as banking sector reforms have improved credit allocation to businesses.

The study found that Automated Teller Machines (ATM) transactions have a significant and positive impact on manufacturing sector growth in Nigeria. This indicates that the availability and use of ATMs facilitate access to liquidity for businesses, enhancing their ability to manage day-to-day operations effectively. This finding corroborates the work of Ozili (2022), who highlighted the role of digital financial services, including ATMs, in improving business efficiency and fostering economic inclusion. The result also agrees with Adu, *et al.* (2022), who found that financial infrastructure expansion, such as ATMs, positively influences industrial growth by reducing

transaction costs and improving access to funds. However, despite this positive outcome, studies such as Ezugwu and Ibe (2021) have noted that ATM penetration in Nigeria is often uneven, with rural areas still lacking sufficient access to this financial infrastructure. This geographic disparity limits the full potential of ATM services in promoting manufacturing growth, particularly in underserved regions where businesses face liquidity constraints.

The study also showed that Point-of-Sale (POS) transactions have a significant and positive impact on manufacturing sector growth in Nigeria. This reflects the increasing adoption of digital payment systems, which have streamlined business transactions, reduced cash dependency, and enhanced operational efficiency for manufacturers. These findings align with the conclusions of Kassi *et al.* (2021), who demonstrated that the proliferation of POS terminals has been instrumental in advancing financial inclusion and reducing transaction costs in developing economies. Similarly, Mensah and Ofori (2021) found that digital payment platforms, including POS systems, significantly boost industrial performance by improving supply chain efficiency and supporting cashless transactions. However, the findings also highlight challenges identified by Mahmood and Chaudhry (2020), who noted that inconsistent network connectivity and limited POS coverage in semi-urban and rural areas can hinder the full utilization of digital financial systems. Despite these limitations, the growing use of POS technology in Nigeria represents a critical step toward strengthening the financial ecosystem and fostering manufacturing sector development.

Conclusion and Recommendations

In conclusion, this study examined the impact of access to financial services—measured by private sector credit, Automated Teller Machines (ATMs), and Point-of-Sale (POS) transactions—on manufacturing sector growth in Nigeria. The findings showed the significant role of financial access in driving industrial development, aligning with the study's main objective of assessing the relationship between financial accessibility and manufacturing sector growth.

First, the positive impact of private sector credit highlights the importance of financial deepening in enabling manufacturers to access capital for investment and productivity enhancement. Second, the significant effect of ATM transactions demonstrates the critical role of financial infrastructure in improving liquidity and facilitating business operations. Third, the positive influence of POS transactions reveals the transformative potential of digital payment systems in reducing cash dependency and enhancing operational efficiency for manufacturers. Together, these findings reaffirm the necessity of a well-functioning financial system in sustaining manufacturing sector growth and economic diversification.

The following recommendations were suggested based on the findings:

    i.   To maximize the impact of private sector credit, the Central Bank of Nigeria (CBN) should mandate commercial banks to offer long-term, low-interest loans tailored to manufacturing needs. The Bank of Industry (BOI) must expand concessional loans for modernizing manufacturing processes.

    ii.   To enhance ATM accessibility, the Nigeria Inter-Bank Settlement System (NIBSS) should prioritize ATM deployment in rural and semi-urban areas. The Federal Ministry of Communications and Digital Economy must improve digital infrastructure to ensure consistent functionality and reduce transaction disruptions. Financial institutions must also educate businesses on leveraging ATM services to improve liquidity management, thereby supporting smoother operations in the manufacturing sector.

    iii.   To boost POS adoption, the CBN and NIBSS should reduce transaction fees and subsidize terminal acquisition for small businesses. NITDA should strengthen network reliability to prevent connectivity issues, enabling manufacturers to rely more on seamless digital payment systems.

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Appendices

Table 5: Data Presentation

Year	Private sector credit (₦' Billion)	ATM (Val (₦' Billion))	POS (Val (₦' Billion))	Manufacturing sector growth (MSG, %)
2012q1	12,641.72	1984.66	48.01	7.79
2012q2	13,424.72	2195.73	76.26	8.10
2012q3	13,893.49	2406.80	104.51	8.41
2012q4	13,732.83	2617.87	132.76	8.72
2013q1	13,926.71	2828.94	161.02	9.03
2013q2	14,395.62	3041.67	198.78	9.21
2013q3	14,974.62	3254.41	236.54	9.39
2013q4	15,279.76	3467.14	274.31	9.57
2014q1	16,034.17	3679.88	312.07	9.75
2014q2	16,376.21	3752.47	346.18	9.70
2014q3	17,094.36	3825.07	380.29	9.64
2014q4	18,223.78	3897.66	414.40	9.59
2015q1	18,605.34	3970.25	448.51	9.53
2015q2	18,894.12	4224.72	526.13	9.34
2015q3	18,592.23	4479.19	603.75	9.15
2015q4	18,811.52	4733.66	681.38	8.96

2016q1	18,962.41	4988.13	759.00	8.77
2016q2	21,415.05	5350.50	921.70	8.79
2016q3	22,677.97	5712.86	1084.40	8.80
2016q4	22,326.33	6075.23	1247.11	8.82
2017q1	22,750.55	6437.59	1409.81	8.83
2017q2	22,356.80	6448.22	1653.14	9.06
2017q3	22,500.48	6458.84	1896.46	9.29
2017q4	22,243.19	6469.46	2139.78	9.52
2018q1	22,279.79	6480.09	2383.11	9.75
2018q2	22,230.90	6488.22	2588.52	10.22
2018q3	22,978.28	6496.35	2793.93	10.69
2018q4	23,536.26	6504.48	2999.34	11.17
2019q1	25,707.79	6512.61	3204.75	11.64
2019q2	24,786.95	9434.37	3585.33	11.93
2019q3	25,758.78	12356.13	3965.92	12.23
2019q4	26,616.74	15277.90	4346.50	12.53
2020q1	28,422.91	18199.66	4727.08	12.83
2020q2	29,555.51	18957.48	9659.16	13.33
2020q3	29,745.78	19715.30	14591.25	13.83
2020q4	29,890.46	20473.12	19523.33	14.33
2021q1	31,437.05	21230.93	24455.42	14.83
2021q2	32,625.54	24085.21	28600.51	14.57
2021q3	33,936.53	26939.48	32745.61	14.31
2021q4	34,920.73	29793.75	36890.71	14.06
2022q1	36,467.41	6,137.17	7,486.28	13.80
2022q2	39,233.61	6,501.97	8,377.80	13.44
2022q3	40,515.28	9,672.33	10,284.98	13.09
2022q4	42,433.84	10,336.56	14,886.74	12.73
2023q1	44,266.23	7,165.56	23,284.14	12.37
2023q2	54,503.99	7,467.00	25,160.72	12.55
2023q3	59,507.35	6,361.69	26,822.05	12.74
2023q4	62,538.68	7,218.34	35,080.18	12.92

Source: CBN, 2023; NIBSS, 2025