Journal of Research and Rural Planning
Volume 14, No. 4, Autumn 2025, Serial No. 51, Pp. 1-14
eISSN: 2783-2007 **ISSN: 2783-2791**
http://jrrp.um.ac.ir

Original Article

Capital Market Efficiency, Financial Innovation and Industrialization in Nigeria

Kazeem Seun Belau[1*], Russell Olukayode Christopher Somoye[2]

1. Assistant Prof. in Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria.
2. Full Prof. in Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria.

Abstract

Purpose- Nigeria remains heavily import-dependent and under-industrialized despite abundant natural resources and repeated industrial development programmes. This study investigated how capital market efficiency and financial innovation influence industrialization in Nigeria, with specific focus on their relevance for rural and regional economic transformation.

Design/methodology/approach- The study employed an *ex-post facto* research design using secondary annual time-series data from 2010-2023 obtained from the Central Bank of Nigeria Statistical Bulletin. Descriptive statistics and the Autoregressive Distributed Lag (ARDL) model were applied to examine both short-run and long-run relationships among stock market depth and liquidity, stock market efficiency, fintech adoption, credit to the private sector, inflation, and industrial output. The study also emphasized the rural and regional development implications of financial sector performance.

Finding- Results showed that Nigeria's manufacturing sector contribution to GDP remains structurally low, and market depth is highly volatile. Fintech adoption exhibits the highest dispersion due to periodic surges in electronic payments, while stock market liquidity is relatively stable. ARDL estimates reveal that market liquidity and market depth exert positive and significant effects on industrialization, whereas fintech adoption and private-sector credit exert negative significant effects. Inflation is insignificant. The bounds test confirms strong long-run cointegration among the variables. The findings indicated that Nigeria's industrialisation is largely driven by short-run financial dynamics, particularly stock market liquidity and credit allocation efficiency. High fintech activity, when weakly regulated, may facilitate capital flight and reduce productive sector investment. Strengthening capital-market institutions, stabilising monetary conditions, and improving rural credit access are essential for sustainable industrial development.

Originality/value– This study contributed to the industrialization literature by integrating capital-market efficiency, financial innovation, and rural or regional development perspectives within a unified ARDL framework for Nigeria. It provided new evidence on how financial sector dynamics shape industrial growth in emerging economies.

Keywords- Industrial output, Stock market depth, Stock market efficiency, Fintech adoption, ARDL model, Rural development.

Use your device to scan and read the article online

How to cite this article:
Seun Belau, K., & Olukayode Christopher Somoye, R. (2025). Capital market efficiency, financial innovation and industrialization in Nigeria. *Journal of Research & Rural Planning, 14*(4), 1-14.

http://dx.doi.org/10.22067/jrrp.v14i4.2305-11146

Date:
Received: 20-09-2025
Revised: 10-11-2025
Accepted: 04-12- 2025
Available Online: 04-12-2025

Corresponding Author:
Seun Belau, Kazeem, Ph.D.
Address: Department of Economy, Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria.
Tel: +2347044776861
E-Mail: belau.kazeem@oouagoiwoye.edu.ng

1. Introduction

Industrialisation remains a persistent challenge for most African economies, which continue to operate as consumption-driven systems dependent on imported machinery and primary commodity exports. Nigeria, similar to other African countries, relies heavily on crude oil as its major source of foreign exchange, making the economy vulnerable to external shocks and inhibiting diversification into manufacturing and agro-industrial sectors (Lawal *et al*., 2019). Past development initiatives including import substitution, rural development programmes, and the Structural Adjustment Programme (SAP) failed to achieve sustained industrial transformation due to structural bottlenecks such as infrastructural decay, technological gaps, low investment, policy reversals, weak institutions, and inadequate financing (Nzau, 2010; Ibi *et al*., 2015).

Recent literature underscores the centrality of a functional capital market to industrial development. Efficient capital markets facilitate the reallocation of resources from inefficient firms to productive ones, reduce credit constraints, and support long-term investment required for industrial growth (Markjackson & Omie, 2018; Ngozi *et al*., 2022). For Nigeria, improving capital-market performance is therefore critical to reducing dependence on crude oil and promoting a diversified industrial base (Ejem & Ogbonna, 2020). Investor confidence driven by transparency, liquidity, and fair returns is equally essential in stimulating investment and broadening industrial financing channels.

Nigeria's high poverty incidence, with a multidimensional poverty index of 0.34 and 64 per cent of the population classified as being poor (Eze & Alugbuo, 2021), further highlights the need for inclusive financial systems. Financial innovation offers new opportunities to reach rural and underserved populations, mobilise savings from the informal sector, and channel funds toward productive industrial activities. Improved payment technologies, digital banking, and fintech platforms can enhance financial inclusion, strengthen rural capital participation, and support the financing of small-scale manufacturing and agro-processing firms that dominate Nigeria's regional economies (Otapo, 2020; Abina, 2023).

Despite Nigeria's abundant natural resources, human capital capacity, and multiple industrialisation programmes, the country remains under-industrialised. Empirical studies show mixed evidence regarding the efficiency of Nigeria's capital market as ranging from weak form (Ajao & Osayuwu, 2012; Falaye *et al*., 2018) to mean-reverting (Lawal *et al*., 2019) and even strong form (Sulaiman & Azeez, 2012). However, these studies do not jointly examine capital-market efficiency and financial innovation as complementary drivers of industrialisation, nor do they adequately integrate rural or regional development implications. Existing research such as Murinde (2012), Nzau (2010), Morris and Fessehaie (2014), and Ledeneva *et al*. (2020) largely treats industrialisation conceptually, while studies by Ibi *et al*. (2015), Gbarato *et al*. (2020), and Ngozi *et al*. (2022) focus only on either capital markets or general economic performance.

Given the increasing role of financial technology, capital-market dynamics, and regional development considerations, there is a clear gap in understanding how capital-market efficiency and financial innovation jointly shape Nigeria's industrialisation trajectory. This study therefore examined the combined influence of capital-market efficiency and financial innovation on industrialisation in Nigeria, contributing new empirical insights relevant to national and rural economic transformation.

The remaining sections of the paper are structured as follows, section two presents the theoretical and empirical literature; section three outlines the methodology; section four discusses the results; and section five concludes with implications and recommendations.

2. Research Theoretical Literature

2.1. Conceptual Review

Industrialisation refers to the sustained expansion of a country's manufacturing and industrial capacity, leading to value addition, productivity growth, and structural transformation. Classical perspectives trace industrialisation to strategic investments, technological upgrading, and efficient resource allocation (Schumpeter, 1934; Rosenstein-Rodan, 1943). In modern economies, industrialisation represents a shift from low-productivity sectors to high-productivity manufacturing and technology-driven industries (Lucas, 1988; Romer, 1990). Industrial output, an indicator of industrialisation, captures production scale, efficiency, and capacity utilisation. Studies

emphasise that industrialisation in Africa including Nigeria depends significantly on institutional quality, financial openness, capital access, and innovation (Ledeneva *et al*., 2020; Amoah & Jehu-Appiah, 2022; Paulin *et al*., 2023). Weak infrastructure, volatile macroeconomic factors, and inefficient financial systems have historically constrained industrial growth (Nzau, 2010; Morris & Fessehaie, 2014).

Capital market efficiency refers to the extent to which stock prices reflect all available information, allowing savings to be channelled into productive investments without friction. Stock market liquidity, is a good indicator of capital market efficiency, and refers to the ease with which financial assets such as shares can be bought or sold in the market without causing significant changes in their prices. A liquid market is characterised by high trading volume, narrow bid–ask spreads, and the ability to execute large transactions quickly. Liquidity enhances market attractiveness for investors, reduces investment risks, and enables firms to raise capital efficiently. In emerging markets like Nigeria, liquidity signals a more mature financial system capable of supporting industrial and economic development.

Another capital market efficiency indicator is stock market depth, which refers to the market's ability to sustain relatively large trading volumes without experiencing significant price volatility. It measures the capacity of the market, that is, how much capital and how many transactions it can absorb. A deep stock market supports long-term investment, reduces reliance on bank financing, and provides a stable source of capital for large-scale industrial and infrastructural projects. Studies in Nigeria confirm that deeper capital markets are associated with improved industrial performance (Adeusi *et al*., 2013; Gbarato *et al*., 2020). Stock market efficiency refers to how well stock prices reflect all available information. According to the Efficient Market Hypothesis (EMH) popularised by Fama (1965), an efficient market immediately incorporates new information into prices, making it impossible for investors to consistently earn abnormal returns.

Financial innovation refers to new technologies, processes, institutions, and financial instruments that enhance efficiency in financial intermediation (Schumpeter, 1934). Modern fintech including mobile banking, digital payments, blockchain, AI, and automated credit scoring, has revolutionised financial services, bridging gaps created by traditional banking systems. The FinTech adoption index reflects how digital platforms improve payment systems, credit delivery, savings mobilisation, and risk management. Financial innovation promotes growth by expanding credit availability, reducing transaction costs, and promoting efficient capital allocation (Murinde, 2012; Michalopoulos *et al*., 2015).

Financial intermediation is strengthened as fintech platforms deepen access to finance, improve operational efficiency, and reduce borrowing constraints. In emerging economies like Nigeria, fintech-driven innovation has become essential for supporting business expansion and industrial activities, particularly where formal financial infrastructure is weak. Inflation refers to the general rise in prices over time, which affects purchasing power, investment decisions, production costs, and the overall macroeconomic environment. In the context of industrial development and financial market performance, inflation is an important macroeconomic stabiliser or destabiliser.

Figure 1.1 shows the conceptual framework where industrialisation in Nigeria is shaped by financial market performance, technological adoption, and macroeconomic conditions. Industrialisation (MP), measured by the share of manufacturing output in GDP, is the outcome the framework seeks to explain. The first pathway emphasises capital market behaviour. Stock market efficiency (NGXTV) and Market liquidity and depth (SML) capture how effectively the Nigerian stock market allocates funds to productive sectors. This is grounded in the Efficient Market Hypothesis (EMH), which argues that when markets process information efficiently, capital flows to its most productive uses, thereby supporting manufacturing growth. The Random Walk Hypothesis further implies that a well-functioning market reduces speculative distortions, ensuring that prices reflect fundamentals and encourage long-term industrial investment.

The second pathway reflects technological and financial system advancement. FinTech Adoption (TEP) aligns with the Technological Growth Model, which holds that technological innovation enhances productivity, reduces transaction frictions, and expands access to financial services

that businesses require for production and expansion. Financial Intermediation (CPS) is linked to the Solow Growth Model, which emphasises capital accumulation as a key driver of output growth; greater credit to the private sector increases firms' ability to invest in machinery, innovation, and production capacity. Finally, Macroeconomic Stability (INFL) is included as a control variable because persistent inflation distorts prices and reduces investment efficiency, potentially weakening the impact of finance and technology on industrialisation.

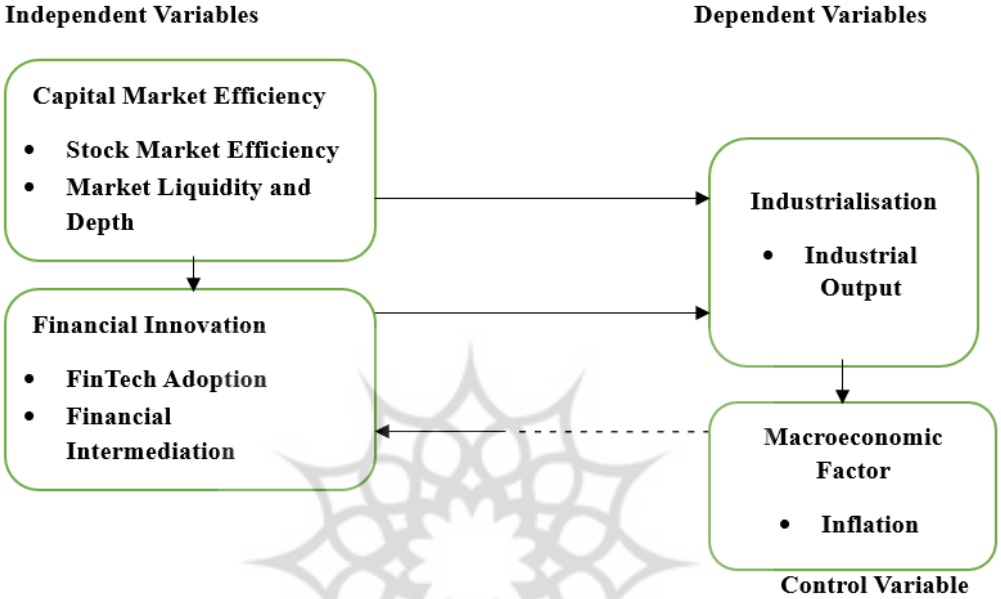

Figure 1. Conceptual Framework

2.2 Theoretical Review

The concept of capital market efficiency is rooted in the random walk hypothesis and the efficient market hypothesis (EMH). Malkiel (1973) originally observed that stock prices follow no predictable pattern, reflecting a random walk and implying that neither technical nor fundamental analysis can consistently outperform the market. The random walk hypothesis therefore assumes that security prices respond only to new information and that past price movements offer no predictive value for future performance.

Fama (1965) extended this view by formalising the EMH, arguing that security prices incorporate all available information such that no investor can earn excess returns by exploiting publicly known data. Fama identified three forms of market efficiency. First, weak-form efficiency posits that past market information is fully reflected in current prices, rendering technical analysis ineffective. Second, semi-strong efficiency states that prices rapidly adjust to both historical and publicly available new information, making both technical and fundamental analysis unproductive. Finally, strong-form efficiency suggests that all forms of information namely, public, private, and insider are instantly reflected in market prices, leaving no room for abnormal profits. Although these models underpin modern financial market analysis, empirical studies in developing countries often show deviations from full efficiency due to institutional weaknesses, information asymmetry, and shallow market depth.

The technological (endogenous) growth model, pioneered by Schumpeter (1934), emphasises innovation, entrepreneurship, and technological change as drivers of long-run growth. Schumpeter's theory was extended by Lucas (1988) and Romer (1990), who stressed the role of human capital accumulation, knowledge creation, and research and development (R&D) in promoting industrialisation. In this context, equity markets serve as crucial channels for providing long-term, risk-bearing finance needed for innovation, especially in intangible assets. Aghion and Howitt (1992) further advanced this perspective through the "creative destruction" model, arguing that growth occurs through

sequential innovations that replace outdated technologies. For this process to be sustained, investors must receive adequate compensation for bearing high innovation-related risks.

Michalopoulos *et al.* (2015) bridge endogenous growth theory with capital market development by emphasising the need to reduce information asymmetry. They argue that well-functioning markets lower uncertainty, encourage R&D investment, and stimulate innovation-led industrial growth.

Exogenous growth models provide complementary perspectives on industrialisation. The Solow (1956) and Swan (1956) model argues that capital accumulation alone cannot sustain long-run industrialisation without technological progress, which they view as exogenous. Kaldor (1957), in his "manufacturing as the engine of growth" hypothesis, asserts that industrial expansion, rather than general gross domestic product growth is central to productivity increases and structural transformation. Earlier, Rosenstein-Rodan (1943) proposed the "big push" theory, contending that large-scale, coordinated investments across sectors are necessary to overcome structural bottlenecks, market failures, and economic dualism common in developing economies.

Efficient financial markets, as described by Fama (1965), require liquidity to ensure that information is rapidly incorporated into stock prices. More liquid markets better allocate capital and reduce uncertainty for firms seeking funding. Market depth strengthens financial intermediation by allowing firms to access capital in large volumes, complementing endogenous growth models (Romer, 1990; Lucas, 1988), which emphasise capital accumulation and technological progress. The random walk theory (Malkiel, 1973) supports EMH by suggesting that price movements are unpredictable. In emerging economies, deviations from efficiency often result from poor disclosure, low investor participation, and information asymmetry. These models highlight that industrialisation requires both technological change and supportive macroeconomic conditions including access to finance, efficient capital markets, and institutional stability.

2.3 Empirical Review

Murinde (2006) noted that African capital markets face structural challenges including weak institutions, fragmented markets, and inconsistent macroeconomic policies that hinder their ability to support long-term industrialisation. Morris and Fessehaie (2014) highlighted linkage development as a pathway to industrialisation, arguing that targeted regulatory policies, commodity-based industrialisation, sectoral productivity improvements, and product quality upgrading can stimulate structural transformation. Ejem and Ogbonna (2020) argued for a broader conceptualisation of capital market efficiency by integrating exchange rate behaviour within global financial-asset markets. They identified two theoretical approaches. First, monetary approach which is when exchange rates are determined by relative demand and supply for money between countries, assuming perfect substitutability between domestic and foreign assets. Second, portfolio balance approach, implying that exchange rates depend on the supply and demand for domestic and foreign bonds, assuming imperfect substitutability. This suggests that changes in investor portfolios, interest rates, and risk preferences influence exchange rate and asset-price dynamics. These models are particularly relevant for emerging markets such as Nigeria, where exchange rate volatility affects foreign investment flows, market depth, and portfolio allocation within the capital market.

Also, Ledeneva *et al*. (2020) emphasised Africa's growing opportunities for industrialisation, including rising urbanisation, an expanding labour force, growing domestic markets, digital penetration, and increased external investment especially from Asia. However, persistent constraints such as weak institutions, low savings, corruption, excessive debt, and underdeveloped capital markets continue to impede progress.

Empirical studies on African capital markets present mixed evidence. For instance, Gbarato *et al*. (2020) found a positive link between market capitalisation and industrial growth, but reported that the value of transactions negatively affects industrial development due to inefficient capital utilisation. Ngozi *et al.* (2022) found market capitalisation to be positively related to GDP, but volume of traded shares to be insignificant, indicating under-trading and low market participation. They recommended a systemic overhaul of the Nigerian capital market to enhance its developmental impact. These studies underscore the need to integrate financial

innovation, market efficiency, technological structure, and macroeconomic stability when analysing pathways to industrialisation in Nigeria.
From the reviewed literature, three major gaps emerge, first, limited joint analysis of capital-market efficiency and financial innovation in explaining Nigeria's industrialisation. Second is the insufficient attention to the role of digital financial systems such as fintech adoption and electronic payments in shaping industrial financing channels. Lastly, lack of integrated frameworks that connect financial markets, macroeconomic factors, and industrial performance within the Nigerian context. This study addressed these gaps by examining how capital market efficiency and financial innovation jointly influence Nigeria's industrialisation using an ARDL model.

3. Research Methodology

This study adopted an *ex -post facto* research design using secondary time series data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (2023). The data comprised macroeconomic indicators drawn from the real, financial, and external sectors of the Nigerian economy. Specifically, the variables extracted include manufacturing sector contribution to GDP, market liquidity, market depth, fintech adoption index, credit to the private sector, and inflation rate. The dataset covered the period between 2010 and 2023. Preliminary diagnostic tests revealed that the variables were integrated at different orders some at level I(0) and others at first difference I(1). This justified the use of the Autoregressive Distributed Lag (ARDL) technique, which is suitable for estimating relationships involving mixed-order integrations without requiring all variables to be stationary at the same level.

To ensure robustness, the study conducted several pre-estimation and post-estimation tests. These include Augmented Dickey–Fuller (ADF) test for unit root, Variance Inflation Factor (VIF) for multicollinearity, descriptive statistics and correlation analysis, Portmanteau Q-test for autocorrelation, Breusch–Pagan (Cook–Weisberg) test for heteroscedasticity, and Breusch–Godfrey Lagrange Multiplier test. Other tests are Wald test for joint significance, Shapiro–Wilk test for normality, CUSUM squared and histogram with kernel density for structural stability and distributional shape respectively.

3.1 Model Specification

The functional relationship is specified as:

$$MP = f(TEP, CPS, NGXTV, SML, INFL) \quad (1)$$

Given the time series nature of the data, the study employed a dynamic ARDL model, specified as:

$$\begin{aligned} MP_t = \; & \alpha_0 + \beta_1 MP_{t-1} + \delta_0 TEP_t + \delta_1 TEP_{t-1} + \phi_0 CPS_t + \phi_1 CPS_{t-1} \\ & + \varphi_0 NGXTV_t + \varphi_1 NGXTV_{t-1} + \lambda_0 SML_t + \lambda_1 SML_{t-1} \\ & + \theta_0 INFL_t + \theta_1 INFL_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Where: MP is manufacturing sector contribution to GDP (proxy for industrialisation), CPS is credit to private sector (proxy for financial intermediation); TEP is Total electronic payments (proxy for fintech adoption), SML is stock market liquidity ratio (proxy for market liquidity and depth), NGXTV is stock market turnover ratio (proxy for capital market efficiency), INFL is inflation rate (proxy for macroeconomic stability).

Table 1. Description of Variables

S/N	Parameter Measured	Variable & Symbol	Measurement	Description
Dependent Variable				
1	Industrialisation	MP	Ratio of manufacturing output to GDP	Indicates the contribution of manufacturing to national output; a higher ratio reflects stronger industrial development.
Independent Variables				
2	Capital Market Efficiency			
	Stock Market Efficiency	NGXTV	Trading volume divided by market capitalisation	Measures how actively the stock market converts investment into liquidity.
	Market Liquidity & Depth	SML	Equity traded divided by market capitalisation	Shows how easily positions can be entered or exited; reflects market depth.
3	Financial Innovation			

	FinTech Adoption	TEP	Growth rate of total electronic payments	Captures adoption of digital financial services (e.g., USSD, mobile banking, POS, ATM, internet banking).
	Financial Intermediation	CPS	Credit to private sector divided by GDP	Indicates financial sector support to private investment and economic activity.
4	Control Variable			
	Macroeconomic Stability	INFL	Growth rate of inflation	Controls for price-level changes affecting economic performance.

Source: Author's Compilation (2025)

4. Research Findings

4.1 Descriptive Analysis

Table 2 presents the descriptive statistics for the selected capital market and macroeconomic variables in Nigeria. The mean manufacturing sector contribution to GDP (MP) is 8.6756, suggesting an average of 8.68 per cent during the review period. The low standard deviation (0.1970) and coefficient of variation (0.0227) indicate relative stability. The negative skewness (-1.5738) reflects a left-tailed distribution, while the kurtosis value (4.0660) shows moderate peakness. The mean NGX trading volume is 72.62 billion units, indicating high trading activity. However, the high standard deviation (58.29) and coefficient of variation (0.8028) reveal large fluctuations. The distribution is right-skewed (0.9731). Total electronic payments (TEP) average ₦2.407 trillion, but exhibit extreme variability, as shown by the high standard deviation (7.1585) and coefficient of variation (2.9735). The variable is strongly positively skewed (3.2771) and highly leptokurtic (11.8583).

Stock market liquidity (SML) has a mean of 0.1233, indicating that about 12.33 per cent of market capitalisation is traded annually. The coefficient of variation (0.2159) suggests moderate variability, while the skewness (0.3463) and kurtosis (2.2650) point to non-normal distribution. Credit to private sector as a percentage of GDP (CPS) averages 0.1878, with low volatility (CV = 0.0889). Its skewness is close to zero (0.0789), and kurtosis (4.2600) indicates a slightly peaked distribution. Inflation averages 7.8 per cent, with moderate volatility (SD = 0.2669). The high coefficient of variation (3.4218), positive skewness (0.7550), and leptokurtic kurtosis (3.8359) indicate occasional inflationary spikes.

Table 2. Descriptive Analysis

Variable	MP	NGXTV	TEP	SML	CPS	INF
Mean	8.6756	72.6163	2.4074	0.1233	0.1878	0.078
Standard Deviation	0.197	58.2943	7.1585	0.02662	0.0167	0.2669
Coefficient of Variation	0.0227	0.828	2.9735	0.2159	0.0889	3.4218
Minimum	8.18	14.35	-0.31	0.08	0.15	-0.3
Maximum	8.81	194.11	27.16	0.17	0.22	0.73
Skewness	-1.5738	0.9731	3.2771	0.3463	0.0789	0.755
Kurtosis	4.06	2.56	11.85	2.26	4.26	3.83

4.2 Pre-Estimation Test (ADF Unit Root Test)

The ADF test results (Table 3) show that MP, TEP, and inflation are stationary at level, confirming I(0) behaviour. Meanwhile, NGXTV, SML, and CPS are non-stationary at level but become stationary after first differencing, indicating they are I(1). This mix of I(0) and I(1) variables supports the suitability of the ARDL methodology.

Table 3. Augmented Dickey-Fuller Unit Root Test

Variable	MP	NGXTV	TEP	SML	CPS	INF
constant	2.8723	17.9649	2.8612	0.0823	0.1308	0.0704
constant t	4.98	1.05	1.26	2	1.84	0.86
L1 t	-4.89	-2.3	-3.66	-1.97	-1.8	-2.89
P-Value	0	0.1709	0.0047	0.3000	0.3799	0.0469

Variable	MP	NGXTV	TEP	SML	CPS	INF
Constant trend	-1.7614	0.237	1.4755	1.5356	0.1572	-0.1488
constant t	0.5454	2.9451	-3.1377	-4.0301	-4.7776	-3.696
P-value	0.036	0.0006	0.0257	0.044	0.001	0.05
Order	I(0)	I(1)	I(0)	I(1)	I(1)	I(0)

4.3 Correlation Analysis

The correlation matrix (Table 4) indicates generally weak linear associations with MP. TEP shows a very weak positive correlation (0.0812), implying minimal connectivity with manufacturing performance. CPS has the strongest positive correlation (0.3470), suggesting that private sector credit moderately supports manufacturing activity. NGXTV (0.2961) also shows a weak-to-moderate positive correlation. SML exhibits a low correlation (0.1419), and inflation has a weak positive correlation (0.1925), indicating limited influence on manufacturing
.

Table 4. Correlation Analysis

Variables	MP	NGXTV	TEP	SML	CPS	INFL
MP	1.0000					
TEP	0.0812	1.0000				
CPS	0.3470	0.0843	1.0000			
NGXTV	0.2961	0.0426	0.0123	1.0000		
SML	0.1419	0.4176	0.4960	0.5610	1.0000	
INFL	0.1925	0.0598	0.5444	-0.1449	0.1210	1.0000

4.4 Test of Multicollinearity

VIF results (Table 5) show no multicollinearity concerns. The highest VIF (3.20 for SML) and the mean VIF (2.07) are below the critical threshold of 5. This confirms that all variables can be retained in the regression model.

Table 5. Variance Inflation Factor

Variables	VIF	1/VIF
SML	3.20	0.3127
CPS	2.30	0.4347
NGXTV	1.91	0.5224
INFL	1.51	0.6635
TEP	1.42	0.7042
Mean VIF	2.07	

4.5 ARDL Regression Analysis

The ARDL estimates (Table 6) provide insight into short-run dynamics. Lagged MP (MP L_1) is highly significant and positive (0.9088), suggesting strong persistence in manufacturing performance. TEP (L_0) has a significant negative effect (–0.0024), implying that increases in electronic payments reduce manufacturing performance in the short run. CPS (L_0 and L_1) both display negative coefficients, though marginally significant, suggesting that credit expansion may not immediately support manufacturing, possibly due to misallocation or consumption-driven lending. NGXTV (L_0) is positive and significant (0.0006), indicating that market trading activity stimulates manufacturing output. SML (L_0) is positive and significant, while SML (L_1) is not significant. This highlights an immediate but not persistent liquidity effect. Inflation is insignificant, suggesting no short-run influence on MP. The model fits strongly (R^2 = 0.9972; Adj. R^2 = 0.9917). The F-statistic confirms joint significance of all regressors.

Table 6. ARDL Analysis

Variables	Lag	Coefficient	Std. Error	t-cal	Significant
MP	L1	0.9088	0.0395	22.98	0.000
TEP	L0	-0.0024	0.0006	-3.49	0.025
CPS	L0	-1.5134	0.6674	-2.27	0.086

Variables	Lag	Coefficient	Std. Error	t-cal	Significant
	L1	-0.8144	0.3221	-2.53	0.065
NGXTV	L0	0.0006	0.0001	5.09	0.007
SML	L0	1.1307	0.2670	4.23	0.013
	L1	0.3223	0.2094	1.54	0.199
INFL	L0	-0.0068	0.0262	-0.26	0.88
C		1.0649	0.2684	3.97	0.017
R^2 = 0.9972; Adj. R^2 = 0.9917; t-cal = 3.97; Sig. = 0.0001; F- cal = 179.29					

4.6 ARDL Bounds Test

The bounds test (Table 7) reveals cointegration, with the F-statistic (87.39) exceeding the upper bound critical value (5.761) at the 1 per cent level. This confirms a long-run relationship among the variables.

Table 7. Bound Test Result

t-statistics	Value	K	I(0)	I(1)
F-statistics	87.3925	5	4.134	5.761

4.6 ARDL Error Correction Model (ECM)

The error correction term (ECM –1) is negative and highly significant (0.000), confirming long-run stability. However, the speed of adjustment (9.08 per cent per year) is slow, implying persistent deviations from equilibrium. In the short run, D(SML) is positive and highly significant at 1 per cent level (0.0003) with coefficient of 1.1359, indicating strong short-run liquidity support for manufacturing. D(CPS) remains negative and highly significant at 1 per cent level (0.0004) but coefficient of –1.5216, implying short-run credit allocation inefficiency.

Table 8. Co-integration Form

Variable	Coefficient	Std Error	t-Value	Probability
D (SML)	1.135946	0.094379	12.03599	0.0003
D (CPS)	-1.521608	0.141972	-10.71765	0.0004
ECM (-1)	-0.090771	0.002321	-39.10716	0.0000

4.8 Long-Run ARDL Results

Long-run coefficients (Table 9) show expected signs of TEP, CPS, and inflation are negative, while SML and NGXTV are positive. However, none of the slope coefficients are statistically significant, suggesting that these variables do not exert long-run measurable effects on manufacturing GDP within the sample. The constant is significant and positive.

Table 9. Long-run ARDL Result

Variable	Coefficient	Std. Error	t-Value	Probability
TEP	-0.02653	0.016278	-1.63007	0.1784
SML	16.05174	8.604512	1.865503	0.1355
NGXTV	0.006734	0.003676	1.831525	0.141
CPS	-25.7384	18.18128	-1.41566	0.2298
INFL	-0.07366	0.274673	-0.26816	0.8018
C	11.70991	2.476883	4.72768	0.0091

4.9 Parameter Estimation Tests

4.9.1 Serial Correlation (Breusch–Godfrey LM Test)

The Breusch-Godfrey LM test is to reveal serial correlation as shown in table 10. The LM statistic

(p = 0.1798) indicates no serial correlation as residuals are independent.

Table 10. Breusch-Godfrey LM Test for Serial Correlation

Lags	Chi2	Df	Prob
1	1.799	1	0.1798
H0: no serial correlation			

4.9.2 Heteroskedasticity (Breusch–Pagan Test)

Table 11 shows the Breusch-Pagan test. The p-value (0.1874) shows no heteroskedasticity, implying constant variance of residuals.

Table 11. Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

chi2(1)	Prob > chi2
1.74	0.1874

4.9.3 Portmanteau Q-Test

The Portmanteau Q-test is shown in table 12. The Q-statistic (p = 0.2253) confirms residuals are white noise.

Table 12. Portmanteau Test for White Noise

Portmanteau (Q) statistic = 12.9716	Prob > chi2(10)
12.9716	0.2253

4.9.4 Wald Test

Table 13 reveals the Wald test. The Wald F-statistic (826.47; p < 0.001) confirms that the explanatory variables have a joint significant effect on manufacturing GDP.

Table 13. Wald Test

Variables	Value
TES	0
CPS	0
NGXTV	0
SML	0
INFL	0
F (5, 9) = 826.47, Prob> F = 0.0000	

4.9.5 Normality Tests

These are tests for examining the normality of the dataset.

a) Shapiro-Wilk

The data set is shown to be non-normally distributed with Shapiro–Wilk (W = 0.6937; p = 0.00048) as revealed in table 14.

Table 14. Shapiro-Wilk Test

Variable	W	Probability
Residual	0.6937	0.00048

b) Skewness and Kurtosis

Residuals are not normally distributed, as indicated by Skewness (p = 0.0030); Kurtosis (p = 0.0361) and Joint Chi-square (p = 0.0062). Despite this limitation, the large sample size and ARDL robustness mitigate concerns.

Table 15. Skewness and Kurtosis Test for Normality

Variable	Pr(Skewness)	Pr(Kurtosis)	Adj Chi2(2)	Prob>Chi2
Residuals	0.0030	0.0361	10.18	0.0062

4.9.6. CUSUM Square Test

The CUSUM of Squares plot in figure 2 shows that the cummulative sum of squared residuals remains within the 5 per cent significance boundaries throughout the sample period (2017–2023). This indicates no structural instability in the model, and therefore the null hypothesis of parameter stability is not rejected.

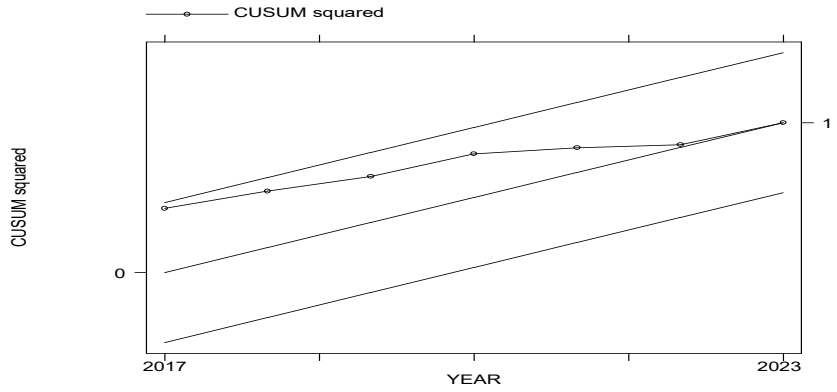

Figure 2. CUSUM Square Test

The kernel density plot of the ARDL fitted values shows a non-normal, multimodal distribution, with two distinct clusters around 8.4 and 8.75. This suggests possible nonlinear dynamics, subgroup effects, or structural differences in the sample. The distribution further supports evidence from normality tests indicating that the model's error structure may deviate from normality.

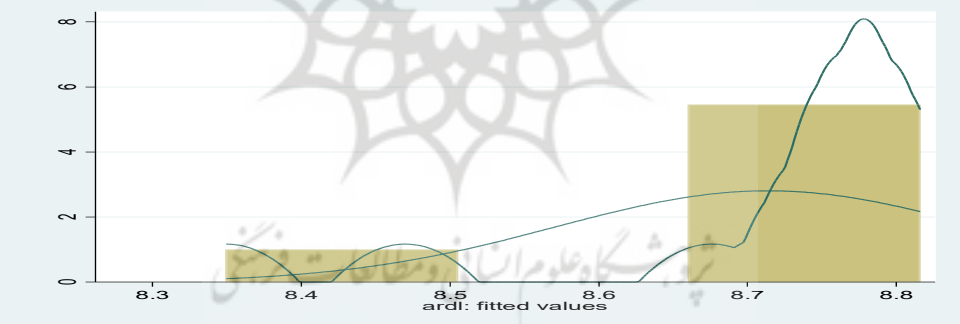

Figure 3. Normality Histogram for K-Density

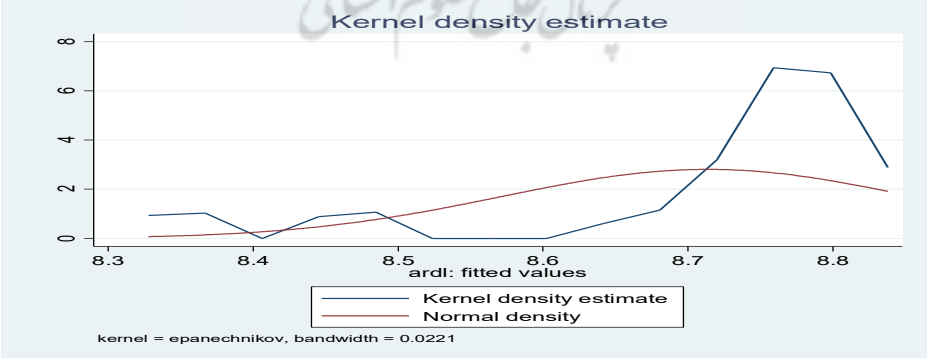

Figure 4. Kernel and Normal Density Estimate

5. Discussion and Conclusions

The analysis reveals that lagged manufacturing performance remains a strong and significant

driver of current industrial output, confirming the persistence of sectoral momentum. This outcome aligns with Murinde (2012) and Ayopo (2015), who emphasise stability effects in industrial growth. However, it contradicts the findings of Olorunfemi *et al.* (2013), who reported that manufacturing performance in Nigeria tends to exhibit volatility rather than persistence, largely due to infrastructural instability.

Total electronic payments show a negative short-run effect on industrialisation, indicating that rapid digital financial growth may initially disrupt productive activity. This supports Morris and Fessehaie (2014), who documented similar structural bottlenecks in Africa's industrial systems. Nonetheless, this result differs from Olayemi *et al.* (2020), who found that digital payments stimulate manufacturing performance by improving supply-chain efficiency, suggesting country- and sector-specific variations.

Credit to the private sector displays a negative influence, both contemporaneously and at lag, suggesting inefficient credit allocation and diversion away from productive investment. This finding is consistent with Ibi *et al*. (2015) and Gbarato *et al*. (2020). It contradicts the results of Nnanna (2004) and Udoka & Anyingang (2014), who found that bank credit significantly supports industrial output when lending conditions are stable and institutions are strong, implying that Nigeria's experience is shaped by structural weaknesses in credit administration.

Both stock market liquidity (SML) and stock market turnover (NGXTV) exert positive and significant short-run effects, reflecting the relevance of market depth in financing industrial capacity. These outcomes are aligned with Adeusi *et al*. (2013) and Michalopoulos *et al.* (2015). Nevertheless, they stand in contrast to Uwubanmwen & Eghosa (2015), who observed that stock market indicators had no meaningful effect on Nigeria's real sector due to volatility and speculative trading activities.

Inflation is insignificant in the short-run model, which conforms with Sulaiman and Azeez (2012); Ihugba *et al.* (2023), who argue that inflationary pressures may be overshadowed by deeper structural constraints. However, this contradicts Okafor *et al.* (2018), who found that inflation exerts a strong negative influence on industrial performance in Nigeria, especially when inflation exceeds threshold levels.

The ARDL bounds test confirms a long-run cointegrating relationship among the variables, supporting the propositions of endogenous growth theory (Lucas, 1988; Romer, 1990) and Schumpeter's innovation model. This long-run relationship aligns with Paulin *et al*. (2023), who argue that sustained industrialisation in Africa requires stable structural linkages. Yet, it differs from Akinlo (2004), who reported no stable long-run link between financial development and industrial output in Nigeria, suggesting empirical divergence depending on model specification and time horizon.

Long-run ARDL estimates show that most variables become statistically insignificant. While the direction of the coefficients aligns with findings by Adeusi *et al*. (2013) and Ngozi *et al*. (2022), the insignificance supports Ajao & Osayuwu (2012) and Falaye *et al*. (2018), who argue that the Nigerian capital market is too shallow to transmit long-term benefits. This contradicts the earlier evidence by Okpara (2010), who found that long-run financial market development significantly enhances industrial output under periods of financial stability.

The study concluded that Nigeria's manufacturing sector is largely shaped by short-run dynamics. Stock market liquidity and trading activity positively influence industrial output, while credit to the private sector has a negative effect, reflecting inefficiencies in allocation. Inflation is insignificant, and high levels of electronic payments may divert resources away from productive manufacturing. The ARDL bounds test confirms a stable long-run relationship, but most long-run coefficients are statistically weak, and the error correction mechanism indicates a slow adjustment toward equilibrium, highlighting persistent structural constraints. The policy implications are that policymakers should focus on improving capital market liquidity to facilitate efficient financing for manufacturing, ensure targeted credit allocation toward productive investments, maintain monetary stability for predictable industrial planning, and regulate digital payment flows to prevent resource outflows from the real sector.

It is therefore, recommended that future studies could examine manufacturing sub-sectors, the role of institutional quality and governance, cross-country comparisons in emerging economies, and the long-term impact of fintech adoption on industrial growth.

Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contributions
The authors equally contributed to the preparation of this article.

Conflict of interest
The authors declare no conflict of interest.

REFERENCES

1. Abina, A., & Deekor, L. N. (2024). Institutional banks' financing and economic growth in Nigeria. *International Journal of Business & Law Research, 12*(1), 236-253. https://www.researchgate.net/publication/380897589
2. Adeusi, S. O., Sulaiman, L. A., & Azeez, B. A. (2013). Impact of capital market development on the Nigerian economy: A post-SAP analysis. *Journal of Economics and Behavioral Studies*, *5*(1), 1. https://scholar.google.com/citations?user=YwyHriwAAAAJ&hl=en
3. Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica, 60*(2), 323–351. https://doi.org/10.2307/2951599
4. Ajao, M. G., & Osayuwu, R. (2012). Testing the weak form of efficient market hypothesis in Nigerian capital market. *Accounting and Finance Research*, *1*(1), 169-179. https://doi.org/10.5430/afr.v1n1p169
5. Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy modeling*, *26*(5), 627-639. https://doi.org/10.1016/j.jpolmod.2004.04.011
6. Amoah, C., & Jehu-Appiah, J. (2022). Factors driving industrialization in Africa: A panel two-stage least square approach. *Modern Economy*, *13*(2), 144-158. https://doi.org/10.4236/me.2022.132010
7. Ayopo, B. A., Isola, L. A., & Olukayode, S. R. (2015). Monetary policy dynamics and the stock market movements: Empirical evidence from Nigeria. *Journal of Applied Economic Sciences*, *10*(8), 1179-1188. https://www.ceeol.com/search/article-detail?id=535860
8. Ejem, C. A., & Ogbonna, U. G. (2020). Nigerian stock exchange and weak form efficiency. *Global journal of business research*, *8*(1), 59-70. https://absu.academia.edu/UdochukwuOgbonna?swp=tc-au-52210492
9. Eze, E., & Alugbuo, J. C. (2021). Financial inclusion and poverty reduction in Nigeria: A survey-based analysis. *GSC Advanced Research and Reviews, 7*(3), 75–84. https://doi.org/10.30574/gscarr.2021.7.3.0127
10. Falaye, A. J., Awonusi, F., Eseyin, O., & Eboigbe, G. (2018). The weak form market efficiency and the Nigerian stock exchange. *Afro Asian Journal of Social Sciences, 9*(4). https://www.researchgate.net/publication/325176787
11. Fama, E. F. (1965). The behavior of stock-market prices. *The journal of Business*, *38*(1), 34-105. https://doi.org/10.2469/faj.v21.n5.55
12. Gbarato, L. M., Cookey, S. C. M., & Nwagu, U. S. (2020). Capital market: Its efficacy on Nigerian industrial growth. *EPRA International Journal of Research and Development, 5*(5), 60–73. https://cdn.epratrustpublishing.com/article/604pm_9.EPRA%20JOURNALS%20-4401.pdf
13. Ibi, E. E., Joshua, N. J., Eja, B. R., & Olatunbosun, H. U. (2015). Capital market and industrial sector development in Nigeria: An empirical investigation. *European Journal of Accounting Auditing and Finance Research*, *3*(6), 63-79. https://doi.org/10.37745/ejaafr.2013
14. Ihugba, O. A., Orji, A. C., & Duru, E. E. (2023). Inflation and manufacturing sector growth in Nigeria: Evidence from ARDL approach. *Journal of Economics and Research*, *12*(3), 45–58. https://jearecons.com/index.php/jearecons/article/view/300
15. Kaldor, N. (1957). A model of economic growth. *The economic journal*, *67*(268), 591-624. https://doi.org/10.2307/2227704
16. Lawal, A. I., Salisu, A. A., Somoye, R. O., Babajide, A. A., & Taiwo, J. N. (2019). *Re-examining stock market efficiency in Nigeria using nonlinear unit root tests.* In R. C. Das (Ed.), *The Impacts of Monetary Policy in the 21st Century: Perspectives from Emerging Economies* (pp. 75–88). Emerald Publishing Limited. https://doi.org/10.1108/978-1-78973-319-820191011
17. Ledeneva, M., Okhremenko, I., Inshakova, E., & Plaksunova, T. (2020). Industrialization in Sub-Saharan Africa: Challenges and opportunities. In E. G. Popkova, B. S. Sergi, L. Haabazoka, & J. V. Ragulina (Eds.), *Supporting Inclusive Growth and Sustainable Development in Africa – Volume I* (pp. 67–89). Springer. https://doi.org/10.1007/978-3-030-41979-0
18. Lucas, R. E., Jr. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7
19. Malkiel, B. G. (1973). *A random walk down Wall Street*. New York: W. W. Norton & Company.

20. Markjackson, D., & Omie, T. K. (2018). Theoretical evidence of the efficient market test in the Nigerian capital market. *International Journal of Scientific and Research Publications, 8*(2), 154–162. https://www.researchgate.net/publication/327573516
21. Michalopoulos, Laeven, L., & Levine, R. (2015). Financial innovation and endogenous growth. *Journal of Financial Intermediation, 24*(1), 1–24. https://doi.org/10.1016/j.jfi.2014.04.001
22. Morris, M., & Fessehaie, J. (2014). The industrialisation challenge for Africa: Towards a commodities-based industrialisation path. *Journal of African Trade*, *1*(1), 25-36. https://doi.org/10.1016/j.joat.2014.10.001
23. Murinde, V. (2012). Financial development and economic growth: Global and African evidence. *Journal of African economies*, *21*(1), 10-56. https://doi.org/10.1093/jae/ejr042
24. Ngozi, C. G., Helen, A. N., & Anyanwu, A. C. (2022). Capital Market, Economic Growth and Industrialization in Nigeria (2000–2016). *Journal of System and Management Sciences*, 24(2), 107–128.
25. Nnanna, O. J. (2004). Financial sector development and economic growth in Nigeria: An empirical investigation. *Economic and Financial Review, 42*(3), 1–19. https://dc.cbn.gov.ng/efr/vol42/iss3/2/
26. Nzau, M. (2010). Africa's industrialization debate: a critical analysis. *Journal of language, technology & entrepreneurship in Africa*, *2*(1), 146-165. https://www.ajol.info/index.php/jolte/article/view/51996
27. Okafor, T. C., Adegbite, E. O., & Babajide, A. A. (2018). Exchange rate fluctuations, inflation, and industrial output in Nigeria. *IBIMA Conference Proceedings*. https://ibima.org/accepted-paper/exchange-rate-fluctuations-inflation-and-industrial-output-in-nigeria
28. Okpara, G. C. (2010). Analysis of capital market performance and the growth of the Nigerian economy: A cointegration approach. *Global Journal of Human Social Science, 10*(4), 9–15.
29. Olayemi, O. O., Okonji, P. S., Oghojafor, B. E. A., & Orekoya, I. O. (2020). Innovative behaviour and firm's performance in the Nigerian manufacturing sector. *Nigerian Journal of Management Studies, 20*(1), 98–105. https://eprints.lancs.ac.uk/id/eprint/175522/
30. Olorunfemi, S., Obamuyi, T. M., Adekunjo, F. O., & Ogunleye, E. O. (2013). Manufacturing performance in Nigeria: Implication for sustainable development. *Asian Economic and Financial Review, 3*(9), 1195–1213. https://archive.aessweb.com/index.php/5002/article/view/1080
31. Otapo, T. W. (2020). Determinants of Exchange Rates in Nigeria: Empirical evidence using the portfolio balance model. *Journal of Business and Management (IOSR-JBM)*, *22*(3), 01-10. https://www.researchgate.net/publication/369273087
32. Paulin, D. D. G., Esperence, F., & Sali, A. M. (2023). The Effect of Foreign Direct Investment on Industrialisation in Subsaharan Africa: thé Rôle if Institutional Quality. *EuroEconomica*, *42*(2), 10-21. https://econpapers.repec.org/article/dugjournl/y_3a2023_3ai_3a2_3ap_3a10-21.htm
33. Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5, Part 2), S71–S102. https://doi.org/10.1086/261725
34. Rosenstein-Rodan, P. N. (1943). Problems of industrialisation of Eastern and South-Eastern Europe. *Economic Journal, 53*(210/211), 202–211. https://www.jstor.org/stable/2226317
35. Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle* (R. Opie, Trans.). Cambridge, MA: Harvard University Press. (Original work published 1911)
36. Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics, 70*(1), 65–94. https://doi.org/10.2307/1884513
37. Sulaiman, L. A., & Azeez, B. A. (2012). Effect of external debt on economic growth of Nigeria. *Journal of Economics and sustainable development*, *3*(8), 71-79.
38. Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record, 32*(2), 334–361. https://doi.org/10.1111/j.1475-4932.1956.tb00434.x
39. Udoka, C. O., & Anyingang, R. A. (2014). Operational efficiency of the Nigerian stock market (1986–2010). *International Journal of Finance and Banking Studies, 3*(1), 173–185. https://www.researchgate.net/publication/298728392
40. Uwubanmwen, A. E., & Eghosa, L. I. (2015). Inflation rate and stock returns: Evidence from the Nigerian stock market. *International Journal of Business and Social Science, 6*(11), 155–167. https://ijbss.thebrpi.org/journals/Vol_6_No_11_November_2015/19.pdf