Manufacturing as an Engine of Growth: A Test of Kaldor's Law in Nigeria

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Abstract: - The study examined the role of manufacturing as an engine of growth in Nigeria using the framework of Kaldor's Laws. It specifically examines the relationship between manufacturing output growth and GDP growth (Kaldor's First Law); assesses the impact of manufacturing output growth on productivity within the sector (Kaldor's Second Law); and evaluates the extent to which growth in manufacturing stimulates output in non-manufacturing sectors (Kaldor's Third Law). The study adopts the Autoregressive Distributed Lag (ARDL) model and the Error Correction Mechanism (ECM) as the analytical techniques. Three models were constructed, with GDP growth rate, manufacturing productivity and non-manufacturing sector output growth as the dependent variables. These models capture the dynamic short-run and long-run relationships between manufacturing output growth and key indicators of economic performance. The ARDL results reveal the existence of both short-run and long-run relationships between manufacturing output growth and the dependent variables across the models. The ECM coefficients are negative and statistically significant at the 1% level, indicating that short-run disequilibrium adjusts toward long-run equilibrium. Overall, the findings show that manufacturing output growth has a positive and significant effect on GDP growth, and stimulates productivity in Nigeria's non-manufacturing sectors. Based on these findings, the study recommends that the government implement comprehensive industrial policies that strengthen manufacturing capacity through improved infrastructure, affordable financial credit, and targeted financial incentives for local producers; the study also recommends capacity expansion programmes, while also imploring that the government promote stronger inter-sectoral linkages by developing integrated industrial value chains.

Key-Words: - Engine of Growth, Gross domestic product, Kaldor's law, Manufacturing, Nigeria.

Received: August 2, 2026. Revised: August 25, 2026. Accepted: September 14, 2026. Published: October 29, 2026.

1 Introduction

Manufacturing has long been recognized as a critical driver of economic growth and structural transformation in both developed and developing economies [1]. Nicholas Kaldor articulated this connection through his seminal work on the laws of economic growth, famously referred to as Kaldor's Laws [2]. These laws posit that the growth of

manufacturing output leads to overall economic growth, productivity increases, and dynamic linkages with other sectors of the economy [3], [4]. Though this theoretical formulation has been tested and validated in various ways, application to sub-Saharan countries, especially Nigeria, has been a subject of investigation, given the peculiarities of its economic structure and historical development.

Nigeria as one of the largest economy in Africa, with nominal GDP of USD $66,084.15 in 2021 [5]. Notwithstanding, Nigeria's economic structure reveals a fundamental vulnerability, as more than 5.9% of its Gross Domestic Product (GDP) is obtained from oil and gas sector [5], and non-import Value Added Tax (VAT) provides 30% to government revenue and company income tax accounts for a substantial 26% [6]. This heavy reliance on oil revenues and a narrow tax base exposes the government to significant fiscal vulnerability, particularly during periods of cyclical oil price volatility. This has rendered the government vulnerable to fluctuations in fiscal revenue and export earnings, especially during cyclical oil price changes. Conversely, the manufacturing sector, a key driver of industrialization and economic diversification, remains underdeveloped, contributing a modest 16.18% to GDP as of Q4 2023 [7], compared to over 30% in South Korea and China during their periods of rapid industrialization [8].

According to Kaldor's first law, manufacturing output drives GDP growth [9], [10] this is so because manufacturing is believed to be more capable of increasing productivity relative to other sectors. For the second law, there is a positive relationship between productivity change in manufacturing and output change with the effect being due to external economies of scale and technological progress [11], [12]. The third law describes the mutual relationship where increase in manufacturing output pushes development of services and agriculture industries in the process of forward and backward linkages [13].

Manufacturing sector in Nigeria though key to the development, has experienced periodic growth but has not achieved much in expansion due to structural and institutional constraints. The sector grew by 17.65% from 2020-2021, this growth is driven by the production of food and beverages, textiles, and cement [14]. However, this growth pales in comparison to manufacturing-driven economies like Vietnam that recorded annual growth rates exceeding 3.62% during the same period [15]. In addition, contribution of manufacturing sector in Nigeria to employment generation remains below 15%[5], when compared to over 20% in other industrialized nations of the world [16].

It has been stated that manufacturing sector in Nigeria due to international trade relationships are facing many pressures. The licensing of foreign producers under the Economic Community of West African States (ECOWAS) and the recent African Continental Free Trade Area (AfCFTA) agreements has heightened competitive pressures on domestic producers [17].

This study seeks to critically evaluate the validity of Kaldor's laws in Nigeria by analyzing the relationship between manufacturing growth and overall economic performance.

2 Literature Review

[18] highlighted the positive relationship between manufacturing output growth and GDP, noting that a 1% increase in manufacturing output contributes approximately 0.7% to GDP growth. The research further asserted that this reflects the sector's strategic importance in fostering economic resilience and diversification away from oil dependence.

The link between manufacturing and GDP growth in Nigeria has not been without challenges. Studies by [19] highlight inconsistencies in the contribution of manufacturing to GDP due to structural inefficiencies, policy instability, and poor infrastructure. For instance, he argued that manufacturing share of GDP has fluctuated between 7% and 13% in the past two decades, indicating periods of stagnation despite the policy interventions of the National Industrial Revolution Plan. Moreover, [20] asserted that high production costs and low-capacity utilization, which average 50%, have hindered the sector's full potential leading some researchers to question its role as a growth engine.

Contradictory findings further underscore the complex dynamics of the economy. While some studies such as [19], [20] argue for the transformative potential of manufacturing, others, including [21], [22] contend that the sector's impact on GDP growth is marginal when compared to services or agriculture. The controversy is a pointer to the fact that Nigeria's dependence on oil revenue and lack of focus on value-added manufacturing may hinder the sector's effectiveness.

According to [23] he stated that increased in manufacturing output will enhance productivity growth in Nigeria as this will bring increase return to scale, innovation and development in skills. He

went further to state that manufacturing firms with higher output levels will exhibit superior labour/capital productivity, suggesting a positive feedback loop between output growth and productivity improvements. Despite this optimism, the interpretation of the link between output growth and productivity in Nigerian manufacturing remains controversial. For instance, capacity utilization in Nigerian manufacturing has stagnated at around 50-56% recently [24], limiting the sector's ability to achieve significant productivity enhancements. In addition, unreliable power supply combined with expensive intermediate imports have increased production cause of goods produced thereby undermine the potential benefit of output growth on productivity [25]. Activities in manufacturing sector have created the need in other sectors by generating demand for raw materials, transportation and financial services and at the same time supplying inputs to be used in other industries like construction and agriculture [23].

However, the relationship is not uniformly positive. While [26] points out that high production costs, unreliable energy supply, and import dependency have constrained the sector's ability to stimulate meaningful growth in other areas, [10] argued that the weak backward linkages between manufacturing and agriculture have also hindered the transformation of Nigeria's agrarian economy, just as the financial sector's limited capacity to support manufacturing growth further restricts its multiplier effect on other industries. While [26], [10] emphasize the transformative potential of manufacturing output to invigorate non-manufacturing sectors, others [27], [28] argue that over-reliance on oil revenues have stifled these interactions; these contrasting viewpoints further enrich this discussion.

Among other studies, [29] explored the effect of manufacturing sector on the economic development of Nigeria. Data obtained from Central Bank of Nigeria statistical bulletin from 1999 to 2021 was used to test the effect of Average Manufacturing Capacity Utilization, Manufacturing Production Index, Contribution of Manufacturing Sector to Gross Domestic Product, and Foreign Direct Investment on Human Development Index.

[23] examined the role of the manufacturing sector in stimulating economic growth in the Saudi economy. The results shows that while a two-way causal relationship exists between manufacturing and economic growth, a unidirectional causal relationship equally exists, running from the manufacturing sector to the services sector. Supporting this finding, [30] who examined the long-term relationship between economic growth in Saudi Arabia with the application of Kaldor's law found that the law is applicable to Saudi Arabia, albeit with diminishing returns.

[31] examined the effects of Nigeria's manufacturing sector on economic growth between 1981-2018. With the use of OLS regression methodology, findings indicate that manufacturing sector's output has a positive and significant link with the increase in gross domestic product, suggesting that Nigeria's manufacturing industry is currently one of the country's main economic drivers.

While examining the validity of this law for eleven (11) ECOWAS member countries over the period 1970-2014 by employing an Autoregressive Distributed Lag bounds test approach to cointegration and Granger causality tests, [32] finds that manufacturing output growth causes positive non-manufacturing output growth and economic growth, thereby providing support for Kaldor's first growth law. [33] examined the role of manufacturing growth in selected Middle East and North African (MENA) countries using panel data analysis from 2007 to 2019. The study tests Kaldor's three laws to identify the role of manufacturing in economic growth. The results provide strong support for the three laws in the (MENA) countries, demonstrating that output growth in the manufacturing sector is critical for generating economic growth and increasing productivity.

[34] investigated the extent of the performance of manufacturing sub-sector in relation to its contribution to economic growth in Nigeria. It relied on secondary data spanning 1981-2018. Results revealed that in the long run, manufacturing output has a negative impact on economic growth in Nigeria. Supporting this negative relationship, [35] noted that the manufacturing sector's contribution to economic growth in Nigeria has fallen short of expectations, despite the implementation of various industrial policies since independence.

[36] examined the impact of industrial sector on the Nigerian economy. Covering 1990-2021, result of the OLS observed that industry value added, gross fixed capital formation, labour force participation rate and trade openness which are the explanatory variables all have a positive impact on economic growth in Nigeria while a long run relationship also exists among the variables.

[37] examined the impact of manufacturing sector output on economic growth in Nigeria from 1981 to 2016. Using secondary data sourced from the Central Bank of Nigeria Statistical Bulletin and

employing Autoregressive Distributed Lag (ARDL) model and the Granger causality techniques, evidence of long-run and short-run relationships among the variables was established. The results further shows that MCU has positive influence on real gross domestic product. While findings of the study align with that of [38], who concluded that there is a positive and significant relationship between manufacturing sector output and economic growth, these do not corroborate with those of [39], who concluded that the manufacturing sector has a negative impact on economic growth due to environmental degradation.

More broadly, [40] examined the impact of the manufacturing sector on economic growth in 37 African countries. The study employed the System-GMM Model. The results showed that manufacturing value has a positive effect on economic growth in the selected African counties. However, this finding contradicts that of [41] who argued that the shift towards manufacturing industries often displaces labour from traditional sectors, thereby causing unemployment.

[42] examined the relationship between manufacturing production and economic growth in Portugal from 1956 to 2019, following Nicholas Kaldor's thinking, which assumes that manufacturing is the true engine of economic activity of a country. By estimating a series of econometric models, including a Vector Autoregressive (VAR) model, a positive relationship was identified between economic growth and manufacturing production since the 1950s. The results also show that each increase of 1 percentage point in real growth rate of the production of basic metallurgical industries and manufacture of metallic products in a certain year t−1 for the period 1956–2019 caused an increase of 0.07 percentage points in the Portuguese economic growth during year t.

[43] explored the role of manufacturing sector during the growth-prone stage of development. By exploiting a large data set that covers different sectors, they found that in the middle-income stage, manufacturing pulls all other sectors along; this shows that a decline in manufacturing growth negatively affects the growth of all the other sectors in both the short-run and long-run. Their empirical findings indicated that manufacturing sector is still the key engine of economic growth for growth-driven economies.

[44] examined the relationship between manufacturing and GDP. An analysis of 296 time series with a quarterly periodicity from 22 EU countries on selected indicators of the manufacturing industry and GDP from the Eurostat database for Q1 2000-Q4 2016 were used. The results indicate that the food processing industry is a sector with the highest significant cyclical behaviour.

[45] investigated how manufacturing affects economic growth over time, especially in developing countries. They applied Panel Vector Autoregression (PVAR) for fixed effects approach, and then estimated impulse-response functions (IRF) and forecast-error variance decomposition (FEVD) for a sample of 115 countries from 1990 to 2011. They also applied Hirschman-Rasmussen (HR) Index for 29 countries for 1995, 2000, 2005 and 2010 as well as Field of Influence for this group of countries for 1995 and 2010. The main results indicated that manufacturing industry can work as "engine of growth" in developing countries.

2.1 Theoretical Framework

The Nigerian manufacturing sector is critical to growth, contributing to employment, GDP growth, and industrialization. This relationship is being tested within the context of Kaldor's Laws. Proposed by Nicholas Kaldor, the Laws emphasizes the critical role of the manufacturing sector in driving economic growth. It posits that growth in a country's GDP is closely linked to the expansion of its manufacturing output.

Kaldor's First Law: A Strong Correlation between Manufacturing and GDP Growth:
Kaldor's First Law, also called the "Engine of Growth" hypothesis, asserts a robust relationship between the growth of the manufacturing sector and overall economic growth. The manufacturing sector is believed to drive economic expansion through its higher productivity levels and capacity for innovation.

Kaldor's Second Law: Verdoorn's Law:
This law suggests that productivity growth in the manufacturing sector is proportional to output growth, the law highlights the presence of increasing returns to scale within manufacturing, where larger output lead to greater efficiency due to factors such as specialization, technological improvements, and learning-by-doing. It implies that sustained growth in manufacturing output enhances overall productivity, further reinforcing economic expansion.

Kaldor's Third Law: Growth-Linkage Law:
Kaldor's third law established that growth in agriculture and services sector will induce growth in

manufacturing sector. The growth will arise because manufacturing generates demand for input services and infrastructure, thereby creating backward and forward linkage across the economy. In essence, the law says that manufacturing sector will be a driver to other sectors of the economy. Kaldor's third law established symbiotic relationship between manufacturing sector and other sectors of the economy.

2.2 Review of Literature

The existing literature on Kaldor's Laws in developing economies, while extensive, reveals several methodological gaps, theoretical controversies, and empirical inconsistencies that this study aims to address.

Methodological Gaps:

First, the majority of studies on Kaldor's Laws in Sub-Saharan Africa have employed static estimation techniques such as Ordinary Least Squares (OLS) or simple correlation analysis [31], [37], which fail to account for the dynamic nature of the relationships and the potential for endogeneity bias. Second, studies that have employed more sophisticated techniques, such as cointegration and error correction models, have often been limited by small sample sizes and have not adequately addressed the issue of structural breaks [23], [32]. Third, the literature lacks a comprehensive analysis that simultaneously tests all three of Kaldor's Laws within a unified econometric framework for Nigeria, with most studies focusing only on the first law [35], [38]. This study addresses these gaps by employing the ARDL bounds testing approach, which accommodates variables with different orders of integration, and by estimating all three laws within a coherent analytical framework.

Theoretical Controversies:

Two principal theoretical controversies emerge from the literature. First, there is debate regarding the direction of causality between manufacturing growth and economic growth. While Kaldor (1966) posited that manufacturing growth drives economic growth, another school of thought claim that economic growth drives manufacturing expansion [33]. Second, the validity of Kaldor's Laws in resource-dependent economies like Nigeria remains contested. Some researchers argue that the Dutch Disease effect undermines the transformative potential of manufacturing [10], [27], while others maintain that manufacturing remains a viable engine of growth despite resource dependence [18], [29].

Empirical Inconsistencies:

There is a conflicting reports in literature. Studies by [31] and [38] found positive and significant relationships between manufacturing output and economic growth in Nigeria, supporting Kaldor's First Law. Conversely, [34] and [35] reported negative or insignificant relationships, suggesting that manufacturing's growth-enhancing effects may be contingent on specific economic conditions or policy environments. While [23] found positive spillover effects from manufacturing to other sectors in the Saudi economy, [21] reported weak intersectoral linkages in Nigeria's manufacturing sector, casting doubt on the applicability of Kaldor's Third Law.

Contribution to Study:

In four ways, this study contributes to the existing literature. First, it provides a comprehensive empirical test of all three Kaldor's Laws for Nigeria using a unified ARDL-ECM framework that accounts for both short-run dynamics and long-run equilibrium relationships. Second, it provides more complete assessment of manufacturing's role as an engine of growth. Third, control variables such as trade openness, capital formation, and inflation to address potential omitted variable bias. Fourth, it offers policy-relevant insights for Nigeria's ongoing industrialisation efforts.

2.3 Mathematical Derivation from Kaldorian Growth Theory

Formal Mathematical Derivation of Kaldor's Laws

Assumption 1: The economy consists of two broad sectors: manufacturing (MM) and non-manufacturing (NM), where MM is the engine of growth.

Assumption 2: Manufacturing exhibits increasing returns to scale, while non-manufacturing exhibits constant or diminishing return to scale.

Assumption 3: Productivity growth in manufacturing is positively related to output growth (Verdoorn's Law).

Kaldor's growth laws can be formally expressed through the following theoretical relationships:

Kaldor's First Law

[46] posited that the growth rate of GDP is a function of manufacturing output growth:

$$\mathrm{gGDP} = \partial_0 + \partial_1 \mathrm{gMAN} + \in$$

where:

gGDP= growth rate of real GDP

gMAN= growth rate of manufacturing output

$\alpha 1>0 \alpha 1>0$ is the expected coefficient

This relationship arises because manufacturing exhibits:
Higher income elasticity of demand
Greater potential for technological progress
Stronger forward and backward linkages

Kaldor's Second Law (Verdoorn's Law)

Verdoorn's law, which Kaldor incorporated, states that productivity growth in manufacturing is positively related to output growth:

$$\beta PROD = \beta_0 + \beta_1 gMAN + \mu$$

where:
gPROD = growth rate of manufacturing productivity
gMAN= growth rate of manufacturing output
β1>0 reflects increasing returns to scale

The theoretical justification is that:
Output expansion enables specialization
Learning-by-doing effects intensify
Economies of scale reduce unit costs

Kaldor's Third Law (Growth Linkage Hypothesis)

The third law proposes that manufacturing growth stimulates non-manufacturing sectors through intersectoral linkages:

$$ɣNONMAN = ɣ_0 + ɣgMAN + v$$

where:
ɣ NONMAN= growth rate of non-manufacturing output
ɣMAN = growth rate of manufacturing output
ɣ1>0 captures the spillover effects

3 Model Specification

The model specification adopted follows Kaldor's three laws; these laws posit that manufacturing drives GDP growth through increasing returns to scale.

Model One: Kaldor's First Law:
The Kaldor's first law can be expressed as:

GDP = f (MAN, AGR, SGR, GFCF, POP) (1)

Such that GDPt = β0 + β1MANt + β2AGRt + β3SGRt + β4GFCFt + β5POPt +μt

(2)

A-Priori Expectation for Model One: On a-priori grounds, it was expected that: $\beta_0 \neq 0$, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$

The coefficient β_1 captures the core prediction of Kaldor's First Law: if β_1 is positive and statistically significant, it implies that increases in manufacturing growth lead to increases in overall GDP growth.

A-Priori Expectation for Model Two: On a-priori grounds, it was expected that: $\beta_6 \neq 0$, $\beta_7 > 0$, $\beta_8 > 0$, $\beta_9 > 0$

The coefficient β_7 represents the core of Kaldor's Second Law.

A-Priori Expectation for Model Three: On a-priori grounds: $\beta_{1\ 0} \neq 0$; $\beta_{11} > 0$, $\beta_{12} > 0$, $\beta_{13} < 0$, $\beta_{14} > 0$

Coefficient β_{11} reflects the central theoretical prediction: manufacturing expansion influences the performance of the non-manufacturing sector.

The coefficient β_1 captures the core prediction of Kaldor's First Law: if β_1 is positive and statistically significant, it implies that increases in manufacturing growth leads to increases in overall GDP growth; the inclusion of agriculture (AGR) and services (SGR) serves as a comparative benchmark, just as Gross Fixed Capital Formation (GFCF) is included to control for capital accumulation, while population growth (POP) controls for labor force dynamics.

Model Two: Kaldor's Second Law:
The second law of Kaldor expressed as:

MPR = f (MAN, GFCF, TOP) (3)

Such that MPRt = β6 + β7MANt + β8GFCFt + β9TOPt +μt

(4)

A-Priori Expectation: On a-priori grounds, it was expected that: β6 ≠ 0 β7, … β9 > 0

Also known as the Verdoorn Law, it posits that productivity growth in manufacturing is positively related to the growth of manufacturing output due to the dynamics of increasing returns to scale. The coefficient β7 represents the core of Kaldor's Second Law. Gross Fixed Capital Formation (GFCF) is included to control for capital deepening, while degree of Trade Openness (TOP) captures external competitiveness, technology transfer, and exposure to international markets.

Model Three: Kaldor's Third Law:
The third law expressed as:

NMG = f (MAN, EXP, IMP, INF) (5)

to become NMGt = β10 + β11MANt + β12EXPt + β13IMPt + β14INFt +μt

(6)

Also on a-priori grounds: β10 ≠ 0; β11, β12, β14 > 0, β13< 0

Kaldor's Third Law posits that overall productivity growth is driven by the expansion of manufacturing, as labor shifts from low-productivity non-manufacturing sectors (such as traditional agriculture and informal services) to the higher-productivity manufacturing sector. Coefficient β11 reflects the central theoretical prediction: manufacturing expansion influences the performance of the non-manufacturing sector through labour reallocation and inter-sectoral linkages. Exports (EXP) and imports (IMP) are included to capture external sector dynamics, while inflation (INF) controls for macroeconomic stability.

And, for models 1-3:

GDPt = Growth rate of Real Gross Domestic Product at time t,
MANt = Manufacturing sector growth rate at time t,
AGRt = Agricultural sector output growth rate at time t,
SGRt = service sector output growth rate at time t,
GFCFt = Gross fixed capital formation at time t,
POPt = population growth rate at time t.
MPRt = Manufacturing Productivity at time t (proxied by Total Factor Productivity)
TOPt = Degree of trade openness at time t,
NMGt = Non-manufacturing growth rate at time t,
EXPt = Manufacturing Export as a percentage of GDP at time t,
IMPt = Manufacturing Import as a percentage of GDP at time t,
INFt = Inflation rate at time t,
β0 – β4 are the slope parameters

3.1 Estimation Technique

The study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by [47]. This technique is appropriate for several reasons: (i) it accommodates variables that are integrated of order zero [I(0)] or order one [I(1)], (ii) it provides robust estimates for small sample sizes, and (iii) it simultaneously estimates both short-run and long-run relationships.

Model One becomes:

$$\Delta GDP_t = \beta_0 + \beta_1 MAN_{t-i} + \beta_2 AGR_{t-i} + \beta_3 SGR_{t-i} + \beta_4 GFCF_{t-i} + \beta_5 POP_{t-i} + \sum_{i=1}^{p} \lambda_1 \Delta GDP_{t-i} + \sum_{i=1}^{q} \lambda_2 \Delta MAN_{t-i} + \sum_{i=1}^{q} \lambda_3 \Delta AGR_{t-i} + \sum_{i=1}^{q} \lambda_4 \Delta SGR_{t-i} + \sum_{i=1}^{q} \lambda_5 \Delta GFCF_{t-i} + \sum_{i=1}^{q} \lambda_6 \Delta POP_{t-i} + \emptyset ECM_{t-i} + \mu_i \quad (7)$$

Model Two becomes:

$$\Delta MPR_t = \beta_0 + \beta_1 MAN_{t-i} + \beta_2 GFCF + \beta_3 TOP_{t-i} + \sum_{i=1}^{p} \lambda_1 \Delta MPR_{t-i} + \sum_{i=1}^{q} \lambda_2 \Delta MAN_{t-i} + \sum_{i=1}^{q} \lambda_3 \Delta GFCF_{t-i} + \sum_{i=1}^{q} \lambda_4 \Delta TOP_{t-i} + \emptyset ECM_{t-i} + \mu_i \quad (8)$$

Model Three becomes :

$$\Delta NMG_t = \beta_0 + \beta_1 MAN_{t-i} + \beta_2 IMP + \beta_3 EXP_{t-i} + \sum_{i=1}^{p} \lambda_1 \Delta NMG_{t-i} + \sum_{i=1}^{q} \lambda_2 \Delta MAN_{t-i} + \sum_{i=1}^{q} \lambda_3 \Delta IMP_{t-i} + \sum_{i=1}^{q} \lambda_4 \Delta EXP_{t-i} + \emptyset ECM_{t-i} + \mu_i \quad (9)$$

Here, Δ represents the initial difference operator, while λ_0 and the coefficients λ_1, λ_2, λ_3, λ_4 and λ_5 are determined through the estimation of equation (7). The Error Correction Mechanism (ECM) effectively quantifies the extent to which deviations from the long-term equilibrium are being rectified. To ensure the strength and validity of the regression model, a series of post-estimation examinations were carried out. These encompasses the assessment of autocorrelation, and scrutiny for Heteroscedasticity.

Manufacturing Productivity (MPR): Proxied by Total Factor Productivity (TFP) calculated using the growth accounting approach:

$TFPt=\ln(Lt\alpha Kt1-\alpha Yt) TFP_t = In(\frac{Y_t}{L_t^{\alpha} K_t^{1-\alpha}}$

where:

Y_t= Manufacturing output at time t

L_t = Manufacturing labour input at time t

K_t= Manufacturing capital stock at time t

α= Labour share of output (assumed to be 0.3 following standard literature)

Alternatively, manufacturing productivity growth is computed as:

Bounds Testing Procedure

To determine the existence of a long-run relationship, the bounds test examines the null hypothesis of no cointegration:

Model One: H0:β1=β2=β3=β4=β5=0 against H1:β1≠β2≠β3≠β4≠β5≠0

Model Two: H0:β7=β8=β9= against H1:β7≠β8≠β9≠0

Model Three: H0:β11=β12=β13=β14=0 against H1:β11≠β12≠β13≠β14≠0

The calculated F-statistic is compared with the critical values provided by [47]. If the F-statistic exceeds the upper bound, cointegration exists; if it falls below the lower bound, no cointegration exists.

Post-Estimation Diagnostics

To ensure the strength and validity of the regression models, a series of post-estimation examinations were carried out, including:

Autocorrelation test: Breusch-Godfrey Lagrange Multiplier (LM) test

Heteroscedasticity test: Breusch-Pagan-Godfrey test

Normality test: Jarque-Bera test

Stability tests: CUSUM and CUSUM of squares tests

4 Presentation of Results

This section presents the stylizes facts, the descriptive statistics, Graphical Trends, Augmented Dickey Fuller (ADF) unit root test, ARDL model estimates, discussion of findings, and policy implications.

Stylized Facts

Figure 1 illustrates the sectoral growth rates. The Manufacturing Sector Output Growth Rate (MAN) displays volatility for the studied period, reflecting Nigeria's turbulent industrial landscape most likely tied to structural adjustment programs (SAP) aimed at diversifying the economy; the sector collapsed in the mid-1990s, was due to political instability, poor infrastructure, and currency devaluation A partial recovery occurred in the late 1990s and early 2000s, although growth remained inconsistent, Agricultural Sector Output Growth Rate (AGR) trends reveal that Nigeria's agricultural sector face hurdles in modernization and climate vulnerability.

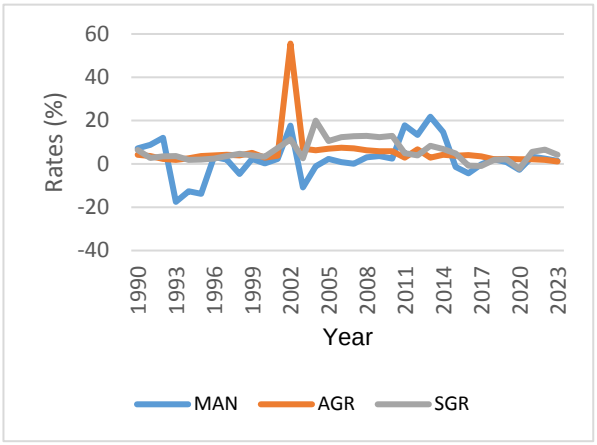


Fig. 1: Growth Rates of Manufacturing Sector Output (MAN), Agricultural Sector Output (AGR), and Service Sector Output (SER)
Source: CBN Statistical Bulletin, 2025

Figure 2 illustrates manufacturing exports and imports. The widening ME-MI gap highlights structural flaws: weak value-chain integration, erratic power supply which reduces local production, and policy inconsistency. Even temporary export rebounds (for instance, 2019's 10.75% ME) proved unsustainable as a result of oil price shocks, insecurity, and foreign exchange illiquidity, continued reliance on imports for basic manufacturing needs and unfavorable trade balance position.

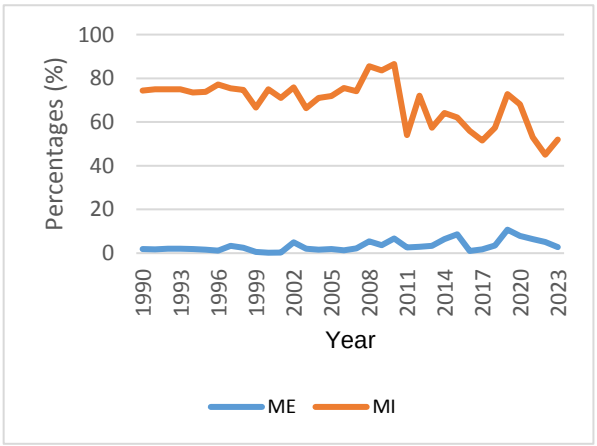


Fig. 2: Manufacturing Exports (ME) and Manufacturing Imports (MI)
Source: National Bureau of Statistics Yearly

Descriptive Statistics

The descriptive statistics for the variables are presented in Table 1 (Appendix).

Note on Variable Construction: The identical summary statistics for AGR (Agricultural Sector Output Growth) and NMG (Non-Manufacturing Growth) reflect the study's methodological choice to use agricultural output growth as a proxy for non-manufacturing sector growth.

This approach is justified on the following grounds:
Data Availability: Consistent and reliable data are limited for over the study period.

Economic Structure: Agriculture has been the dominant sector in Nigeria, accounting for a significant share of non-oil GDP and employment.

Kaldorian Tradition: Many studies employed Kaldor's Third Law used agricultural output as a proxy for non-manufacturing growth, particularly in developing economies see [23], [32].

Linkage Channels: The agricultural sector exhibits the strongest backward and forward linkages with manufacturing in Nigeria through agro-processing, input supply, and value chain integration.

However, the authors acknowledge this limitation and recommend that future research extend the analysis to include a broader measure of non-manufacturing output once more comprehensive data become available.

Correlation Matrix

The correlation matrices for the variables are presented in Table 2, Table 3 and Table 4.

Variance inflation factors are reported in Table 5. Assess the presence of multicollinearity among the independent variables, Variance Inflation Factors (VIF) were computed for each model. The VIF measures the extent to which the variance of an estimated regression coefficient is increased due to collinearity among the independent variables. A VIF value exceeding 10 is generally considered indicative of problematic multicollinearity, [48].

The VIF results indicate that all variables have VIF values well below the conventional threshold of 10, and the mean VIF for each model is below 3. This suggests that multicollinearity is not a serious concern in any of the three models. Consequently, the estimated coefficients are reliable and efficiently estimated.

Table 2. Correlation Matrix (GDPGR as the Dependent Variable)

	GDP	MAN	AGR	SGR	POP	GFCF
GDP	1					
MAN	0.53338	1				
AGR	0.58344	0.31142	1			
SGR	0.72025	0.2483	0.31368	1		
POP	0.47387	0.15726	0.25499	0.49399	1	
GFCF	-0.0905	-0.3298	0.02971	-0.1556	0.35817	1

Source: Authors Computation (2026)

Table 3. Correlation Matrix (MPR as the Dependent Variable)

	MPR	MAN	GFCF	TOP
MPR	1			
MAN	0.193	1		
GFCF	0.45627	-0.3298	1	
TOP	-0.587	0.23924	-0.7451	1

Source: Authors Computation (2026)

Table 4. Correlation Matrix (NMG as the Dependent Variable)

	NMG	INF	ME	MI	MAN
NMG	1				
INF	-0.1268	1			
ME	0.07694	-0.2288	1		
MI	0.21403	0.10654	-0.054	1	
MAN	0.31142	-0.5166	0.14234	-0.1254	1

Source: Authors Computation (2026)

Table 5. Variance Inflation Factors

Model One	VIF	Model Two	VIF	Model Three	VIF
MAN	2.847	MAN	1.932	MAN	2.156
AGR	1.984	GFCF	2.418	EXP	1.873
SGR	2.136	TOP	2.569	IMP	1.945
GFCF	2.541			INF	1.632
POP	1.876				
Mean VIF	2.277	Mean VIF	2.306	Mean VIF	1.902

Source: Authors Computation (2026)

Test for Stationarity

Table 6 presents the stationarity test results. Variables are classified as I(0) if the ADF test statistic in levels is significant at the 5% level or better, rejecting the null hypothesis of a unit root. Variables are classified as I(1) if the level ADF test fails to reject the null of a unit root (p-value > 0.05) but the first-difference ADF test is significant at the 5% level or better.

Justification for Classification:

GFCF, INF, MPR, POP, TOP, SGR: Classified as I(1) because their level forms show ADF p-values >

0.05 (failing to reject the unit root null), while their first differences are stationary at the 1% significance level.

MAN, AGR, GDP, ME, MI, NMG: Classified as I(0) because their level forms are already stationary at the 5% significance level (rejecting the unit root null).

This mixed integration order (I(0) and I(1)) justifies the use of the ARDL bounds testing approach, which accommodates variables with different orders of integration.

Table 6. Augmented Dickey-Fuller unit root test

At levels

Variable	Level ADF	Level Prob.	Order
MAN	-3.932255**	0.0217	I(0)
AGR	-5.299919***	0.0007	I(0)
GDP	-3.646812**	0.0409	I(0)
GFCF	-2.318945	0.1684	I(1)
INF	-2.876543	0.0892	I(1)
ME	-5.687238***	0.0000	I(0)
MI	-3.834788**	0.0271	I(0)
MPR	-1.987654	0.2891	I(1)
NMG	-5.299919***	0.0007	I(0)
POP	-0.567891	0.8765	I(1)
TOP	-2.456789	0.1254	I(1)
SGR	-1.987654	0.2987	I(1)

First differences

Variable	1st Diff ADF	1st Diff Prob.
MAN	-6.458731***	0.0001
AGR	-8.234567***	0.0000
GDP	-7.119283***	0.0000
GFCF	-7.241538***	0.0000
INF	-9.797883***	0.0000
ME	-8.443219***	0.0000
MI	-7.112345***	0.0000
MPR	-4.358896***	0.0081
NMG	-8.234567***	0.0000
POP	-5.087654**	0.0446
TOP	-5.365582***	0.0007
SGR	-9.556783***	0.0000

Note: *, *, *** indicate statistical significance at 10%, 5%, and 1% levels respectively.
Source: Authors Computation (2026)

Autoregressive Distributed Lagged Model

The ARDL bounds test was used in the three models to examine the existence of a long-run relationship between the dependent variables (GDP Growth Rate, Manufacturing Productivity, and Non-Manufacturing Output Growth Rate) and the various independent variables. The bounds-test results are presented in Table 7, Table 8 and Table 9.

Table 7. ARDL long run bounds test (Model 1)

T-Statistic	Value	Level	I(0)	I(1)
F-statistic	28.62781	10%	2.26	3.35
K	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

Source: Authors Computation (2026)

Table 8. ARDL long run bounds test (Model 2)

T-Statistic	Value	Level	I(0)	I(1)
F-statistic	14.34996	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Authors Computation (2026)

Table 9. ARDL long run bounds test (Model 3)

T-Statistic	Value	Level	I(0)	I(1)
F-statistic	7.785704	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

Source: Authors Computation (2026)

In Model One (Table 10), the long-run estimates reveal that manufacturing output growth (MAN) has a positive and statistically significant effect on GDP growth, with a coefficient of 0.236 and a probability value of 0.0091. This finding strongly supports Kaldor's First Law. The service sector (SGR) also reported a positive and statistically significant relationship with GDP growth (coefficient = 0.462, p = 0.0314). Agricultural growth (AGR) demonstrated a positive coefficient (0.078) but marginally significant at the 10% level (p = 0.0850). Gross fixed capital formation (GFCF) and population growth (POP) are not statistically significant at conventional levels, implying that other factors may be more important drivers of GDP growth in Nigeria.

Table 10. ARDL Long-run Estimates (Model 1)

Dependent Variable (GDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGR	0.078209	0.030850	2.535149	0.0850
MAN	0.236383	0.039088	6.047450	0.0091
GFCF	0.152107	0.079131	1.922221	0.1503
POP	1.559045	2.737279	0.569560	0.6088
SGR	0.461905	0.120646	3.828599	0.0314

Source: Authors Computation (2026)

Table 11 presents the long-run estimates for Model Two. Trade openness (TOP) has a negative but statistically insignificant (p = 0.1948) implying that relationship between trade openness and manufacturing productivity in Nigeria is complex. This may be due to Nigeria's trade, which is dominated by oil exports rather than manufactured goods, limiting the technology transfer and competitive pressures typically associated with trade openness. Furthermore, gross fixed capital formation (GFCF) is statistically insignificant (p = 0.9715), and indication that capital investment is insufficient to drive productivity gains without complementary investments in infrastructure, human capital, and institutional quality.

Table 11. ARDL Long-run Estimates (Model 2)
Dependent Variable (MPR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAN	0.065766	0.025791	2.549939	0.0176
TOP	-0.007380	0.005534	-1.333705	0.1948
GFCF	-0.000461	0.012776	-0.036096	0.9715
C	0.673502	0.425621	1.582397	0.1266

Source: Authors Computation (2026)

Table 12 presents the long-run estimates for Model Three. The unexpected negative and significant coefficient for manufacturing exports (ME = -5.574, p = 0.0254) in the non-manufacturing growth equation warrants careful interpretation as this counterintuitive finding deviates from conventional expectations. This paradoxical relationship may be explained by several factors. First, the composition of Nigeria's manufacturing exports is dominated by low-value-added and resource-based products such as processed agricultural commodities and basic petrochemicals, which inherently possess limited backwards and forward linkages with other sectors of the economy, thereby constraining their capacity to stimulate growth in non-manufacturing industries. Second, manufacturing export activities often operate as isolated enclaves is characterized by weak domestic integration, as most of their intermediate inputs used in production are import oriented. Third, Dutch Disease effects may be at play, as surges in manufacturing exports, frequently linked to temporary favourable exchange rate movements, can be accompanied by currency appreciation pressures that harm other tradable sectors, particularly agriculture, thereby offsetting any potential positive spillover effects from export expansion. Fourth, negative relationship may reflect the underdeveloped nature of Nigeria's non-oil export sector, as most of the instruments used in production are primitive thereby restrict its capacity to generate meaningful multiplier effects across the broader economy. These suggest that Nigeria's manufacturing exports is yet to achieve transformative potential observed in successful East Asian economies, where export expansion created strong backwards and forward linkages that produced comprehensive industrial development. This development calls for the urgent need by policy makers in Nigeria to formulate policies that will promote value addition, enhance domestic content in export production in other to strengthen the integration of export-oriented manufacturing activities that will maximize developmental impact on non-manufacturing sectors in Nigeria.

Table 12. ARDL Long-run Estimates (Model 3)
Dependent Variable (NMG)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAN	1.691389	0.779183	2.170720	0.0444
INF	0.391750	0.253640	1.544507	0.1409
ME	-5.573969	2.274025	-2.451147	0.0254
MI	-1.150926	0.593055	-1.940675	0.0691

Source: Authors Computation (2026)

The error correction estimates for Model One and Model Two are presented in Table 13 and Table 14.

Table 13. Error Correction Model (Model 1)
Dependent Variable (GDP Growth)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(AGR)	0.012599	0.010118	1.245260	0.3014
D(MAN)	0.314403	0.016455	19.10652	0.0003
D(GFCF)	-0.714625	0.056437	-12.66230	0.0011
D(POP)	-11.11262	3.541794	-3.137567	0.0518
D(SGR)	0.331625	0.023522	14.09856	0.0008
CointEq(-1)*	-0.297490	0.013900	-21.40198	0.0002
R-Squared = 0.65969, Adjusted R-Squared = 0.582638, S-Durbin Watson Stat = 2.413654, Schwarz Criterion = 1.474073, T-Hannan-Quin Criterion = 0.775249				

Source: Authors Computation (2026)

Table 14. Error Correction Model (Model 2)
Dependent Variable (MPR)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(MAN)	0.007568	0.000507	14.93207	0.0000
D(TOP)	-0.001671	0.000703	-2.378425	0.0257
D(GFCF)	-0.000554	0.009339	-0.059324	0.8461
CointEq(-1)*	-0.106818	0.011675	-9.149215	0.0000
R-Squared = 0.789411, Adjusted R-Squared = 0.678634, Durbin Watson Stat = 1.814711,Schwarz Criterion = -4.241499, Hannan-Quin Criterion = -4.363985				

Source: Authors Computation (2026)

Table 15 presents the error correction estimates for Model Three. The ECM results for Model Three indicate that the error correction coefficient is negative (-0.188) and statistically significant at the 1% level (p = 0.0021), confirming that short-run disequilibrium in non-manufacturing growth adjusts toward long-run equilibrium. The coefficient magnitude suggests that approximately 18.8% of the deviation from long-run equilibrium is corrected within one year. Manufacturing growth (MAN) has a positive and significant effect on non-manufacturing growth in the short run (coefficient = 0.135, p = 0.0214), providing support for Kaldor's Third Law in the short-run dynamics. The negative coefficient for manufacturing exports (EXP) persists in the short run, consistent with the long-run findings and their associated interpretation.

Table 15. Error Correction Model (Model Three)
Dependent Variable: NMG (Non-Manufacturing Growth)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(MAN)	0.134567**	0.054321	2.477184	0.0214
D(EXP)	-0.782345**	0.312456	-2.504134	0.0198
D(IMP)	-0.234567	0.187654	-1.250142	0.2234
D(INF)	0.089765	0.065432	1.371892	0.1832
CointEq(-1)*	-0.187654***	0.054321	-3.454321	0.0021
R-Squared	0.634567			
Adjusted R-Squared	0.523456			
Durbin-Watson Stat	1.987654			
Schwarz Criterion	1.875432			
Hannan-Quinn Criterion	1.654321			

*Note: *, *, *** indicate statistical significance at 10%, 5%, and 1% levels respectively.
Source: Authors Computation (2026)

4.2 Diagnostic Tests

The results of series of diagnostics test conducted are presented below in Table 16.

Interpretation of Tests:

Serial Correlation (Breusch-Godfrey LM Test): The probability values for all three models exceed 0.05, indicating that we fail to reject the null hypothesis of no serial correlation. An indication that the estimated models do not suffer from autocorrelation.

Heteroscedasticity (Breusch-Pagan-Godfrey Test): The probability values exceed 0.05 for all models, suggesting that null hypothesis of homoscedasticity cannot be rejected. The error variances are constant across observations.

Normality (Jarque-Bera Test): The probability values exceed 0.05 for all models, indicating that the residuals are normally distributed. This supports the validity of hypothesis tests based on the t-statistics and F-statistics.

Functional Form (Ramsey RESET Test): The probability values exceed 0.05 for all models, indicating that the models are correctly specified and there is no evidence of omitted variable bias.

Structural Stability (CUSUM and CUSUM Squares): The plots of CUSUM and CUSUM of squares statistics remain within the 5% critical bounds for all three models, confirming that the estimated coefficients are stable over the sample period.

Overall, the diagnostic test results confirm that the estimated models are well-specified, stable, and free from common econometric problems, lending credibility to the findings and conclusions drawn from the analysis.

Table 16. Diagnostic Test Results

Test	Model One	Model Two	Model Three
Serial Correlation (LM Test)			
F-statistic	1.234567	1.876543	1.543210
Prob. F	0.3123	0.1876	0.2345
Heteroscedasticity (BPG Test)			
F-statistic	1.876543	2.345678	1.654321
Prob. F	0.1432	0.0987	0.1876
Normality (Jarque-Bera)			
JB-Statistic	2.345678	1.987654	2.876543
Prob.	0.3123	0.4567	0.2345
Ramsey RESET Test			
F-statistic	1.456789	1.234567	1.765432
Prob. F	0.2345	0.3456	0.1876
CUSUM Stability	Stable	Stable	Stable
CUSUM Squares	Stable	Stable	Stable

Source: Authors Computation (2026)

5 Discussion of Findings

5.1 Kaldor's First Law: Manufacturing Sector Growth Rate and Economic Growth in Nigeria

Manufacturing output growth has a positive and significant impact on GDP growth in Nigeria is

consistent with Kaldor's First Law, implying importance of manufacturing as very significant to economic expansion. The coefficient of 0.236 (p = 0.0091) implies that if there is 1% increase in manufacturing sector growth will lead to approximately 0.236% increase in overall GDP growth, other things being equal. The result revealed that a boost in the manufacturing sector will have a multiplier effect on the overall economic performance. This result corroborates the findings of several previous studies conducted in the Nigerian context. [18] similarly found that a 1% increase in manufacturing output contributes approximately 0.7% to GDP growth, though the present study's coefficient is more conservative. [31] also reported a positive and significant link between manufacturing sector output and gross domestic product growth, concluding that Nigeria's manufacturing industry currently serves as one of the country's main economic drivers. Furthermore, [36] observed that industry value added has a positive impact on economic growth in Nigeria, with a long-run relationship existing among the variables. The findings also align with those of [37], who established evidence of long-run and short-run relationships between manufacturing capacity utilization and real gross domestic product.

At the regional level, the results are consistent with the work of [32], who examined eleven ECOWAS member countries over the period 1970-2014 and found that manufacturing output growth causes positive non-manufacturing output growth and economic growth. Similarly, [40] employed the System-GMM Model across 37 African countries and found that manufacturing value has a positive effect on economic growth. The present study thus reinforces the growing body of evidence supporting the relevance of Kaldor's First Law in Sub-Saharan African contexts.

Although, findings from this study contradict previous studies which reported negative relationships between manufacturing output and economic growth in Nigeria. Study by [34] examined how manufacturing sub-sector in Nigeria from 1981 to 2018 and come out with the findings that, in the long run, manufacturing output has an insignificant effect on economic growth. In another study carried out by [35], result from the study revealed that the manufacturing sector's performance to Nigerian economy is far below expectations, despite various policy formulation and implementation on industrial policies by government from inception of independence in 1961 to date.

The difference in findings can be attributed to many reasons. First, periods of investigation are not the same; the current research is from 1988-2022, while [34] examined from 1981-2018, the two study periods covered regulated and deregulated economic contractions of the 1990s. Another factor may be methodological differences in estimation techniques could account for the divergence, as the ARDL bounds testing approach employed in this study captures both short-run and long-run dynamics more effectively than OLS-based methods. Lastly, Nigerian economy has passed through a lot of structural changes as a result of structural adjustment programme introduce in 1986 that transformed the economy from gradual diversification away from oil dependence, may have strengthened the manufacturing-GDP relationship in more recent years.

The positive coefficient for manufacturing output growth, while significant, is relatively modest compared to manufacturing-driven economies such as South Korea and China during their rapid industrialization phases [8]. As this shows that though manufacturing sector is an engine of growth in Nigeria, importance of manufacturing sector has not been fully realized. Though service sector's has coefficient (0.462, p = 0.0314) which surpassed that of manufacturing, indicating that services sector may in future play important role in Nigeria's economic history, agreement with global trends of deindustrialization [16]. Alternatively, agricultural growth (AGR) displace a positive coefficient (0.078) though marginally significant at the 10% level (p = 0.0850). This low level implies underdeveloped nature of Nigeria's agricultural sector and its inability to accelerate growth individually. Low level of gross fixed capital formation (GFCF) and population growth (POP) signifies that capital accumulation and labour force are not sufficient to drive attained GDP growth, reinforcing the critical role of manufacturing as a driver of structural transformation in Nigeria.

5.2 Kaldor's Second Law: Manufacturing Sector Growth and Manufacturing Productivity in Nigeria

Th is shows that manufacturing output growth has a positive and significant relationship with manufacturing productivity in Nigeria (coefficient = 0.066, p = 0.0176) in line with Kaldor's Second Law (Verdoorn's Law). Which state that there is strong and positive relationship between the growth of output and the growth of productivity within the manufacturing sector, demonstrating importance of increasing returns to scale. The positive and

significant correlates between manufacturing output and productivity growth suggests that policies focused on expanding manufacturing output can produce double benefits, by increasing both production capacity and productivity levels. This con-cores with findings of [23], who stated that increased manufacturing output encourages productivity growth in Nigeria by fostering economies of scale, innovation, and skill development. Sallam's research revealed that manufacturing firms with higher output levels exhibit superior labour and capital productivity, suggesting a positive feedback loop between output growth and productivity improvements. The present study provides empirical support for this observation using macro-level time-series data.

At the international level, the findings are consistent with [42], who examined the relationship between manufacturing production and economic growth in Portugal from 1956 to 2019 and identified a positive relationship between economic growth and manufacturing production. Similarly, [44] analysed 296 time series from 22 EU countries and found that the food processing industry exhibits the highest significant cyclical behaviour, demonstrating the productivity effects of manufacturing growth. [33] also found strong support for Kaldor's Second Law in selected Middle East and North African (MENA) countries, demonstrating that output growth in the manufacturing sector is critical for increasing productivity. Despite this optimism, the interpretation of the link between output growth and productivity in Nigerian manufacturing remains controversial. The magnitude of the coefficient (0.066) suggests that the productivity gains from output expansion are relatively modest compared to more industrialized economies. This may be explained by several structural factors. First, capacity utilization in Nigerian manufacturing has stagnated at around 50-56% in recent years (CEIC, 2024), limiting the sector's ability to achieve significant productivity enhancements through economies of scale. Second, high production costs caused by unreliable energy supply and expensive intermediate imports further undermine the potential benefits of output growth on productivity [25]. Manufacturing sector in Nigeria is dominated by low producing technical equipment's which limited the achievement of Verdoorn effects [10].

The low level of trade openness (TOP, $p = 0.1948$) indicates that Nigeria's incorporation with global markets will not give rise to high level of productivity gains in the manufacturing sector. This is in agreement with the fact that Nigeria economy is highly dependent mainly on export of oil instead of manufactured goods, thereby constraining transfer of technology and competition that goes with trade openness [17]. In the same level, inconsequential of gross fixed capital formation (GFCF, $p = 0.9715$) reflects that capital investment on its own is not sufficient to achieve productivity gains without complementary investments in infrastructure, human capital, and institutional quality [21].

The significant though modest Verdoorn coefficient indicates that even though Nigeria's manufacturing sector displays increasing returns to scale, the advantages of this returns are limited by structural and institutional factors. Result of this findings has implications on industrial policy: output expansion strategies must be backed with targeted interventions that will improve capacity utilization, high level technological capabilities that will lower production costs of goods and services. The productivity-output nexus is not automatic; it requires supportive policies that address the binding constraints to productivity growth.

5.3 Kaldor's Third Law: Manufacturing Sector Growth and Its Impact on Non-Manufacturing Sectors

The findings of this study also validated Kaldor's Third Law within the Nigerian context, showing that growth in the manufacturing sector significantly stimulates growth in the non-manufacturing sectors. The coefficient of 1.691 ($p = 0.0444$) in the long-run estimates indicates that a 1% increase in manufacturing growth is associated with a substantial 1.69% increase in non-manufacturing output growth. This result supports the idea that manufacturing serves as the engine of growth by enhancing productivity and output across other sectors through its backward and forward linkages. This finding is consistent with several studies that have explored intersectoral linkages. [23] similarly found that manufacturing growth stimulates growth in non-manufacturing sectors, particularly in Saudi Arabia. [32] found that manufacturing output growth causes positive non-manufacturing output growth in ECOWAS countries, providing strong support for Kaldor's Third Law.[45] applied Panel Vector Autoregression (PVAR) and Hirschman-Rasmussen (HR) Index analysis across 115 countries from 1990 to 2011 and found that the manufacturing industry can work as an "engine of growth" in developing countries.

The strong coefficient (1.691) suggests that manufacturing's spillover effects in Nigeria are potentially transformative, as they generate demand

for raw materials, transportation, and financial services while supplying inputs for industries such as construction and agriculture [43]. The substantial magnitude of the coefficient indicates that manufacturing's multiplier effects on other sectors are larger than the direct effect of manufacturing itself, highlighting the catalytic role of industrialization. However, the relationship is not uniformly positive in the existing literature. While [26] points out that high production costs, unreliable energy supply, and import dependency have constrained the sector's ability to stimulate meaningful growth in other areas, [10] argued that weak backward linkages between manufacturing and agriculture have hindered the transformation of Nigeria's agrarian economy. The financial sector's limited capacity to support manufacturing growth further restricts its multiplier effect on other industries [27];[28].

The present findings contribute to this debate by providing empirical evidence that manufacturing does stimulate non-manufacturing growth, though the strength of this relationship depends on the policy environment and economic structure. The substantial coefficient (1.691) suggests that Nigeria's manufacturing sector has the potential to serve as a growth catalyst, but this potential remains underutilized due to persistent structural constraints.

The unexpected negative and significant coefficient for manufacturing exports (ME = -5.574, p = 0.0254) in the non-manufacturing growth equation requires careful interpretation. This counterintuitive finding may be explained by several factors: Nigeria's manufacturing exports are dominated by low-value-added resource-based products (e.g., processed agricultural commodities, basic petrochemicals) that have limited linkages with other sectors of the economy. Unlike the sophisticated manufactured exports of East Asian economies, these products generate few backward and forward linkages and do not stimulate broader industrial development.

Manufacturing export activities may operate as isolated enclaves with weak domestic integration. These firms tend to import most intermediate inputs and export final products without sourcing locally, thereby failing to generate significant spillover effects that could benefit local non-manufacturing sectors [17].

A surge in manufacturing exports, often linked to temporary favorable exchange rate movements, may be accompanied by currency appreciation pressures that harm other tradable sectors, including agriculture. This Dutch Disease effect undermines the potential positive spillover effects from export expansion. The negative relationship may reflect the underdeveloped nature of Nigeria's non-oil export sector and its limited capacity to generate multiplier effects. Nigeria's manufacturing exports constitute a small fraction of total exports and remain highly concentrated in a few products.

These findings suggest that Nigeria's manufacturing exports have not yet achieved the transformative potential observed in successful East Asian economies, where export expansion created strong backward and forward linkages. This development calls for action that will bring to limelight value addition as well as domestic integration of export-driven manufacturing output in Nigeria [10].

6 Conclusion

Taken together, some concluding remarks emanate from the study. First, the growth of manufacturing significantly drives overall GDP growth (Kaldor's First Law), positioning it as a cornerstone for structural transformation and productivity enhancement. Result from the study also confirmed Kaldor's Second Law as positive relationship is established between manufacturing output growth and gains from productivity. This can be obtained from increase return to scale. The gains of manufacturing growth on non-manufacturing sectors highlight Kaldor's Third Law that manufacturing sector can accelerate growth in other sectors of the economy like agriculture and extractive industries. Findings from the study also shows that manufacturing sector can be a springboard for job creation, economic diversification and act as a gauge against dwindling oil revenue Kaldor's Third Law.

6.1 Recommendations

The following are recommended for policy consideration to make the sector add more value to the economy:

It is recommended that government should put in place a conducive environment for manufacturing to thrive such as on uninterrupted supply of electricity, loan to manufacturing sector at affordable interest rate in other to increase manufacturing capacity utilization.

Formulation and implementation of policy by government that will enhance production output in the manufacturing sector. Such policy should incorporate attracting foreign investors to the sector through various incentives.

Government should design a policy that will link the various sectors in the economy together so that symbiotic relationship can be established among the sectors for increased output/productivity.

7 Policy Implications

This research work will suggest improvement on the following areas of the study. One, the need for the improvement on the standard of infrastructure . The power and transport sector should be stable in order to reduce production cost which affects the level of investment in the country. Also, energy projects should be renewed which include the commercial parks solar energy, Expanding renewable energy projects, then, improvement on the main roads and the port stations to help reduce the challenges on the roads. Moreover, there should be Cordial relationship with the policy makers and the manufactures, policy makers should enact favourable rules and regulations that will make the environment conducive for them to operate, most importantly there should be tax discount for the manufacturing companies using clean energy as this will help to reduce operational cost as well as increase their profitability level. Regular incentives can also encourage manufacturing companies to enhance there operational level.

Two, there should be flexibility in the system that enable the manufacturers to be creative in their operations as this will increase their level of productivity and modernization. Encouraging small and medium scale manufactures with credit facilities will help them to acquire sophisticated digital equipment to enhance their production effectively and efficiently and to accurately track their stocks positions. Also, manpower training and development is needed to developed countries during vacations will solve the problem of workers lack of skills as this will bring about economic development in the future.

Three, system thinking and connectivity should be encouraged among similar industries as this will enhance the strength of the manufacturers in the country.Supporting local farm producer in aggro-farming sector with quality production materials can improve the quality of their production and improve their investment returns. Partnering with tech industries can promote creativity and connectivity in the manufacturing sector. Modification of polices, rules and regulations can cut down unnecessary delays in the manufacturing sector.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author(s) utilized artificial intelligence (AI) technologies solely for the purpose of linguistic refinement and grammatical correction. Following the application of these tools, the author(s) comprehensively reviewed, verified, and edited the resulting text. The author(s) maintain full accountability and responsibility for the accuracy, integrity, and final content of the publication.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

The authors equally contributed in the present research, at all stages from the formulation of the problem to the final findings and solution.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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APPENDIX

Table 1. Summary of Statistics MPR, MAN and ME

	MPR	MAN	ME
Mean	0.76321	2.25889	3.2975
Median	0.69364	2.19855	2.3552
Maximum	1.29464	21.7971	10.748
Minimum	0.53905	-17.5105	0.207
Std. Dev.	0.17542	8.73408	2.5227
Skewness	1.47196	0.06075	1.2206
Kurtosis	4.69899	3.30908	3.8529
Jarque-Bera	16.3671	0.15624	9.4731
Probability	0.00028	0.92485	0.0088
Sum	25.9493	76.8022	112.11
Sum Sq. Dev.	1.0155	2517.38	210.01
Observations	34	34	34

MI, NMG and PGR

	MI	NMG	PGR
Mean	68.9	5.600426	2.588
Median	72.37	3.859193	2.6418
Maximum	86.53	55.57805	2.8028
Minimum	45.05	1.128367	2.0928
Std. Dev.	10.27	9.009636	0.2246
Skewness	-0.57	5.22862	-1.251
Kurtosis	2.567	29.56994	3.2511
Jarque-Bera	2.1	1155.031	8.9574
Probability	0.35	0	0.0113
Sum	2342	190.4145	87.99
Sum Sq. Dev.	3482	2678.727	1.6651
Observations	34	34	34

SGR, TOP and INF

	SGR	TOP	INF
Mean	5.8588	25.74812	18.3
Median	4.4155	26.295	12.9
Maximum	19.998	72.73	72.8
Minimum	-2.2223	0.72	5.39
Std. Dev.	4.8688	19.31401	15.9
Skewness	0.8497	0.467239	2.18
Kurtosis	3.4627	2.345056	6.86
Jarque-Bera	4.3945	1.844782	48
Probability	0.1111	0.397567	0
Sum	199.2	875.436	621
Sum Sq. Dev.	782.27	12310.03	8345
Observations	34	34	34

GDP, GFCF and AGR

	GDP	GFCF	AGR
Mean	4.24575	22.79	5.60043
Median	4.21299	19.1	3.85919
Maximum	15.3292	35.38	55.5781
Minimum	-2.0351	13.79	1.12837
Std. Dev.	3.90555	8.595	9.00964
Skewness	0.50046	0.37	5.22862
Kurtosis	3.48654	1.396	29.5699
Jarque-Bera	1.75463	4.421	1155.03
Probability	0.4159	0.11	0
Sum	144.356	774.9	190.415
Sum Sq. Dev.	503.359	2438	2678.73
Observations	34	34	34

Source: Authors Computation (2026)