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Industrial Sector and Economic Growth in Nigeria: A Subsector Analysis

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Abstract. This study investigated the impact of the industrial sector on Nigeria's economic growth from 1996 to 2023. The industrial sector was disaggregated into key subsectors, namely the manufacturing industry, mining and quarrying industry, construction industry, electricity, gas, steam and air-conditioning industry, and water supply, sewage and waste management sector, while the interest rate served as a macroeconomic control variable. Data were sourced from the Central Bank of Nigeria statistical bulletin and analyzed using the autoregressive distributed lag approach, which accounts for both short-run and long-run dynamics among variables. The Bounds test for cointegration confirmed a long-run relationship between industrial sectors and economic growth in Nigeria. In the long run, the results indicated that manufacturing, mining and quarrying, construction, and electricity and gas industries had positive and significant impacts on Nigeria's economic growth, while the water supply, sewage and waste management sector had a negative but insignificant effect. The interest rate exhibited a positive and significant long-run effect on growth. In the short run, manufacturing, mining, and electricity sectors maintained significant positive influences on gross domestic product growth, whereas the construction and water supply sectors showed negative and insignificant effects. The error correction term was correctly signed as negative and significant, indicating that about 67.9% of short-run disequilibrium is corrected annually toward long-run equilibrium. Diagnostic tests confirmed that the model satisfied the assumptions of normality, homoscedasticity, and stability. The study concludes that Nigeria's industrial sector remains a key driver of economic growth, with manufacturing, mining, construction, and energy subsectors playing dominant roles. The study recommended that the government should promote manufacturing diversification, invest in infrastructure and energy, reform the mining sector, maintain stable interest rates, enhance industrial financing, and ensure policy consistency to sustain industrial-led growth and long-term economic development.

Keywords: Industrial Sector, Economic Growth, Manufacturing Industry, Mining and Quarrying, Construction Industry, Electricity and Energy Sector and ARDL Model.

1. Introduction

The industrial sector remains a cornerstone of economic growth and national development, particularly for developing economies. Abdu and Bassey (2018) noted that industrialization is central to economic transformation, providing employment opportunities, raising incomes, and stimulating the production of goods and services for domestic consumption and export. Economies that have attained high levels of industrialization are often classified as developed, as industrial growth drives productivity, technological advancement, and structural transformation.

The industrial sector comprises activities that convert raw materials into finished goods and services, spanning construction, mining, quarrying, and manufacturing. Within Nigeria, the manufacturing industry is widely recognized as one of the country's foremost growth drivers (Ogundipe, 2022). However, empirical evidence suggests that Nigeria still requires deeper industrialization, particularly through manufacturing expansion to attain optimal levels of economic growth and development (Ibitoye, Ogunoye, & Kleynhans, 2022). The Central Bank of Nigeria (CBN, 2020) classifies Nigeria's industries into five broad categories: Mining and Quarrying including crude petroleum, natural gas, coal, metal ores, and other minerals. The manufacturing sector covers oil refining, cement, food and beverages, textiles, footwear, wood and paper products, chemicals and pharmaceuticals, plastics, metals, vehicles, and electronics. Electricity, gas, steam

and air conditioning, water supply, sewage, and waste management and the construction industry.

Industrialization in Nigeria has historically been pursued through several policy frameworks, including import-substitution strategies, export-promotion measures, and foreign direct investment-driven industrialization (Arize, 2023). Successive governments introduced structural adjustment programmes and public investment initiatives, such as the Ajaokuta steel plant, Warri and Kaduna rolling mills, aluminum smelter plants, petroleum refineries, fertilizer factories and cement industries (Okorontah & Uruakpa, 2023). Recent economic data underscore both the importance and fragility of the sector, the industrial sector contributed 30.8% to gross domestic product in 2022 and slightly improved to 32.2% in 2023 (CBN, 2023). However, its share remains modest compared to global standards. The manufacturing subsector contributed only 12.7% to GDP in 2023 (CBN, 2023), reflecting persistent structural bottlenecks.

The mining and quarrying subsector, dominated by crude petroleum and natural gas, remains Nigeria's largest industrial contributor. Oil revenues provide a substantial share of fiscal earnings and foreign exchange, but the sector's volatility exposes the economy to global price shocks. For instance, the mining sector's GDP contribution fell from 5.47% in 2024 Q1 to 4.38% in 2025 Q1, while crude petroleum demonstrates a strong positive impact on GDP (Saka & Adegbembo, 2022), the solid minerals subsector remains underdeveloped, contributing only 0.8% to GDP in 2022 (NEITI, 2023).

The manufacturing subsector holds greater promise for sustainable development due to its potential for value addition, employment generation, and structural transformation. Yet, it has experienced inconsistent growth. Between 2018 and 2022, it contributed approximately 9% of GDP (Kolawole, 2023). However, its share declined from 16.04% in Q4 2023 to 12.68% in Q2 2024, recording a modest 1.28% year-on-year growth in Q4 2024. Persistent challenges include unreliable electricity, inadequate infrastructure, and dependence on imported raw materials. Nevertheless, manufacturing remains integral to Nigeria's growth prospects through its forward and backward linkages, productivity gains, and export diversification potential (IJSRM, 2023). The construction subsector plays an equally significant role by facilitating infrastructure development, including roads, housing, bridges, and industrial facilities, which, in turn, enhance productivity across sectors. Studies confirm the sector's positive effect on GDP (Saka & Adegbembo, 2022), though benefits materialize gradually. It also provides substantial employment and stimulates industries such as cement, steel, and real estate. However, corruption, project abandonment, and fluctuating government expenditure continue to undermine its performance (Multitech Journal, 2023).

Overall, the mining, manufacturing, and construction subsectors present both opportunities and challenges. While mining guarantees revenue but fosters dependence on oil, manufacturing offers long-term transformation but suffers from infrastructural constraints, and construction drives infrastructure and job creation but is hindered by governance inefficiencies. Achieving sustainable growth requires Nigeria to diversify into solid minerals, deepen value addition in manufacturing, and sustain infrastructure investment. Such outcomes depend on sound macroeconomic policies, infrastructure upgrades, human capital development, and robust institutional frameworks to ensure efficiency and accountability. Against this backdrop, this study investigates the industrial sector's impact on Nigeria's economic growth, with particular focus on mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction. This research will enable policy makers to adequately and effectively formulate designs and implement appropriate policies and regulations in managing the various challenges in the industrial sub sector of mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction and as it affects economic growth which has not been carryout by other researchers.

This study is divided into five sections. Section one deals with the general introduction of the study which encompasses, background to the study, statement of the problem, research questions, objectives of the study, hypotheses, significance of the study, scope and organization of the study. Section two reviews related literature. Section three deals with research methods and theoretical framework, section four shows the presentation of data, analysis and discussion of results, while section five contains the conclusion and recommendations.

2. Literature Review

2.1. Conceptual Review

2.1.1 The Industrial Sector

The industrial sector is that sector of the economy that deals with the conversion of raw materials taken from the primary sector into end-user products. Thus, industrialization could be described as the process of transforming raw materials, with the aid of human resources and capital goods into consumers goods, new capital goods which allows more consumers goods (including food) to be produced with the same human

resources, and social overhead capital, which together with human resources provides new services to both individuals and businesses (Ekpo, 2018). The term industrialization is an offshoot of the industrial sector; therefore, industrialization is basically the process of transforming an extraction-based economy (raw materials) into a manufacturing one. With the help of industries, raw materials are transformed into finished goods that are ready for local consumption and exportation.

As noted by Enwerem and Gylch (2017) industrialization can also be defined "in terms of income levels reaching a certain threshold. It is on the basis of this that countries are classified into, low-income; lower middle income, higher middle income, lower upper income, higher upper income and high-income countries". Industrialization is the process by which an economy is changed from a primarily agricultural one to an economy that is based on the manufacturing of goods. This has to do with a change from manual labour to a mechanized mass production. Some characteristics of industrialization are economic growth, increased efficient division of labour, improvement in the use of technological innovations (Rasure, 2021).

While noting the critical place industrialization occupies, Okosodo (2006) posited that industrialization helps in curbing inflation especially in Africa where inflation comes about from inadequate supply of basic industrial goods and services leading to reliance on imported materials including machinery, spare parts and raw materials through industrialization these goods will be made available locally and also halt persistent excess demand. Achieving industrialization in Nigeria, though desirable, has faced myriads of challenges. As Nafisat (2018) rightly noted, inadequate access to credit facility; huge interest rate on loans for entrepreneurs; industrialist not willing to partake in partnership with other investors; imported expensive machineries; poor infrastructures; militants and insurgency problems are some of the reasons the Nigerian economy remains underdeveloped and non-industrialized. These issues and challenges are capable of stalling or slowing down Nigeria's potential for industrialization and industrial growth.

The term industrial growth could be understood from different perspectives. As Clunies-Ross, Foresyth, and Huq (2016) noted "it can be conceived as a shift in a country's pattern of output and workforce towards manufacturing or secondary industry". It can also be defined in terms of the expansion of a country's manufacturing activities, which includes the generation of electricity and also the development of the country's communications network activities; industrial growth reduces the emphasis on the extractive industries while it increases the emphasis on secondary and tertiary sector of the economy (Akinwumi, Omotayo & Alani, 2020).

2.1.2 Mining and Quarrying Industry

According to the European Commission, mining and quarrying include the extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved by different methods such as underground or surface mining, well operation, seabed mining etc. This section includes supplementary activities aimed at preparing the crude materials for marketing, for example, crushing, and grinding, cleaning, drying, sorting, concentrating ores, liquefaction of natural gas and agglomeration of solid fuels.

2.1.3 Manufacturing Industry

According to Wikipedia, manufacturing is the creation or production of goods with the help of equipment, labor, machines, tools, and chemical or biological processing or formulation. It is the essence of secondary sector of the economy. The term may refer to a range of human activity, from handicraft to high-tech, but it is most commonly applied to industrial design, in which raw materials from the primary sector are transformed into finished goods on a large scale. Such goods may be sold to other manufacturers for the production of other more complex products (such as aircraft, household appliances, furniture, sports equipment or automobiles), or distributed via the tertiary industry to end users and consumers (usually through wholesalers, who in turn sell to retailers, who then sell them to individual customers)

2.1.4 Construction Industry

The construction industry is a vital component of any nation's economy, serving as the backbone of infrastructural development and physical transformation. It encompasses the processes involved in the design, planning, financing, and execution of projects such as buildings, roads, bridges, dams, and other civil engineering works. According to Ofori (2015), the construction industry is a major driver of economic growth because it provides the necessary infrastructure that facilitates the operation of other sectors, including manufacturing, transport, health, and education. In Nigeria, the construction industry plays a significant role in job creation, poverty reduction, and capital formation.

It is often regarded as a catalyst for development due to its strong linkages with industries that supply construction materials, such as cement, steel, and glass. Despite its potential, the Nigerian construction sector faces several challenges, including inadequate financing, corruption, insufficient technical expertise, and policy instability. Nonetheless, the industry remains a key contributor to the nation's Gross Domestic Product

(GDP) and an essential driver of sustainable economic growth and urbanization.

2.1.5 Electricity, gas, steam and air conditioning industry

The electricity, gas, steam, and air conditioning industry comprises activities related to the generation, transmission, and distribution of electrical power; the production and supply of gaseous fuels; and the provision of steam and air conditioning systems. This sector is fundamental to industrialization and economic performance as it provides the energy necessary for production, transportation, and household consumption. The International Energy Agency (IEA, 2022) notes that reliable and affordable energy access is critical for productivity enhancement, investment attraction, and technological advancement. In Nigeria, the electricity sub-sector has long been constrained by limited generation capacity, transmission inefficiencies, and frequent outages, which have adversely affected industrial growth.

However, the gas sub-sector holds immense potential due to Nigeria's abundant natural gas reserves, which, if properly harnessed, can boost electricity generation and industrial productivity. The steam and air conditioning segment also contributes significantly to industrial processes requiring temperature control and environmental management. Therefore, this industry is central to improving production efficiency, supporting business operations, and enhancing living standards in the economy.

2.1.6 Water Supply, Sewage and Waste Management Industry

The water supply, sewage and waste management industry is responsible for the provision of clean water, sewage treatment, and solid waste management services. It is a crucial pillar of public health, environmental protection, and sustainable economic development. According to the United Nations (2020), effective water supply and waste management systems are vital to ensuring environmental sustainability, improving public health, and achieving the Sustainable Development Goals (SDGs). In Nigeria, this sector plays a key role in providing safe water for households and industries, preventing waterborne diseases, and maintaining sanitation through effective waste collection and disposal systems. The sewage and waste management sub-sector also contributes to pollution reduction and natural resource conservation through recycling and waste-to-energy initiatives. However, inadequate infrastructure, weak institutional frameworks, and insufficient funding, remains the major constraints. Strengthening this industry is therefore necessary to enhance environmental quality, safeguard public health, and support industrial and agricultural activities across the country.

2.1.7 Economic Growth

Economic growth can be defined as a long-term expansion of the productive potential of a country's economy. This expansion has to do with all the sectors of the economy, high standards of living, high levels of productivity and the country being able to achieve all her macroeconomic objectives- high output, high rate of employment and reduction in inflation rate (Babatunde and Seiyefa 2017). Potters (2021) defines Economic growth as a rise in the production of economic goods and services compared from one particular period of time to another in a given country. This growth can be measured in nominal or real terms i.e. adjusted for inflation. Economic growth is said to have occurred when there is an increase in capital goods, in technology, labour force and also in human capital. Growth in economics is mostly modelled as a function of the following: labour force, physical capital, technology and human capital. Economic growth has been conceived as increase in per capital income over a period of time (Clunies – Ross, et al., 2016; Jhingan, 2018). According to Iganiga (2006) Economic growth can be seen as the rate of change in national output or income in a given period of time, the increase in output could result from an increase in the capital stock, increase in the population of the country or increase in the productivity of the labour force or increase in the technological innovations of that economy; It could be measured in terms of; i. Nominal value (output), ii. Real value (output), iii. Per capita value measurement of growth. Abbott (2003) considers the following as key positive factors stimulating industrialization in an economy: good governance, good legal framework, availability of natural resource, relative low-cost, skilled labour, and technology.

2.2. Theoretical Review

The relationship between industrial development and economic growth is deeply rooted in economic theory, with various schools of thought providing complementary explanations of how the industrial sector drives productivity, structural transformation, and long-run development. A synthesis of these theories reveals that industry serves as a central engine of growth through capital accumulation, technological progress, labour reallocation, and productivity enhancement.

The Structural Transformation Theory, as articulated by Arthur Lewis (1954) and Simon Kuznets (1971), directly links industrialization to economic growth. Lewis (1954) argues that the transfer of surplus labour from the low-productivity agricultural sector to the high-productivity industrial sector increases overall output and income. This process not only raises wages but also stimulates

urbanization and modernization. Kuznets (1971) reinforces this view by emphasizing that industrialization is the hallmark of sustained economic growth, as it drives structural shifts that enhance productivity and income levels. In this context, the expansion of the industrial sector is both a cause and consequence of economic growth, particularly in developing economies such as Nigeria.

The Cobb–Douglas Production Theory, developed by Charles Cobb and Paul Douglas (1928), provides a microeconomic foundation for understanding how industrial output contributes to growth. The model specifies that output is a function of capital and labour inputs, both of which are heavily utilized in the industrial sector. Industrialization typically involves increased capital intensity, technological adoption, and improved labour productivity. Through this framework, the industrial sector enhances economic growth by increasing total factor productivity and optimizing the use of production inputs. Empirically, improvements in industrial efficiency translate into higher aggregate output and economic expansion.

The Classical Growth Theory, associated with Adam Smith (1776), David Ricardo (1817), and Thomas Malthus (1798), also underscores the importance of industry in economic growth. Smith (1776) emphasized that industrial activities promote division of labour and specialization, which significantly enhance productivity. Ricardo (1817) highlighted how industrial specialization and comparative advantage in manufacturing can boost international trade and economic growth. Although Malthus (1798) focused on resource constraints, industrialization has historically mitigated these constraints through technological innovation and increased production capacity. Thus, the classical perspective suggests that industrial expansion is essential for overcoming the limitations of agrarian economies and achieving sustained growth.

The Neoclassical Growth Theory, developed by Robert Solow (1956) and Trevor Swan (1956), further explains the role of industry in growth through capital accumulation and technological progress. The industrial sector is a major recipient of investment and a key driver of capital formation. As industries expand, they contribute to increases in the capital stock, which raises output in the short run. However, due to diminishing returns to capital, sustained growth in the industrial sector depends on continuous technological innovation. Industrial activities often serve as channels for the diffusion of new technologies, thereby enhancing productivity and supporting long-term economic growth. The convergence hypothesis also implies that countries with developing industrial sectors can catch up with advanced economies by adopting modern industrial technologies.

The Endogenous Growth Theory, advanced by Paul Romer (1990) and Robert Lucas (1988), provides a stronger link between industry and sustained economic growth. This theory posits that industrial sectors are key sites for innovation, research and development (R&D), and knowledge spillovers. Romer (1990) emphasizes that industrial firms invest in innovation, which generates new technologies and drives long-run growth. Lucas (1988) highlights that industrialization promotes human capital development through skill acquisition, training, and learning-by-doing. Unlike the neoclassical model, endogenous growth theory suggests that the expansion of the industrial sector can generate self-sustaining growth through continuous innovation and productivity improvements.

The Harrod–Domar Model, developed by Roy Harrod (1939) and Evsey Domar (1946), emphasizes the importance of investment in driving economic growth, with the industrial sector playing a central role. Industrialization requires substantial capital investment in machinery, infrastructure, and technology. According to the model, higher savings lead to increased investment in industries, which in turn boosts output and employment. However, the model also highlights the need for balanced growth, as insufficient or excessive investment in the industrial sector may lead to macroeconomic instability. Nevertheless, the framework supports the view that industrial expansion is a critical pathway to accelerating economic growth in developing economies.

In conclusion, all the major growth theories converge on the idea that the industrial sector is a key driver of economic growth. Structural transformation theory highlights labour reallocation into industry; the Cobb–Douglas model explains productivity gains from industrial inputs; classical theory emphasizes specialization and industrial trade; neoclassical theory underscores capital accumulation and technological diffusion; endogenous growth theory focuses on innovation and human capital within industry; and the Harrod–Domar model stresses investment-led industrial expansion. Collectively, these perspectives affirm that a robust and dynamic industrial sector is indispensable for achieving sustained economic growth, particularly in developing economies seeking structural transformation and long-term development.

2.3 Empirical Review

Several studies have been carried out to examine the impact of industrial sector performance on economic growth. Kida and Angahar (2020) examined impact of industrialization on economic growth in Nigeria. As a result of the link between industrialization and economic growth, both theoretical and econometric analysis were

used to examine the contribution of industrialization to economic growth in Nigeria, using GDP as the dependent variable and crude petroleum and natural gas, manufacturing and solid mineral as independent variables from 1981 to 2018. The study adopted ordinary least squares (OLS) in formulating the model. The methods of analysis included, augmented dickey-fuller (ADF) unit root test, Johansen co-integration test and error correction method (ECM). The results show that crude petroleum and natural gas, manufacturing and solid mineral, significantly contribute to economic growth. The study recommended creating a conducive environment to achieve strong performance of the industrial sector. Sustaining efforts at generating local materials for infant industries and supporting the campaign of the local contempt initiative.

Kazeem (2020) carried out a study on industrial sector and the finance-growth nexus: using Nigeria as a case study, time series data from 1986–2018 and autoregressive distributed lag (ARDL) approach to co-integration proposed by Pesaran and Shin (2001) found that financial development exerts a positive impact on economic growth in Nigeria in both short and long terms while industrial sector development insignificantly enhances economic growth in Nigeria both in the short and long run. The study concludes that financial development (proxied by domestic credit to the private sector) and industrial sector stimulates economic growth. Oburota, Eke, and Adeyemi (2024) investigated the effect of manufacturing output on economic growth using disaggregated data that covers food, beverages, tobacco and textiles. Employing time series econometric techniques, the study found that manufacturing output showed a positive and statistically significant effect on economic growth in both the short and long run. The authors emphasized that different manufacturing subsectors contribute unevenly to GDP growth, reinforcing the importance of sectoral disaggregation in empirical analysis. Similarly, Shaka, Gatawa, and Olarinde (2022) worked on the industrial development and economic growth nexus in Nigeria by disaggregating the sector into manufacturing, solid minerals, and crude petroleum and gas. Using the Autoregressive Distributed Lag framework, the study stated that all subsectors positively influence economic growth, although the petroleum and gas subsector exerts the strongest effect. This finding underscores Nigeria's continued reliance on extractive industries despite policy emphasis on diversification.

Uzoma and Kevin (2024) extended this line of inquiry by examining the restructuring of the industrial sector and its implications for growth. The study revealed that manufacturing and crude petroleum and gas significantly stimulate economic growth, whereas the solid minerals subsector shows a positive but statistically insignificant effect. Beyond output measures, Adeosun, Odior, Shittu, and Adegbite (2023) incorporated human capital development into the industrial growth framework, the study made use of time series data from 1981 to 2020, the authors found that industrial sector performance positively influences economic growth, but the magnitude of this effect depends significantly on the quality of human capital. The study demonstrates that industrial expansion alone is insufficient; complementary investments in education and skills development are essential for sustainable growth.

Anibuko and Otto (2025) adopted a broader disaggregation by examining manufacturing, mining, electricity, construction, and water and waste management. Their analysis revealed mixed short run effects but confirmed that long run industrialization contributes meaningfully to economic growth. Notably, electricity and construction exhibited significant long run relationships with GDP, suggesting that infrastructure related subsectors serve as critical enablers of industrial productivity and macroeconomic expansion. Ijokoh (2025) approached the issue from a financial intermediation perspective by examining the nexus between capital market performance and industrial sector output. The findings indicate that capital market development significantly influences industrial output, which in turn supports economic growth. Joseph and Dimosi (2025) examined industrial sector performance and economic development using a vector autoregression model. The study established a significant positive relationship between industrial output and economic development indicators. Importantly, manufacturing capacity utilization and industrial employment were identified as key transmission mechanisms linking industrial activity to broader development outcomes.

Nwogo and Orji (2019) examined the impact of industrialization on the growth of the Nigerian economy. The study adopted the ex-post facto research design based on its efficacy in facilitating the projection of future outcomes with past occurrences. The dependent variable was real gross domestic product (RGDP) while the independent variables were the manufacturing sector contribution to the gross domestic product (MSO), crude petroleum and natural gas output (CPNGO), solid mineral mining output (SMMO), and real exchange rate (REXR); data analysis was done using the vector error correction and system equation estimation technique. The study found that there is a positive and significant impact of the manufacturing sector output, crude petroleum and natural gas output, and solid mineral and mining output on the real gross domestic product; also, a long-run relationship was found to exist among the variables used.

Otalu and Keji (2019) adopted the co-integration and error correction model to evaluate the determinants of

industrial sector growth in Nigeria. The results indicated that all the identified determinants have more of permanent effect on industrial output than transitory effect. Labour and capital have significant impact; exchange rate shows a positive and significant impact indicating that currency appreciation might be inimical to the growth of the industrial sector. There was evidence of co-integration between industrial output and it's identified determinants in Nigeria, describing the long run relationship. Obioma, Anyanwu and Kalu (2015) examined the effect of industrial development on economic growth in Nigeria from 1973-2013. The study concluded that the influence of industrial output on economic growth is not statistically significant, though the sign obtained from its àpriori expectation is positively related to (economic growth) GDP, savings has a positive relationship and also significant impact on the economy.

Okuneye (2019) examined the industrial sector performance and economic growth in Nigeria. The scope of the study was within the period of 1981 to 2016 using the ordinary least squares (OLS) method of analysis to evaluate the empirical model within the framework of the classical linear regression model. The study found that the industrial sector performance, proxied by industrial output exerts a significant positive effect on economic growth in Nigeria at 1% level of significance, while economic growth is positively influenced by inflation rate, interest rate does not exhibit any significant effect on growth in Nigeria. Using the pairwise granger causality tests, the results showed that the causality between economic growth and industrial output, inflation rate and economic growth and also industrial output and inflation rate in Nigeria was uni-directional. It was recommended that, there is need for the government to initiate and pursue policies that will help stimulate private sector-driven industrialization in Nigeria and also high interest rate should be reviewed.

Mandara (2018) worked on the appraisal of the impact of industrialization on economic growth in Nigeria from 1981 to 2015. The data was analysed using augmented dickey fuller test, KwiatkowskiPhillips-Schmidt-Shinto, Zivot-Andrews mechanism to ascertain the stationarity of the variables and ARDL technique was also used for the regression analysis. The result of the ARDL regression showed that there is a positive and significant impact between industrial output and gross domestic product. The result of the Bound test showed that the study variables were co integrated in the long run, meaning that the government should revive the key industries like the textile and steel industries.

Abdu and Bassey (2018) investigated the evaluation of the Nigerian industrial sector and economic growth in the face of sustainable development goals. The research used time series and secondary for the study covering the period of 1981 to 2016. Using stata to analyze the results, the study found that the industrial output has a positive effect on economic growth in Nigeria.

Enwerem and Gylych (2017) assessed the impact of industrialization on economic growth within ECOWAS Members' States. The study selected ten Economic Communities of West Africa States (ECOWAS) and member states within the period of 2000-2013. Namely; Republic of Nigeria, Benin Republic, Cabo Verde, Cote D'Ivoire, The Gambia, Ghana, Guinea-Bissau, Mali, Niger, and Senegal. The ordinary least square (OLS) technique was used for the analysis, revealing that industrialization has a negative impact on economic growth in Nigeria in the long run. Abubakar (2017) examined external financing and industrialization in Nigeria within the period of 1985 to 2016 using the Johansen co-integration test and error correction model for the data analysis. The study revealed that there is a negative relationship between external financing and industrialization in Nigeria, while foreign direct investment had a positive impact on industrial output.

Ogbonna and Uma (2017) worked on Re-strategizing Nigeria's industrialization and industrial policy for economic recovery in South Korea. The study showed industrialization strategy and policies adopted by Nigeria and South Korea over the years which made South Korea to rise from poverty status to a rich industrialized economy because of their successful execution of policies and strategies. The study found that South Korea industrialization strategy and policies began with sufficient reform of macroeconomic environment, infrastructural reforms, development of domestic machines, establishment of interdependent industries, great reliance on domestic resources for production, special manpower training and the government's determined aspiration to uplift the economy overshadowed every other motive which Nigerian approach could not adopt and apply. They recommended that industrialization strategy in Nigeria should involve the government, taking time to look inwards so as to develop indigenous technology and manpower and also, should guide against termination of industrial production due to lack of affordability of foreign raw materials, spare parts and required expatriate manpower.

Abdu and Anam (2018) evaluated the nexus between industrial sector and economic growth in Nigeria, quantitative research, time series and secondary data was used for the study over a period of 35 years from 1981 to 2016. The secondary data used, was extracted from the World Bank indicators. Stata software was used to analyze the data and the results revealed that industrial output has a positive effect on economic growth in Nigeria.

Momodu (2017) examined manufacturing sector indicator and economic growth in Nigeria. Through the use of empirical methods such as Exploratory data analysis (EDA), and a range of qualitative and quantitative data, the relationship between oil and GDP growth is studied to show the impact oil has had on the Nigerian economy since 1969. The findings of this research demonstrate there is a positive correlation between manufacturing sector indicator and GDP growth which is affected by a lack of diversification and the fluctuations in world oil price.

Ibitoye, Ogunoye and Kleynhans (2022) examine the impact of industrialization on economic growth in Nigeria. Employing the co integration techniques, the results show that industrialization is a significant driver of economic growth in Nigeria. Furthermore, Chukwu and Nduka (2022) explored the effect of the manufacturing sector on the economic development of Nigeria. Annual data from 1999 to 2021 were obtained from the statistical bulletin of the Central Bank of Nigeria and were used to test the effect of explanatory variables (average manufacturing capacity utilization, manufacturing production index, contribution of manufacturing sector to gross domestic product and foreign direct investment) on the dependent variable (human development index). The auto regressive distributed lag technique (ARDL) were employed to analyze the data and the result indicates that the manufacturing sector has an insignificant effect on the human development index in Nigeria. The study therefore recommends the need to encourage local production while investing in infrastructure like power, water, roads and transportation. The study also recommends the need for the manufacturing sector to have access to finance, also tax incentives should be given to manufacturers as this will encourage local investors and attract foreign investors.

2.4 Gap in Literature

This study provides an up-to-date comprehensive and disaggregated analysis of five key industrial subsectors (manufacturing industry, mining and quarrying industry, construction industry, electricity, gas, steam and air-conditioning industry, and water supply, sewage and waste management sectorMAN, MAQ, CON, EGA and WSE), it also made use of modern econometric techniques (ARDL) which is capable of distinguishing both short run and long run effects. Clear policy insights based on the individual performance of each subsector, rather than the industrial sector as a single block was considered.

3. Research Methods

3.1 Theoretical Framework

This study is hinged on the Cobb Douglas Production theory, which is also known as the Cobb-douglas production function. The theory was developed by Charles W. Cobb (a mathematician) and Paul H. Douglas (an economist) in 1928. It provides insights into the determinants of long run economic growth and also emphasizes the role of capital accumulation, labour or population growth and technological progress.

When applied to the industrial sector, the theory helps to analyze how the different industrial subsectors contribute to Nigeria's economic growth. The Cobb Douglas production theory conforms to the basic properties of production theories and suits the nature of growth of the real sectors (Castiglione, 2012). It is thought to be a plausible way of characterizing many real-world production processes and it is often used by economists to study issues related to input productivity or production costs (Hajkova & Hurnik, 2007). It explains the functional relationship between inputs used in production and the resulting output. It is widely applied in economics to analyse productivity, efficiency and growth.

The theory assumes, diminishing marginal returns to each input, substitutability between capital and labour, competitive factor markets and technology captured by parameter A remains constant in the short run. For empirical analysis, the function is transformed into a linear form using logarithms, this allows researchers to estimate the elasticities using regression analysis. As a theoretical framework, the Cobb–Douglas model provides a structured explanation of how input variables determine output. It helps to examine the contribution of different factors to productivity, measure efficiency, analyse growth patterns and determine returns to scale.In applied research, capital and labour can be replaced with context specific variables. The Cobb–Douglas theory offers a clear analytical foundation for examining how input factors influence output. Its mathematical simplicity and empirical usefulness make it a strong theoretical base for productivity and performance related studies.

The popularity of this function is due to the fact, it is amenable to mathematical manipulations and it satisfies the restrictions imposed on production function. These restrictions are: (1) both inputs are essential for production such that no output can be produced without using at least some of both inputs; (2) The marginal product of each input is positive (3) the marginal product diminishes with increased use of each of the inputs; (4) The marginal product of an input increases with increased use of the other input (Husain & Islam, 2016).

The function can be generalised in the case of 'n' factors of production. The unknown parameters, α and β in the function can be easily computed. The parameters α and β measure the responsiveness of output to changes in capital and labour. For example, if α is 0.4, a one percent increase in capital will increase output by 0.4 percent, holding labour constant. The sum of α and β determines returns to scale:
If $\alpha + \beta = 1$, there are constant returns to scale.
If $\alpha + \beta > 1$, there are increasing returns to scale.
If $\alpha + \beta < 1$, there are decreasing returns to scale.

The Cobb-Douglas production function is expressed quantitatively as:

$$Q = AK^{\alpha}L^{\beta} \quad (3.1)$$

Where Q is output and L, K are inputs of labor and capital respectively. A is Total factor productivity or technology level, α is Output elasticity of capital while β is Output elasticity of labour.
A, a and b are positive parameters where $\alpha > 0, \beta > 0$. The equation tells that output depends directly on L and K and that part of output which cannot be explained by L and K is explained by A which is the 'residual', often called technical change. Although the Cobb - Douglas production function is a multiplicative type and is non-linear in its general form, it can be transformed logarithmic form.

$$\text{Log } Q = \log A + \alpha \log L + \beta \log K \quad (3.2)$$

The Cobb-Douglas production is adapted in its log - linear form from equation (3.2) and it is specified in stochastic form as:

$$ln_{it} = \beta_0 + \beta_1 lnK_{it} + \beta_2 lnL_{it} + u_{it} \quad (3.3)$$

Where y = output of quoted real industrial sector, K = capital input of real sector, L = labour input of real sector, ln = natural logarithm, $\beta_0 - \beta_2$ are unknown parameters to be estimated, i = individual firms, t = time dimension, u = the stochastic term errors. Equation (3.3) is used in this study to calculate the impact of changes in the inputs such as industrial infrastructure on economic growth in Nigeria.

3.2 Model Specification

The empirical model of Kida and Angahar (2020) was adapted for the study. In their study, they examined the contribution of industrialization to the economic growth in Nigeria, where GDP is specified as a function of crude petroleum and natural gas, manufacturing, labour force, solid mineral and interest rate. This is shown in equation [3.4]:

GDP=F (PNG, MAN, SOM, LF, INTR) (3.4)

Where GDP is Gross Domestic Product, PNG is petro and natural gas, MAN is manufacturing industry, SOM is solid mineral industry, LF is labour force and INTR is interest rate.
For the purpose of this study, the model of Kida and Angahan (2020) was strictly modified by adding
Mining and quarrying (MAQ), electricity, gas, steam and air conditioning (EGA), water supply, sewage and waste management (WSE) and construction industry (CON) on economic growth.
GDP was replaced with GDPGR (GDP growth rate). The functional form of the equation is given below as:

GDPR =F (MAQ, MAN, CON, EGA, WSE, INTR) (3.5)

The structural form of the model is shown in equation (3.6)

$$GDPR = \alpha_0 + \alpha_1 MAQ + \alpha_2 MAN + \alpha_3 CON + \alpha_4 EGA_t + \alpha_5 WSE_t + \alpha_6 INTR_t + u_t \quad (3.6)$$

From equation (3.6), a natural log was introduced to the series measured in monetary terms to reduce the large values. The transformed equation is given as:

$$GDPGR = \alpha_0 + \alpha_1 l_{og} MAQ + \alpha_2 l_{og} MAN + \alpha_3 l_{og} CON + \alpha_4 \log EGA_t + \alpha_5 \log WSE_t + \alpha_6 INTR_t + u_t \quad (3.7)$$

The apriori expectation requires that $\alpha_1 - \alpha_5 > 0$ while $\alpha_6 < 0$
Where;
GDPGR =Gross Domestic Product Growth Rate (%)
MAN=Manufacturing sector (in billion)
MAQ=Mining and Quarrying sector (in billion)
CON=Construction sector (in billion)
EGA= Electricity, gas, steam and air conditioning sector (in billion)
WSE= Water supply, sewage and waste management (in billion)
INTR=Interest rate (%)
α_0 = Constant
α_1- α_6 are coefficients estimated
l_{og} =Natural logarithm
u_t = Error term

The ARDL model and the inclusion of the Error Correction mechanism for equation (3.7) in logarithm form is expressed as follows:

$$\Delta GDPR_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta GDPR_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta \ln(MAQ)_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta In(MAN)_{t-i} + \sum_{i=0}^{p} \alpha_4 \Delta In(CON)_{t-i}$$
$$+ \sum_{i=0}^{p} \alpha_5 \Delta In(EGA)_{t-i} + \sum_{i=0}^{p} \alpha_6 \Delta In(WSE)_{t-i} + \sum_{i=0}^{p} \alpha_7 \Delta In(INTR)_{t-i} + +\delta_1 (GDPGR)_{t-1} +$$
$$\delta_2 \ln(MAQ)_{t-1} + \delta_3 In(MAN)_{t-1} + \delta_4 In(CON)_{t-1} + \delta_5 In(EGA)_{t-1} + \delta_6 In(WSE)_{t-1} +$$
$$+ \delta_7 (INTR)_{t-1} + \beta ECM_{t-1} + \upsilon_t \qquad (3.8)$$

The coefficients from α_1 to α_7 represent the short-run coefficients whereas the coefficients from δ_1 to δ_7 represent the long-run coefficients of the ARDL model. Also, α_0 is the drift component, "p" is the maximum lag length while v_t is the stochastic error term. β is the coefficient of the error correction term (ECM) and it measures the speed of adjustment towards the long run equilibrium. The bound F-statistic test was used to check the existence of a stable, long-run relationship among the variables in the model. For instance, if the calculated F-statistic in equation (3.8) is greater than the appropriate upper bound critical values, the null hypothesis is rejected implying the existence of co-integration relationship. But if the value of the F-statistic is below the lower bound, the null cannot be rejected, indicating the absence of co-integration. Besides, if the F-statistic value lies within the lower and upper bounds, the results are considered inconclusive (Pesaran et al., 2001), if the bound test shows evidence of co-integration among variables specified for example as in equation (3.8).

3.3 Sources of Data

The data set was annual time series data which were sourced from the Central Bank of Nigeria Statistical Bulletin (2023) and the World Bank Development Indicators. The data set was collected for a period which spanned from 1996 to 2023.

3.4 Method of Data Analysis.

The Autoregressive Distributed Lag (ARDL) methodology developed by Pesaran & Shin (1999) and Pesaran et al. (2001) was used to investigate the long and short-run relationship among industrial subsector of mining and quarrying, manufacturing, electricity, gas, steam, and air conditioning, water supply, sewage, and waste management and construction industry and the growth of the Nigerian economy. The ARDL bound model has three advantages when compared with the Engle and Granger (1987) two-step method and Johansen and Juselius (1990) cointegration method. The ARDL method is applied to deal with the series having mixed stationary issues (i.e. the mixture of I(0) and I(1)). Hence, it relaxes the assumption that all series must be integrated in the same order. The next advantage is that the ARDL test is relatively more efficient in the case of small and finite sample data sizes. The method produced unbiased estimates of the long-run model (Harris & Sollis, 2003). The bounds test is a simple technique because it allows the co-integration relationship to be estimated by OLS once the lag order of the model is identified, unlike other multivariate co-integration methods. Furthermore, to determine the performance of the estimated model, RESET test, Serial correlation, normality and Heteroscedasticity tests were conducted, whereas the Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUM Q) of residual of the ARDL model test was conducted to verify the stability nature of the model.

4. Data Analysis and Interpretation of Results

4.1 Data Presentation

The study examines the impact of the industrial sector on Nigeria economic growth. The data for the model estimation are presented in appendix A. The data used includes: gross domestic product growth rate (GDPGR) proxy for economic growth which is the dependent variable while the explanatory variables are mining and quarrying industry (MAQ), manufacturing industry (MAN), construction industry (CON), electricity, gas, steam and air conditioning industry (EGA), water supply, sewage and waste management industry (WSE) and Interest rate (INTR).

4.2 Descriptive Statistics

This study commences its empirical analysis by examining the characteristics of the series used in the study. The descriptive statistics of the entire series is presented in Table 4.1.

Table 4.1: Descriptive Statistics for the Series

Date: 10/04/25
Time: 15:18
Sample: 1996 2023

	GDPGR	WSE	MAQ	MAN	INTR	EGA	CON
Mean	4.693214	140.1118	6453.624	7069.203	17.14750	478.8768	4060.789
Median	4.625000	40.35500	5390.250	3335.255	17.10000	169.0650	1427.220
Maximum	15.33000	933.3800	14866.30	28442.90	24.85000	2427.590	22142.59
Minimum	-1.790000	11.46000	433.2000	780.4800	11.48000	3.160000	59.22000
Std. Dev.	3.503282	221.7111	4848.050	8339.794	2.874225	629.7948	6035.677
Skewness	0.617849	2.278282	0.207540	1.591180	0.195702	1.671701	1.864417
Kurtosis	4.495534	7.651635	1.571143	4.314125	3.652234	5.054041	5.322047
Jarque-Bera	4.390836	49.46665	2.582911	13.83006	0.675040	17.96365	22.51213
Probability	0.111312	0.000000	0.274870	0.000993	0.713538	0.000126	0.000013
Sum	131.4100	3923.130	180701.5	197937.7	480.1300	13408.55	113702.1
Sum Sq. Dev.	331.3706	1327206.	6.35E+08	1.88E+09	223.0515	10709322	9.84E+08
Observations	28	28	28	28	28	28	28

***Source**: Author's computation*

The descriptive statistics in Table 4.1 gave the characteristics of the variables. These statistics provide useful insights into the central tendency, dispersion, and distributional properties of each variable over the study period. The key measures analyzed include the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and the Jarque–Bera test for normality. The analysis covers 28 annual observations.

The mean values indicate the average performance of each variable over the period under review. The average economic growth rate (GDPGR) in Nigeria stood at 4.69%, suggesting that the country experienced moderate economic expansion during the study period. The manufacturing sector (MAN) and mining and quarrying sector (MAQ) recorded mean outputs of ₦7,069.20 billion and ₦6,453.62 billion, respectively, indicating that both sectors made substantial contributions to Nigeria's industrial output. Similarly, the construction industry (CON) and the electricity, gas, steam and air-conditioning (EGA) sector had average outputs of ₦4,060.79 billion and ₦478.88 billion, respectively. In contrast, the water supply, sewage and waste management (WSE) sector had the lowest mean output of ₦140.11 billion, implying relatively lower investment and output levels in this component of the industrial sector. The interest rate (INTR) averaged 17.15%, which reflects the high cost of borrowing in Nigeria's financial system over the years.

Examining the median values shows that most variables are close to their respective means, indicating moderate symmetry in distribution for some sectors. However, substantial differences between the mean and median values, as observed in MAN (mean = 7,069.20; median = 3,335.26) and CON (mean = 4,060.79; median = 1,427.22), suggest the presence of a few exceptionally high values that raised the average, implying a positively skewed distribution. This is corroborated by the skewness coefficients. The maximum and minimum values reflect the range of fluctuations within each variable. Economic growth (GDPGR) varied between –1.79% and 15.33%, indicating that Nigeria experienced both economic recessions and expansions during the period. The manufacturing sector ranged from ₦780.48 billion to ₦28,442.90 billion, while the mining and quarrying sector fluctuated between ₦433.20 billion and ₦14,866.30 billion, suggesting wide variability in industrial performance. The construction industry exhibited an even broader spread, ranging from ₦59.22 billion to ₦22,142.59 billion, signifying strong growth in construction activities in certain years. Similarly, the EGA sector recorded significant variation from ₦3.16 billion to ₦2,427.59 billion, implying fluctuations in energy production and consumption. The interest rate ranged from 11.48% to 24.85%, highlighting notable variations in monetary policy and lending conditions during the period.

The standard deviation values reveal the degree of dispersion around the mean. The largest standard deviations are observed in MAN (₦8,339.79 billion), CON (₦6,035.68 billion), and MAQ (₦4,848.05 billion), indicating high variability in these sectors. In contrast, GDPGR (3.50) and INTR (2.87) show moderate variability, while WSE (221.71) and EGA (629.79) indicate relatively smaller but noticeable fluctuations. The high degree of dispersion in the industrial output variables reflects the instability often associated with Nigeria's industrial sector, which is sensitive to economic shocks, policy shifts, and global commodity price fluctuations. The skewness statistics indicate the symmetry of the data distribution. A perfectly symmetric distribution has a skewness value of zero. In this study, all the variables exhibit positive skewness, implying that their distributions are right-skewed, meaning that higher-than-average values are more frequent. Notably, WSE (2.278), CON (1.864), and EGA (1.672) are highly skewed, showing the presence of outlier years where output was significantly above average. This may reflect periods of expansion in infrastructure investment or sectoral reforms. The kurtosis values measure the peakedness of the data distribution. A normal distribution has a kurtosis value of 3. Values above 3 indicate a leptokurtic distribution, meaning the data are more peaked with heavy tails. In this analysis, all variables except MAQ (1.57) have kurtosis values greater than 3. Specifically, WSE (7.65), CON (5.32), and EGA (5.05) display high kurtosis, implying that these series are prone to extreme values, consistent with periods of strong sectoral booms and contractions.

The Jarque–Bera (JB) test assesses the normality of the data distribution. A probability value greater than 0.05 indicates normality, while a value below 0.05 suggests deviation from normality. The results show that GDPGR ($p = 0.111$), MAQ ($p = 0.275$), and INTR ($p = 0.714$) are normally distributed. However, WSE ($p = 0.000$), MAN ($p = 0.001$), EGA ($p = 0.0001$), and CON ($p = 0.00001$) deviate from normality, implying the presence of skewness and kurtosis in these variables. Nevertheless, given the sample size and the characteristics of macroeconomic data, mild departures from normality are not unusual and do not invalidate further econometric analysis.

4.3 Unit Root Test:

The Augmented Dickey–Fuller (ADF) unit root test was conducted to determine the stationarity properties of the variables used in the study. Stationarity is an essential prerequisite in time series analysis because using non-stationary data may lead to spurious regression results and unreliable inferences. The null hypothesis of the ADF test assumes the presence of a unit root, implying non-stationarity, while the alternative hypothesis suggests that the series is stationary. The test was carried out at both level and first difference, and the results are summarized in Table 4.2.

Table 4.2: Results of Augmented Dickey Fuller (ADF) Unit Root Test

Variable	ADF Calculated Value in Level	ADF Calculated Value at 1st Difference	Mckinnon 5% Critical Value	Order Of Integration
GDPGR	-3.0358*	-	-2.9763	1(0)
LOG(CON)	-0.4707	-4.3480*	-2.9810	1(1)
LOG(EGA)	-1.1562	-5.3809*	-2.9810	1(1)
INTR	-2.7181	-6.7357*	-2.9810	1(1)
LOG(WSE)	-6.1405*	-	-2.9763	1(0)
LOG(MAN)	-1.2429	-8.1521*	-2.9810	1(1)
LOG(MAQ)	-1.1491	-4.6002*	-2.9810	1(1)

Source: Regression Output using Eviews (2026)
*Significant at 5 per cent

The unit root results reported in Table 4.2 indicate that interest rate (INT), construction sector output (CON), electricity, gas, steam and air conditioning (EGA), manufacturing sector output (MAN), and mining and quarrying sector output (MAQ) are all stationary at first difference, that is, I(1). This is because their calculated Augmented Dickey-Fuller (ADF) statistics exceed the MacKinnon 5% critical values in absolute terms after first differencing. In contrast, water supply, sewage and waste management (WSE) and GDP growth rate are stationary at level, that is, I(0), since their ADF statistics at level are greater than the MacKinnon 5% critical values.

4.4. Lag Length Criteria

The next step is determining the appropriate lag. The lag-length selection criteria such as sequential modified LR test statistic (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hanna-Quinn information criterion (HQ) were employed to determine the appropriate lag length of the models. The test results of the different lag selection methods are reported in Table 4.3. After a meticulous examination of the different lag lengths by estimating the VAR at each lag length and diagnosing the whiteness of resulting residuals, two (2) lag lengths was recommended by Aikaike Information Criteria AIC statistic, was selected for the model.

Table 4.3: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDPGR LOG(MAN) LOG(MAQ) LOG(CON01) LOG(EGA) INTR LOG(WSE)
Included observations: 26

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-209.3048	NA	0.039714	16.63883	16.97755	16.73637
1	-57.17712	210.6383*	1.65e-05	8.705932	11.41568*	9.486241
2	19.20239	64.62882	5.38e-06*	6.599816*	11.68059	8.062895*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
Source: Regression Output using Eviews (2026)

4.5. Bounds Test for Co-Integration

The next step after determining the order of integration and lag length of the variables was to apply the bound F-test in order to establish the existences or otherwise of long-run relationship among the variables. The summary results of the bounds test for co-integration for the model is shown in Tables 4.5 alongside with critical values. The computed F-statistic from bound test for the models is 16.8959. These values exceed the upper bounds critical value of 3.28 at 5% significance level. This implies that the null hypothesis of no co-integration is rejected.

Table 4.4: Summary of ARDL Bound Test Results

Models	**Test statistic**	**Computed F-statistic**	**Lag**	**Significance level**	**Bound Critical values**	
					Lower Bounds I(0)	Upper Bounds I(1)
Model 1	F-statistic	16.8959	2	5%	2.27	3.28

Source: *Regression Output using Eviews (2026)*

4.6 Long Run Regression Results of the ARDL Model

The results of the estimated long-run coefficients using the ARDL approach are presented in Table 4.5. The models selected by AIC are (2,2,0,2,2,2,2).

Table: 4.5. Summary of the Long Run ARDL Regression Results

Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Prob.**
LOG(MAN)	0.1218*	0.0514	2.3685	0.0497
LOG(MAQ)	0.1758*	0.0374	4.6983	0.0022
LOG(CON)	0.4156*	0.0815	5.0993	0.0014
LOG(EGA)	0.1465*	0.0415	3.5281	0.0096
INTR	0.6557	0.1540	4.2584	0.0038
LOG(WSE)	-0.0295	0.0446	-0.6609	0.5298
C	3.0358	0.6363	4.7713	0.0020

Note: * is significant at 5% level of significance.
Source: Regression Output using Eviews (2026)

From Table 4.5, it can be observed that the coefficient of manufacturing industry (MAN) has a direct and significant impact on the growth of Nigeria's economy. One percent increase in MAN leads to a 0.1218 percent increase in the growth of the Nigerian economy. This is consistent with the apriori expectation. The variable is statistically significant with a probability value of 0.0497 and a T-value of 2.3685 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that the manufacturing industry has a significant impact on the growth of Nigeria's economy.

The coefficient of the mining and quarrying industry (MAQ) has a direct and significant impact on the growth of the Nigerian economy. One percent increase in MAQ leads to a 0.1758 percent increase in the growth of the Nigerian economy. This is consistent with the apriori expectation. The variable is statistically significant with a probability value of 0.0022 and a T-value of 4.6983 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that the mining and quarrying industry has a no significant impact on the growth of Nigeria's economy.

The coefficient of the Construction industry (CON) is positively signed which indicates that a direct relationship exists between the construction industry and Nigeria's economic growth. This is consistent with the apriori expectation. The value of the coefficient is 0.4155, which implies that a one percent increase in (CON) leads to a 0.4155 percent increase in Nigeria's economic growth. The coefficient of the variable is significant at a 5 percent level of significance with a probability value of 0.0014 and a T-value of 5.0993 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis, and conclude that the construction industry has a significant impact on the growth of the Nigerian economy. This result supports the fact that in the long run, increase in the construction industry will contribute to the growth of the Nigerian economy. This finding is in line with Okoye, Mbakwe and Igbo (2018) who showed that the construction sector has a direct impact on the Nigerian economy.

The results revealed that the coefficient of electricity, gas, steam and air conditioning industry (EGA) is positively signed which indicates that a direct relationship exists between EGA and Nigeria's economic growth. This is consistent with the apriori expectation. The value of the coefficient is 0.1465, which implies that a one percent increase in (EGA) leads to a 0.1465 percent increase in Nigeria's economic growth when other regressors are held constant. The coefficient of the variable is significant at a 5 percent level of significance with a probability value of 0.0096 and a T-value of 3.5281 which is greater than critical value of 2.167. Thus, the null hypothesis is rejected, and concludes that, the electricity, gas, steam and air conditioner industry variable has a significant impact on the growth of the Nigerian economy in the long run.

The coefficient of water supply, sewage and waste management sector (WSE) is negatively signed which indicates that an inverse relationship exists between water supply, sewage and waste management industrial sector and Nigeria's economic growth. The value of the coefficient is -0.0295, which implies that a one percent increase in (WSE) leads to a 0.0295 percent decrease in Nigeria's economic growth. The coefficient of the variable is insignificant at a 5 percent level of significance with a probability value of 0.5298 and a T-value of 0.6609 which is less than the critical value of 2.167. Thus, we fail to reject the null hypothesis, and conclude that water supply, sewage and waste management industrial sector has no significant impact on the growth of the Nigerian economy.

The coefficient of interest rate (INTR) is positively signed. This shows that the variable has a direct relationship with the growth of Nigeria's economy. The value of the coefficient is 0.6557 which implies that a one percent increase in INTR leads to a 0.6557 per cent increase in the growth rate of Nigeria's economy in the long run. The variable is statistically significant with a probability value of 0.0038 and a T-value of 4.2584 which is greater than the critical value of 2.167. Thus, we reject the null hypothesis that interest rate as a macroeconomic policy variable has significant impact on the growth of Nigeria's economy. This is in line with Ademola, Alalade, Ogbebor and Aworinde (2023) who concluded that interest rate is a significant factor influencing real GDP growth in Nigeria. Therefore, maintaining a stable lending rate is one of the basic requirements for developing countries to attain high level of economic growth.

4.7 Short Run Estimation of the ARDL Model

In order to capture the short run deviations that might have occurred in estimating the long run co-integration equation, a dynamic parsimonious error correction estimate is reported in Table 4.7.

Table 4.6: Summary of Short Run Estimations of the ARDL model

Variable	Coefficient	Standard Error	t-Statistic	Prob.
GDPGR(-1)	-0.5069*	0.0708	-7.1572	0.0002
DLOG(MAN)	0.0200*	0.0060	3.3131	0.0129
DLOG(MAN(-1))	-0.0203*	0.0050	-2.9084	0.0227
DLOG(MAQ)	0.0300*	0.0081	3.7075	0.0013
DLOG(CON01)	0.0155	0.0215	0.7220	0.4937
DLOG(CON(-1))	-0.0913*	0.0213	-4.2819	0.0036
DLOG(EGA)	0.0600*	0.0085	7.0533	0.0002
DLOG(EGA(-1))	0.0194*	0.0082	2.4020	0.0473
DLOG(INTR)	0.0376	0.0265	1.4204	0.1985
DLOG(INTR(-1))	-0.1604*	0.0334	-4.7963	0.0020
DLOG(WSE)	-0.1076*	0.0360	-2.9903	0.0202
DLOG(WSE(-1))	-0.0973*	0.0388	-2.5072	0.0406

ECM(-1)	-0.6794*	0.0413	-16.4414	0.0000
R-squared		0.9750		
Adjusted R-squared		0.95553		
Durbin – Watson stat		1.9398		

Note: * is significant at 5% level of significance.
Source: Regression Output using Eviews (2026)

Table 4.7 indicates that the model demonstrates a very high explanatory power, with an R-squared value of 0.9750, indicating that approximately 97.5% of the variations in Nigeria's economic growth are explained by changes in the included industrial sectors and interest rate. The adjusted R-squared (0.9555) confirms that the model remains robust even after adjusting for degrees of freedom. Furthermore, the Durbin–Watson statistic of 1.9398 suggests the absence of significant autocorrelation, confirming the reliability of the regression estimates.

The results revealed that the coefficient of the manufacturing Sector (MAN) is 0.0200 with a t-statistic of 3.3131 and a probability value of 0.0129, which is statistically significant at the 5% level. This implies that a one percent increase in manufacturing output leads to a 0.02 percent increase in economic growth in the short run which is consistent with the long run findings. However, the lagged term DLOG(MAN(-1)) = -0.0203 (p = 0.0227) indicates a negative adjustment from the previous period, suggesting that short-term shocks in manufacturing output tend to stabilize after a lag.
The mining and quarrying sector has a positive and significant effect on economic growth, with a coefficient of 0.0300 (t = 3.7075, p = 0.0013). This implies that a 1% rise in mining and quarrying activities increases GDP growth by 0.03%, highlighting the sector's immediate contribution to Nigeria's industrial and overall economic performance. While the contemporaneous effect of construction (DLOG(CON01) = 0.0155) is positive but not statistically significant (p = 0.4937). However, the lagged value DLOG(CON(-1)) = -0.0913 (p = 0.0036) is significant and negative, indicating that while short-term construction activities do not immediately influence growth, previous expansions may generate temporary costs or adjustments that negatively affect GDP growth in subsequent periods.

The coefficient of electricity, gas, steam and air conditioning industry (EGA) exhibits a strong positive relationship with GDP growth. The coefficient for DLOG(EGA) is 0.0600 (t = 7.0533, p = 0.0002), indicating that a 1% increase in this sector's output results in a 0.06% rise in GDP growth. The lagged term DLOG(EGA(-1)) = 0.0194 (p = 0.0473) is also positive and significant, emphasizing that both current and previous increases in electricity and gas output foster economic expansion. This underscores the critical role of energy supply in driving industrial productivity and overall growth. The water supply, sewage and waste management (WSE) both the current (DLOG(WSE) = -0.1076, p = 0.0202) and lagged (DLOG(WSE(-1)) = -0.0973, p = 0.0406) coefficients are negative and statistically significant. This suggests that an expansion in the WSE sector, possibly reflecting higher public expenditures without corresponding efficiency gains, may temporarily reduce economic growth in the short run. The results imply inefficiencies or non-productive investments in this sector during the study period.

The immediate effect of the interest rate (DLOG(INTR) is 0.0376, p = 0.1985 is positive but insignificant, implying that short-term changes in interest rates may not immediately affect growth. However, the lagged interest rate (DLOG(INTR(-1)) = -0.1604, p = 0.0020) is significantly negative, suggesting that higher interest rates in the previous period tend to suppress economic growth. This aligns with theoretical expectations that elevated interest rates increase borrowing costs and reduce investment. The error correction term (ECM(-1)) has a coefficient of -0.6794 (t = -16.4414, p = 0.0000), which is highly significant and carries the expected negative sign. This indicates that approximately 67.9% of short-run disequilibrium from the previous period is corrected within one year. In essence, the model quickly adjusts back to the long-run equilibrium after a shock, reflecting a strong level of economic stability and the capacity of Nigeria's industrial structure to recover from short-term fluctuations. The ARDL regression results reveal that manufacturing, mining and quarrying, and electricity, gas, steam and air-conditioning sectors exert positive and significant short-run impacts on Nigeria's economic growth. In contrast, the construction and water supply sectors show mixed or negative short-run influences, suggesting possible inefficiencies in these industries. In addition, the interest rate exerts a lagged negative effect on growth, emphasizing the importance of monetary policy management to stimulate investment. The significant and negative ECM term further confirms the existence of a long-run equilibrium relationship between industrial output and economic growth in Nigeria, with a relatively rapid speed of adjustment.

4.8 Diagnostic statistical testing

The results of the ARDL estimation for the model are subjected to statistical diagnostic tests. The diagnostic test results is reported in Table 4.7.

Table 4.7: Diagnostic Tests on the ARDL Estimated

Purpose of test	Test	Test statistic	Probability	Conclusion
Normality	Jarque-Bera	0.7465	0.6885	Normal
Heteroscedasticity	Breusch–Pagan-Godfrey Heteroskedasticity Test	1.4419	0.3231	No heteroscedasticity
Serial correlation	Breusch–Godfrey serial correlation LM test	2.4260	0.1835	No serial correction
Ramsey RESET	Model Specification fitness	0.5580	0.5970	Correctly Specified

Source: *Author's Compilation with Information from Regression Output (2026)*

From Table 4.7, the tests as captured by Jarque-Bera, Breusch-Godfrey LM test, Breusch–Pagan-Godfrey Heteroskedasticity and Ramsey RESET test among others, revealed the fitness of the estimated equation results and the desired properties of an econometric model. The diagnostic tests confirm the suitability of the estimated model. Thus, the model residual series are normally distributed as suggested by the Jarque–Bera statistic, while the Breusch–Godfrey LM test statistics indicate that the model does not have significant serial correlation problem. Moreover, the Breusch–Pagan-Godfrey test show that the residuals are homoscedastic and the model has correct functional form while Ramsey RESET test shows that the ARDL models are correctly specified.

4.9 Stability Test

Stability test was also performed using Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUM Q) of residual of the ARDL model. The results are shown in Figure 4.1 and 4.2

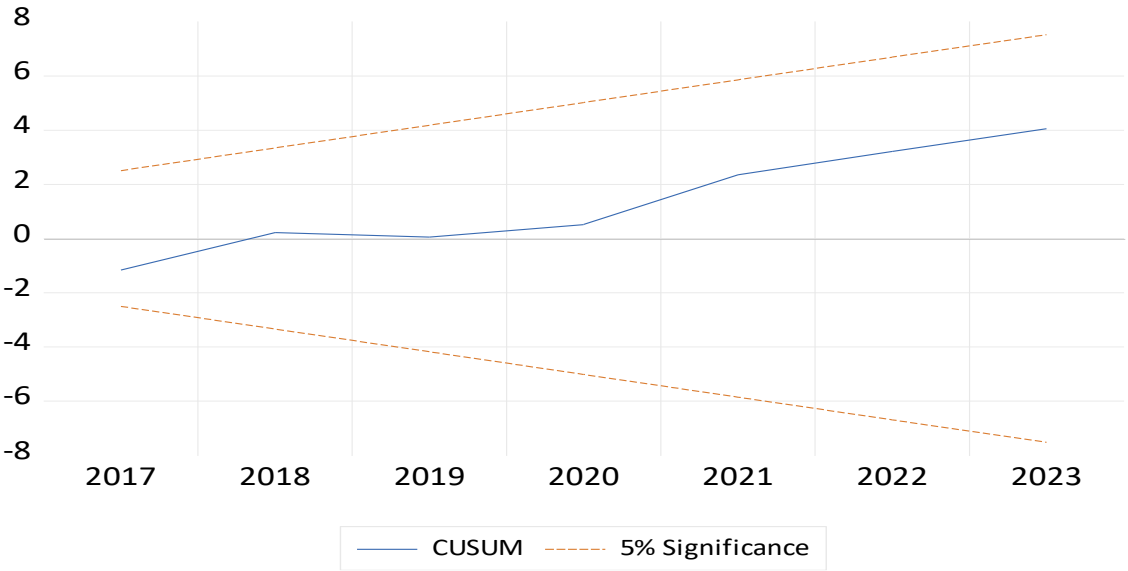

Figure 4.1: Plot of Cumulative Sum of Recursive Residual for the ARDL Model

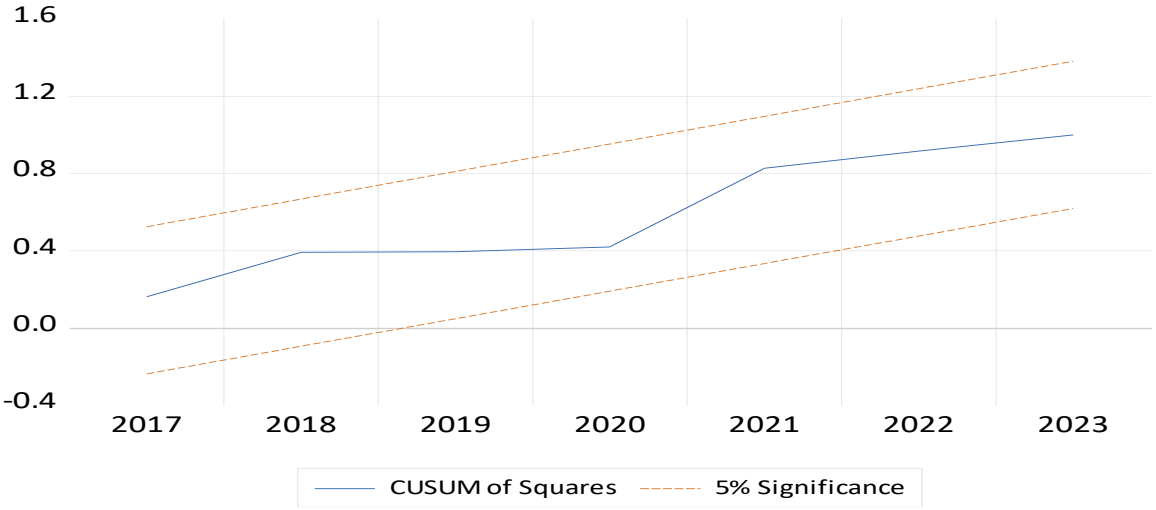

Figure 4.2: *Plot of Cumulative Sum of Square of Recursive Residual for the ARDL Model*

The existence of model stability is established if the Cumulative Sum of the residual goes outside the area between the critical (dotted bounded) lines. It is estimated at a 5 per cent critical level. From Figures 4.1 and 4.2 it can be inferred that the ARDL model at a 5 per cent level of significance has been stable over time.

5. Conclusion and Policy Recommendations

5.1 Conclusion

The study examined the impact of the industrial sector on Nigeria's economic growth using annual time series data from 1996 to 2023. The industrial sector was disaggregated into five key components; manufacturing (MAN), mining and quarrying (MAQ), construction (CON), electricity, gas, steam and air-conditioning (EGA), and water supply, sewage and waste management industry (WSE) while interest rate (INTR) served as a macroeconomic control variable. Economic growth, proxied by Gross Domestic Product Growth Rate (GDPGR), was the dependent variable. The study employed descriptive statistics, the augmented dickey Fuller (ADF) unit root test, Bounds cointegration test, and the autoregressive distributed lag (ARDL) estimation technique to capture both the long-run and short-run dynamics among the variables. Based on the empirical evidence obtained, the study concludes that industrial sector development significantly drives economic growth in Nigeria in both the short and long run. Specifically, the construction, manufacturing, mining and quarrying, and electricity and gas sectors exert strong positive impacts on GDP growth, while water supply and waste management sector shows an inverse and significant relationship in the long run but significant in the short run. The positive and significant coefficients of the key industrial sectors imply that improvements in industrial capacity utilization, infrastructure development, and access to energy are essential pathways for achieving sustainable economic growth. The speed of adjustment (ECM) further indicates that deviations from equilibrium are quickly corrected, signifying the robustness of the long-run relationship between industrialization and growth. Therefore, the study reinforces the Classical and Keynesian arguments that industrialization remains the engine of economic transformation, and that sustained industrial expansion is a prerequisite for long-term growth and development in Nigeria.

5.2 Recommendations

Based on the findings and conclusion of the study, the following recommendations are advocated:

The government should promote manufacturing diversification by prioritizing industrial policies that encourage local production and stable power supply, as this will enhance productivity and value addition within the manufacturing sector.

The mining and quarrying sector should be reformed through strengthened policies that promote transparency, environmental standards, and technology adoption, while incentivizing private investment and addressing security challenges to boost the sector's growth impact.

The government should increase investment in infrastructure and construction, to stimulate employment, enhance productivity, and create multiplier effects across other sectors of the economy.

There should be sustainable investment in the energy sector, especially in electricity generation and gas distribution, to expand energy access, reduce production costs, and promote industrialization and foreign investment.

To address inefficiencies, the government should enhance the efficiency of the water supply, sewage and waste management sector by promoting public-private partnerships that improve service delivery, resource management, and recycling systems.

Finally, the Central Bank of Nigeria should maintain a stable and moderate interest rate regime to stimulate private sector investment, enhance credit accessibility, and sustain macroeconomic stability.

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