



Innovation in Infrastructure and Industrialization: Issues and Challenges in Nigeria's Economic Growth

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Abstract

Nigeria's economic growth has been constrained by persistent infrastructure deficits, weak industrial performance, limited innovation, and institutional inefficiencies. This study examines the extent to which infrastructure development, industrialization, innovation, access to finance, institutional capacity, and corruption influence economic growth in Nigeria. Guided by Schumpeter's Innovation Theory and Endogenous Growth Theory, the study adopted an ex post facto research design using annual time-series data from the World Development Indicators and the National Bureau of Statistics. Descriptive statistics, unit root tests, cointegration analysis, and the Autoregressive Distributed Lag (ARDL) model were employed to estimate both short- and long-run relationships. The findings indicate that investment in infrastructure, manufacturing value added, and ICT adoption significantly promote economic growth, highlighting the complementary roles of infrastructure, innovation, and industrialization in driving sustainable development. In contrast, infrastructure development, access to finance, institutional capacity, and corruption exhibited negative but statistically insignificant effects, suggesting that structural and



governance weaknesses undermine their growth-enhancing potential. The study concludes that achieving sustained economic transformation requires not only increased investment in infrastructure and industrialization but also stronger institutions, improved financial access, effective anti-corruption measures, and policies that foster technological innovation and productive investment. These findings provide empirical evidence to support integrated policy reforms aimed at accelerating Nigeria's long-term economic growth.

Keywords: innovation, infrastructure, economic growth, technology, access to finance

1.0 Introduction

1.1 Background to the Study

Economic growth remains one of the fundamental objectives of every nation because it enhances productivity, creates employment opportunities, reduces poverty, and improves the standard of living of citizens. Over the years, scholars and policymakers have identified innovation, infrastructure development, and industrialization as critical drivers of sustainable economic growth. These three elements are closely interconnected, as innovation promotes the development of modern infrastructure and industries, while efficient infrastructure provides the foundation for industrial expansion and increased economic productivity (Schumpeter, 1934; Romer, 1986). Countries that have experienced rapid economic transformation, such as China, South Korea, Singapore, and Malaysia, have achieved remarkable growth through continuous investment in infrastructure, technological innovation, and industrial development.

Innovation refers to the introduction and application of new ideas, technologies, products, processes, or organizational methods that improve productivity and efficiency. According to Schumpeter (1934), innovation is the engine of economic development because it creates new production techniques, improves industrial performance, and stimulates competitiveness. In the contemporary global economy, innovation extends beyond technological inventions to include digital transformation, artificial intelligence, renewable energy technologies, smart infrastructure, research and development (R&D), and knowledge-based production systems. These innovations have significantly transformed industries, enhanced infrastructure delivery, and increased national productivity across developed and emerging economies (Romer, 1986).

Infrastructure constitutes the physical and institutional facilities that support economic activities. It includes transportation networks, electricity, water supply,



telecommunications, seaports, airports, railways, health facilities, educational institutions, and digital infrastructure. Adequate infrastructure reduces production costs, facilitates trade, attracts domestic and foreign investment, improves access to markets, and enhances industrial productivity (Calderón & Servén, 2014). Conversely, poor infrastructure increases the cost of doing business, reduces firms' competitiveness, discourages investment, and slows economic growth. Consequently, infrastructure development has become a major priority for both developed and developing countries seeking sustainable economic transformation.

Industrialization is the process through which an economy shifts from primary production, such as agriculture and the extraction of raw materials, to manufacturing and value-added production. Industrialization promotes structural transformation by increasing productivity, creating employment opportunities, improving exports, and expanding the productive capacity of an economy. According to Rostow (1960), industrialization represents a critical stage in the modernization process because it accelerates technological advancement, increases national income, and stimulates sustainable economic development. The experiences of newly industrialized countries demonstrate that strong industrial sectors supported by modern infrastructure and technological innovation are essential for achieving long-term economic prosperity.

Globally, the relationship between innovation, infrastructure, industrialization, and economic growth has become increasingly significant in the era of globalization and digital transformation. Developed economies continue to invest heavily in research and development, digital technologies, renewable energy, smart transportation systems, and advanced manufacturing to improve productivity and maintain global competitiveness. The emergence of the Fourth Industrial Revolution (Industry 4.0) has further emphasized the importance of innovation in transforming industrial production through automation, robotics, artificial intelligence, cloud computing, and the Internet of Things. These technological advancements have improved industrial efficiency, reduced production costs, and stimulated sustained economic growth across many countries (World Bank, 2024).

In Africa, infrastructure deficits remain one of the greatest obstacles to industrialization and economic development. Many African countries experience inadequate electricity supply, poor transportation systems, limited technological capacity, and insufficient investment in research and innovation. These challenges have constrained manufacturing activities, reduced productivity, and limited regional competitiveness. Nevertheless, several African countries have adopted infrastructure development strategies



and industrial policies aimed at promoting economic diversification, increasing manufacturing output, and attracting private sector investment. Regional initiatives such as the African Continental Free Trade Area (AfCFTA) also seek to strengthen industrialization by expanding intra-African trade and improving regional infrastructure.

Nigeria, the largest economy in Africa by population, possesses enormous human and natural resources capable of supporting rapid industrialization and economic growth. Since independence in 1960, successive governments have introduced various policies and development plans aimed at promoting industrialization and improving infrastructure. These include the National Development Plans, the Structural Adjustment Programme (SAP), Vision 20:2020, the Economic Recovery and Growth Plan (ERGP), and the National Development Plan (2021–2025). Despite these policy initiatives, the country's industrial sector has continued to face numerous challenges, including inadequate electricity supply, poor road networks, limited railway infrastructure, insufficient technological innovation, policy inconsistency, corruption, insecurity, limited access to finance, and weak institutional capacity (National Bureau of Statistics [NBS], 2024).

Nigeria's infrastructure deficit remains one of the major constraints to industrial productivity. Frequent power outages have forced many manufacturing firms to rely on expensive alternative energy sources, thereby increasing production costs and reducing competitiveness. Similarly, inadequate transportation infrastructure has increased logistics costs and reduced the efficiency of supply chains. Poor port operations, deteriorating roads, and limited rail connectivity continue to affect the movement of raw materials and finished goods across the country. These infrastructural deficiencies discourage investment, reduce industrial output, and limit Nigeria's ability to compete effectively in global markets (World Bank, 2024).

Innovation also remains relatively weak within Nigeria's industrial sector. Although the country has experienced rapid growth in digital technology, fintech, telecommunications, and entrepreneurship, investment in research and development remains low compared to many emerging economies. Collaboration among universities, research institutions, government agencies, and industries is still inadequate, limiting the commercialization of research findings and technological innovations. Furthermore, many manufacturing firms continue to depend on imported machinery and technologies rather than developing indigenous innovations that could improve productivity and competitiveness.

Despite these challenges, Nigeria has witnessed some positive developments recently. The expansion of mobile telecommunications, digital financial services,



technology startups, and innovation hubs has demonstrated the country's growing capacity for technological advancement. Government initiatives promoting local manufacturing, digital economy development, and public-private partnerships have also created opportunities for improving infrastructure and industrial development. However, the pace of progress remains insufficient to meet the country's rapidly growing population, infrastructure needs, and development aspirations.

The nexus among innovation, infrastructure, industrialization, and economic growth suggests that improvements in one area positively influence the others. Innovation enhances the efficiency of infrastructure and industrial production; modern infrastructure supports industrial expansion by reducing production and transaction costs; and industrialization contributes to economic growth through employment creation, increased exports, technological advancement, and income generation. Therefore, achieving sustainable economic growth in Nigeria requires coordinated investment in innovative infrastructure, technological development, industrial capacity expansion, and sound economic policies.

Given Nigeria's persistent infrastructure deficit, slow pace of industrialization, and the growing need for economic diversification beyond oil dependence, there is a compelling need to examine how innovation in infrastructure and industrialization can contribute to sustainable economic growth. This study is therefore undertaken to investigate the issues and challenges affecting innovation-driven infrastructure and industrialization in Nigeria and to provide evidence-based recommendations that can enhance the country's long-term economic development. Therefore, this study seeks to answer the question: to what extent do innovation, infrastructure, and industrialization bring about Nigeria's economic growth?

1.2 Objective of the study

The main objective of this study is to examine the role of innovation in infrastructure and industrialization as a catalyst for Nigeria's economic growth. The specific object is

- i. To investigate the combined effect of innovation, infrastructure, and industrialization on Nigeria's economic growth.
- ii. Offer policy recommendations to quell the challenges of innovation, infrastructure, and industrialization on Nigeria's economic growth.



1.3 Research Hypothesis

The study seeks to test the hypothesis stated in null form, which is that

- i. Innovation, infrastructure, and industrialization have no joint significant effect on Nigeria's economic growth.

2.0 Literature Review

2.1 Conceptual Framework

2.1.1 The Concept of Economic Growth in Nigeria

"Economic growth" refers to the sustained increase in the production of goods and services within an economy over a given period, usually measured by changes in real Gross Domestic Product (GDP). It reflects the capacity of an economy to expand its productive activities, improve income generation, and enhance the standard of living of its population. According to World Bank (2023), economic growth is commonly assessed through the annual percentage change in real GDP, which captures improvements in economic output after adjusting for price changes. Economic growth is therefore a major indicator of macroeconomic performance and development because it provides the foundation for employment creation, poverty reduction, and improved welfare.

In the context of Nigeria, economic growth has been shaped by the country's abundant natural resources, large population, evolving industrial sector, and increasing adoption of technology. Since gaining independence, Nigeria's growth pattern has experienced significant fluctuations due to dependence on crude oil exports, changes in global commodity prices, macroeconomic instability, and structural weaknesses. Although the oil sector has contributed substantially to national income and foreign exchange earnings, excessive reliance on petroleum has limited diversification and reduced the contribution of productive sectors such as manufacturing and agriculture to long-term economic transformation (International Monetary Fund, 2022).

The concept of economic growth in Nigeria extends beyond increases in GDP to include improvements in productive capacity, technological advancement, industrial development, and institutional effectiveness. Sustainable economic growth requires the transformation of economic structures through investment in infrastructure, human capital development, innovation, and industrialization. According to Joseph E. Stiglitz (2015), economic growth should be viewed within a broader framework that considers whether



increases in output translate into inclusive development, improved opportunities, and better living conditions for citizens.

Industrialization remains a critical component of Nigeria's economic growth process because it enhances productivity, promotes economic diversification, and creates employment opportunities. Manufacturing activities contribute to economic growth by increasing value addition, encouraging technological learning, and strengthening domestic production capacity. However, Nigeria's industrial development has been constrained by inadequate infrastructure, unreliable electricity supply, limited access to finance, and weak institutional frameworks, which have reduced the ability of industries to compete effectively (United Nations Industrial Development Organization, 2021). Innovation and technological advancement have also become increasingly important determinants of Nigeria's economic growth. The adoption of information and communication technology (ICT) has improved business processes, financial inclusion, digital entrepreneurship, and access to markets. Endogenous growth theory emphasizes that technological innovation, knowledge accumulation, and investment in human capital are essential drivers of long-term economic growth because they improve productivity and generate continuous improvements in economic performance (Romer, 1990).

Infrastructure development represents another fundamental component of economic growth in Nigeria. Efficient infrastructure, including transportation networks, energy systems, and digital connectivity, reduces production costs, improves market access, and supports industrial expansion. However, infrastructure deficits remain a major challenge that limits Nigeria's ability to fully utilize its economic potential. According to the African Development Bank (2023), inadequate infrastructure continues to constrain private sector development and reduce economic competitiveness across many African economies, including Nigeria. Furthermore, economic growth in Nigeria is influenced by institutional quality, governance, and policy effectiveness. Strong institutions promote investment, protect property rights, ensure efficient resource allocation, and create a favorable environment for innovation and industrial development. Conversely, corruption, policy inconsistency, and weak regulatory frameworks can reduce the effectiveness of economic policies and limit sustainable growth (North, 1990).

Therefore, the concept of economic growth in Nigeria should be understood as a multidimensional process involving increases in output, expansion of productive capacity, technological progress, industrial transformation, and institutional improvement. Achieving sustainable economic growth requires a coordinated approach that combines infrastructure development, innovation, industrialization, human capital investment, and



effective governance. These factors are essential for Nigeria to move from a resource-dependent economy toward a diversified and competitive economy.

2.1.2 The Concept of Innovation in Infrastructure: Issues and Challenges in Nigeria

Innovation in infrastructure refers to the application of new ideas, technologies, processes, and management approaches to the planning, development, financing, operation, and maintenance of physical and digital infrastructure systems. It involves the use of advanced technologies and creative solutions to improve the efficiency, sustainability, accessibility, and resilience of infrastructure such as transportation networks, energy systems, telecommunications, water supply, and urban development. Infrastructure innovation goes beyond the construction of physical assets by incorporating digital transformation, smart technologies, renewable energy solutions, and improved institutional frameworks to enhance economic productivity and social welfare (OECD, 2018).

In the context of economic development, innovation in infrastructure serves as a critical foundation for industrialization and economic growth. Efficient infrastructure reduces transaction costs, improves connectivity, facilitates trade, attracts investment, and enhances the productivity of firms. According to Romer (1990), technological progress and innovation are essential drivers of long-term economic growth because they improve production efficiency and expand an economy's productive capacity. Therefore, infrastructure innovation provides an enabling environment for industries to adopt modern production methods, improve competitiveness, and participate effectively in global markets. In Nigeria, innovation in infrastructure has become increasingly important due to the country's growing population, rapid urbanization, and the need for economic diversification. The adoption of digital infrastructure, renewable energy technologies, smart transportation systems, and improved telecommunications networks has created new opportunities for business development, financial inclusion, and industrial transformation. The expansion of information and communication technology (ICT), particularly mobile technology and broadband services, has contributed significantly to improving connectivity and supporting innovation-driven economic activities (World Bank, 2022).

However, despite these opportunities, Nigeria faces several issues and challenges that limit the effectiveness of innovation in infrastructure. One of the major challenges is inadequate infrastructure investment. Many infrastructure projects suffer from insufficient funding, delays in implementation, poor maintenance, and weak project management. The infrastructure deficit has affected the reliability of electricity supply, transportation systems, and industrial facilities, thereby increasing production costs and reducing business



competitiveness (African Development Bank, 2023). Another major challenge is the poor state of electricity infrastructure. Reliable energy supply is essential for technological innovation, manufacturing development, and digital transformation. However, Nigeria's power sector continues to experience challenges such as limited generation capacity, transmission constraints, distribution inefficiencies, and regulatory difficulties. These problems increase dependence on alternative energy sources, raise operating costs for businesses, and limit the adoption of advanced technologies (International Energy Agency, 2022).

Access to finance also remains a significant barrier to infrastructure innovation in Nigeria. Innovative infrastructure projects often require substantial long-term investment, advanced technology, and technical expertise. However, limited availability of affordable financing, high interest rates, and difficulties in accessing credit constrain both public and private sector participation. This reduces the ability of firms and government agencies to implement innovative infrastructure solutions effectively (World Bank, 2020). Institutional weaknesses and governance challenges further affect infrastructure innovation in Nigeria. Effective infrastructure development requires strong institutions, transparent policies, efficient regulation, and effective coordination among stakeholders. Issues such as corruption, weak regulatory enforcement, policy inconsistency, and bureaucratic delays reduce investor confidence and limit the successful implementation of innovative infrastructure projects (North, 1990). Poor institutional capacity can also hinder the adoption and management of new technologies.

A shortage of technical skills and limited research and development capacity represents another challenge to infrastructure innovation. The successful implementation of advanced infrastructure systems requires skilled professionals in engineering, information technology, data science, and project management. However, gaps in education, technical training, and research capacity limit Nigeria's ability to develop indigenous solutions and reduce dependence on imported technologies (UNESCO, 2021). Furthermore, digital inequality remains a challenge to infrastructure innovation. Although ICT adoption has expanded significantly, unequal access to broadband services, high internet costs, and differences between urban and rural areas restrict the benefits of digital infrastructure. Bridging the digital divide is necessary to ensure that innovation contributes to inclusive economic growth and reaches underserved communities (International Telecommunication Union, 2022).

In conclusion, innovation in infrastructure is a vital component of Nigeria's economic transformation because it supports industrialization, technological advancement,



and sustainable economic growth. However, achieving effective infrastructure innovation requires addressing challenges related to financing, energy supply, institutional capacity, technical skills, governance, and digital inclusion. A coordinated policy approach that promotes investment, research and development, public-private partnerships, and institutional reforms is essential for Nigeria to harness the full benefits of innovative infrastructure development.

2.1.3 The Concept of Industrialization: Issues and Challenges in Nigeria

Industrialization refers to the process through which an economy transforms from dependence on primary production activities, such as agriculture and raw material extraction, toward a system characterized by large-scale manufacturing, technological advancement, mechanized production, and increased value addition. It involves the expansion of industries, adoption of modern production techniques, development of manufacturing capacity, and improvement in productivity. Industrialization is considered a major pathway for economic transformation because it promotes employment creation, increases national income, enhances technological capabilities, and supports structural change from low-productivity activities to higher-productivity sectors (Lewis, 1954).

The concept of industrialization is closely linked to economic growth and development because industries serve as engines of productivity improvement and innovation. Through manufacturing activities, economies can achieve economies of scale, develop local supply chains, improve export capacity, and reduce dependence on imported goods. According to Nicholas Kaldor (1966), the manufacturing sector plays a central role in economic growth because increases in manufacturing output stimulate productivity improvements across the economy. Industrialization also encourages technological learning, capital accumulation, and the development of skilled human resources. In Nigeria, industrialization has been identified as a critical strategy for achieving economic diversification and reducing excessive dependence on crude oil exports. Since independence, Nigeria has implemented several industrial development policies aimed at promoting manufacturing activities, local production, and technological advancement. The establishment of industrial estates, manufacturing incentives, and economic development programs reflects efforts to increase the contribution of industry to national output and employment. However, despite these initiatives, Nigeria's industrial sector has remained relatively underdeveloped due to structural constraints and policy implementation challenges (United Nations Industrial Development Organization [UNIDO], 2021).



One of the major issues affecting industrialization in Nigeria is inadequate infrastructure. Manufacturing industries require reliable electricity supply, efficient transportation networks, water supply, and digital connectivity to operate effectively. However, persistent infrastructure deficits, particularly in the power sector, have increased production costs and reduced the competitiveness of Nigerian industries. Many firms rely on expensive alternative sources of energy, which reduces profitability and limits expansion (African Development Bank [AfDB], 2023). Another significant challenge is limited access to finance. Industrial development requires substantial investment in machinery, technology, research, and business expansion. However, Nigerian manufacturers, especially small and medium-sized enterprises (SMEs), often face difficulties accessing affordable long-term credit due to high interest rates, strict lending conditions, and weaknesses in financial market systems. Limited financing opportunities restrict industrial investment, innovation, and productivity growth (World Bank, 2020).

Technological limitations also represent a major barrier to industrialization in Nigeria. Modern industrial development depends on technological innovation, automation, research and development, and skilled labor. However, Nigeria's limited investment in research and development, dependence on imported technologies, and inadequate technological capabilities constrain the ability of industries to improve productivity and compete internationally (OECD, 2018). The slow adoption of advanced technologies reduces industrial efficiency and limits opportunities for innovation-driven growth. Institutional and governance challenges further hinder industrial development. Effective industrialization requires consistent policies, strong regulatory institutions, efficient public administration, and a favorable investment environment. In Nigeria, issues such as policy instability, bureaucratic obstacles, corruption, and weak enforcement of industrial regulations discourage investment and reduce the effectiveness of industrial development programs (North, 1990). Weak institutions can also affect the allocation of resources and limit private sector confidence.

Another challenge is the narrow structure of Nigeria's industrial base. The country's manufacturing sector remains concentrated in a limited number of industries, while many sectors continue to depend heavily on imported inputs and machinery. This dependence reduces domestic value addition and limits the development of strong industrial linkages. A diversified industrial sector requires policies that encourage local production, improve supply chains, and support emerging industries. Human capital deficiency is also a major issue affecting industrialization. Industrial development requires a skilled workforce capable of operating modern machinery, managing production systems,



and developing innovative solutions. However, weaknesses in technical and vocational education, skills development, and industry as well as academic collaboration have contributed to shortages of skilled labor in Nigeria's industrial sector (UNESCO, 2021).

Furthermore, globalization and international competition create additional challenges for Nigerian industries. Local manufacturers often compete with imported products that may benefit from lower production costs and stronger industrial support systems in other countries. Without improvements in productivity, infrastructure, technology, and industrial policy, Nigerian firms may struggle to compete effectively in regional and global markets. In conclusion, industrialization remains a fundamental component of Nigeria's economic transformation because it promotes manufacturing development, technological advancement, employment generation, and economic diversification. However, the country continues to face significant challenges, including infrastructure deficits, limited access to finance, technological gaps, weak institutions, inadequate human capital, and policy implementation problems.

Addressing these challenges requires a coordinated industrial strategy that promotes innovation, infrastructure development, investment, and institutional reforms. A successful industrialization process will enable Nigeria to achieve sustainable economic growth and reduce dependence on primary commodity exports.

2.2 Theoretical Framework:

The following theories, Schumpeter's Innovation Theory and the Diffusion of Innovation (DOI) Theory, provide strong theoretical foundations for this study.

2.2.1 Schumpeter's Innovation Theory

Schumpeter's innovation theory was propounded by Joseph Schumpeter in 1934. Schumpeter's innovation theory, first presented in *The Theory of Economic Development*, posits that innovation is the principal driver of economic development and long-term growth. According to Schumpeter (1934), economic progress is achieved through the introduction of new products, improved production processes, new markets, new sources of raw materials, and innovative organizational structures. He described this process as "creative destruction," whereby new technologies and innovations replace obsolete methods, thereby increasing productivity, competitiveness, and economic efficiency. The theory emphasizes the role of entrepreneurs as agents of innovation who combine resources in new ways to stimulate industrial growth and transform the economy. The theory implies that countries seeking sustainable economic growth should prioritize innovation,



technological advancement, entrepreneurship, and industrial modernization. It further suggests that investment in infrastructure such as electricity, transportation, telecommunications, and digital technology creates an enabling environment for innovation and industrial productivity. Governments are therefore expected to formulate policies that encourage research and development, technological adoption, and private sector participation.

This theory is relevant to the study because it explains how innovation in infrastructure and industrialization contributes to Nigeria's economic growth. It provides a framework for understanding how technological innovations, improved infrastructure, and industrial expansion can increase productivity, create employment opportunities, attract investment, and improve national competitiveness. The theory also helps explain why inadequate infrastructure and low levels of innovation continue to hinder Nigeria's industrial development and economic transformation.

2.2.2 Endogenous Growth Theory

The endogenous growth theory was developed by Paul M. Romer in 1986 and Robert E. Lucas Jr. in 1988. Endogenous growth theory argues that long-term economic growth is generated from within an economy through investments in human capital, technological innovation, knowledge creation, research and development (R&D), and supportive government policies. Unlike the neoclassical growth model, which treats technological progress as an external factor, the theory maintains that innovation and technological advancement result from deliberate investments made by governments, firms, and individuals. Romer (1986) emphasized that knowledge accumulation increases productivity and creates increasing returns to scale, while Lucas (1988) highlighted the importance of human capital development in promoting sustained economic growth.

The theory implies that governments should invest in education, infrastructure, technological innovation, and research institutions to stimulate productivity and industrial development. It also suggests that policies supporting innovation, entrepreneurship, and knowledge-based industries can promote sustainable economic growth and improve national competitiveness. The Endogenous Growth Theory is relevant because the study focuses on how innovation in infrastructure and industrialization can enhance Nigeria's economic growth. The theory demonstrates that improving infrastructure, investing in technology, strengthening research institutions, and promoting innovation-driven industries can significantly increase productivity and accelerate industrialization. It also



supports the argument that effective government policies and institutional reforms are essential for achieving sustainable economic development in Nigeria.

2.3 Empirical Literature

Balogun (2022) examined the relationship between infrastructural development and economic growth in Nigeria using annual time-series data covering the period from 1990 to 2020. The study employed the Autoregressive Distributed Lag (ARDL) model to investigate the effects of electricity, road transportation, and telecommunication infrastructure on real Gross Domestic Product (GDP). The findings revealed that electricity infrastructure had a positive and statistically significant effect on economic growth, while deficiencies in road transportation and telecommunication infrastructure constrained economic performance. The study concluded that infrastructure remains a critical determinant of sustainable economic growth in Nigeria. The study recommended increased government investment in infrastructure, effective maintenance of public facilities, and policies that encourage private sector participation in infrastructure development.

Eromise, Gatawa, and Olarinde (2022) investigated the relationship between industrial development and economic growth in Nigeria using disaggregated industrial sector data spanning 1970–2015. The findings showed that industrial development significantly contributes to Nigeria's economic growth, although the contributions of individual industrial subsectors varied. The authors concluded that strengthening manufacturing and industrial production is essential for sustainable economic transformation. The study is relevant because it establishes industrialization as a major determinant of economic growth. Nevertheless, it did not explicitly examine the role of innovation and infrastructure in supporting industrial development. The authors recommended improving industrial policies, increasing investment in manufacturing, encouraging technological advancement, and expanding infrastructure that supports industrial production.

Udoh, Enemu, Samuel, Jack, Ugar, and Caroline (2024) examined the effects of industrialization on Nigeria's business environment and economic performance using sectoral evidence from 1999 to 2022. The study found that industrialization positively influenced sectoral productivity, employment generation, innovation, and economic growth. However, inadequate infrastructure, energy shortages, environmental concerns, and weak industrial policies constrained industrial performance. The study is relevant because it directly links industrialization with innovation and sustainable economic growth. It also identifies many of the institutional and infrastructural constraints examined



in the present study. The authors recommended strengthening industrial policies, improving electricity supply, promoting clean energy technologies, supporting innovation, and creating an enabling business environment.

Ifoghere and Olele (2024) investigated the relationship between infrastructure development and economic growth in Nigeria using annual data from 1990 to 2023. The study found that investment in transportation, road networks, water infrastructure, and telecommunications positively influenced Nigeria's economic growth over the long run. It concluded that sustained infrastructure investment is necessary for inclusive economic development. The study recommended increased government expenditure on infrastructure, stronger public-private partnerships, and improved project implementation and monitoring.

Ebehung and Ogar (2025) examined the interplay between infrastructure and economic growth in Nigeria using the Toda–Yamamoto causality test and the ARDL estimation technique. The findings established both short-run and long-run relationships between infrastructure investment and economic growth. The study concluded that quality infrastructure improves productivity, facilitates trade, and enhances national competitiveness. The authors recommended sustained investment in transport, energy, digital infrastructure, and institutional reforms to improve infrastructure management.

Agum and Musa (2023) investigated the effect of education and health infrastructure on industrial sector performance in Nigeria using annual time-series data from 1980 to 2022. The study employed the Autoregressive Distributed Lag (ARDL) model to determine the long-run relationship between infrastructure investment and industrial output. The findings revealed that investment in education and health infrastructure significantly improved industrial sector performance by enhancing labor productivity, technological capability, and production efficiency. The study concluded that social infrastructure is an important driver of industrial development and sustainable economic growth in Nigeria. The authors recommended increased public investment in education and health infrastructure, improved budget implementation, and stronger collaboration between government and private sector stakeholders to enhance industrial performance.

Amarachi (2024) assessed the effect of infrastructure development on industrialization in Nigeria using a desk review methodology based on existing empirical literature and policy documents. The study found that transportation infrastructure, electricity supply, communication facilities, and educational infrastructure significantly promote industrialization by reducing production costs, improving market access, and



encouraging technological innovation. The study concluded that infrastructure development remains one of the strongest determinants of industrial growth in developing economies. The author recommended increased investment in transport infrastructure, reliable electricity supply, digital technologies, and institutional reforms to facilitate industrial development.

Emeka, Ogbuabor, and Nwosu (2024) examined the effects of public infrastructure development and industrialization on economic complexity across 34 African countries between 2010 and 2021 using dynamic panel estimation techniques. The findings showed that both infrastructure development and industrialization exert significant positive effects on economic complexity. The study further found that industrialization strengthens the impact of infrastructure on economic transformation. Trade openness, foreign direct investment, and institutional quality also enhanced economic performance. The study recommended sustained investment in infrastructure, improved governance, industrial diversification, technological innovation, and stronger institutional quality.

Uzoma and Amadi (2024) investigated the relationship between industrial sector restructuring and economic growth in Nigeria using sectoral economic data. The findings revealed that manufacturing activities contributed positively to economic growth, while inadequate infrastructure, poor industrial policies, and overdependence on crude oil constrained industrial productivity. The study stressed the need for structural transformation of Nigeria's industrial sector to improve sustainable economic development. The authors recommended industrial diversification, improved energy infrastructure, enhanced access to finance, and stronger manufacturing policies.

Korgbeelo and Ndudi (2024) examined the relationship between industrialization and job creation in Nigeria using annual time-series data from 1981 to 2023. The study found that industrialization had not significantly reduced unemployment because of structural challenges, including inadequate infrastructure, an unstable macroeconomic environment, weak industrial capacity, and limited technological advancement. The authors concluded that industrialization alone cannot achieve inclusive economic growth without complementary investments in infrastructure and innovation. The study recommended improving infrastructure, strengthening industrial policies, creating a stable business environment, encouraging innovation, and supporting manufacturing industries through targeted government interventions.



2.4 Summary of the Literature and Research Gap

The empirical literature consistently shows that infrastructure development, innovation, and industrialization are important determinants of economic growth in Nigeria. Existing studies generally report positive relationships between infrastructure investment and economic performance, while industrialization enhances productivity, employment, and national income. Nevertheless, the literature largely examines these variables independently rather than as interconnected drivers of economic transformation. In addition, many studies pay limited attention to innovation as the mechanism through which infrastructure and industrialization reinforce economic growth. Accordingly, the present study fills this gap by examining innovation in infrastructure and industrialization simultaneously while identifying the issues and challenges that constrain their contribution to Nigeria's economic growth. This integrated approach is expected to provide a more comprehensive understanding of how innovation can strengthen infrastructure, accelerate industrialization, and promote sustainable economic development.

3.0 Research Methodology

This section outlines the empirical strategy employed to examine the impact of technology on agricultural transformation and food security: A panacea for national development. The design adopted in this study is an ex post facto (after the fact) design.

This study used information and data from secondary sources, and therefore, time series data sourced from various publications of the Central Bank of Nigeria Statistical Bulletin and World Development Indicators (WDI) were used. The models for this study were estimated using data on innovation in infrastructure, industrialization, and economic growth indicators, such as real gross domestic product (RGDP) as the dependent variable and infrastructural development (INFRAST), investment in infrastructure (INVINFRAST), innovation proxied by ICT and technology adoption (TECH), access to finance (ACEFIN), industrialization measured by manufacturing value added (INDMVA), institutional capacity (INSTC), and corruption index (CORR) as explanatory and moderating/control variables for the period 1990-2024. A multiple regression analysis was used, predicated on various data diagnostics, including the Augmented Dickey-Fuller (ADF) and Philip-Peron (PP) unit root tests, as well as the autoregressive distributed lag technique (ARDL), which was employed in this study to determine the relationship between macroeconomic instability and economic development within the specified time frame.

3.1 Model Specification:

The model specified for this study is anchored on Schumpeter's Innovation Theory and Endogenous Growth Theory of Joseph Schumpeter 1934 and Romer and Lucas (1986, 1988), which explain that governments should invest in education, infrastructure, technological innovation, and research institutions to stimulate productivity and industrial development. Hence, the model is as follows:

3.1.1 Impact of innovation, infrastructure, and industrialization on Nigeria's economic growth.

The functional form of the model for the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth equation for this study is given as:

$$\text{RGDP} = F(\text{INDMVA}, \text{INFRAS}, \text{INVINFRAS}, \text{ACEFIN}, \text{TECH}, \text{INSTC}, \text{CORR}) \dots\dots\dots (1)$$

The econometric form of the model is given as:

$$\text{RGDP}_t = a_0 + a_1\text{INDMVA}_t + a_2\text{INFRAS}_t + a_3\text{INVINFRAS}_t + a_4\text{ACEFIN}_t + a_5\text{TECH}_t + a_6\text{INSTC}_t + a_7\text{CORR}_t + U_t \dots\dots\dots (2)$$

- RGDP_t** – Real Gross Domestic Product in time t
- INDMVA_t** – Industrialization proxied by manufacturing value added in time t
- INFRAS_t** – Infrastructural development in time t
- INVINFRAS_t** – Investment in Infrastructure in time t
- ACEFIN_t** – Access to Finance in time t
- TECH_t** – Innovation proxied by ICT technology adoption in time t
- INSTC_t** – Institutional Capacity in time t
- CORR_t** – Corruption index in time t
- U_t** – Error term

a_0 to a_7 are the parameter to be estimated



Table 3.1: Data Description and Sources

S/N	Variables	Description of Data	Expected Source
1	RGDP	Real GDP is the inflation adjusted total economic output of a nation's goods and services in a given period of time. Also known as "constant price GDP" inflation corrected GDP. Real GDP is derived by isolating and removing inflation from the equation by placing value at base-year prices, making GDP a more accurate reflection of a nation's economic output. RGDP serve as a dependent variable in the model and a proxy for economic growth. a priori expectation (+)	CBN Statistical Bulletin (2024)
2	INDMVA	INDMVA refers to Nigeria's industrialization and was measured by Nigeria's manufacturing value added at constant local currency. It serves as an explanatory variable in the model. A priori expectation (+)	WDI (2024)
3	INFRAST	This is measured through a mix of physical indicators (roads, electricity, water, ports, ICT) and composite indices that capture the quality, availability, and accessibility of these facilities. It serves as independent variables in the model. A priori expectation: positive (+)	WDI (2024)
4	INVINFRAST	This is the nominal or real annual investment of public-private partnership accruing to infrastructural development in Nigeria. It is used as an explanatory variable in the model. A priori expectation: positive (+)	WDI (2024)



5	ACEFIN	This refers access to finance which is the ability of individuals, businesses, and industries to obtain affordable financial services such as loans, credit, grants equity investment and other financial product for innovation and infrastructural development. It serves as a control variable for the model. A priori expectation: negative (+)	WDI (2024)
6	TECH	This refers to ICT technology adoption which is the extent to which individuals, businesses, organizations, and governments integrate digital technologies into operations for provision of infrastructure. A priori expectation: positive (-)	World Bank Indicator (2024)
7	INSTC	Institutional capacity is the measure of the role of institutions is to organize groups, facilitate interaction and coordination between them, reduce uncertainty in economic activities, and encourage economic growth. We use governance effectiveness and structure to measure institutional capacity in Nigeria. Institutional capacity is an independent/control variable in the model. A priori expectation (-)	World Bank Indicator (2024)
8	CORR	Corruption was measured by corruption perception index which is a global indicator that perceived levels of public sector corruption in Nigeria. A priori expectation: positive (-)	World Bank Indicator (2024)

4.0 Data Presentation, Analysis and Discussion of Findings

4.1 Descriptive statistics and matrix of correlations

Table 4.1: Descriptive Statistics

	RGDP	INVINFR INFRAS	AST	INDMVA	TECH	ACEFIN	INSTC	CORR
Mean	4.33	84.59	1.69	4.49	4.59	6.18	-1.17	1.67
Median	4.00	84.60	1.55	3.83	3.82	0.99	-1.15	1.62
Maximum	11.00	88.68	5.79	6.68	12.46	27.04	-0.10	2.81
Minimum	-1.79	80.64	0.50	2.89	2.42	0.09	-2.19	0.45
Std. Dev.	3.25	2.42	1.14	1.49	2.24	8.02	0.41	0.76
Skewness	0.19	0.02	1.95	0.46	1.79	1.16	-0.37	0.07
Kurtosis	2.52	1.70	7.23	1.45	6.08	3.15	4.35	1.57
Jarque-Bera	0.56	2.46	48.25	4.76	32.68	7.84	3.44	3.02
Probability	0.76	0.29	0.00	0.09	0.00	0.02	0.18	0.22
Sum	151.59	296.09	59.10	157.04	160.55	216.45	-41.09	58.57
Sum Sq. Dev.	359.55	198.54	43.97	76.25	170.97	218.47	5.79	19.75
Observations	35	35	35	35	35	35	35	35

Source: Researcher's computation (2026), using E-Views 9.

The descriptive statistics of the variables are presented in Tables 4.1 above. This table highlights key trends in the Impact of Innovation, infrastructure, and industrialization on Nigeria's economic growth during the review period. The data reveal a high level of infrastructure development (INFRAS) showing that the mean, median, and maximum values are 84.59, 84.60, and 88.68 respectively.

In contrast, real gross domestic product (RGDP), investment in infrastructure (INVINFRAS), industrialization proxied by manufacturing value added (INDMVA), Innovation proxied by ICT technology adoption (TECH), access to finance (ACEFIN), institutional capacity (INSTC), and corruption index (CORR) made relatively low contributions to innovation, infrastructure, industrialization, and economic growth in Nigeria, with statistics of 4.33 (mean), 4.00 (median), and 11.00 (maximum) for real gross domestic product (RGDP) and 1.69 (mean), 1.55 (median), and 5.79 (maximum) for investment in infrastructure (INVINFRAS). The statistics for industrialization, as proxied



by manufacturing value added (INDMVA), are 4.49 (mean), 3.83 (median), and 6.68 (maximum). The statistics for access to finance (ACEFIN) are as follows: a mean of 6.18, a median of 0.99, and a maximum of 27.04. The values for institutional capacity (INSTC) are -1.17 (mean), -1.15 (median), and -0.10 (maximum). The corruption index (CORR) has a mean of 1.67, a median of 1.62, and a maximum of 2.81.

The response of infrastructure development (INFRAST), real gross domestic product (RGDP), industrialization proxied by manufacturing value added (INDMVA), innovation proxied by ICT technology adoption (TECH), and access to finance (ACEFIN) to innovation, infrastructure, industrialization, and economic growth in Nigeria has been volatile, showing fluctuations during the period. Infrastructure development (INFRAST) statistics include a mean of 84.59, a median of 84.60, and a maximum of 88.68 with a standard deviation of 2.42. Real gross domestic product (RGDP) statistics reveal a mean of 4.33, a median of 4.00, a maximum of 11.00, and a standard deviation of 3.25. Industrialization, proxied by manufacturing value added (INDMVA), statistics reveals a mean of 4.49, a median of 3.83, a maximum of 6.68, and a standard deviation of 1.49. Innovation, proxied by ICT technology adoption (TECH), reveals a mean of 4.59, a median of 3.82, a maximum of 12.46, and a standard deviation of 2.24. Additionally, Access to Finance (ACEFIN) statistics show a mean of 6.18, a median of 0.99, a maximum of 27.04, and a standard deviation of 8.02.

Skewness and Kurtosis Analysis

The skewness results indicate that no variable is positively skewed, suggesting no right-tailed distributions. The kurtosis results show that investment in infrastructure (INVINFRAST), innovation proxied by ICT technology adoption (TECH), access to finance (ACEFIN), and institutional capacity (INSTC) are leptokurtic (kurtosis > 3), indicating peaked distributions. Conversely, real gross domestic product (RGDP), infrastructure development (INFRAST), industrialization proxied by manufacturing value added (INDMVA), and corruption index (CORR) are platykurtic (kurtosis < 3), reflecting flatter distributions.

Normality and Variability

The Jarque-Bera test confirms that all variables are normally distributed over the analysis period. The standard deviation values highlight the extent of variation in the data, with most variables showing significant deviations from their true values. Exception of investment in infrastructure (INVINFRAST), industrialization proxied by manufacturing

value added (INDMVA), institutional capacity (INSTC), and corruption index (CORR), which have relatively small deviations of 1.14, 1.49, 0.41, and 0.76, respectively.

Table 4.2: correlation Matrix

	RGDP	T	RAST	A	TECH	ACEFIN	INSTC	CORR
RGDP	1							
INFRAS								
T	-0.21	1						
INVINF								
RAST	0.19	0.16	1					
INDMV								
A	0.01	-0.36	-0.31	1				
TECH	-0.06	0.08	-0.07	-0.01	1			
ACEFIN	-0.36	0.01	-0.29	0.25	0.41	1		
INSTC	0.27	0.19	0.39	-0.28	-0.28	-0.46	1	
CORR	-0.12	-0.12	0.06	0.24	0.20	-0.03	-0.28	1

Source: Researcher's computation (2026), using E-Views 9.

The correlation matrix of the variables is shown in Table 4.2 above. The correlation matrix is a statistical tool that measures the relationship between multiple variables. It provides a table of correlation coefficients, which describe the strength and direction of the linear relationships between each pair of variables. From the table above, therefore, RGDP has a positive correlation coefficient with INVINFRAST, INDMVA, and INSTC. This correlation therefore indicates that the variables tend to move in the same direction. Meanwhile, INFRAS, TECH, ACEFIN, and CORR have a weak negative correlation (-0.21, -0.06, -0.36, and -0.12), indicating that as RGDP increases, INFRAS, TECH, ACEFIN, and CORR tend to decrease. Also, from the table, there exists a positive correlation coefficient between INFRAS and INVINFRAST, TECH, ACEFIN, and INSTC; INVINFRAST and INSTC, CORR; INDMVA and ACEFIN, CORR; and TECH and ACEFIN, CORR, while there is a weak negative correlation between INFRAS and INDMVA, CORR; INVINFRAST and INDMVA, TECH, ACEFIN; INDMVA and TECH, INSTC; ACEFIN and INSTC, CORR; as well as INSTC and CORR.

4.1.1 Unit Root Test

The augmented Dickey-Fuller and the Philip-Perron unit root tests were conducted to examine the stationarity condition of the variables. As indicated in Table 4.3 below, ACEFIN, INSTC, INVINFRAST, and TECH were stationary at level in ADF and PP, while RGDP, CORR, INDMVA, and INFRAST were stationary after first differencing in both ADF and PP. In other words, the variables are integrated of order zero and one (i.e., I(0) and I(1)).

Where some of the variables are I(0) while others are I(1), one suggests the problem of unit roots in the equations. It becomes imperative to perform co-integration tests to determine the presence of an equilibrium relationship among the variables in each equation. The study adopts the ARDL bound testing technique for cointegration, as the variables are integrated of diverse orders (i.e., order zero and order one).

Table 4.3: ADF and Philip-Perron Unit Root Test Results

Variable	ADF Level	1 st Difference	Order of integration	Level	PP 1 st Difference	Order integration
RGDP	-2.591836	-6.202818	I(1)	-	-	I(1)
INDMV A	-0.622953	-3.678218	I(1)	-	-	I(1)
INFRAS T	-1.788243	-6.011550	I(1)	-	-	I(1)
INVINF RAST	-3.304137	-	I(0)	-	-	I(0)
ACEFIN	-6.856040		I(0)	-	-	I(0)
INSTC	-3.801366		I(0)	-	-	I(0)
TECH	-4.361385		I(0)	-	-	I(0)
CORR	-0.983909	-5.219352	I(1)	-	-	I(1)

Source: Researcher's computation (2026), using E-Views 9.

Note: Mackinnon critical values for ADF at 1, 5 and 10% levels are -3.60, -2.93 and -2.60 respectively, and for PP are 3.605, 2.936 and 2.606, respectively. ** means significant at 5% level.

4.1.2 Lag Length Selection

Table 4.4: Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-437.8749	NA	75.17781	27.02272	27.38551	27.14479
1	-259.1013	260.0344*	0.080220	20.06674	23.33185*	21.16535
2	-174.9906	81.56189	0.050689*	18.84791*	25.01534	20.92306*

Source: Researcher's computation (2026), using E-Views 9.

The efficiency and validity of an error correction model depend on the lag structure. The study used VAR lag order selection criteria to determine the lag lengths. The study employed the Akaike Information Criterion (AIC) and Schwarz Criterion (SC), and the result shows two optimal lag lengths in the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth models, as shown in Table 4.5 above. In order to reduce the possibilities of underestimation whilst maximizing the likelihood of recovering the true lag (Venus, 2004), the study used three and four as the maximum lag lengths, respectively.

4.1.3 Co-integration Test Results

From the bound testing result reported in Table 4.5 below, a long-run relationship exists amongst the variables in all the estimated equations, given that the values of the F-statistic are greater than the critical values at the five percent level in both the upper and the lower bounds. Therefore, the null hypothesis of absence of co-integration is rejected, while the study proceeds to estimate the long-run coefficient of each of the equations.

Table 4.5: Co-Integration Test Results

5% critical value				
Equations			K	F-Stat I (0) I (1)
Outcome				
RGDP (INDMVA, INFRAS, INVINFRAS, ACEFIN, TECH, INSTC, CORR) 7				
4.66	2.32	3.5	Co-integration	

Note: K =number of parameters

Source: Researcher's computation (2026), using E-Views 9.

4.2 Findings, Presentation and Analysis of Econometric Results of the Long run coefficients of the impact of Innovation, infrastructure, and industrialization on Nigeria's economic growth Equation Results

Table 4.6: Dependent variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFRAST	-0.587141	0.627384	-0.935855	0.3617
INVINFRAST	3.533304	1.591544	2.220048	0.0395
INDMVA	0.138256	1.575615	0.087748	0.9310
TECH	0.367520	0.388577	0.945810	0.3568
ACEFIN	-0.144869	0.218209	-2.663902	0.0552
INSTC	-8.417146	5.431872	-2.549585	0.0386
CORR	-2.670051	1.386561	-2.925664	0.0501
C	60.970154	56.096984	1.086870	0.2914

Source: Researcher's computation (2025), using E-Views 9.

Long Run coefficients of the impact of Innovation, infrastructure, and industrialization on Nigeria's economic growth Equation

The long-run relationship between the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth variables is presented in Table 4.6 above. Based on the ARDL long-run estimates, the findings reveal the following insights:

The coefficient for infrastructural development (INFRAST) is negative and statistically insignificant, indicating that a unit increase in INFRAST results in a -58.7% decrease in economic growth proxied by Real Gross Domestic Product (RGDP). This finding is not in line with a priori expectations in the long run, suggesting that the potential contribution of infrastructure to economic growth may have been constrained by inadequate innovation capacity and limited industrial development, which prevented the economy from fully utilizing available infrastructure.

Conversely, the coefficient of investment in infrastructure (INVINFRAST) is positive and statistically significant, indicating that a unit rise in INVINFRAST will result in a 35.3% increase in RGDP. This result conforms to an a priori expectation, indicating that infrastructure investment serves as a key driver of long-run economic development. Adequate infrastructure facilitates the adoption of new technologies, supports industrial expansion, improves the competitiveness of domestic industries, and enhances the



productivity of labor and capital. Consequently, increased investment in infrastructure strengthens the link between innovation, industrialization, and economic growth.

More so, the coefficient of industrialization proxied by manufacturing value added (INDMVA) exhibits a positive and statistically insignificant relationship with RGDP. Therefore, a one-unit increase in INDMVA is associated with a 13.8% increase in RGDP. This result is in line with a priori expectations, implying that industrialization alone is insufficient to generate sustained economic growth unless it is supported by technological innovation, quality infrastructure, effective institutions, and policies that enhance productivity and industrial competitiveness. The weak relationship may also indicate that the manufacturing sector's share in Nigeria's economy remains relatively small compared to sectors such as oil and gas and services, thereby reducing its overall influence on aggregate economic growth.

The coefficient for innovation proxied by ICT technology adoption (TECH) is positive and statistically insignificant, indicating that a one-unit increase in TECH will lead to a 36.7% increase in RGDP. This finding is in line with theoretical expectation, suggesting that innovation, as measured by ICT technology adoption, contributes positively to economic growth but is insufficient on its own to drive significant long-run economic transformation. The effectiveness of ICT adoption depends on complementary factors such as adequate infrastructure, industrial development, skilled human capital, favorable regulatory frameworks, and continuous technological advancement. Without these supporting conditions, the economic benefits of ICT innovation may remain limited. The coefficient for access to finance (ACEFIN) is negative and statistically significant, showing that a unit rise in ACEFIN will lead to -14.4% decreases in RGDP. This result deviates from a priori expectation, indicating that the Nigerian financial system has not effectively supported the productive transformation of the economy. Structural challenges such as high lending interest rates, limited access to long-term credit for manufacturers and innovative firms, weak financial intermediation, poor loan monitoring, non-performing loans, inadequate institutional quality, and policy inconsistencies may have reduced the effectiveness of financial resources in stimulating long-run economic growth.

The coefficient of institutional capacity (INSTC) is negative and statistically significant, specifically; a unit rise in INSTC will lead to -84.1% decreases in RGDP. This result is in line with a priori expectation, indicating that institutional arrangements may have hindered the effective implementation of policies aimed at promoting innovation, infrastructure investment, and industrial development. Weak regulatory frameworks, bureaucratic inefficiencies, policy inconsistency, corruption, poor public sector



accountability, weak contract enforcement, and ineffective governance may have reduced the efficiency of public investments and discouraged private sector participation. Consequently, institutional deficiencies may have limited the capacity of the economy to transform investments in innovation and infrastructure into sustained long-run economic growth.

Finally, the coefficient of corruption index (CORR) is negative and statistically significant; therefore, a unit rise in CORR will lead to -26.7% decreases in RGDP. This result deviates from a priori expectations, indicating that corruption has significantly hindered the effectiveness of policies and investments aimed at promoting innovation, infrastructure development, and industrialization. Resources intended for strategic infrastructure projects and technological advancement may have been mismanaged or diverted, resulting in poor-quality infrastructure, delayed project completion, reduced industrial competitiveness, and limited technological progress. These institutional inefficiencies diminish the ability of innovation and industrialization to generate sustained economic growth.

In summary, the long-run analysis highlights the complex interplay between the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth variables in Nigeria. While certain factors such as investment in infrastructure (INVINFRAST), industrialization proxied by manufacturing value added (INDMVA), and innovation proxied by ICT and technology adoption (TECH) positively influenced the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth, others like infrastructural development (INFRAST), access to finance (ACEFIN), institutional capacity (INSTC), and corruption index (CORR) posed significant challenges. This outcome may reflect inefficiencies in policy implementation, poor governance, weak institutional frameworks, inadequate maintenance of infrastructure, misallocation of financial resources, and persistent corruption. Therefore, the findings underscore the need for targeted policy interventions to focus on improving the quality and efficiency of infrastructure investment, strengthening access to finance for productive sectors, enhancing institutional capacity, intensifying anti-corruption reforms, promoting innovation-driven industrialization, improving public-private partnerships (PPPs), ensuring policy consistency and macroeconomic stability, and strengthening monitoring and evaluation systems.

4.2.1 Findings, Presentation and Analysis of Econometric Results of the Short run coefficients of the impact of Innovation, infrastructure, and industrialization on Nigeria's economic growth Equation Results

Table 4.7: Dependent variable: RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFRAST)	-0.387146	0.396081	-0.977440	0.3413
D(INVINFRAST)	0.497779	0.603451	0.824887	0.4202
D(INDMVA)	2.100969	1.885892	1.114045	0.2799
D(TECH)	0.242333	0.289610	0.836756	0.4137
D(ACEFIN)	-0.329682	0.313049	-1.053131	0.3062
D(ACEFIN(-1))	0.804345	0.225541	3.566292	0.0022
D(INSTC)	2.107875	1.878950	1.121837	0.2767
D(INSTC(-1))	-3.484572	2.044835	-2.704085	0.0156
D(CORR)	-1.760564	0.811698	-2.168988	0.0437
CointEq(-1)	-0.659375	0.213051	-3.094915	0.0062
R-squared	0.741030	Mean dependent var	4.199697	
Adjusted R-squared	0.539609	S.D. dependent var	3.283832	
S.E. of regression	2.228149	Akaike info criterion	4.743174	
Sum squared resid	89.36364	Schwarz criterion	5.423405	
Log likelihood	-63.26238	Hannan-Quinn criter.	4.972051	
F-statistic	3.679014	Durbin-Watson stat	2.538536	
Prob(F-statistic)	0.005415			

Source: Researcher's computation (2026), using E-Views 9.

The short-run dynamics of the relationship between the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth equation results are as presented in Table 4.8 and reveal several significant findings.

In the short run, infrastructural development (INFRAST) exhibits a negative and insignificant relationship with RGDP. Specifically, a 1% increase in INFRAST will lead to a -38.7% decrease in RGDP in the short run. This result is not in line with a priori expectations, suggesting that infrastructural innovations alone are insufficient to stimulate short-run economic growth. Factors such as inadequate maintenance, poor project implementation, corruption, weak institutional capacity, unreliable electricity supply, and



low industrial absorptive capacity may prevent infrastructure investments from effectively supporting industrial production and economic activities in the short term.

The short-run dynamics of investment in infrastructure (INVINFRAST) show that it is positive and insignificantly related to RGDP in the short run, indicating that a one percent rise in INVINFRAST will lead to 49.7% increases in RGDP in the short run. This result conforms to a priori expectation, suggesting that innovative infrastructure investments are moving in the expected direction by supporting economic activities, industrial production, and productivity. However, the insignificant effect suggests that existing investments have not yet reached the scale or level of efficiency required to produce a statistically significant improvement in economic growth. This situation may be attributed to challenges such as inadequate funding, delays in project completion, poor maintenance culture, corruption, policy inconsistency, weak institutional frameworks, and unreliable power supply, all of which reduce the effectiveness of infrastructure investment. Industrialization proxied by manufacturing value added (INDMVA) shows a positive and insignificant relationship with RGDP in the short run. Specifically, a unit rise in INDMVA will lead to 21.0% increases in RGDP in the short run. This finding is in line with a priori expectation, implying that improvements in manufacturing value added alone may not immediately translate into higher economic growth because the sector faces several structural constraints. Challenges such as inadequate infrastructure, unreliable electricity supply, high production costs, limited access to finance, outdated technology, low research and development capacity, and weak industrial policies may reduce the ability of manufacturing firms to achieve higher productivity and competitiveness.

The coefficient of innovation proxied by ICT technology adoption (TECH) is positive and statistically insignificant in the short run. Therefore, a unit rise in TECH will lead to 24.2% increases in RGDP. This result is in line with a priori expectation, reflecting that technological advancement requires complementary conditions before its full economic benefits can be realized. Challenges such as inadequate digital infrastructure, unstable electricity supply, high cost of internet services, limited technological skills, cybersecurity concerns, low investment in research and development, and unequal access to digital technologies may constrain the ability of ICT innovation to significantly influence economic growth in the short term. Furthermore, the insignificant relationship may indicate that ICT adoption is still largely concentrated in communication and service-related activities rather than being fully utilized to transform industrial production, manufacturing processes, and productivity. Without strong linkages between ICT



innovation, infrastructure development, and industrialization, technological adoption may have limited immediate effects on output growth.

The coefficient of access to finance (ACEFIN) is negative and statistically insignificant in the current period and positive and significant after a period lag of the short run. Therefore, a unit rise in ACEFIN will lead to a -32.9% decrease in RGDP in the current period and an 80.4% increase after a period lag. The result of the current period is not in line with a priori expectations, while the result of the first period lag conforms to theoretical expectations, reflecting that access to finance plays an important role in supporting long-term productive activities, particularly by enabling firms to invest in innovative technologies, modern infrastructure, and manufacturing capacity. Financial support can enhance industrial competitiveness, encourage technological adoption, and improve the ability of businesses to participate in economic transformation. However, the delayed impact highlights that financial resources must be accompanied by supportive policies, reliable infrastructure, and an enabling business environment to achieve sustainable growth outcomes.

The coefficient of institutional capacity (INSTC) is positive and statistically insignificant in the current period and negative but significant at the first period lag of the short run. Therefore, a unit rise in INSTC will lead to 21.0% increases in RGDP in the current period and -34.8% decreases after a period lag. The result of the current period lag is not in line with a priori expectations, while the result of the first period lag aligns with theoretical expectations, highlighting the importance of institutional quality as a foundation for sustainable economic transformation. Although innovation requires strong institutions to support research and development, protect intellectual property, and encourage entrepreneurship, weak institutional structures can limit the adoption and diffusion of new technologies. Similarly, infrastructure investments may fail to produce immediate growth benefits when institutions are unable to ensure efficient project execution, maintenance, accountability, and private-sector participation. Industrialization also depends on effective institutions that provide policy stability, investment protection, and support for productive enterprises.

Finally, the coefficient of corruption index (CORR) is negative and statistically significant in the short run. Therefore, a unit rise in CORR will lead to -17.6% decreases in RGDP. This result is in line with a priori expectation, suggesting that a high level of corruption can discourage innovation by reducing incentives for entrepreneurs, limiting access to funding, distorting competition, and weakening the protection of intellectual property rights. Innovative firms may face additional costs through informal payments,



regulatory bottlenecks, and unfair market practices, thereby reducing their ability to contribute to productivity growth.

The ECM coefficient (-0.659375) is correctly signed and statistically significant, indicating that approximately 65% of short-run disequilibria adjust to the long-run equilibrium within a year. The t-statistic (-3.094915) confirms the significance of the ECM at the 5% level.

The R-squared value (0.741030) and adjusted R-squared (0.539609) demonstrate that approximately 74% of the variation in RGDP is explained by the included variables (both current and lagged), with 26% attributable to factors outside the model. The F-statistic (3.67) confirms the joint significance of the model's variables, ensuring a good overall fit. Additionally, the Durbin-Watson statistic (2.53) indicates no autocorrelation, affirming the reliability of the results for forecasting and policy formulation.

The stability test using the cumulative sum (CUSUM) test in figure 4.1 below further shows that the variables included in the economic growth (RGDP) equation were stable during the study period. This is evidenced by the swing of the trends within the CUSUM bound at the $\pm$ five percent significance level. The study, therefore, implies that the equation is stable and consistent enough to be adopted for economic policies and forecasts.

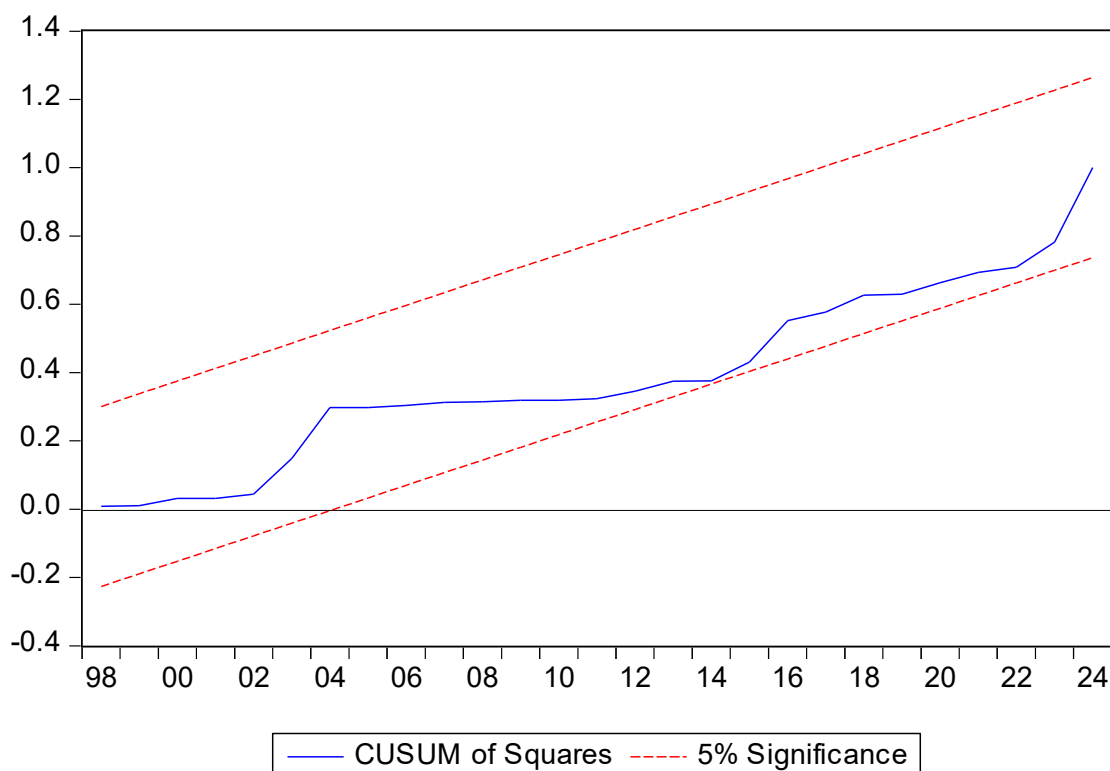


Figure 4.1: The impact of Innovation, infrastructure, and industrialization on Nigeria's economic growth Equation CUSUM.

Source: Researcher's Computation (2026).

4.3 Discussion of Findings

The short-run and long-run ARDL dynamics show an intriguing insight as the regression result offers a positive and significant relationship between the three key variables of innovation, infrastructure, and industrialization: investment in infrastructure (INVINFRAST), industrialization proxied by manufacturing value added (INDMVA), and innovation proxied by ICT technology adoption (TECH), which interacted with the dependent variable Nigeria's economic growth proxied by real gross domestic product (RGDP). The results suggest that increases in the underlisted variables, in essence, will lead to corresponding increases in economic growth in Nigeria. This finding therefore suggests that Nigeria's ability to achieve higher economic growth depends on overcoming existing infrastructure deficits, strengthening industrial policies, promoting technological innovation, and creating an environment that encourages private sector investment. A



coordinated approach to innovation, infrastructure development, and industrialization is essential for achieving inclusive and sustainable economic growth.

However, infrastructural development (INFRAST), access to finance (ACEFIN), institutional capacity (INSTC), and corruption index (CORR) showed an expected negative and insignificant relationship with the impact of innovation, infrastructure, and industrialization on economic growth in Nigeria in both the long and short run periods under review, reflecting that when this variable increases, economic growth tends to increase, suggesting that in both the short and long run, improving Nigeria's economic performance requires not only increased investment in infrastructure and industrial development but also stronger institutions, improved access to finance, effective anti-corruption measures, and policies that encourage innovation and productive investment. Addressing these issues will enhance the role of infrastructure and industrialization as drivers of long-term economic growth.

The models were estimated using the error correction mechanism (ECM), and the outcome of the key urbanization and economic development equations revealed a positive and significant relationship among the variables in both the short run and long run.

The error correction coefficients in all the estimated models met the three criteria for its acceptability given that they are negative, fractional, and statistically significant. Consequently, the estimated result confirms the presence of a long-run relationship among the variables in the models. It also shows that the speed of adjustments is moderate in all the estimated models. The value of the adjusted R-squared implies that the models have a good fit, as the independent variables have high explanatory powers. The Durbin-Watson statistic connotes the absence of autocorrelation in the estimated equations.

The study, therefore, accepts the null hypotheses of no serial correlation in the models. This further implies that the error terms of different periods are not serially correlated. The stability test using the cumulative sum tests showed that the variables included in all the models were stable within the period of the study.

5.0 Conclusion

The study examines the impact of innovation, infrastructure, and industrialization on Nigeria's economic growth using data from 1990 to 2024, adopting the autoregressive distributive lag model. The study observed that changes in the ratios of investment in infrastructure (INVINFRAST), industrialization proxied by manufacturing value added (INDMVA), and innovation proxied by ICT technology adoption (TECH) interacted with the dependent variable economic growth in Nigeria. In addition, the study revealed a



negative impact of infrastructure development (INFRAST), access to finance (ACEFIN), institutional capacity (INSTC), and the corruption index (CORR) on economic growth in Nigeria. It means that Nigeria's economic performance requires not only increased investment in infrastructure and industrial development but also stronger institutions, improved access to finance, effective anti-corruption measures, and policies that encourage innovation and productive investment. Addressing these issues will enhance the role of infrastructure and industrialization as drivers of long-term economic growth.

5.1 Recommendations

Therefore, we recommend that:

- i. Government and policymakers should strengthen project implementation, improve financial accessibility, enhance institutional performance, and reduce corruption. The country should also pursue structural reforms that promote innovation, industrial competitiveness, and sustainable infrastructure development in the long run. These measures will enable infrastructure and industrialization to serve as effective drivers of economic growth and economic transformation.
- ii. Government and policymakers should pursue a coordinated development strategy that integrates infrastructure expansion, industrial transformation, technological innovation, and human capital development. Such policies will strengthen economic diversification, improve global competitiveness, and ensure that innovation and industrialization contribute sustainably to Nigeria's economic growth.

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