NEXUS BETWEEN INFRASTRUCTURE DEVELOPMENT AND MANUFACTURING SECTOR PERFORMANCE IN NIGERIA: THE MODERATING ROLE OF INSTITUTIONAL QUALITY

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ABSTRACT
The role of infrastructure development in the manufacturing growth process is recognized in the literature and policy cycles, therefore, what determines it is also worthy of attention. This study investigates the relationship between infrastructural development and manufacturing sector performance in Nigeria: the moderating role of institutional quality. To accomplish this objective, the study employs an Autoregressive distributed lag (ARDL) from (2002–2021). The results show that institutional quality in Nigeria has a negative impact on manufacturing sector performance both in the short run and long run. The study reveals that productive infrastructure development is positively and significantly improving manufacturing sector performance in Nigeria. In general, institutional quality is introduced to improve the influence of infrastructural development on manufacturing sector performance. Furthermore, the study presents a perspective on the role of government in establishing an enabling environment that promotes infrastructural development. and, as a result, enhances manufacturing sector performance in Nigeria. Based on this finding, the study recommends the implementation of measures and policies aimed at encouraging productive infrastructural development that contributes to manufacturing sector performance in Nigeria. In addition, government and policymakers should improve the quality of institutions such as improving Government Effectiveness, Political Stability, Absence of Violence, Voice and Accountability, Regulatory Quality, Rule of Law, and Control of Corruption.
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1. INTRODUCTION

The manufacturing sector plays a key role in the industrialization and growth process of any country. This is because the sector offers unique opportunities for capital accumulation, promotes economies of scale by driving technological progress while providing spillover effects through linkages to other economic sectors, displays a higher level of productivity, and has more capacity to generate employment compared to other sectors (Efobi and Osabuohien, 2016; Martorano, Sanfilippo and Haraguchi, 2017; Anyanwu, 2018; Abdulrahmaman, and Ajayi, 2022). Again, by fostering productivity and sustainable economic growth, the manufacturing sector can also foster a reduction in poverty and inequality (Ndulu, 2006; Lavopa and Szirmai, 2012; Ojike, Uwajuogu, and Didigu, 2022; Oduntan, 2022; Ogunjinmi, 2022). Despite the apparent importance of the manufacturing sector, particularly for SSA countries where structural and development indicators are appalling, the performance of the manufacturing sector has to a large extent been abysmal (Acar, and Berk, 2022). The manufacturing sector accounts for a significant share of the industrial sector in developing countries. (Pham and Adebayo, 2011; Rehman, and Islam, 2023).

However, boosting the performance of the manufacturing sector and consequently promoting industrialization which are integral aspects of development policy in many SSA countries including Nigeria would require the removal of major impediments to manufacturing value-added growth. One such bottleneck is the infrastructure deficit. Extant literature attests to the huge infrastructural gap in Nigeria compared to other developing countries (Abdulrahmaman, and Ajayi, 2022; Yepes, Pierce, and Foster, 2008; Foster and Briceno-Garmendia, 2010; Gutman, Sy, and Chattopadhyay, 2015, Kodongo and Ojah, 2016; World Bank, 2020). Infrastructure is not just an input in the production process; it also complements other factor inputs; thus, it provides productivity enhancements (Kodongo and Ojah, 2016; Andy, et. al. 2022).

The experience of Nigeria is typical of other countries in Africa, the annual percentage growth in manufacturing value added in Nigeria, 1981-2021. Between 1981 and 1983, manufacturing value experienced a negative average growth of 16.9 %. In 1984, manufacturing value added rise to 5. 2 % before dropping to -9.2% in 1985. In 1999, the sub-sector recorded positive growth of 0.2 % and rose further to 2.34% in 2000. However, between 2002 and 2003, the average manufacturing value-added growth was -9.0%. The highest growth of 17.8% was recorded in 2010 however declined to 13.5% in 2011. In 2012, 2013, 2014, 2015, 2016, 2017, and 2018, annual growth in manufacturing value added in Nigeria was 21.8%, 14.7%, -4.61%, -0.21%, 2.1%, and 0.77%. Nigeria's manufacturing output for 2019 was $51.63B, a 26.89% increase from 2018, for 2020 was $54.75B, a 6.03% increase from 2019, and Manufacturing, value added (annual % growth) in Nigeria was reported at 3.3484 % in 2021 (World Bank, 2020).

However, reliable infrastructural development is crucial for powering businesses, lowering transaction costs, improving market access, and the efficiency of other productive factors (Luo and Xu, 2018; Nkemgha, Nchofoung, and Sundjo, 2023). In particular, energy infrastructure (electricity) the lifeblood of manufacturing is necessary for adding value to raw materials and intermediate products as they are being progressively transformed into final consumer products (Anyanwu, 2018; Okwu, et. al. 2022). Transport infrastructure allows for the movement of people and manufactured products in a cost-efficient manner. Information and communication technology (ICT) aids production and exchange by easing the dissemination of information among economic agents (Ismail and Mahyideen, 2015). In sum, infrastructure can boost both the input and the output process in a production system allowing for competitiveness in the production of industrial goods. All of these are germane for enhancing manufacturing value added and overall economic performance (Efobi and Osabuohien, 2016; Nnyanzi, et. al. 2022).

However, Nigeria like many other Sub-Saharan African countries has been overwhelmed with the lack of useful infrastructure to grow their economies. This poor state of infrastructure has now engaged the attention of many African governments, especially in attracting foreign investments, as the development of infrastructural facilities is one of the determinants of foreign direct investment inflow into any economy. It is practically impossible for any nation to achieve and sustain meaningful development without efficient, reliable, and adequate infrastructural facilities, of all the basic infrastructural facilities, generally known as essential amenities; (hospital facilities, power, water, transport, etc.) (Abdulrahmaman, and Ajayi, 2022; Osmond, et. al. 2022).

In addition, the contribution of infrastructure development to an economy, especially its manufacturing sector, cannot be over-stressed; this is because it makes productivity more of a breeze through the promotion of investment, movement of products, people, and services, and facilitation of information and communication, all these, being salient factors for economic diversification (Osei, and Bentum-Ennin, 2022; Rehman, and Islam, 2023). However, the deplorable situation of most of the infrastructural facilities in Nigeria (as well as their lack of maintenance) especially of the roads, electric power, and water, tend to go against these values of infrastructure, mostly due to inadequate funding from the government for maintenance of these facilities, careless use, vandalization, corruption, and construction delays. Poor infrastructure leads to low productivity because producers of goods and services are discouraged because of the higher cost of production, and sometimes, the overall inability to get goods to the points of sale (Abdulrahmaman, and Ajayi, 2022). This further leads to a lower generation of income. Inadequate supply of electric power from 1996-1998 can be listed as one of the factors that led to the decline in industrial output (162.9 in 1990, down to 131.8 in 1998) and manufacturing capacity utilization (73.3% in 1981, down to 32.4% in 1998) (CBN, 2022).

By and large, the infrastructural development alone may not lead to desired growth, except the institutional quality is brought in to improve the impact of the infrastructural development on manufacturing sector performance; the role of Institutions in promoting infrastructure and manufacturing sector performance has been acknowledged in the literature (North 1990; Aigheyisi, 2017; Stoica, Roman & Rusu 2020; Nadabo,& Salisu, 2021; Rahi, et. al. 2023; Dada, et. al. 2023). By and large, the differential impact of either infrastructure or institutional quality on manufacturing output suggests the need for further in-depth analysis of the issue. Infrastructure development has often been heavily tied to the institutional characteristics of countries (e.g. Ogbaro, 2019; Sahni, Nsiah & Fayissa, 2021; Zergawu et al., 2020; Saha and Sen 2020).

Improvement in the institutional quality in Nigeria could be a possible remedy for low infrastructural development. Therefore, the study hypothesises that improved infrastructural development will enhance productivity, whereas productivity improvement will improve manufacturing sector performance and, by extension, business continuity, poverty reduction, and employment creation. To the best of our knowledge, no known study investigates the moderating role of institutions on infrastructure development and manufacturing sector performance nexus in Nigeria, hence the motivation for this study. The main objective of the research is to examine the relationship between infrastructure development and manufacturing sector performance in Nigeria: the moderating role of institutional quality while the specific objectives are as follows:

i. To explore the effect of infrastructural development on manufacturing sector performance in Nigeria.
ii. To investigate the causal relationship between infrastructural development, institutional quality, and manufacturing sector performance in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Issues

Concept of Manufacturing Value Added

The manufacturing value added (MVA) of an economy is the total estimate of the net output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate consumption. Measurement of MVA requires appropriate demarcation of the type of economic activity and of the territory in which the activity takes place. On the other hand, manufacturing value-added measures an exclusive and exhaustive contribution of manufacturing to the gross domestic product of an economy (UNIDO, 2022).

Concept of Infrastructure

Infrastructure is the set of facilities and systems that serve a country, city, or other areas, and encompasses the services and facilities necessary for its economy, households, and firms to function. Infrastructure is composed of public and private physical structures such as roads, railways, bridges, tunnels, water supply, electricity, and telecommunications.

Concept of Institutions

The World Bank study on Africa in 1989 defined governance as the exercise of political power to manage a nation's affairs. Later, the World Bank (1992) described governance as "how power is used to manage a country's economic and social resources for development."

North (1990) defined institutions as rules of the game or, more formally, as the humanly devised formal and informal constraints that shape human interactions. He asserted that formal institutions are primarily constitutions, statutes, and clear government rules and regulations, codified and imposed by impersonal mechanisms most importantly, the state with its coercive power and organization.

Kaufmann et al. (2010) identified governance measures (that capture six dimensions or indices of institutional quality corresponding to each of these measures). They include voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, the rule of law" and "control of corruption.

2.2 Theoretical Review

Endogenous growth theory

This study reviews some economic theories which support the relationship between infrastructure investment and manufacturing output. One such theory is the neo-classical (exogenous) growth model. The major supporters of this theory are Domar (1946) and Solow (1956). The theory allows lab or as a substitute for capital and vice versa in determining output. Endogenous growth theory holds that economic growth primarily results from endogenous and not external forces (Romer, 1990). The theory primarily holds that the long-run growth rate of an economy depends on policy the endogenous growth model supports that investment in infrastructural development complemented with advanced technology will generate economic development in the future (Hlotywa and Ndaguba, 2017). The endogenous growth model introduces government expenditure on infrastructure (G) as public good into the model such that: $Y=f(K, L, G)$.

Theory of Infrastructure-led Development

The Theory of Infrastructure-led Development was developed by Agenor (2010). The theory proposes a long-term economic development based on government infrastructure which was referred to as the main engine of growth. The theory stipulates that government investment in agriculture and government infrastructures will enhance the productivity of both commodities

The New Institutional Economics (NIE)

The emergence of the New Institutional Economics (NIE) approach shared common intellectual ground on institutional economics that institutions matter. Moreover, it suggests that institutions determine the economic performance differentials across countries (North, 1994). Interestingly, Williamson (1998) observed that NIE is inherently an interdisciplinary undertaking, which includes works in property rights analysis, the economic analysis of the law, public choice theory, constitutional economics, the theory of collective action, transaction cost economics, the principal-agent approach, the theory of relational contracts, and comparative economic systems (Richter, 2005).

2.3 Empirical Literature

The productive manufacturing sector is positively linked with infrastructure improvement, and institutions and stimulates economic growth.

Azolibe and Okonkwo (2020), the study investigates Infrastructure development and industrial sector productivity in Sub-Saharan Africa. Using a panel least square estimation technique on panel data of SSA region data spanning from 2003 to 2018. They find the quantity and quality of telecommunication infrastructure to be the major factor that influences industrial sector performance. The study attributes the relatively low level of industrial sector performance in the region to poor electricity and transport infrastructure, underutilization of water supply as well as sanitation infrastructure.

Ahmed (2016) study examines the Social infrastructure and productivity of manufacturing firms Evidence from Pakistan. Records similar findings on the role of social infrastructure on manufacturing firms' productivity in Pakistan, though only positive for urban areas and negative for rural regions.

Ijaiya and Akanbi (2009) explore the impact of infrastructure on manufacturing development in Nigeria. It was revealed that a long-run relationship occurs between infrastructural development and manufacturing performance. Electricity, telecommunication, and transport were found to have a negative impact on manufacturing output.

Soneta et al. (2012) and found that transport, electricity, and gas distribution have insignificant effects on manufacturing output in Pakistan, the study used a time series regression model based on data collected from 1981-2009.

Rietveld, Kameo, et al. (1994) investigate the impact of roads, telecommunication, and electricity on the development of manufacturing industries, and the result reveals a positive and significant impact of infrastructure on manufacturing sector performance.

Sahoo et al. (2010) examine the impact of electricity, energy power, telephone, road, railway, and port on manufacturing output and found that government infrastructure has a positive and significant effect on manufacturing sector performance.

In addition, Hulen, Bennathan, and Srinivasan (2003) explore the impact of electricity on manufacturing performance in India. It was found that the effect of electricity on the manufacturing sector depends largely on the degree of network, which is more pronounced in relatively underdeveloped areas. However, Paul et al. (2004) explore the effects of government infrastructure on manufacturing performance in Canada. The estimated coefficients provide strong evidence of the importance of government infrastructural development on manufacturing sector performance.

Goel (2003). A study on the impact of infrastructure on the manufacturing sector in India using capital, and intermediate input and assumed infrastructure to be quasi-fixed, results reveals that infrastructure provision accentuates manufacturing sector performance. Chitkara and Nagpal (2017) adopt a non-parametric index number approach to explore the nexus between manufacturing sector development and infrastructure in Indian states and found that the development of the manufacturing sector is strongly linked with the conditions of infrastructural development.

Dollar, Hallward-Driemeier, and Mengistae (2005) investigate that fluctuating power supply has a strong negative impact on the manufacturing sector in Bangladesh, Pakistan, India, and China. Orji, Worika, and Umofia (2017) study that transportation infrastructure development does not support manufacturing sector performance, and electricity was found to have a positive and insignificant impact on manufacturing sector performance. Thoung, Tyler, and Beaven (2015) examined the effect of infrastructure development on manufacturing sector productivity in Europe. The study reveals that infrastructure development had a positive and significant impact on manufacturing sector productivity.

Mesagan and Ezeji (2016) explore the impact of infrastructure on manufacturing sector performance in Nigeria. Findings indicate that capital expenditure and telecommunication had a positive and significant impact on manufacturing performance while electricity, health expenditure, and lending rate had a negative and insignificant impacts on manufacturing sector performance.

Edeme et al. (2020) examine the impact of infrastructural development on manufacturing value added in the case of African economies. Findings reveal that information and communication technology and electricity had a positive impact on manufacturing value added while transport had a negative impact on manufacturing value added.

Azolibe, (2021), in the study Does foreign direct investment influence manufacturing sector growth in the Middle East and North African region? using the IV-SLS technique with year and sub-regional fixed effects, finds that social infrastructure has variant effects on manufacturing output. Conversely, the study does not find any significant role of ICT infrastructure, proxied by mobile phone subscriptions. Among the other factors, foreign direct investment stock, political globalization, and energy use intensity are found to exhibit differential impacts.

Abokyi et al. (2018) the study explores Consumption of electricity and industrial growth in the case of Ghana. Data spanning from 1971 to 2014 periods, the results obtained from the ARDL Bounds test, in confirmation of the hypothesis that infrastructure development in terms of electricity consumption negatively impacts manufacturing sector output. Similarly, the positive effect of institutional quality on industrial output can be traced in Grigorian (2000) in 27 Asian and Latin American countries.

As shown earlier, the infrastructure development of Nigeria still remains unsatisfactory compared to other developing countries. Therefore, there is a need to investigate what determines infrastructure development in Nigeria. However, to the best knowledge of the researcher, no known study could be found that did this. This study attempts to fill this gap by empirically investigating the moderating role of institutional quality on the relationship between infrastructure development and manufacturing sector performance in Nigeria over the period 2002 to 2021 by applying the ARDL approach hence the motivation for this study.

3. METHODOLOGY

3.1 Theoretical Framework

The study adopted the endogenous growth model originated by Romer (1990) and Lucas (1988), which is the extension of the neoclassical growth model developed by Ramsey (1928). It will be expanded to incorporate Infrastructure, Institutions, and Manufacturing sector performance. The neoclassical model was popularized by Solow (1956). This model assumes technological change as exogenous and returns to scale considered to be constant. The model postulates that capital and labour can be substituted, and their marginal products are assumed to be diminishing. The essential neoclassical production function can be written as:

Y = f (K, L).. (1)

Here, Y denotes the output level, K capital formation, and L labor force.

Romer (1990) and Lucas (1988). Extended the neoclassical model specified in equation (1) by incorporating human capital, (H) innovation, (I), and knowledge as the determinant of economic growth to formulate the new endogenous growth model as follows:

Y = f (K, L, H, I,).. (2)

Equation 2 represents the new endogenous growth model that expresses economic growth as a linear function of human capital, innovation, and knowledge.

3.2 Data Source

The data for the study are annual time series data covering the period 2002-2021 and were source from the World Bank (World Development Indicators). The methodology for this study took a cue from that of Edeme et al. (2020), who studied infrastructure development and manufacturing sector performance. This study uses the ARDL model approach to cointegration and the Causality approach to estimate the model.

3.3 Model Specification

The empirical model used in this study is the endogenous growth model version of Edeme et al. (2020). The model assumed that manufacturing sector performance is determined by a set of infrastructure development variables and thus, manufacturing sector performance can be express as follows:

Y = f (K, L, H, MVA, INFR) .... (3)

MVA represents the manufacturing value added and INFR is the infrastructural development, and other variables (K and L) have already been defined.

MVA=f (INFR, INSQ, GFCF, HDI) …………………………….…………….... (4)

Taking the natural logarithms of MVA, we arrive at the mathematical model of the study as shown in equation 6.

$lnMVA_t = \beta_0 + \beta_1 INFR_t + \beta_2 INSQ_t + \beta_3 GFCF_t + \beta_4 HDI_t$…………………………... …..…… (5)

Where: LMVA represents the natural log of manufacturing value added (MVA) INFR depicts infrastructural development, INSQ is the institutional quality, GFCF is the gross fixed capital formation, HDI describes human development index. Furthermore, the model in equation (5) assumes that MVA (LMVA) is linearly determined by (INFR) infrastructural development, (INSQ) the institutional quality, and (GFC) the gross fixed capital formation. β_o is a constant parameter, while β_1, β_2, β_3, β_4, β_5, β_6, and β_7 are parameters estimates measuring the effects of explanatory variables on the dependent variable.

$LMVA_t = \alpha_0 + \beta_1 INFR_t + \beta_2 INSQ_t + \beta_3 GFCF_t + \beta_4 HDI_t + \mu_t$……………………..…………. (6)

Equation 6 is the stochastic model employed to achieve the study's objectives after further transformation.

For this study, the Autoregressive Distribution Lag (ARDL) approach which was proposed by Pesaran Shin and Smith (2001) was employed because of its numerous advantages over others cointegration approaches such as Engle and Granger (1987) and Johansen and Juselius (1990). Unlike those two techniques, the ARDL can be applied to small sample size. The approach also does not restrict the integration order of the variables being all I(1), as such ARDL can accommodate variables of different order such as I(0) and I(1). It also allows the researcher to estimate both short and long-run components of the model simultaneously. Another advantage of the approach is that it has the estimation power of removing auto-correlation, omitted variables, provides an unbiased estimate of the long-run model, even when some of the regresses are endogenous (Narayan, 2004). Once the optimum lag is appropriately selected, ARDL can estimate the co-integration relationship using the OLS method. However, if the test result shows that there is evidence of a long-run relationship among the variables concerned; then, both the long run and short-run parameters can be estimated using the following models: The ARDL version of model 1 would be specified in equation 7:(The effect of infrastructural development, institutional quality on manufacturing value added)

$$\Delta LMVA_t = \alpha_0 + \alpha_1 LMVA_{t-1} + \alpha_2 INFR_{t-1} + \alpha_3 INSQ_{t-1} + \alpha_4 GFCF_{t-1} + \alpha_5 HDI_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta LMVA_{t-i} + \sum_{i=1}^{q-1} \beta_2 \Delta INFR_{t-i} + \sum_{i=1}^{q-1} \beta_3 \Delta INSQ_{t-i} + \sum_{i=1}^{q-1} \beta_4 \Delta GFCF_{t-i} + \sum_{i=1}^{q-1} \beta_5 \Delta HDI_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The error correction model is expressed as follows:

$$\Delta LMVA_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta LMVA_{t-i} + \sum_{i=1}^{q-1} \beta_2 \Delta INFR_{t-i} + \sum_{i=1}^{q-1} \beta_3 \Delta INSQ_{t-i} + \sum_{i=1}^{q-1} \beta_4 \Delta GFCF_{t-i} + \sum_{i=1}^{q-1} \beta_5 \Delta HDI_{t-i} + ECT_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. (8)$$

3.4 Estimation Techniques

To arrive at the study's objective, we implement a five-step strategy: descriptive statistics, correlation matrix, unit root tests result and the bounds test for cointegration and the result for the long-run and short-run dynamic effect of entrepreneurship and institutional Quality variables on economic growth.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Descriptive Statistics

The study summarized the variables; Manufacturing Value Added (MVA), Infrastructure (INFR) institutional quality (INSQ), Gross fixed capital formation (GFCF), and Human Development Index (HDI), in the form of mean, median, minimum, maximum, standard deviation, kurtosis, skewness, and some observations (N). The detailed interpretation of this table is explained under Table 1 as follows.

Table-1. Descriptive statistics.

Variables	Mean	Median	Min	Max	S.D	Kurtosis	Skewness	N
MVA	2176.693	2309.232	1598.820	2550.470	301.416	1.919	-0.535	72
INFR	11.278	10.770	4.420	25.140	5.174	4.173	1.122	72
INSQ	0.167	0.164	0.155	0.198	0.012	3.894	1.375	72
GFCF	3.796	3.282	-21.895	40.389	13.946	4.058	0.477	72
HDI	11.974	12.156	5.388	17.863	3.204	2.423	-0.133	72

Table 1 indicates that the per capita real MVA of Nigeria during 2002-2021 was on average counts for 2176 USD with a standard deviation of 301$. Similarly, infrastructure activity counts for 11.27 % of Nigeria's overall MVA from 2002 through 2021 with a standard deviation of 5.17%. The minimum percentage age of MVA as institutional quality during the same period was 0.18% while the maximum of the same was 0.16%. The table indicates that the average value of the institutional quality index in Nigeria during the period of 2002-2021 is 0.18, which indicates a moderately corrupt Government in this country with a standard deviation of 0.16.

4.2 Correlation Matrix

The correlation matrix is a measure that shows the direction and strength of the relationship among the variables. The positive or negative sign indicates the direction of the relationship before the value of the coefficient. If the coefficient is positive, it means that as one variable increases, the other also increases. On the other hand, if the coefficient is negative, as one variable increases, the other decreases. The value of the coefficient varies from 0.0 to 1.0. The closer is to 1.0, the stronger the relationship among the variables. Table 2 provides the correlation matrix between the variables under study.

Table 2 Correlation Matrix

Variables	GDPPC	TEA	INSQ	GFCF	INFLN	INSQ_TEA
MVA	1					
INFR	-0.018	1				
INSQ	-0.928	0.104	1			
GFCF	-0.105	-0.184	0.069	1		
HDI	-0.232	0.248	0.300	-0.111	1	

4.3. Testing the Unit Root

Table 3 below reports the test statistic values for Augmented Dicky Fuller, as well as Philips & Peron tests of stationarity. The table reports the test statistic values of both tests at the level and the first difference for six variables; in the present study. The detailed interpretation is given under Table 3 as follows.

Table 3. Unit root test (Based on ADF and PP).

Variables	ADF		PP	
	Level	First Difference	Level	First Difference
MVA	0.941	0.080*	0.1502	0.0000***
INFR	0.0624*	0.0016***	0.0413**	0.0000***
INSQ	0.0282**	0.0000***	0.0003***	0.0000***
GFCF	0.0062***	0.0001***	0.0030***	0.0000***
HDI	0.1178	0.0035***	0.0871*	0.0000***

Note: * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 3 reports unit root testing procedure at the level as well as at first difference for six different indicators; the Table confirms the stationarity of five variables (MVA, INFR, INSQ, and HDI) at first difference only. However, the (GFCF) indicates stationarity at level, strong stationarity at the first difference using both tests; ADF, and PP.

4.4. Results of ARDL Bound Tests

Table 4 presents the co-integration testing of the long-run relationship between the variable of study using the bound testing procedure of the ARDL process. The table indicates the test statistic values for F and t, as well as their critical values based on significance levels in the percentage of 1%, 2.5%, 5%, and 10%. The null hypothesis for this test is that there is no co-integration between the variables of the study. If the test statistic value of F > upper bound I(1) values, the null hypothesis is rejected. Similarly, if the t-value of test statistics is less than the upper bound I(1), the null hypothesis is rejected.

Table 4. Bound testing (For long term co-integration).

Test Statistics F value = 4.876 T-value = 3.972	**Critical Values Based on F-test**		**Critical Values-Based on T-test**	
Significance Level (%)	**I(0)**	**I(1)**	**I(0)**	**I(1)**
10%	2.26	3.35	-2.57	-3.86
5%	2.62	3.79	-2.86	-4.19
2.5%	2.96	4.18	-3.13	-4.46
1%	3.41	4.68	-3.43	-4.79

Table 4 indicates an F-values of test statistics as 4.276 which is greater than the f-test critical values from upper bound I(1). Similarly, the t-values from test statistics are indicated as 3.972 which is greater than the t-test critical values. Therefore, the null hypothesis is rejected and it is inferred that a long-run relationship exists between the variables of the study.

Table 5. Long-run and Short-run Estimation Results

ARDL (1, 1, 1, 1, 0, 1) selected based on AIC: Dependent variable: MVA

Regressors	**Coefficients**	**Standard Error**	**t-Ratio**	**Prob.**
Long-run				
INFR	-56.274	19.660	-2.845	0.006
INSQ	-68.460	16.590	-4.255	0.000
GFCF	-0.254	2.447	-0.104	0.017
HDI	-11.779	13.931	-0.846	0.001
Short-run				
C	14.413	47.660	2.892	0.005
D(INFR)	-19.645	46.558	-4.073	0.000
D(INSQ)	-29.480	46.213	-6.198	0.000
D(GFCF)	-0.708	0.273	-2.595	0.012
D(HDI)	12.170	29.363	4.071	0.000
ETC_{t-1}	-0.101	0.0349	-2.880	0.006

Note that *, ** and *** donates statistically significant at 10%, 5% and 1% respectively.

Table 5 reports the ARDL estimates for the study. It includes the long-run as well as the short-run estimates for independent variables (MVA), and dependent variables (INFR, INSQ, HDI, GFCF) for Nigeria for the period of 2002-2021. Additionally, assumptions of ARDL estimations were also reported at the bottom of Table 6. The further explanations of ARDL estimations and inference of the study are explained below the Table 5 indicates and confirms a long-run as well as a short-run relationship with a highly significant impact of INFR, INSQ on MVA in Nigeria for the period of study 2002-2021. The INFR of Nigeria during the period of study is strongly enhanced by 56.27% in the long run, and 19.65% in the short run through MVA. The longer and shorter relationship between both variables of the study are constant with the comparable outcomes as verified by Acs et al., (2018); Okonkwo, et. al. (2022). The positive relationship between infrastructure and manufacturing value added growth in Nigeria during the period of the study confirms the acceptance of the first Hypothesis. However, some of the past evidence does not support the positive link between INFR and MVA, (e.g., Antony, Klarl & Lehmann 2017; Ashakah, and Ogbebor, 2020). Similarly, the existence of a long-run relationship between INFR and MVA is accepted, while the existence of a short-run relationship between both variables is accepted. It is inferred from the findings of the study that infrastructure of Nigeria is strongly boosted manufacturing sector performance both in the long run and in the short run.

Table 5 above also indicates a negative and highly significant relationship between institutional quality and manufacturing sector performance in the long run for Nigeria during the period of 2002-2021. Similarly, a negative and weakly significant link was observed between institutional quality and manufacturing sector performance in the short run for Nigeria during the period of study. The negative link between institutional quality and manufacturing sector performance in Nigeria rejects the second hypothesis.

However, the existence of a long run, as well as a short run relationship between the variable of the study, accepts the hypothesis. The long-run relationship indicates that the manufacturing sector performance of Nigeria during the period of study is strongly decreased by 68.46%. The short-run link between the variable of the study indicates that the manufacturing sector performance of Nigeria during the period of study is strongly decline by 29.48% if institutional quality increases 1% in long run as well as in long run. The results of this study are comparable with the similar findings of Narayan, (2004) Orji, et., al. (2017); Nadabo and salisu (2021). It is inferred from the evidence of this study the institutional quality contributes negatively in explaining the relationship between infrastructure and manufacturing sector performance of Nigeria during the period of study for the long run, as well as in the short run.

Table 6. Diagnostic Test

Tests	F-Statistic	Probability
Serial CorrelationBreusch-gd	0.752	0.476
Heteroskedasticty/Breusch-pg	6.026	0.813
Ramsey Rest Test	1.421	0.161

Source: Author’s computations (2022)

To ascertain the reliability of estimates of the model, diagnostic tests were conducted and the results of the tests are shown in Table 6. The results show that the model is free from the problem of serial correlation because the F statistic value 0.476 is not statistically significant at the 5% level. So also, the result of the heteroscedasticity test with the probability value 0.813 affirmed the absence of heteroscedasticity in the residuals. The Ramsey Rest Test with the probability value (0.161) shows that the model is correctly specified.

5. CONCLUSION & POLICY RECOMMENDATIONS

The impact of infrastructure on manufacturing sector performance depend on institutional quality. Second, as indicated in our findings, low institutional quality promotes the ineffectiveness of infrastructure on manufacturing sector performance in Nigeria. This is due to a flawed bureaucratic system that undermines the way policies are designed and implemented.

Therefore, it becomes imperative for Nigerian policymakers to improve the quality of institutions. In this regard, this study recommends the following:

- The government is also advised to improve the overall efficiency of institutional quality and reduce corrupt behaviour opportunities among bureaucrats. In addition, accountability and transparency are needed to ensure that infrastructure is executed as planned without leakage.
- Nigeria must improve the quality of governance since it affects infrastructural development and the manufacturing sector performance positively. In particular, actions like substantial punishment by the law must be taken to prevent using public power for private gain and manipulating the state by elites for private interest.

REFERENCES

Abdulrahmaman, B. S., & Ajayi, O. E. (2022). Impact of infrastructure on foreign direct investment inflow to Nigeria. *Journal of Economics and Allied Research*, *7*(2), 42–52.

Abokyi, E., Appiah-Konadu, P., Sikayena, I., & Oteng-Abayie, E. F. (2018). Consumption of electricity and industrial growth in the case of Ghana. *Journal of Energy, 2018,* 1–11.

Acar, P., & Berk, I. (2022). Power infrastructure quality and industrial performance: A panel data analysis on OECD manufacturing sectors. *Energy*, *239*, 122277.

Acs, Z. J., Estrin, S., Mickiewicz, T., & Szerb, L. (2018). Entrepreneurship, institutional economics, and economic growth: an ecosystem perspective. *Small Business Economics*, *51*, 501-514.

Adenikinju, A. F. (1998). Productivity growth and energy consumption in the Nigerian manufacturing sector: a panel data analysis. *Energy policy*, *26*(3), 199-205.

Agénor, P. R. (2010). A theory of infrastructure-led development. *Journal of Economic Dynamics and Control*, *34*(5), 932-950.

Ahmed, R. (2016) Social infrastructure and productivity of manufacturing firms Evidence from Pakistan. Discussion Paper No. 16–038, ZEW - Centre for European Economic Research, Mannheim.

Aigheyisi, O. S. (2017). Does corruption affect the effect of foreign aid on economic growth in nigeria? an empirical investigation. *Journal of Economics and Allied Research*, *2*(1), 1–11.

Andy, T. O., Moses, N. O., Titilayo, J. and Deborah, K. A. (2022). Government education expenditure and human capital development in Nigeria: an empirical investigation: *2022 Journal of Economics and Allied Research. Vol. 7 No. 2 (2022): June.*

Antony, J., Klarl, T., & Lehmann, E. E. (2017). Productive and harmful entrepreneurship in a knowledge economy. *Small Business Economics*, *49*, 189-202.

Anyanwu, J. C. (2018). Does human capital matter in manufacturing value added development in Africa? *Asian Journal of Economic Modelling*, *6*(3), 294-316.

Ashakah, O. F., & Ogbebor, T. O. (2020). Foreign Direct Investment, Financial Development and Economic Growth in Key Emerging Markets. *Journal of Economics and Allied Research*, *5*(1), 57–72.

Azolibe, C. B. (2021). Does foreign direct investment influence manufacturing sector growth in Middle East and North African region? *International Trade, Politics and Development*, *5*(1), 71–85.

Azolibe, C. B., & Okonkwo, J. J. (2020). Infrastructure development and industrial sector productivity in Sub-Saharan Africa. *Journal of Economics and Development*, *22*(1), 91109.

CBN, (2022). Quarterly Central bank of Nigeria Report. Statistical Bulletin publication of the Central Bank of Nigeria. 11(2), 12-14.

Chitkara, S., & Nagpal, C. (2017). A non-parametric index number approach to investigate linkages between manufacturing sector development and public infrastructure. *The Journal of Industrial Statistics*, *6*(1), 1-14.

Dada, J. T., Awoleye, E. O., Arnaut, M., & Al-Faryan, M. A. S. (2023). Revisiting the Military Expenditure-Growth Nexus: Does Institutional Quality Moderate the Effect? *Peace Economics, Peace Science and Public Policy*.

Deng, T. (2013). Impacts of transport infrastructure on productivity and economic growth: Recent advances and research challenges. *Transport Reviews*, *33*(6), 686-699.

Dollar, D., Hallward-Driemeier, M., & Mengistae, T. (2005). Investment climate and firm performance in developing economies. *Economic Development and Cultural Change*, *54*(1), 1-31.

Domar, E. D. (1946). Capital expansion, rate of growth, and employment. *Econometrica, Journal of the Econometric Society*, 137-147.

Efobi, U. R., & Osabuohien, E. S. (2016). Manufacturing export, infrastructure and institutions: Reflections from ECOWAS. *Accelerated economic growth in West Africa*, 157-179.

Edeme, R. K., Buzugbe, N. P., Nkalu, N. C., & Arazu, W. O. (2020). Assessing the Impact of Infrastructural Development on Manufacturing Value Added and Employment in Africa Emerging Economies. *Journal of Applied Economic Sciences*, *15*(2).

Engle, R. F., Hendry, D. F., & Trumble, D. (1985). Small-sample properties of ARCH estimators and tests. *Canadian Journal of Economics*, 66-93.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.

Foster, V., & Briceño-Garmendia, C. (2010). *Africa's infrastructure: a time for transformation*. World Bank.

Gutman, J., Sy, A., & Chattopadhyay, S. (2015). Financing African Infrastructure can the world deliver. *Renewable and Sustainable Energy Reviews*, *75*, 393-401.

Grigorian, D.A. and A. Martinez. (2000). Industrial growth and the quality of institutions: What do (Transition) economies have to gain from the rule of law? Policy Research Working Paper; No. 2475. World Bank, Washington, DC.

Hlotywa, A., & Ndaguba, E. (2017). Assessing the impact of road transport infrastructure investment on economic development in South Africa. *Journal of Transport and Supply Chain Management*, *11*(1), 1-12.

Ijaiya, G. T., & Akanbi, S. B. (2009). An empirical analysis of the long-run effect of infrastructure on industrialization in Nigeria. *Journal of International Economic Review*, *2*(1-2), 135-149.

Ismail, N. W., & Mahyideen, J. M. (2015). The Impact of infrastructure on trade and economic growth in selected economies in Asia.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration--with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, *52*(2), 169-210.

Kodongo, O., & Ojah, K. (2016). Does infrastructure really explain economic growth in Sub-Saharan Africa? *Review of Development Finance*, *6*(2), 105-125.

Lavopa, A., & Szirmai, A. (2012, April). Manufacturing growth, manufacturing exports and economic development, 1960-2010. In *14th ISS Conference, Brisbane, Australia*.

Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, *22*(1), 3-42.

Martorano, B., Sanfilippo, M., & Haraguchi, N. (2017). What factors drive successful industrialization? Evidence and implications for developing countries. *Inclusive and sustainable Industrial Development Working Paper Series*.

Mesagan, E. P., & Ezeji, A. C. (2016). The role of social and economic infrastructure in manufacturing sector performance in Nigeria.

Nadabo, Y. S., & Salisu, S. M. (2021). Entrepreneurship and economic growth nexus in Nigeria: moderating effect of institutional quality: ARDL cointegration approach. *Epra International journal of economic and business review Vol. 9 No. 9 (2021): September.*

Narayan, P. (2004). *Reformulating critical values for the bounds F-statistics approach to cointegration: an application to the tourism demand model for Fiji* (Vol. 2, No. 04). Australia: Monash University.

Ndulu, B. J. (2006). Infrastructure, regional integration and growth in Sub-Saharan Africa: Dealing with the disadvantages of geography and sovereign fragmentation. *Journal of African economies*, *15*(suppl_2), 212-244.

Nkemgha, G. Z., Nchofoung, T. N., & Sundjo, F. (2023). Financial development and human capital thresholds for the infrastructure development-industrialization nexus in Africa. *Cities*, *132*, 104108.

Nnyanzi, J. B., Kavuma, S., Sseruyange, J., & Nanyiti, A. (2022). The manufacturing output effects of infrastructure development, liberalization and governance: evidence from Sub-Saharan Africa. *Journal of Industrial and Business Economics*, *49*(2), 369-400.

North, D. C. (1990). A transaction cost theory of politics. *Journal of theoretical politics*, *2*(4), 355-367.

North, D. C. (1994). Economic performance through time. *The American economic review*, *84*(3), 359-368.

Oduntan Oluwakemi (2022). Socio-economic effect of community-based natural resources management programme on poverty status among fishing households in the riverine areas of ondo state, Nigeria: *2022 Journal of Economics and Allied Research. Vol. 7 No. 2 (2022): June*

Ogbaro, E. O. (2019). Threshold effects of institutional quality in the infrastructure-growth Nexus. *Journal of Quantitative Methods, 3*(2), 2019.

Ogunjinmi, O. O. (2022), Estimating the growth effects of population, poverty and unemployment in Nigeria. *Journal of Economics and Allied Research,* Vol. 7 (1) 178-190

Ojike, R., Uwajuogu, N.R., Didigu., C. (2022). Do education outcomes enhance sustainable development in Nigeria? *Journal of Economics and Allied Research,* Vol. 7 (2) 53-66

Okesola, O. J., Okokpujie, K. O., Adewale, A. A., John, S. N., & Omoruyi, O. (2017, December). An improved bank credit scoring model: a naïve Bayesian approach. In *2017 International Conference on Computational Science and Computational Intelligence (CSCI)* (pp. 228-233). IEEE.

Okonkwo, O.N, Ogwuru, H.O.R., Echeta, D.O. & Manasseh, C.O. (2022) Implications of Covid-19 for Agriculture, Food Security, and Poverty in Nigeria Journal of Economics and Allied Research (JEAR) 7(2) 33 - 41.

Okwu, A.T., Moses, N. Owolabi, T. J., Adejola, D.K. (2022) Government education expenditure and human capital development in Nigeria: An Empirical investigation. *Journal of Economics and Allied Research,* Vol. 7 (2) 206-222

Osei, D. B., & Bentum-Ennin, I. (2022). Infrastructure Development and Sectoral Growth Nexus: Evidence from Sub-Saharan Africa. In *the Palgrave Handbook of Africa's Economic Sectors* (pp. 841-866). Cham: Springer International Publishing.

Osmond, N. O., Ogwuru, H. O., Alu, R. O., Desmond, O. E. and Charles, O. M. (2022). Government education expenditure and human capital development in Nigeria:an empirical investigation. *2022 Journal of Economics and Allied Research. Vol. 7 No. 2 (2022): June*

Orji, K. E., Worika, I. L. and Umofia, N. (2017). The Impact of Infrastructure Development on Nigeria' s industrial Sector. African Research Review, 11(3), 23-30.

Paul, S., Sahni, B. S., & Biswal, B. P. (2004). Public infrastructure and the productive performance of Canadian manufacturing industries. *Southern Economic Journal*, *70*(4), 998-1011.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Pham, D. T., Adebayo-Williams, O., & Thomas, A. (2011). A framework for fit manufacturing. *International Journal of Computer Aided Engineering and Technology*, *3*(3-4), 415-431.

Rahi, A. F., Chowdhury, M. A. F., Johansson, J., & Blomkvist, M. (2023). Nexus between institutional quality and corporate sustainable performance: European evidence. *Journal of Cleaner Production*, *382*, 135188.

Ramsey, F. P. (1928). A mathematical theory of saving. *The economic journal*, *38*(152), 543-559.

Rehman, F. U., & Islam, M. M. (2023). Financial infrastructure—total factor productivity (TFP) nexus within the purview of FDI outflow, trade openness, innovation, human capital and institutional quality: Evidence from BRICS economies. *Applied Economics*, *55*(7), 783-801.

Rehman, F. U., & Islam, M. M. (2023). Does energy infrastructure spur total factor productivity (TFP) in middle-income economies? An application of a novel energy infrastructure index. *Applied Energy*, *336*, 120836.

Richter, R. (2005). The new institutional economics: its start, its meaning, its prospects. *European Business Organization Law Review (EBOR)*, *6*(2), 161-200.

Rietveld, R., Vlaanderen, N., Kame, D., & Schipper, Y. (1994). Infrastructure and industrial development: the case of central Java. *Bulletin of Indonesian Economic Studies*, *30*(2), 119-132.

Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, *98*(5, Part 2), S71-S102.

Saha, S., & Sen, K. (2020). The corruption-growth relationship: Does the political regime matter? *Journal of Institutional Economics*, *17*(2), 243–266.

Sahni, H., Nsiah, C. and Fayissa, B. (2021), Institutional quality, infrastructure and economic growth in Africa (February 3, 2021). Journal of African Development (forthcoming), Special issue on Infrastructure & Finance in Africa. Available at SSRN: https:// ssrn. com/ abstr act= 37783 99

Sahoo, P., Dash, R. K., & Nataraj, G. (2010). Infrastructure development and economic growth in China. *Institute of Developing Economies Discussion Paper*, *261*, 1-33.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, *70*(1), 65-94.

Sonata, K. Bhutto, N.A. Butt, F.N. Mahar and Sheikh, (2012) Impact of Infrastructure on and Government Spending in Pakistan, Pakistan Manufacturing Sector of Pakistan. Proceedings of 2 Institute of Development Economics Islamabad, and International Conference on Business Management PIDE Working Papers, pp: 32. (ISBN: 978-969-9368-06-6).

Stoica, O., Roman, A., & Rusu, V. D. (2020). The nexus between entrepreneurship and economic growth: A comparative analysis on groups of countries. *Sustainability*, *12*(3), 1186.

Thoung, C., Tyler, P., & Beaven, R. (2015). Estimating the contribution of infrastructure to national productivity in Europe. *Infrastructure Complexity*, *2*, 1-22.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics*, *66*(1-2), 225-250.

Williamson, O. E. (1998). The institutions of governance. *The American Economic Review*, *88*(2), 75-79.

World Bank. (2017). *World development report 2017: Governance and the law*. The World Bank.

Yeaple, S. R., & Golub, S. S. (2007). International productivity differences, infrastructure, and comparative advantage. *Review of International Economics*, *15*(2), 223-242.

Yepes, T., Pierce, J., & Foster, V. (2008). Making sense of sub-Saharan Africa's infrastructure endowment: a benchmarking approach. *AICD, World Bank, Washington, DC*.

Zergawu, Y. Z., Walle, Y. M., & Giménez-Gómez, J.-M. (2020). The joint impact of infrastructure and institutions on economic growth. *Journal of Institutional Economics*, *16*(4), 481–502.