Infrastructure and Manufacturing Sector Performance in Nigeria

Ihuoma Chikulirim Eke, Felix Awara Eke* and Awara Emeng Edom

Department of Economics, University of Calabar, Calabar, Nigeria

*Correspondence author

DOI: https://doi.org/10.51244/IJRSI.2023.10717

Received: 09 June 2023; Revised: 08 July 2023; Accepted: 14 July 2023; Published: 11 August 2023

Abstract: The objective of this study was to investigate the effect of infrastructure (electricity consumption and paved roads) on manufacturing sector performance in Nigeria for the period 1981-2019. The ex post facto research design was adopted for the study, using a combination of the traditional Ordinary Least Squares (OLS) econometric method, and the Augmented Dickey-Fuller unit root test for robust and valid estimation results. The co-integration test showed that the equations in the model were integrated. The study findings revealed that infrastructure, proxy by electricity supply had an adverse but not significant effect on manufacturing sector performance while paved roads had a positive and significant impact on manufacturing performance in Nigeria. The study recommends a total overhaul of the electricity sub-sector and targets increased supply specifically for industrial consumption as well as exploring alternative options to increase the road network such as public-private partnership arrangements given its importance to industrial performance.

Keywords: Infrastructure, Manufacturing performance, Electricity consumption, Paved Road

JEL Classification: C32; H54; H55; L60

I. Introduction

Infrastructural deficit adversely affects manufacturing output and depletes the contribution of the sector to the Gross Domestic Product of the nation. In 2023, a lack of foreign exchange forced 18 to 20% of manufacturing enterprises to close, resulting in significant unemployment. Also, the price of diesel had risen from N847 to N900 per litre, which has raised the cost of manufacturing astronomically. Other issues confronting the manufacturing sector include multiple taxation, government use of touts to harass enterprises, rising insecurity, failure to tackle concerns raised about the African Continental Free Trade Area (AfCFTA), and repatriation of funds. (MAN, 2023). The organization also identified poor power supply and dilapidated and decaying road infrastructure as among the most debilitating challenges faced by the manufacturers in Nigeria.

The availability of good infrastructural base results in the rapid attainment of sustained industrialization. Ubi, Eke, and Oduneka (2011) noted that an adequate electricity supply ensures optimal use of modern technologies and processes. Manufacturing plants can seldom work without adequate electricity and a human capital base to support them. Transport and electricity infrastructure appear to be very important in view of their linkage effect on all other variables of economic growth. It is sad to note that the low annual budgetary allocations to the transport (road) and power (electricity) sectors and the near-total neglect of road and electricity infrastructure have limited the effectiveness of the manufacturing sector and its contributions to Nigeria's GDP growth over many years.

Among all the basic infrastructural facilities generally known as essential amenities required for industrial growth, the transport (road) and power (electricity) infrastructure stand out. An efficient transport (road) system has remained an important element of economic growth and development. Omimakinde (2022) pointed out that the road transport sector is the pivot of the economy, the hub upon which the economy revolves, and that the neglect of this sector draws development backward. The importance of transportation to a nation's manufacturing performance cannot be overemphasized. It aids the distribution of products from the point of production to the appropriate target markets in a timely manner. Vagliasindi and Gorgulu (2023) view infrastructure as the basic physical amenities that can produce multiplier effects that significantly reduce poverty and inequality, and facilitate all other economic activities in the system. Infrastructure can further be classified into two broad categories, softcore infrastructure or social infrastructure, and hard-core infrastructure or physical infrastructure. Softcore infrastructures are made up of the provision of healthcare and educational services, government structure, accountability, and property right. Soft-core infrastructure is unequivocally seen as an essential factor for industrial activity while hard-core infrastructure includes physical structures such as telecommunication, power, transportation, water etc. Hard-core infrastructures are generally seen as the 'wheels' of economic activity. This conceptualization of infrastructure strongly suggests that both the softcore and hardcore infrastructure complement industrialization.

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

The Nigerian manufacturing sector seems to be worse hit by the poor condition of transport and electricity infrastructure in the country. No fewer than three hundred and fifty (350) firms closed shop between 2015 and 2019 due to high operating costs emanating mainly from power and transportation difficulties (MAN, 2023). The findings of this study revealed that infrastructure, proxy by electricity supply had an adverse but insignificant effect on manufacturing sector performance while paved roads had a positive and significant impact on manufacturing performance in Nigeria.

The manufacturing sector's contribution to the GDP also depends greatly on the nature of the road network and the stability of power (electricity) in the country. The poor manufacturing performance in Nigeria is caused by transportation and electricity challenges among others which makes this study imperative. Therefore, this study was carried out to investigate the relationship between infrastructure and manufacturing sector performance. It is based on this premise that the study specifically investigated the effect of infrastructure (electricity supply and paved road) on manufacturing sector performance in Nigeria. The rest of the study is in five sections including concept and challenges of the manufacturing sector in section two, theoretical framework and literature review in the third section, methodology in section four, results and discussion of findings as well as conclusion in sections five and six, respectively.

II. The Challenges of Manufacturing Sector in Nigeria

Manufacturing performance can be captured in terms of output from the manufacturing sector or in terms of its share of GDP. The higher its share to GDP the higher the performance.

Within the period under review, the manufacturing sector's performance has dropped drastically and thus affects its general performance and contribution to GDP. This is because of the challenges facing the sector which include: a poor business environment, poor and inadequate infrastructure, low access to financial resource/ credit, technological backwardness, and inadequate domestic demand.

A trend analysis of the share of manufacturing GDP shows that in 2016 it was 14.25 percent, in 2017 it was 10.32 percent, showing a decline of 2.93 percent while in 2017 it was 8.81 percent indicating that the share of manufacturing to GDP has continued to decline within this period.

The manufacturing sector's contribution to the GDP as shown in Table 1 reveals that between 1981 and 1985, it stood at 18.3%. This was perhaps because of high capital stock and a good educational system. This could largely be attributed to factor accumulation rather than efficiency in resource use. In 1986 – 1990, the sector contributions to GDP dropped from 18.3% to 18.1% (0.2% decrease) because of concentration on the oil sector.

However, with the adoption of SAP, there was a rebound in the sector's contribution to GDP from 18.1% to 87.4% from 1991 to 1995. This was because of adequate capital stock, efficient and reliable infrastructure. The sector's contribution to GDP dropped drastically from 1996 to 2000 by 12.9% compared with the previous five years' average contribution, this was due to poor infrastructure, especially on the road network and electricity generation.

Also, with the 8.6% manufacturing sector contribution to GDP between 2011-2016. The sector's contribution to GDP rose marginally to 11.8% between 2017 to 2021. This result cannot be said to be impressive, rather they suggest lost opportunities in Nigeria's attempts at industrialization and stimulation of the exportation of manufactured goods.

Between 2015 and 2019, no fewer than 350 enterprises may have shut down operations in Nigeria because of the unfriendly operating climate caused by the Federal Government's economic policies of foreign exchange restrictions imposed by the Central Bank of Nigeria (CBN) on 41 products.

According to industry stakeholders. around 50 of the affected 350 enterprises were in the manufacturing sector before succumbing to the difficult operating environment. According to the Manufacturers Association of Nigeria (MAN), while some affected manufacturers relocated their operations to neighbouring countries, at least 222 small-scale enterprises closed their doors during the crisis, putting an estimated 180,000 Nigerians out of work.

In addition, the 2022 world economic forum annual index of infrastructure quality ranked Nigeria was placed in the 132nd position out of 136 countries in infrastructure development and noted that the country's infrastructure deficit will amount to 3 trillion dollars in 30 years. This ranking place the country behind most countries within the African sub-region.

Most manufacturing companies experienced tough times between 2015 and 2023 especially in southeast Nigeria, due to the deplorable and dilapidated nature of the highways including federal, state, and local roads. Goods worth billions of naira were damaged in transit because of heavy and hopeless traffic congestion, breakdown of trucks, robbery attacks and lost markets from customers who could not wait for the late arrival of ordered products (Babatunde, 2013). In fact, all federal roads leading to the eastern states: Enugu – Port Harcourt, Aba – Ikot Ekpene, Bende – Ikot Ekpene, Umuahia- Ikot Ekpene, Onitsha- Enugu, Abakaliki

– Enugu, Okigwe to Abakaliki and other roads linking the five states and other zones had remained largely un-motorable. Only recently has the federal government started the reconstruction of some of the roads (MAN, 2023).

Table 1: Contribution of the Manufacturing Sector to GDP (1981-2017)

Year	GDP	MANU	MANU/GDP	%
1981 - 1985	165.09	30.27	0.183	18.3
1986 - 1990	338.22	60.51	0.181	18.1
1991 - 1995	1,484.59	250.82	0.874	87.4
1996 - 2000	4,936.92	636.94	0.129	12.9
2001 - 2005	14,471.85	1,343.04	0.486	48.6
2006 - 2010	39,942.71	2,798.94	0.353	35.4
2011 - 2016	83,244.16	7,318.67	0.086	8.6
2017 - 2021	142,302.14	16,909.30	0.118	11.8

Source: Authors' computation, 2023

In addition to the unfavourable state of infrastructure, Nigeria's manufacturing sector is confronted with daunting challenges. Some of the identified constraints facing the sector include poor business environment which can be attributed to bad governance, corruption, and lack of government commitment to manufacturing sector development; poor and inadequate Infrastructure, which results in high cost of production and thus increased cost of doing business in Nigeria. Other challenges confronting the sector are lack of access to finance with high lending and low saving rates, technological backwardness, low level of domestic demand, and low capital inflow which slows down manufacturing.

III. Theoretical Framework and Literature Review

Infrastructure is essential for the growth of any economy's manufacturing sector. Development economists particularly those of the classical and neoclassical persuasion emphasize the importance of infrastructure as a key stimulus to economic development in developing countries. Empirical studies such as Nnyamzi et al (2022), and Nworji and Oluwalaiye, 2012, have shown that infrastructure can have a significant impact on output. Infrastructure development can promote industrialization which is one of the pre-requisites for attaining sustainable growth. Also, studies have indicated that infrastructure, including soft infrastructure, facilitates the generation of industrial and economic growth through the provision of an environment for productive activities, (Omimakinde, 2022; Vagliasindi, M., & Gorgulu, 2023) and can also aid economic diversification (Ebi & Eke, 2018).

In an empirical investigation by Azolibe and Okonkwo (2020), which used a panel least square estimation technique on panel data from the SSA region from 2003 to 2018, discovered that the amount and quality of telecommunication infrastructure is the most important factor influencing industrial sector productivity. The authors ascribe the region's comparatively low level of industrial sector productivity to weak electrical and transportation infrastructure, as well as underutilization of water supply and sanitary infrastructure.

A study by Anyanwu in 2017, which focused on North Africa and employed a similar methodology, finds that ICT infrastructure/technology, trade openness, and inward stock of FDI all have a significant positive effect on manufacturing value-added output, while the opposite is true for political globalization and civil violence, among other things.

In a later study focusing on Africa as a region from 1990 to 2011, by same Anyanwu (2018), he discovered that social infrastructure had variable effects on manufacturing output using the IV-SLS technique with year and sub-regional fixed effects. While primary education has an inverted U-shaped relationship and secondary education has a significant negative relationship, only postsecondary education has a significant positive relationship. In contrast, the author does not believe that ICT infrastructure, as represented by mobile and landline phone subscriptions, has a substantial influence. It has also been discovered that, in addition to the quantity of infrastructure required for production development, the quality of infrastructure should be regarded as a determining variable. According to Chakamera and Alagidede (2017), the low quality of current infrastructure exacerbates the negative effects of inadequate infrastructure on growth. A similar study on Ghana, however, by Abokyi et al. (2018), spanning a period of 1971-2014, reveals results obtained from the ARDL Bounds test, in confirmation of the hypothesis that infrastructure development in terms of electric consumption negatively impacts the manufacturing sector output, and that this was due to the continuous nosedive in Ghana's average share of industrial sector's electricity consumption.

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

With mixed results from panel data, Apuv and Uzma (2020) examined the impact of infrastructure investment and development on economic growth in Brazil, Russia, India, China, and South Africa (BRICS) countries separately and as a group, concluding that energy infrastructure investment and development lead to economic growth, whereas telecommunication infrastructure investment and development are significant and negatively linked with economic growth.

Ogunjimi and Amune (2019) asserts that a country with the availability of good infrastructure such as electric power is more attractive to foreign direct investment than a country with poor infrastructure development and this is aided by technology deployment which enhances the use of capital for investment and hence growth and development (Eke, Agala and Offum, 2019)

The Manufacturing Association of Nigeria (MAN) carried out surveys on the Nigerian manufacturing capacity utilization stood at 54.9% as of July 2023 and revealed that only 10 percent of manufacturing firms were operating at about 48.8 percent of their installed capacity and that about 60 percent of manufacturing companies surveyed were operating at their average cost while about 30 percent have closed due to their inabilities to cover the average cost. According to the MAN report (2023), most of these industrial outfits suffered from inadequate infrastructural supply (especially electricity and road networks). Obviously, these figures are not a mere statistical abstraction but a reflection of the poor infrastructural supply and accessibility in Nigeria. These facts go a long way to corroborate the assertion that there exists a direct or indirect correlation between output and infrastructure availability.

Moyo (2013) investigated the impact of power infrastructure quality on industrial productivity in Africa at the company level, using a power infrastructure quality proxy based on the number of hours per day without power and the percentage of output lost owing to outages. These factors were revealed to be negative and significant drivers of production in Uganda, Tanzania, and Zambia.

This study adopts the Cobb-Douglas production function in investigating the empirical relationship between infrastructure and manufacturing sector performance. By using the Cobb-Douglas (C-D) production function as adapted from Ndebbio (2006), it is possible to demonstrate how the formal neoclassical production function can be unrestricted. This is stated thus:

$$Y = AK^{b}L^{c} \quad (1)$$

Where:

Y = Output

A = State of technology or efficiency parameter

K = Capital

L = Labour

b &c are weights, such that b+c = 1 (displaying constant returns to scale)

The Cobb-Douglas (C-D) function is modified to capture increasing returns scale. This is thus stated as:

$$Yt = AKt^{b}L^{c}t \quad (2)$$

Here, b + c > 1, indicating increasing returns to scale

An exponential element (e) is introduced in the modified equation to form equation 3.

This is stated thus:

$$Yt = AK^{n}tL_{t}^{1-n}\, et^{\,vts} + Ut \quad (3)$$

In log-linear equation (3) can be shown in equation (4) as:

$$\text{Log } Yt = \text{LogA} + \text{nlogkt} + (1\text{-n})\ \text{logLt} + \text{vloget} + \text{slonget} \quad (4)$$

Where:

V = rate of embodied technology in equation (3) & (4)

S = growth rate of output due to influence of factors which promote technology-changing capabilities (like infrastructure) in equation (3) & (4)

U = error term.

It should be noted that equations (3) and (4) portray that the returns are in two parts – the first is the constant returns to factors of production while the second is the returns due to technological progress or improvement.

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

The Cobb-Douglas formulation has, however, been criticized severally because some of its assumptions are unrealistic. Among other things, it is assumed that the production function is deterministic. There is also the usual issue with unitary elasticity of substitution and competitive equilibrium. These criticisms are "theoretical worries" which exist in all economic models. The practical significance of such concerns may not alter the theoretical model's economic message. Apart from this, more complex models do not necessarily provide more realistic predictions. A complex model may indeed become a problem because it can undermine the complexity of economic occurrences to be explained.

IV. Methodology

4.1 Model Specification

The model is derived from the extended Cobb-Douglas production function stated as:

$$Y = AK^bL^c \quad (5)$$

Where:

Y = Output

A = Efficiency parameter or state of technology

K = Capital

L = Labour force

b& c are weights, such the b + c = 1 (depicting constant returns to scale).

In modern manufacturing process, technology and changing capabilities have made for increasing returns to scale rather than constant returns to scale. In this case, technology changing capabilities are characterized by increasing returns to scale. Hence equation (5) modified to ensure that factors which stimulate accumulation to accommodate the efficiency in the use inputs associated with technology using skills is taken into account. The modified Cobb- Douglas (C-D) function is given as:

$$Y_t = AK_t^bL^c_t \quad (6)$$

b+ c > 1, indicating increasing returns to scale. Equation 6 is modified and augmented into equation 7 to allow for other direct and indirect factors.

Thus: $Y= AK_\alpha L+ U \quad (7)$

But "A" (efficiency parameter) is a function of infrastructure. Infrastructure in this study is captured by number of paved roads (PAR) and electricity supply (ES)

Thus A = f(PAR, ELS) (8)

Therefore, the model for the study is written as:

Y = M =f (K,L,PAR,ELS,TEC) (9)

Where:

Y=M = Manufacturing Output - GDP ratio

K = capital in millions of Naira represented by Gross fixed capital formation

L = Labour force (Measured by adult literacy for skilled labour)

PAR = Number of Paved Roads

ELS = Electricity Supply in megawatt.

TEC = Technology (time variables, one year one data point)

Putting equation 9 in log- linear form, we then have:

$$\text{Log } M_t = \text{Log } a_0 + a_1\log K_t + a_2L_t + a_3\log PAR_t + a_4\log ELS_t + a_5\log TEC_t + U_t \quad (10)$$

U_t = error term, a priori, a_1-a_5>0

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

4.2 Data and Description of Variables

Data used in the study is time series extracted from secondary sources particularly the publication from the Central Bank of Nigeria (CBN) statistical bulletin of various issues, CBN annual statement of account (2019), and World Development Indicators (2019).

Manufacturing output (MO): This is the total output of all the facilities producing goods within a country. (GDP ratio).

Electricity Supply (ELS): this is energy generated from hydrocarbon and other energy-generating sources used to power machinery in factories and appliances at home.

Paved Road (PAR): This road is covered with a firm surface suitable for travel.

Capital (K): These are resources financial or physical or both use in production to create more wealth. Its returns are called profit. It is represented here by Gross fixed capital formation (GFCF).

Labour (L): human physical and mental efforts used in production. It is measured by Adult Literacy Rate.

Technology (TEC): Is the use of scientific knowledge for practical purposes or applications whether in industry or in our everyday lives.

4.3 Model estimation procedure

Some estimation procedures were employed in the study. The first was unit root tests which were done to ascertain the stationarity properties of the time series data. After that, a cointegration test was deployed to determine the long-run relationship among the variables of the study. The last test was the ECM estimation to ascertain the short run and long run dynamics of the models of the study.

4.3.1 Unit Root Tests.

This is usually done to ascertain the stationarity properties of a time series. There are several methods for testing for unit root but the most popular are the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests.

The ADF equation is specified as:

$$dY_t = \alpha_0 + \beta_1 T + Yy_{t-1} + \delta_1 dY_{t-1} \ldots\ldots \delta p\text{-}1 \quad dY_{t-p} + 1^{-1}\ \mu t \qquad (11)$$

Where: d = change or delta, α = constant, β = the coefficient on the time trend, and P = the lag order of the autoregressive process.

Imposing the restrictions $\alpha = 0$ and $\beta = 0$ is suitable in formulating a random walk with a drift.

The decision rules are thus: If $\beta 1 = 0$, then the null hypothesis is accepted, which is that the variable is non-stationary. But if $\beta 1 < 0$ and is statistically significant, then the null hypothesis is rejected.

The PP equation is expressed as: $dY_t = \alpha_0 + d\ \beta y_{t-1} + \mu_t$ (12)

Where: d= the first difference operator, α_0 = constant and μ_t = random error term.

The decision rule is thus: if $\beta = 1$, the series is non-stationary or but $\beta < 1$ = stationary.

4.3.2 The cointegration test

This test for long-run relationship among variables. The most popular cointegration test is that of Johansen and Juselius. According to Hall and Henry, (1989) when two or more variables move together, even though the series drift, the existing difference existing amongst them is stationary When there is no cointegration, it implies that variables tend not to move together in the long run. Dickey (1987) opined that in principle they move in different directions from one another without interactions. The trace and maximum Eigenvalue statistics are used for testing cointegration, and it is based on a five percent level of significance. When the calculated value is greater than the critical value then there is cointegration which means there is a long-run relationship among the variables.

V. Results And Discussion of Findings

5.1 Descriptive statistics

In Table 2, the mean values of the variables were: 103.2296 megawatts for electricity supply, 60.52522 for adult literacy rate, 1.95505 percent for gross fixed capital formation (capital accumulation), 1.01850 percent for manufacturing output (MGDP) and 23.33611 percent for pave road for the period under investigation.

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

Table 2: Descriptive statistics

	ELS	L	K	MGDP	PAR
Mean	103.2296	60.52522	1.95505	1.01504	23.33611
Median	93.11616	59.93404	4.26750	2.19502	23.35000
Maximum	155.8544	78.60000	8.57310	5.48503	30.90000
Minimum	50.70674	41.00000	2.02540	8.61356	18.10000
Std. Dev.	28.16550	9.785551	2.75560	1.66570	3.989855
Skewness	0.390274	-0.316683	1.498547	1.832457	0.476527
Kurtosis	2.031032	2.445064	3.550190	4.728170	2.238927
Jarque-Bera	2.322231	1.063659	13.92793	24.62725	2.231318
Probability	0.313137	0.587529	0.000945	0.000004	0.327699
Sum	3716.267	2178.908	7.01011	3.62511	840.1000
Sum Sq. Dev.	27765.34	3351.495	2.64E+22	9.67E+21	557.1631
Observations	36	36	36	36	36

Source: Authors' computation, 2023

The standard deviations of the variables were 28.16550 megawatts, 9.78551 percent, 2.75560 percent, 1.66570 percent, and 3.989856 percent for electricity supply, adult literacy rate, gross fixed formation, manufacturing output, and pave road respectively.

Analysis of the skewness of the distributions showed that the distributions were positively skewed, given their positive values. This means that all the distributions were skewed to the right except adult literacy which skewed otherwise.

5.2 Unit root test result

Unit root tests were performed on the variables to determine their time series properties. Table 3 shows that all variables are stationary at the first difference, indicating that they are 1 (1) variables.

The stationarity of the variables is indicated by the absolute value of the Augmented Dickey –Fuller (ADF) test statistic being greater than the absolute critical values. Thus, the null hypotheses are rejected. Based on the result, the cointegration test is justified.

Table 3: Unit root test result

Variables	**ADF Value at level**	**5% Critical Value at level**	**Order of Integration**
L	-8.703430	-2.951125	1(1)
ELS	-7.941304	-2.951125	1(1)
MGDP	-4.237122	-2.951125	1(1)
K	-5.044601	-2.951125	1(1)
PAR	-5.266128	-2.957110	1(1)
TEC	-3.42516	-2.951125	1(1)

Source: Author's computation, 2023

5.3 Cointegration Test Result

Table 4 shows the results of cointegration. From the results, there is a long-run relationship among manufacturing performance, GFCF, electricity supply, pave roads, and technology.

The Trace test results indicate that there is at least one (1) cointegrating equation at a five percent level of significance that is, the TRACE – Statistic value of the first hypothesized number of cointegrating equations for which the null hypothesis is not rejected, 52.69734 is lower than the critical value 60.06141.

Table 4: Johansen cointegration test result

Hypothesized No. of CE(s)	**Eigen value**	**Trace Statistic**	**5 percent Critical Value**	**Max-Eigen Value**	**5% Critical Value**
None*	0.638457	87.28809	83.93712	34.59075	36.63019
At most 1	0.558655	52.69734	60.06141	27.80958	30.43961
At most 2	0.299851	24.88776	40.17493	12.11973	24.15921
At most 3	0.254281	12.76804	24.27596	9.975810	17.79730
At most 4	0.076043	2.79226	12.32090	2.689065	11.22480
At most 5	0.003030	0.10316	4.129906	0.103161	4.129906

Source: Author's computation, 2019

Note: Trace and Max-Eigen Statistics indicates 1cointegrating equation at 5 percent level of significance.

* indicates significance.

Table 5: Parsimonious model results

Dependent Variable: MGDP				
Variable	Coefficient	Standard Error	t-Statistic	Probability.
C	-8.475409	9.834509	-0.861578	0.3960
L	-0.931218	3.6415536	-2.557201	0.0160
ELS	-1.530330	2.3220177	-0.659052	0.5151
K	0.640665	0.021125	30.32801	0.0000
LOG(PAR(-1))	0.345309	2.774509	2.564469	0.0086
ECM(-1)	-0.828084	0.098700	8.389915	0.0000
R^2	0.989768	Durbin-Watson stat		1.522773
Adjusted R^2	0.988003	Akaike info criterion		40.66390
F-statistic	561.0302	Schwarz criterion		41.93053
Prob(F-statistic)	0.000000			

Source: Author's computation, 2023

The result of the over-parsimonious model is shown in Table 5. The coefficient of electricity supply signifies a negative relationship between it (a measure of infrastructure) and manufacturing output in Nigeria. This is not in line with a priori expectation since the improvement in electricity supply will result in an increase in manufacturing sector performance. The result indicates that an increase in electricity supply by one megawatt will lead to a reduction in manufacturing output contribution to GDP by 1.5 percent in Nigeria. The negative effect of electricity supply on manufacturing output in Nigeria in this study is in line with the study by Yakubu *et al* (2015), and Abokyi et al (2018). This result is not completely unconnected with the deteriorating and epileptic electricity supply in Nigeria. Another reason for the negative result is dependent on the voltage quality and the usefulness of the electricity when it is available. More so, the manufacturing sector depends more on the private supply of electricity to run manufacturing activities.

ISSN No. 231-2705 | DOI: 10.51244/IJRSI | Volume X Issue VII July 2023

Further analysis showed that paved road is positive and statistically significant. When paved roads are increased by one kilometer, the contribution of manufacturing to GDP will likely increase by 0.3 percent. This result proves that paved road is important in enhancing manufacturing performance in Nigeria. The positive coefficient may be because of huge government spending on road construction and fixing the dilapidated road network and the near lack of alternatives for conveying finished products in Nigeria

With the availability of basic infrastructure like good roads, stable and sustainable electricity supply, labour (skilled and technical know-how), and capital, it is believed that there would be a drastic improvement in manufacturing output in Nigeria.

However, the negative impact of labour shows that the proportion of skilled labour employed in the manufacturing sector has reduced greatly. This could be a result of the fact that there are less skilled persons and technical know-how in manufacturing to handle specific machines and technology. Furthermore, an increase in labour is likely to cause a fall in per unit production cost, which would affect manufacturing sector performance. A reduction of capital used in production would also affect labour leading to an inverse relationship. This implies a reduction in the quality and quantity of manufacturing output in Nigeria.

The significance of the model using these criteria reveals that the model is not spurious.

The coefficient of capital as shown in Table 5 is 0.640665, this is positive and statistically significant and is in accordance with a priori expectation. This implies that a one percent increase in capital will lead to a 0.640665 percent increase in manufacturing output. The reason behind this is that the ability of firms to grow depends on raising capital which will lead to technical progress. Investment in capital would also lead to an increase in production of goods thereby enhancing manufacturing sector performance. This is in line with the study carried out by Jhingan (2006). The coefficient of a one-period lag is 0.345309. This is positive and statistically significant, meaning that a percent increase in paved roads will enhance the performance of the manufacturing sector by 0.345309 percent.

ECM's coefficient has the expected sign (negative) and is statistically significant. This indicates that it is well-behaved. ECM coefficient is -0.828. This implies that about 83 per cent of the deviations in manufacturing sector performance from equilibrium are corrected in each period. The Adjusted R^2 (Adjusted Co-efficient of determination) is 0.9880. This indicates that about 98.80 percent of the total variation in manufacturing GDP is explained by changes in the independent variables.

The F-statistic value 561.0302 is statistically significant at a five percent level as indicated by the corresponding probability value 0.000, meaning all the independent variables can jointly explain or influence manufacturing sector performance in Nigeria.

Again, the D.W statistic (1.5227), which is below 2, suggests the existence of positive autocorrelation among the variables. The effect of this autocorrelation can however be described as minimal, since 1.5227 is closer to 2 than 0. Also, the value of the D.W statistic is greater than the adjusted R^2 value of 0.98, indicating that the model is not spurious. The results of Akaike and Schwarz criterion (40.66390 and 41.93053), respectively indicate that the model is a good one.

VI. Conclusion And Recommendations

This study investigated the impact of infrastructure (electricity supply and paved roads) on manufacturing sector performance in Nigeria from 1981 – 2019. To achieve this aim, the study employed the OLS technique in estimating the relevant equation. The study also carried out pre-estimation tests of unit root and cointegration. Infrastructure, proxy by electricity supply had adverse and insignificant effects on manufacturing sector performance in Nigeria during the study period. Paved roads had a positive and significant impact on manufacturing output in Nigeria. Lastly, labour force had a negative and insignificant impact on manufacturing output in Nigeria.

The unstable power supply which adversely affects all sectors especially the manufacturing sector where power is key in overall performance and productivity could be the reason for the negative effect of electricity supply on manufacturing sector performance. Arising from these results, therefore, there should be a total overhaul of the electricity sub-sector and targeted increased supply specifically for industrial consumption. Also, the significant positive impact of infrastructure proxy by paved roads on manufacturing sector performance underscores the necessity of road transport in manufacturing sector activity. Therefore, the government should ensure that more roads are constructed and paved if manufacturing activities have to be enhanced in the country.

References

1. 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. https://doi.org/10.1155/2018/8924835
2. African Development Bank Report (AfDB) (2020). African Infrastructure Development Index 2019. https://www.afdb.org/en/documents/economic-brief-africa-infrastructure-development-index-aidi-2020-july-2020 African Union (AU) (2014)

3. Anyanwu, J. C. (2017). Manufacturing value added development in North Africa: Analysis of key drivers. Asian Development Policy Review, 5(4), 281–298.
4. Anyanwu, J. C. (2018). Does human capital matter in manufacturing value-added development in Africa? Asian Journal of Economic Modelling, 6(3), 294–317.
5. Appiah-Otoo, I., & Song, N. (2021). The impact of ICT on economic GROWTH-COMPARING rich and poor countries. Telecommunications Policy. https://doi.org/10.1016/j.telpol.2020.102082
6. Apurv, R. and Uzma, S.H. (2021), "The impact of infrastructure investment and development on economic growth on BRICS", Indian Growth and Development Review, 14 (1), 122-147. https://doi.org/10.1108/IGDR-01-2020-0007
7. Azolibe, C. B., & Okonkwo, J. J. (2020). Infrastructure development and industrial sector productivity in Sub-Saharan Africa. Journal of Economics and Development, 22(1), 91–109. https://doi.org/10.1108/JED-11-2019-0062
8. Babatunde, D. (2013). Long run relationship between education and economic growth in Nigeria: evidence from the Johansen's co-integration approach. A paper presented at regional conference on education in West Africa: constraints.
9. CBN, (2022) Central Bank of Nigeria Statistical Bulletin, CBN Abuja Nigeria.
10. Ebi, B. O. and **Eke, F. A.** (2018). Institutional Quality and Economic Diversification in Oil-Rich Economies: A Case Study of Nigeria. Journal of Economics and Sustainable Development. 9(14), 57-62
11. **Eke, F. A;** Agala, F. B. and Offum, P. F. (2019). Technological advancement and economic growth in Nigeria: a splitting sample and threshold approach. African Journal of Applied and Theoretical Economics. 5 (1), 124-145.
12. Essia, U. (2000) "Industrial and Technological Progress: Comparative Development in East-Asia and Sub-Saharan Africa, Proceeding of the Millennium Conference of Nigeria Economic Society Abuja.
13. Iwayemi, A., (1991) Infrastructure deficiencies and the Nigeria business Environment: Basic issues and policy options. Proceedings of a One-Day Seminar organized by the Nigerian Economic Society, Ibadan.
14. Jhingan, M.L (2006). The Economics of Development and Planning. 36th, Vrinda Publication, Ltd. Delhi
15. Manufacturers Association of Nigeria (2023). Uncertainty beclouds manufacturing sector in 2023. 21st Century Chronicle of January 19, 2023. Retrieved from https://21stcenturychronicle.com/uncertainty-beclouds-manufacturing-sector-in-2023-man-chairman.
16. Moyo, B. (2013) Power infrastructure quality and manufacturing productivity in Africa: A firm level analysis. Energy Policy, 61, 1063-1070. https://doi.org/10.1016/j.enpol.2013.05.111
17. Ndebbio , J. E.U (2006) The Structural Economic Dimension of Underdevelopment, Associated Viscissitude and Imperatives: Agenda for positive change.33rd Inaugural Lecture, University of Calabar-Nigeria, Saesprint Publisher-Nigeria.
18. 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 volume 49, 369–400 https://doi.org/10.1007/s40812-022-00216-2
19. Nworji I.D. and Oluwalaiye O.B (2012) Government Spending on Road Infrastructure and its Impact on the Growth of Nigerian Economy .International Journal of Management and Business Studies.
20. Ogunjimi, J.A. and Amune, B. O. (2019) Impact of Infrastructure on Foreign Direct Investment in Nigeria: An Autoregressive Distributed Lag (ARDL) Approach. Journal of Economics and Sustainable Development 10 (3), 1-8. Retrieved from www.iiste.org
21. Omimakinde J. A. (2022) Impact of Road Transport Infrastructure on Nigeria's Economic Growth. International Journal of Innovative Science, Engineering & Technology, 9(6), 49-62.
22. Ubi, P.S., Eke F.A and Oduneka, A. E (2011). The Role of Industrialization in a Developing Economy: The Case of electricity supply and Education in Nigeria in Udoh E, Ogbuagu U, and Essia U. Industrial Development: A Catalyst for economic growth. P. N. Davison publications.
23. Vagliasindi, M., and Gorgulu, N. (2023) Beyond brick and mortar: Key lessons learned on the impact of infrastructure on economic development. World Bank Blog. Retrieved from https://blogs.worldbank.org/ppps/beyond-brick-and-mortar-key-lessons-learned-impact-infrastructure-economic-development.
24. World Bank (1994) Infrastructure for development. World Development Report 1994, New York: Oxford University Press.
25. Yakubu, Y., B.S. Manu and U. Bala (2015) Electricity supply and Manufacturing output in Nigeria: Autoregressive distributive lag (ARDL) Bound testing approach. Journal of Economics and Sustainable Development,6 (17): 7-19.