The Economics and Finance Letters
2020 Vol. 7, No.2, pp. 104-111.
ISSN(e): 2312-430X
ISSN(p): 2312-6310
DOI: 10.18488/journal.29.2020.72.104.111

INFRASTRUCTURE DEVELOPMENT, CAPACITY UTILIZATION AND MANUFACTURING VALUE ADDED IN NIGERIA

Richardson Kojo Edeme[1+]
Johnson Nchege[2]
Idiota Dorathy[3]

[1,2,3]*Department of Economics, University of Nigeria, Nsukka, Nigeria.*
[1]*Email: richard.edeme@unn.edu.ng Tel: +2348035813888*
[2]*Email: johson.ncheje@unn.edu.ng Tel: +2348068529340*
[3]*Email: dorathy.idiota@unn.edu.ng*

(+ Corresponding author)

Article History
Received: 20 May 2020
Revised: 25 June 2020
Accepted: 27 July 2020
Published: 18 August 2020

Keywords
Infrastructure
Capacity utilization
Manufacturing value added
Electricity
Capital expenditure
Average capacity utilization.

JEL Classification:
C22; C32; L60; L86.

ABSTRACT

One of the greatest challenges being grappled with by most developing countries is to boost manufacturing sector performance. In achieving this however, emphasis has been laid on the role of infrastructural development coupled with utilization of capacity in the manufacturing sector. Previous studies have focused on the effect of infrastructure on manufacturing productivity. This study differs from the rest by examining the impact of infrastructure development and capacity utilization on manufacturing value added, using Nigeria data from 1980-2019. Our framework of analysis employed electricity, average capacity utilization, government capital expenditure and manufacturing value added annual percentage growth as variables of analytical relevance. Finding indicates that electricity had negative and insignificant effect on manufacturing value added while manufacturing capacity utilization and capital expenditure had positive and significant effect on manufacturing value added. The result reiterates that capital expenditure on social and economic infrastructure has the capacity to improve manufacturing value added.

Contribution/Originality: This study is one of the few studies which have investigated infrastructure development, capacity utilization and manufacturing value added in Nigeria.

1. INTRODUCTION

Many researchers have agreed that manufacturing sector is the bedrock of growth and development. The sector has been adjudged as imperative to fostering productive activities, export expansion, employment generation and human welfare (Andreas, 1997; Behun, Gavurova, Tkacova, & Kotaskova, 2018; Canning & Pedroni, 2008; Goel, 2003; Herman, 2016; Mehta & Rajan, 2017). Apart from infrastructure, it has also been asserted the performance of the manufacturing sector is influenced by capacity utilization which accounts for increased productivity, contribution to gross domestic product (GDP) and employment generation. This justifies the current study to link infrastructure development, capacity utilization and manufacturing value added in Nigeria which previous studies ignored.

The experience of East Asian and newly emerging economies shows that the manufacturing sector have contributed to growth, poverty reduction and employment creation. But the same cannot be said of countries of Africa. The experience of Nigeria is typical of other countries in Africa, if not worse. Figure 1 shows annual percentage growth in manufacturing value added in Nigeria, 1981-2018. Between 1981 and 1983, manufacturing value experienced negative average growth of 16.9 %. In 1984, manufacturing value added increased to 5. 2 %

before plummeting 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, average manufacturing value added growth was -9.0%. The highest growth of 17.8% was recorded in 2010 which 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%.

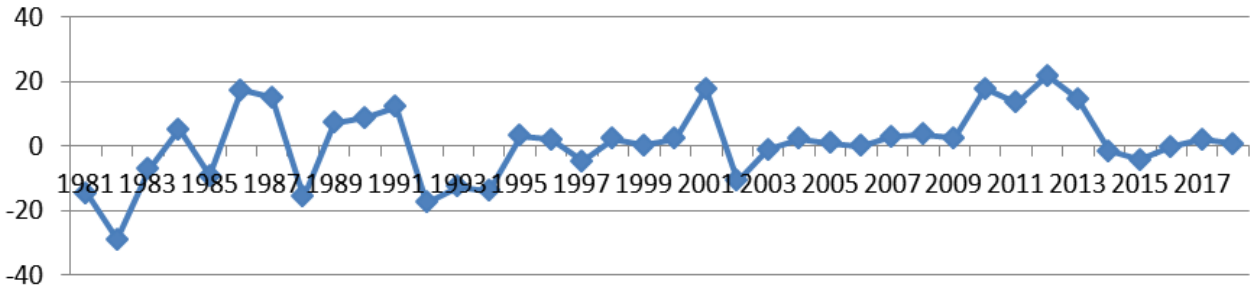

Figure-1. Manufacturing value added in Nigeria (Annual % growth), 1981-2018.

In relation to contribution to gross domestic product (GDP), the manufacturing sector performance declined by over 9.8% between 1981 and 1999 and contributed an average of 38% to industrial output between 2010 and 2018 (World Bank, 2019). A cursory look at the manufacturing capacity utilization depicts that average capacity in the manufacturing sub sector which stood at 43.4% in 1999 improved marginally from 57. 8% in 2013 to 59.5% in 2014. It however declined to 55.6% in 2018. The poor performance of the manufacturing sector has been blamed on several factors including quality of capital expenditure, poor infrastructure, lack of adequate electricity supply and other regulatory constraints. All these have contributed negatively to the manufacturing sector performance.

In assessing the potential of the manufacturing sector in Africa, it was unanimously agreed by Signe (2018) and Edeme, Buzugbe, Nkalu, and Arazu (2020) that apart from human capital, infrastructure development greatly influence the performance of the manufacturing sector. As aptly put by World Bank (2019) the desired goal of accelerating the growth and performance of the manufacturing sector in Africa might be a mirage if public infrastructure is not developed and capacity utilized effectively. In Nigeria, that there is still some relatively high rate of capacity under-utilization which has affected manufacturing sector contribution to growth. It therefore follows that inspite of the various industrial policies in place, the manufacturing sector in Nigeria have fallen beyond expectation in its contribution to economic growth and development. There is much capacity availability in the country but these capacities are underutilized. In agreement with this, Ukoha (2000), Adenikinju. and Olofin (2000) notes that the performance of the manufacturing sector has not been impressive and this accounts for its low contribution to sustainable economic development. The greatest challenge of the manufacturing sector in Nigeria is capacity under-utilization, which is attributable to lack of enabling environment, poor and inadequate infrastructure, poor implementation of incentives to manufacturing (Uchimura & Gao, 1993; Udah, 2010). As further argued by Luger, Butler, and Winch (2003), Bailey, De Propris, and Janger (2015) while infrastructure supports manufacturing activity is a wide of ways, development in infrastructure also stimulates innovations in manufacturing. Thus, the evolving relationship between manufacturing and infrastructure will provide the spring board for investment in productive activities in the industrial sector, create value and employment opportunities in the manufacturing sector. In all these, infrastructure is either satisficing or enabler of manufacturing productivity. While this may be true, there are also concern on manufacturing sector capacity utilization. Just like infrastructure-manufacturing connection has changed over the years, to role of capacity utilization has evolved of the years. Not only that a lot of changes have taken place in the manufacturing sector in Nigeria, capacity utilization in different sector differs It is therefore imperative to examine the relationship among infrastructure development, capacity utilization and manufacturing value added. It is important to understand this relationship in order to make right investment in infrastructure being in mind available capacity. This study becomes important considering the fact

that existing studies have always linked economic infrastructure to the performance of the manufacturing sector, neglecting the role of social infrastructure in enhancing manufacturing value added. The study focuses on Nigeria with data from 1980-2019. Major finding is that capital expenditure and manufacturing capacity utilization had positive and significant effect on manufacturing value added. Electricity had negative and insignificant effect on manufacturing value added

2. LITERATURE REVIEW

Evidence abound from several studies on the positive effect of infrastructure on growth, poverty reduction and income distribution (César & Luis, 2004; Dissou & Didic, 2013; Palei, 2015; Sawada, 2015; Uchimura & Gao, 1993; World Bank, 1994). Other studies such as Chenery (2005); Bhagwati (2008) alludes that productive manufacturing sector is positively correlated with improvement in income and stimulates growth. Ijaiya and Akanbi (2009) examine the effect of infrastructure on industrial development in Nigeria. Based on non-linear production function, it was shown that a long run relationship exists between infrastructure and industrial output. Transport, telecommunication and electricity was found to have negative effect on industrial output. This contradicts the findings of Adenikinju (1998). The study reports that infrastructure and government capital expenditure had negative effect on manufacturing productivity.

The study by Orji, Worika, and Umofia (2017) reports that transport infrastructure does not support manufacturing sector productivity. Other infrastructure, electricity was found to have positive and insignificant effect on manufacturing performance. In Mexico, Carlsson (2002) conducted research on the effect of transport and electricity infrastructure on manufacturing growth. Finding indicates that transport contributes to manufacturing productivity by 65 percent while increase in electricity increases manufacturing performance by 10 percent. Mamatzakis (1999) examine the impact of infrastructure on manufacturing sector performance in Greece and found that infrastructure enhances manufacturing productivity. Going further, Seitz and Licht (2005) examined the effect of infrastructure on manufacturing production using regional data from Germany. It was found that infrastructure enhances regional competitiveness, reduces cost of production and reduces price. Benvenuti and Marangoni (1999) study on the impact of infrastructure on manufacturing output found that infrastructure enhances manufacturing output in the short run and improves income and employment generation in the long run. Holl (2004) used data from Spain and reported that transport infrastructure has positive effect on manufacturing output. This finding was upheld by Gibbons, Lyykainen, Overman, and Sanchis-Guarner (2019).

Thoung, Tyler, and Beaven (2015) examined the effect of infrastructure on productivity in Europe. The study finds that infrastructure had positive and significant effect on manufacturing productivity. Using panel data from cross-section of countries from 18 developed and developing countries, Stephan (1997) provide further evidence supporting the positive effect of infrastructure on manufacturing output.

The main concern of the study by Mesagan and Ezeji (2016) was to determine the effect of both economic and social infrastructure on manufacturing performance in Nigeria. Findings indicate that capital education expenditure and telecommunication had positive and significant effect on manufacturing performance while health expenditure, electricity and prime lending rate had negative and insignificant effect on manufacturing performance. More recently, Edeme et al. (2020) assessed the effect of infrastructural development on manufacturing value added in the case of emerging African emerging economies. Empirical findings indicate that electricity, information and communication technology and electricity had positive and insignificant effect on manufacturing value added while transport had negative effect on manufacturing value added.

In a different strand, Simon-Oke and Awoyemi (2010) examined the impact of manufacturing capacity utilization on industrial development using Nigeria data from 1976-2005. Result had it that a long-run positive relationship exist between manufacturing capacity utilization and industrial productivity.

From the literature review, apart from the fact that results from previous studies on the effect of infrastructure on manufacturing performance.is inconclusive, there are no studies linking infrastructure development, capacity utilization and manufacturing value added. This perceived gap in literature is covered by the present study.

3. METHODOLOGY

The theoretical framework underlying this study is rooted in the Cobb-Douglas production framework. The framework posits that technological advancement in relation to other inputs such as capital and labour determines output. Assuming that production output is determined by two factor inputs, labour and capital, the relationship can be represented technically in Equation 1 as:

$$Y=AK^{\alpha}L^{\beta} \qquad (1)$$

Where Y denotes total output, K is capital input, L is labour input and A is total factor productivity. α and β represent respective output elasticity of capital and labour inputs. In relation to this, it can be inferred that manufacturing value added is influenced by several factors such infrastructure, government capital expenditure, capacity utilization, among others. In line with variables considered in this study, the model for empirical estimation is stated in Equation 2 as:

$$MVD_t = \alpha_0 + \alpha_1 GCEX/GDP_t + \alpha_4 ELCON_t + \alpha_5 AMCU_t + \mu_{1t} \qquad (2)$$

where:

MVD is manufacturing value added (proxied by growth in manufacturing value added, annual %), $GCEX/GDP$ = government capital expenditure (measured as government capital spending on transportation, water facilities, housing, education, health, sanitation, energy and other utilities as percentage of GDP), *ELCON* = electricity consumption (measured as total electricity net consumption, Billion Kilwatt hours), *AMCU*= average manufacturing capacity utilization. Equation 2 portrays that manufacturing value added is dependent on government capita expenditure, electricity and average manufacturing capacity utilization.

The study employed annual data from 1980-2019 generated from World Bank's (World Development Indicators), Central Bank of Nigeria (CBN) Statistical Bulletin and International Energy Statistics. Table 1 present the descriptive summary statistics of the variables.

Table-1. Summary Statistics.

Variables	Mean	Std. Deviation	Minimum	Maximum
MVD	5.01	6.23	10.28	267650.5
GCEX/GDP	3232	5543	978	1790
ELCON	4.68	5.94	2.01	23.11
AMCU	0.09	1.09	4.90	3.11

The summary descriptive statistics indicate that manufacturing of value added had mean value of 5.01 percent while the average government capital expenditure stood at N3232 million. Average electricity consumption stood at 4.68 billion Kilwatt hours while average manufacturing capacity utilization was 0.09.

4. EMPIRICAL RESULTS

4.1. Unit Root Test

Since time series are used for empirical estimation, it is a common practice to determine their stationarity and hence unit root tests. The test was conducted with both the Augmented Dickey-Fuller (ADF) and Philips-Peron (P-P) tests. The result is reported in Table 2.

Table-2. Result of the ADF and P-P unit root tests.

Variable	ADF Test Result		P-P Results		LagOrder	~I(d)
	Level	1st difference	Level	1st difference		
MVD	-9.768	-3.233*	-1.950	-5.270*	2	I(1)
GCEX/GDP	-4.622*	-3.574	-5.217*	-	2	I(1)
ELCON	-4.377	-3. 553			2	I(1)
AMCU	-4.078	-5.433*	-2.771	6.078*	2	I(0)

Note: * indicates 5 percent level of significance. Both the Akaike Information Criterion (AIC) and Akaike Final Prediction Error (FPE) was adopted to choose the optimal lag lengths. ADF and P-P 5% critical value at level and 1st difference is -2.884 and 2.885 respectively. A constant is included in both the ADF and P–P unit root test models estimated.

In Table 2, the ADF test result shows that manufacturing value added, government capital expenditure, electricity and average capacity utilization are not stationary at levels. The level form test statistics respectively is less than the critical value at 5% level in absolute terms. As further indicated in the P-P test result, manufacturing value added, government capital expenditure and electricity became stationarity after first difference I(1). Average capacity utilization is stationary at level I(0). This result is in conformity with the ADF test results.

4.2. Co-integration Test

Since the unit test results of the variables is mixed, there is need to further conduct co-integration test so as to establish the long relationship among the variables. Similar to ADF test, we conclude that with a critical value at 5% level of significance that the variables are co-integrated.

Table-3. Result of co-integration test.

Variable	ADF Test stat	Critical value
Residual term U_t	-3.7110	3.5684

The result which is presented in Table 3 reports coefficient of -3.7110, which is greater than the critical value of 3.5684 at 5%. This implies that although the variables are independently non-stationary but stationary when combined. Thus, we conclude that there is the existence of long-run relationship among the variables.

Table-4. Result of the impact of infrastructure development, capacity utilization and manufacturing value added.

Variable	Coefficient	Standard Error	t-Statistic	*p-value*
GCEX/GDP	0.4938	0.3925	3.4283	0.0196
ELCON	-0.6780	2.3569	0.2289	0.8207
AMCU	1.4964	3.5372	4.1686	0.0531
Constant	1065.15	148.050.5	3.3422	0.1350
R^2		0.71887		
F-Stat		73.6185		
DW		0.8262		
Prob. (F-stat)		0.0000		

As indicated in Table 4, government capital expenditure had positive and insignificant effect on manufacturing value added. Going by the estimated coefficient, an increase in government capital expenditure enhances manufacturing value added by 4.94 percent. The outcome is similar to Mesagan and Ezeji (2016) that

manufacturing sector performance is positively correlated with government capital expenditure in the case of Nigeria. Again, electricity had negative effect on manufacturing value added. The coefficient for electricity consumption which is -0.6780 implies that increase in access to electricity consumption led to a corresponding reduction in manufacturing value added by about 6.78 percent. This implies that electricity does not support manufacturing activities in Nigeria due to its poor, erratic and epileptic nature. This contradicts (Edeme et al., 2020) that found positive relationship between electricity and manufacturing value added in the case of Nigeria and Africa emerging economies.

Furthermore, average manufacturing capacity utilization had positive impact on manufacturing value added. The result shows that an increase in the utilization of manufacturing capacity has the tendency of improving manufacturing value added by 1.49%. The result of the study has some far-reaching implications. Firstly, the positive and insignificant effect of government capital expenditure on manufacturing value added connotes that capital expenditure on sectors that accentuates manufacturing productive activities is not enough. Specifically, World Bank (2019) contends that in the last decade, developing countries of Africa have not much in enhancing infrastructure development that supports manufacturing activities.

5. CONCLUSION

With the growing need to diversify the economy in Africa, emphasis have been on the contribution of the manufacturing sector to the growth process. In the face of this however is the dauting challenge of infrastructure development and utilization of capacity in the manufacturing sector. It is therefore germane to ascertain the effect of infrastructure development, capacity utilization and manufacturing value added. The study focuses on Nigeria based on data from 1980-2019.

The major findings emanating our study is that government capital expenditure and average manufacturing capacity utilization had positive and insignificant effect on manufacturing value added. Again, electricity had negative effect on manufacturing value added. The coefficient for electricity consumption which is -0.6780 implies that increase in access to electricity consumption led to a corresponding reduction in manufacturing value added by about 6.78 percent. This implies that electricity has not supported manufacturing performance due to its poor, erratic and epileptic nature. Our result has some far-reaching implications. Firstly, the positive and insignificant effect of government capital expenditure on manufacturing value added connotes that capital expenditure on sectors that accentuates manufacturing productive activities is not adequate. This reiterate that capital expenditure on social and economic infrastructure has the capacity of improving manufacturing value added.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Acknowledgement: All authors contributed equally to the conception and design of the study.

REFERENCES

Adenikinju, A. F. (1998). *Government investment and manufacturing performance in Nigeria*. Paper presented at the In Nigerian Economic Society Annual Conference.

Adenikinju., A., & Olofin, S. O. (2000). Economic policy and manufacturing sector growth performance in Africa. *Nigerian Journal of Economics and Social Studies, 42*(1), 67-80.

Andreas, S. (1997). The impact of road infrastructure on productivity and Growth: Some preliminary results for the German manufacturing sector. WZB Discussion Paper, No. FS IV 97-47, Wissenschaftszentrum Berlin für Sozialforschung (WZB), Berlin.

Bailey, D., De Propris, L., & Janger, J. (2015). New industrial policy for more inclusive and sustainable growth, No. 9, WWW for Europe Policy Brief. Retrieved from: http://www.foreurope.eu/fileadmin/documents/pdf/Policybriefs/WWWforEurope_PB_no09_D306.2.pdf.

Behun, M., Gavurova, B., Tkacova, A., & Kotaskova, A. (2018). The impact of the manufacturing industry on the economic cycle of European union countries. *Journal of Competitiveness*, *10*(1), 23-39. Available at: 10.7441/joc.2018.01.02.

Benvenuti, S. C., & Marangoni, G. (1999). Infrastructure and performance of the Italian economic system. *Economic Systems Research*, *11*(4), 1-15.

Bhagwati, J. (2008). Export promoting trade strategy: Issues and evidence. *World Bank Research Observer*, *2*(1), 27-57.

Canning, D., & Pedroni, P. (2008). Infrastructure, long-run economic growth and causality tests for cointegrated panels. *The Manchester School*, *76*(5), 504-527. Available at: https://doi.org/10.1111/j.1467-9957.2008.01073.x.

Carlsson, B. (2002). The measurement of efficiency in production: An application to swedish manufacturing industries. *Swedish International Journal of Economics*, *4*(4), 568-598.

César, C., & Luis, S. (2004). The effects of infrastructure development on growth and income distribution. Policy Research Working Paper No.3400. World Bank, Washington, D.C, World Bank.

Chenery, S. L. (2005). Productivity growth, external shocks and capital inflow in Chile 1977-81: A general equilibrium analysis *The Journal of Policy Modeling*, *8*(2), 1-14.

Dissou, Y., & Didic, S. (2013). Infrastructure and growth, in Cockburn, J., Dissou, Y, Duclos, J Y abd Tiberti, L (eds) infrastructure and economic growth in Asia economic studies in inequality, social exclusion and well-being (pp. 5-45). Cham: Springer.

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*, *XV*, *Summer*, *2*(68), 366-376. Available at: https://doi.org/10.14505/jaes.v15.2(68).09

Gibbons, S., Lyykainen, T., Overman, H. G., & Sanchis-Guarner, R. (2019). New road infrastructure: The effects on firms. *Journal of Urban Economics*, *110*(2), 35-50. Available at: https://doi.org/10.1016/j.jue.2019.01.002.

Goel, D. (2003). Impact of infrastructure on productivity: Case of Indian registered manufacturing. *Indian Economic Review*, *38*(1), 95-113.

Herman, E. (2016). The importance of the manufacturing sector in the Romanian economy. *Procedia Technology*, *22*, 976-983. Available at: https://doi.org/10.1016/j.protcy.2016.01.121.

Holl, A. (2004). Manufacturing location and impacts of road transport infrastructure: Empirical evidence from Spain. *Regional Science and Urban Economics*, *34*(3), 341-363. Available at: https://doi.org/10.1016/s0166-0462(03)00059-0.

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.

Luger, M., Butler, J., & Winch, G. (2003). Infrastructure and manufacturing: Their evolving relationship. Future of Manufacturing Project: Evidence Paper 20, Foresight, Government Office for Science. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/283894/ep20-infrastructure-and-manufacturing.pdf.

Mamatzakis, E. C. (1999). Public infrastructure, private input demand, and economic performance of greek industry. Working Papers 406, Queen Mary University of London, School of Economics and Finance, 49-64.

Mehta, Y., & Rajan, A. J. (2017). Manufacturing sectors in India: Outlook and challenges. *Procedia Engineering*, *174*, 90-104. Available at: https://doi.org/10.1016/j.proeng.2017.01.173.

Mesagan, E. P., & Ezeji, A. C. (2016). The role of social and economic infrastructure in manufacturing sector performance in Nigeria, Munich personal RePEc archive. Retrieved from: https://mpra.ub.uni-muenchen.de/78310/1/MPRA_paper_78310.pdf.

Orji, K. E., Worika, I. L., & Umofia, N. (2017). The impact of infrastructural development on Nigeria's industrial sector. *African Research Review*, *11*(3), 23-30.

Palei, T. (2015). Assessing the impact of infrastructure on economic growth and global competitiveness. *Procedia Economics and Finance*, *23*(2015), 168-175. Available at: https://doi.org/10.1016/s2212-5671(15)00322-6.

Sawada, Y. (2015). The Impacts of Infrastructure in development: A selective survey. ADBI Working Paper 511, Tokyo: Asian Development Bank Institute.

Seitz, H., & Licht, G. (2005). The impact of public infrastructure capital on regional manufacturing production cost. *Regional Studies*, *29*(3), 231-240. Available at: 10.1080/00343409512331348923.

Signe, L. (2018). The Potential of manufacturing and industrialization in Africa trends, opportunities, and strategies, Africa growth initiative, https://www.brookings.edu/wp-content/uploads/2018/09/Manufacturing-and-Industrialization-in-Africa-Signe-20180921.pdf.

Simon-Oke, O., & Awoyemi, O. (2010). Manufacturing capacity utilization and industrial development in Nigeria: An assessment (1976–2005). *African Research Review*, *4*(2), 265-275. Available at: https://doi.org/10.4314/afrrev.v4i2.58315.

Stephan, A. (1997). The impact of road infrastructure on productivity and growth: Some preliminary results for the German manufacturing sector. Discussion Paper FS IV 97-47, Wissenschaftszentrum Berlin.

Thoung, C., Tyler, P., & Beaven, R. (2015). Estimating the contribution of infrastructure to national productivity in Europe. *Infrastructure Complexity*, *2*(5), 1-11.

Uchimura, K., & Gao, H. (1993). *The importance of Iinfrastructure on economic development*. Washington, DC: Latin America and the Caribbean Regional Office, World Bank.

Udah, E. B. (2010). Industrial development, electricity crisis and economic performance in Nigeria. *European Journal of Economics, Finance and Administrative Sciences*, *18*(1), 105-121.

Ukoha, O. O. (2000). Determinants of manufacturing capacity utilization in Nigeria, 1970 1998. *The Nigeria Journal of Economics and Social Studies*, *42*(2), 121-130.

World Bank. (1994). *World development report, infrastructure for development*. Washington, DC: The World Bank.

World Bank. (2019). World development indicators. Retrieved from: https://www.worldbank.org.