Impact of Electricity Consumption on Manufacturing Sector Growth in Nigeria

[1]Hitlar Inedu, [2]Silas Idoko Abu, [3]Mary Abdul Yusuf

[1&2]Department of Economics, Prince Abubakar Audu University, Anyigba, Kogi State – Nigeria
[3] School of General studies, Department of Economics, Kogi State Polytechnic - Nigeria

***Abstract*: This study was conducted to examine the impact of electricity consumption on manufacturing sector growth in Nigeria covering the period of 1986 to 2020. The data for the study were sourced from World Bank's Development Indicator and International Energy Agency (IEA). The study employed Augmented Dickey Fuller unit root, Autoregressive Distributed Lag (ARDL), Johansen Co integration and Pairwise Granger Causality test. For the objectives, the outcome revealed that electricity consumption had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in electricity consumption led to increase in manufacturing sector growth in Nigeria within the study period. Also, electricity generation had a significant negative effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in electricity generation led to increase in manufacturing sector growth in Nigeria within the study period. Government should ensure that there is increase in electricity generation to boost electricity consumption towards enhancing the contribution of manufacturing sector to Gross Domestic Product so as to improve manufacturing sector growth in the Nigerian economy.**

***Keywords*: Electricity, Consumption, Manufacturing growth.**

Introduction

Electricity is a flexible form of energy and critical resource for modern life and a vital infrastructural input for economic growth and development. In all economies, households and companies have extensive demand for electricity. This demand is driven by such important factors as industrialization, extensive urbanization, population growth, rising standard of living and even the modernization of the manufacturing sector (Ken, 2015). Furthermore, electricity is considered as one of the determinants of any economic activity and indeed industrial production towards achieving desired level of manufacturing sector growth. Conversely, before the oil crisis in 1973, the world had failed to draw attention to the significance of electricity in the production process of any economy. However, the crisis emphasized the value of electricity consumption to achieve desired level of manufacturing sector contribution to Gross Domestic Product (Erbaykal, 2018).

In Nigeria, the demand for electricity consumption by manufacturing firms had been on the rise and ever due to epileptic power supply. This had been due to the fact that Africa's energy sector remains a significant component of the continent's economic growth and development agenda (Esso & Loesse, 2010). Globally, Africa is naturally endowed in energy resources which include the sun, wind, hydro, coal, natural gas, electricity, petroleum amongst others. Electricity consumption from the power sector is generated using coal and to some extent the use of hydro power (Energy Sector in Africa, 2011).

The demand for electricity consumption had been on the rise in West Africa. However, the energy sector in West Africa had over the years been crippled with various challenges such as the inconsistency in the supply of electricity. In spite of these electricity challenges, West African economies have not performed poorly (Adegbemi & Babatunde, 2013). Contribution of manufacturing sector to GDP growth rate in the Nigerian economy had been slow over the 1990s. This was because manufacturing sector growth had reduced from a value of 4.0% recorded in 1993 to 2.1% in 1994 (Ruth, 2018). In recent times, however, according to the World Bank (2015), manufacturing sector growth rate in Nigeria was estimated to be 6% in 2014 and growth is expected to rise to 6.1% in the year 2016 and 7.5% in the year 2018, reversed is the case as the country recorded manufacturing sector growth rate of 0.8% in 2019 (CBN, 2019).

Nigerian economy is endowed with abundant energy resources but suffers from persistent energy crisis (Olusanya, 2012). Considering the level of electricity consumption in Nigeria, World Bank (2011) reported that the size of the Nigerian economy in terms of manufacturing sector growth marked by the Gross National Income per capita was put at $1,190 and ranked 162 out of 213 countries in the World Development Index in 2011. Nigerian economy also recorded high manufacturing sector growth rate as the country's GDP per capita expanded by 132 percent between independence in 1960 and 1969, and rose to a peak growth of 283 percent between 1970 and 1979. The severity of this depression led to the restructuring of the economy in 1986. In the period 1988-1997 which constituted the period of structural economic adjustment and liberalization, the contribution of manufacturing sector to GDP responded to economic adjustment policies and grew at a positive rate of 4%. In 2006, the real contribution of manufacturing sector to GDP growth rate in Nigeria was 7%. Furthermore, the Nigerian economy measured by the real contribution of manufacturing sector to GDP in 2010 grew by 7.87% (National Bureau of Statistics, 2010). Currently in Nigeria, the contribution of manufacturing sector to GDP figure in 2018 was $397,270. Hence, Nigeria is number 31 in the ranking of contribution of manufacturing sector to GDP among 196 countries. Manufacturing sector growth rate in the Nigerian economy was averagely high from 2017 to 2018; this was because the contribution of the sector to GDP per capita of Nigeria in 2018 was $2,028, $56 less than 2017, when it was $1,972 (World Bank, 2018).

Despite the challenges confronting Nigerians in terms of poor electricity consumption, Olusegun (2019) asserted that high level of electricity consumption is a bone for economic growth, holding to the fact based on his study electricity consumption contributed

positively to economic growth in Nigeria. Hence, greater electricity consumption implied that there will be more economic activity in the nation and as a result higher manufacturing sector growth.

Statement of Problems

Electricity consumption is supposed to enhance manufacturing sector growth. However, the real situation of electricity generation deficiency in Nigeria is unimaginable despite the Federal Government over the years initiated many policies, projects and programs to tackle energy problems in Nigeria for many decades.

Despite the fact that Nigeria has potentials in energy development, the current situation of low power generation capacity and poor electricity consumption by manufacturing sectors depicts that the country is not well-prepared to benefit from the projected increases in power generation from coal, gas-powered and renewable sources towards achieving desirable level of growth in the manufacturing sector. There have been many policy statements regarding Nigeria's willingness to increase electricity generation to enhance its consumption but the available generation capacity is yet to meet up to the increase in population growth and the activities of the manufacturing sector, thereby leading to decline in productive capacity of real sectors as well as drastic fall in GDP growth rate of the manufacturing sector which would have helped to achieve the desired level of economic growth in the Nigerian economy (Aliyu, 2014).

Also, CBN (2013) depicted that government expenditure and private capital investment in power generation has skyrocketed since mid-1980s while power generation in terms of Megawatt per hour has not been measuring up to the expenditure and investments towards enhancing GDP growth rate of the sectors in the economy especially manufacturing sector. In 2014 after Gross Domestic Product (GDP) rebasing, Nigerian economy became the largest in Africa notwithstanding the slow pace in growth of power generation capacity. CBN (2015) data depicted that private capital investment in power generation over the years increased from ₦175 billion in 1999 to over ₦1.5 billion in 2020. However, despite this increment the desired GDP growth rate of manufacturing sector in the Nigerian economy is yet to be achieved due to epileptic power generation and consumption which also resulted to contraction in power sector GDP growth rate by -15% in full year 2019 from -9.25% in 2017 and -8.69% in 2015. The price of power generation or power generation charges has constantly been increasing following the shortages of power generation in Nigeria from 2008 to 2019 (CBN, 2019). This implied that availability and cost of power generation play a major role to competitiveness of the firms. Therefore, increasing the cost of electricity or power generation hurts the companies' competitiveness, electricity consumption and results in closing down of some companies which in return led to decline in its growth rate in Nigeria. Hence, the study intends to examine the impact of electricity consumption on manufacturing sector growth in Nigeria. The main objective of the study is to empirically examine the impact of electricity consumption on manufacturing sector growth in Nigeria and to determine if there is a causal relationship between electricity consumption to manufacturing sector growth in Nigeria. This study is divided into five sections. The first section deals with the introduction. Section two deal with the literature review and theoretical framework while section three presents the methodology of the study. Section four examines the presentation of data, analysis of empirical results and discussion of results; and Section five presents the summary, conclusion and recommendation of the study.

This study shall cover the period 1986 to 2020; that is the period of 34 years. 1986 which is the base year was chosen in order to examine contribution of electricity consumption to manufacturing sector growth in Nigeria during the period of Structural Adjustment Program (1986).

Literature Review

Theoretical Literature

Neoclassical Energy Theory

Stern (2004) propounded a neoclassical model which explained the linkage between energy and growth. Stern asserted that there has been extensive debate concerning the trend in energy efficiency in developed economies, especially since the two oil price shocks of the 1970s. Stern (2004) in the neoclassical model argued that in the United States of America (U.SA) economy, electricity consumption hardly changed in the period 1973 to 1991, despite a significant increase in Gross Domestic Product (GDP). According to Stern, these facts were indisputable and the break in the trend has been the subject of argument. The theory referred to neoclassical perspective of the production function to examine the factors that could reduce or strengthen the linkage between energy use and economic activity over time and depicted that there has been a decoupling of economic output and resources, which implies that the limits to growth are no longer as restricting as in the past.

Energy Ladder Theory

Rajmohan and Weerahewa (2005) propounded the energy ladder theory as one of the most common approaches used in studying the rural informal economy energy use patterns. The concept of energy ladder hypothesis states that people with low incomes generally use traditional fuels as their main energy source and people with higher incomes tend to use modern fuels (Nicolai & Fiona, 2008). This trend tends to shift from traditional fuels to modern fuels basically when the income of the rural informal economy increases. As used by different researchers on household energy; (Masera, Saatkamp and Kammen, 2000; Barnett, 2000; Sheilah and Alison, 2002; Arnold, Kohlin, and Persson, 2006) results of the energy demand research revealed that the income, fuel prices, government policies, Intra-household income distribution, Fuel availability, Distribution network proximity, Cultural preferences, Demographic distribution, Physical environment (rural or urban) and household characteristics influence electricity consumption levels. There is evidence to show in these researches that people in urban areas use more kerosene, LPG, and electricity. They also suggest that price-based and quantity-based government policies tend to influence the urban fuel demand patterns more than does the household income level (Bhatia, 1988).

It is shown that the concept of energy ladder hypothesis is loosely based on economic theory of consumer behavior (Hosier & Kipondya, 1993). This explains the theory partially, showing when income increases households not only consumes more of the

same good but they also climb the ladder to more modern goods with higher quality i.e. as a household gains socioeconomic status, it ascends the ladder to cleaner and more efficient forms of energy Further it assumes that cleaner fuels are normal economic goods while traditional fuels are inferior goods (Rajmohan et al, 2005).

Empirical Literature

Aliyu, Lawal and Beki (2018) examined the electricity consumption and economic growth in Nigeria, using the time frame of thirty (30) years period from 1986-2016 and the data are source from CBN statistical bulletin. The study used OLS estimation technique. The result of the study reviewed that electricity consumption had significant relationship with economic growth in Nigeria. The study suggested that energy conservation policies could be effectively implemented without having any negative effect on economic growth in Nigeria and energy growth policy should be adopted in such a way that, growth in the energy sector could stimulates economic growth and thus expands employment opportunities in the country.

Mahmood and Kanwal (2017) analyzed the relationship between energy efficiency and economic growth in Pakistan during the period 1980-2016. The data are source from Pakistan bureau of statistics. The study explored Error Correction Model, Johansen Co-integration Vector Error Correction Model and Granger Causality test. The study found that long-run relationship between energy intensity and GDP. Whereas results from VECM showed that energy intensity is increasing with economic growth. The study recommends that; the government of Pakistan should use energy efficient management policy for this sector. For example, government can promote public transport by introducing energy efficient transport system with the help of China in all major cities.

Babatunde (2016) investigated the time-varying relationship between electricity consumption and economic growth in Nigeria using annual data for the period 1970-2014 and the data are source from the CBN statistical bulletin and NBS. Vector Autoregression, Augumented Dickey Fuller and Phillips Peron were used in the study. The findings of this paper found statistical independence between electricity consumption and economic growth. The lack of long-run relationship between electricity consumption and economic growth implies that electricity consumption does not have any linkage with economic growth in Nigeria. The study recommended that until certain bottlenecks are removed, Nigeria may not be able to utilize the abundant non-renewable energy resources.

Majeed and Siddique (2016) analyzed the relationship between electricity consumption and economic growth of Pakistan over period 1982-2015 with data from Pakistan central bank. Using Ordinary Least Square and Granger Causality Test. The results indicate that bidirectional causality between consumption of oil and economic growth, between coal and economic growth, and between electricity and economic growth. The oil, gas, coal and electricity are affecting economic growth of Pakistan positively and all are significant source of energy. The study recommended that government should take strong measure to eliminate the energy theft from the country which is a major cause of less energy available for use.

Neuhaus (2016) examined the renewable electricity consumption economic growth nexus in Sub-Saharan African countries during the period 1990-2011 and the data are from world data indicators. The study adopted Panel Cointegration, Granger Causality test and Fully-Modified Ordinary Least Squares (FMOLS) methodology to analyze the relationship. The found a long-run and statistically significance relationship between real GDP and renewable energy. The results from the Granger causality tests indicate unidirectional causality running from GDP to renewable electricity consumption in the long-run. The recommended that expanding renewable energy technologies in sub-Sahara African may be a difficult policy objective including uncertainties surrounding the technology's revenues and costs, accessibility of technology, government constraints including but fiscal and legislative constraints.

Mustapha and Fagge (2015), examined relationship between electricity consumption and economic growth using Nigeria's data from 1980-2011. The study used Johansen Cointegration, Vector Error Correction to examine the dynamic relationship between electricity consumption and economic growth. The result revealed that, long-run relationship was established at 1 percent level of significance and the direction of causality using pairwise Granger causality and wald test confirm the absence of causality. The study recommended that the country can pursue an expansive or conservative energy policy without undermining it economic growth.

Oyaromade, Mathew and Abalaba (2014) analyzed the relationship between electricity consumption and economic growth in Nigeria using annual data for the period 1970-2010. The study employed Augmented Dickey Fuller, Phillips perron and Granger Causality test. The study finds no clear relationship between electricity consumption and economic growth. The real GDP was found not to cause electricity consumption while electricity consumption was also found not to cause real GDP. The study recommended that the policy maker need to implement policies that link electricity consumption with growth generating activities

Echeta, Igwemma and Nwosu (2014) examined access to energy and productivity of firms using a comparative analysis of two industrial clusters in South-eastern Nigeria (Owerri industrial cluster and Osakwe industrial cluster in Onitsha). The study employed descriptive data analysis based on questionnaire administered to both clusters, the study reveals that the nadir state of the energy sub-sector is the reason for the exodus of firms and bane of productivity growth among Nigerian firms. Owing to inadequate power supply, all firms that have remained in business run private power plants at an alarming cost thereby hampering productivity growth of firms. The study recommended that not only should a state of emergency be declared on the power sector, but also, privatization should be pursued with vigor to transform Nigeria's energy sector.

Ouedraogo (2013) examined electricity consumption and economic growth among Economic Community of West African States (ECOWAS). The study employed panel cointegration techniques and granger causality to test the long-run relationship between electricity consumption and economic growth rate across fifteen of the ECOWAS member from 1980-2008 and the data are obtained from WDI. The study found that GDP and electricity consumption move stable in the long-run. The result of the study also shows a unidirectional causality that run from electricity consumption to GDP in the long-run and from GDP to electricity consumption in the short-run.

Methodology

Considering the various theories on energy in this study, this research is anchored on David Stern Theory of Energy. This is because Stern propounded a neoclassical model which explained the linkage between energy and growth. Stern asserted that there has been extensive debate concerning the trend in energy efficiency in developed economies, especially since the two oil price shocks of the 1970s. Stern in the neoclassical model argued that in the United States of America (U.SA) economy, electricity consumption hardly changed in the period 1973 to 1991, despite a significant increase in Gross Domestic Product (GDP). According to Stern, these facts were indisputable and the break in the trend has been the subject of argument. The theory referred to neoclassical perspective of the production function to examine the factors that could reduce or strengthen the linkage between energy use and economic activity over time and depicted that there has been a decoupling of economic output and resources, which implies that the limits to growth are no longer as restricting as in the past. A general production function of Stern can be represented as follows:

Q_i …….$Q_m = f\ (A, X_i.,..X_n, E_k,….,E_p)$ ……1

Where the Qi are various outputs (such as manufactured goods and services), the Xi are various inputs (such as capital, labor, etc.), the E_k are different energy inputs (such as coal, oil, etc.), and A is the state of technology as defined by the total factor productivity of the manufacturing sector indicator.

The data set for this study was obtained from World Bank Popular Indicator Data Base (2020) and International Energy Agency (IEA) within the period 1986 to 2020. The variables of interest in the study are; Contribution of manufacturing sector to Gross Domestic Product (MGDP) as proxy for manufacturing sector growth rate being the dependent variable, Gross Domestic Product (GDP) as a supplementary dependent variable will proxy economic growth while electricity consumption (ECON), Electricity Generation (EGEN), Private Capital Investment on Electricity Generation (PEG), Government Expenditure on Power Generation (GEG) and Electricity Consumption Bills (ECB) will be used as independent variables

Model Specification

The study will employ the Autoregressive distributive lag (ARDL). ARDL is a least squares regression approach involving the lag of both the endogenous variable and exogenous variables. ARDL model is normally denoted using ARDL notion (p_1 q_1, q_2, q_3, …….q_k). P denotes the number of lags of the endogenous variable and q1 is the number of the lags of the first exogenous variable, and q_k is the lags of the kth exogenous variable.

In building the ARDL model for the study, the functional, mathematical and stochastic forms of the model are presented in Equation 3.1 and 3.2 respectively.

MGDP=F (ECON, EGEN, PEG, GEG, ECB)…….…….2

GDP=F (ECON)…….…….……...3

ARDL Model

The ARDL model will be used to examine the impact of electricity consumption on manufacturing sector growth in Nigeria. The ARDL model based on the linear model specification in Equation 3.3 and 3.4

$$\Delta LMGDP_t = \alpha_0 + \sum_{i=1}^{p} \delta_i\, \Delta LMGDP_{t-1} + \sum_{k=0}^{p} \beta_k\, \Delta LECON_{t-k} + \sum_{k=0}^{p} \epsilon_k\, \Delta LEGEN_{t-k} + \sum_{l=0}^{p} \gamma_l\, \Delta LPEG_{t-l} + \sum_{m=0}^{p} \varphi_m\, \Delta LGEG_{t-m}$$
$$+ + \sum_{m=0}^{p} \varphi_m\, \Delta LECB_{t-m} + \lambda_1 LMGDP_{t-1} + \lambda_2 LECON_{t-1} + \lambda_3 LEGEN_{t-1} + \lambda_4 LPEG_{t-1} + \lambda_5 LGEG_{t-1}$$
$$+ \lambda_6 LECB_{t-1} + \mu_t ----------4$$

Where; α_0 and μ_t is the autonomous component and white noise respectively. The expression with the signs of summation in the equation is error correction. The parameter coefficient denotes the short run effects while lambda (λ) is the corresponding relationship in the long run. Contribution of manufacturing sector to Gross Domestic Product (MGDP) growth rate as proxy for manufacturing sector growth rate being the dependent variable while electricity consumption (ECON), Electricity Generation (EGEN), Private Capital Investment on Electricity Generation (PEG), Government Expenditure on Power Generation (GEG) and Electricity Consumption Bills (ECB) will be used as independent variables. Other pre-estimation diagnostic check (bound co-integration and unit root test) will be carry out to check for the stationary of the variables.

Presentation of Results
Descriptive Statistic

Table1: Descriptive Statistic Result

	MGDP	ECON	EGEN	PEG	GEG	ECB
Mean	3.933	0.957	10.938	0.062	0.156	0.017
Median	3.060	0.900	8.300	0.825	1.200	1.060
Maximum	10.830	0.730	27.000	7.450	6.800	7.940
Minimum	0.930	1.350	1.000	1.550	1.430	2.210
Std. Dev.	2.643	0.155	6.795	2.488	2.251	2.766
Skewness	1.383	0.909	0.898	1.797	1.977	1.685
Kurtosis	3.94	3.155	2.892	4.978	5.560	4.547
Jarque-Bera	12.107	4.719	4.592	23.861	31.438	19.492
Probability	0.002	0.004	0.017	0.030	0.021	0.034
Observations	35	35	35	35	35	35

Source: Researcher's Computation using Eviews 9.5, 2021

Table 1 indicated 35 observations for all the variables of interest. The reason for the descriptive statistic is to test the normality of the variables of interest in this study. Based on the skewness values for all the variables of interest, it was revealed that all the variables were positively skewed. Finally, based on the Jarque-Bera statistic, all the variables of interest are not normally distributed because their probability values (0.002, 0.004, 0.017, 0.030, 0.021 and 0.034) respectively are less than 0.05 level of significance. Thus, since the variables were not normally distributed, there is need to carryout unit root test for stationarity.
The study carried out ADF unit root test as showed in Table 4.2 below to determine whether the variables are stationary or not using the Augmented Dickey Fuller (ADF) Statistic. Obviously, the ADF unit root test results in Table 4.2 showed that all the variables of interest had mixed order of stationarity.

2. Unit Root Test

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

Variables	ADF Statistic at level	ADF Statistic at first difference	Critical values of 5% at level	Critical values of 5% at first difference	P-values at level	P-values at first difference	Order of integration
MGDP	-1.211	-7.345	2.965	-2.973	0.456	0.000	I(1)
GDP	-1.523	-6.398	-2.723	-2.680	0.508	0.043	I(1)
ECON	-1.328	-8.221	-2.965	-2.973	0.082	0.000	I(1)
EGEN	-3.487	- 1.785	-2.965	-2.973	0.001	0.562	I(0)
PEG	-2.349	-9.234	2.965	-2.973	0.366	0.000	I(1)
GEG	-1.587	-6.123	-2.965	-2.973	0.238	0.001	I(1)
ECB	-3.454	- 2.056	-2.965	-2.973	0.010	-0.471	I(0)

Source: Researcher's Computation using Eviews 9.5, 2021

3. ARDL Bounds Co-integration Test

Table 4.5: ARDL Bounds Co-integration Test for Long Run Relationship

F-Bounds Test				Null Hypothesis: No levels relationship
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.884	10%	1.894	2.891
K	8	5%	2.175	3.237
		1%	2.738	3.912

Source: Researcher's Computation using Eviews 9.5, 2021

Given Table 3, the F-statistic (7.884) is greater than both the lower bound and upper bound critical values at 1%, 5% and 10% level of significance. Hence, the null hypothesis of no long-run relationship among the variables of the selected ARDL (1, 0, 0, 0, 0, 0) is to be rejected while the alternative hypotheses was accepted. This implied the variables of interest used in this study were co-

integrated. To this end, it was concluded that there existed a long run relationship between foreign portfolio investment on electricity and economic growth in Nigeria within the study period.

Table 4: Estimated ARDL Result

Dependent Variable: D(LNMGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.659	1.598	0.412	0.322
ARDL Short-Run Form				
D(LNMGDP(-1))	0.346	0.0248	13.963	0.000
D(LNECON(-1))	0.530	0.084	6.278	0.028
D(LNEGEN(-1))	0.475	0.109	4.368	0.016
D(LNPEG(-1))	0.401	0.064	6.227	0.002
D(LNGEG(-1))	0.304	0.076	4.003	0.003
D(LNECB(-1))	-0.588	0.087	-6.720	0.017
ECT(-1)	-0.645	0.092	7.044	0.009
ARDL Long-Run Form				
LNMGDP	0.329	0.288	1.143	0.621
LNECON	0.458	0.085	5.377	0.004
LNEGEN	0.538	0.075	7.225	0.015
LNPEG	0.483	0.053	9.043	0.006
LNGEG	0.506	0.064	7.859	0.000
LNECB	-0.622	0.074	-8.375	0.000
R-squared	0.816	Durbin-Watson stat		1.746
Adjusted R-squared	0.707			
F-statistic	17.375			
Prob(F-statistic)	0.000			

Source: Researcher's Computation using Eviews 9.5, 2021

The short run form of the ARDL estimate in Table 4 accounted for the speed of adjustment to long run equilibrium of the variables used. For this reason, the speed of adjustment of the model to long run equilibrium is determined by the coefficient of the first lag of the Error Correction Term (ECT (-1)). The Error Correction Term (-0.64) has the right apriori sign and it is statistically significant. Hence, the result of the ECT (-1) showed that 64% of the deviation of the variables in the short run would be restored in the long run within one year.

The table showed the long run form of the estimated ARDL. Based on the result, electricity consumption (ECON) has an estimated coefficient of 0.46 approximately. This implied that a 1% increase in electricity consumption led to 46% increase in Contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. As a result, electricity consumption had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. Therefore, increase in electricity consumption led to increase in manufacturing sector growth in Nigeria within the study period. Also, based on the result, Electricity Generation (EGEN) has an estimated coefficient of 0.54 approximately. This implied that a 1% increase in electricity generation led to 54% increase in contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. As a result, electricity generation had a significant negative effect on contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. Therefore, increase in electricity generation led to increase in manufacturing sector growth in Nigeria within the study period.

As such, Private Capital Investment on Electricity Generation (PEG) has an estimated coefficient of 0.48. This implied that a 1% increase in private capital investment on electricity generation led to 48% increase in contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. As a result, private capital investment on electricity generation had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. Therefore, increase in private capital investment on electricity generation led to increase in manufacturing sector growth in Nigeria within the study period. In addition, Government Expenditure on Power Generation (GEG) has an estimated coefficient of 0.51 approximately. This implied that a 1%

increase in government expenditure on power generation led to 51% increase in contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. As a result, government expenditure on power generation had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. Therefore, increase in government expenditure on power generation led to increase in manufacturing sector growth in Nigeria within the study period.

Furthermore, Electricity Consumption Bills (ECB) has an estimated coefficient of 0.62. This implied that a 1% increase in electricity consumption bills led to 62% increase in contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. As a result, electricity consumption bills had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product (MGDP) in Nigeria. Therefore, increase in electricity consumption bills led to increase in manufacturing sector growth in Nigeria within the study period.

Finally, the result also revealed that the independent variables such as; electricity consumption (ECON), Electricity Generation (EGEN), Private Capital Investment on Electricity Generation (PEG), Government Expenditure on Power Generation (GEG) and Electricity Consumption Bills (ECB) explained about 82% of the total variation in contribution of manufacturing sector to Gross Domestic Product (MGDP) as proxy for manufacturing sector growth while the remaining 19% unexplained was captured by the error term. Considering the prob (F-statistic) of 0.000, and it's less than 0.05, it there implied that all the parameter estimates in the long run ARDL model are statistically significant. The Durbin Watson statistic of 1.746 showed absence of autocorrelation or serial correlation in the model. This is because it is approximately less than '2' being the rule of thumb.

Granger Causality Test

Table 5: Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
ECON does not Granger Cause MGDP	35	8.287	0.000
MGDP does not Granger Cause ECON		7.865	0.002

Source: Author's Computation using Eviews 9.5, 2021

Table 4.8 showed the results of the granger causality test. The F-statistic of the granger causality test between electricity consumption and manufacturing sector contribution to gross domestic product had probability values of 0.000 and 0.002 respectively. Given that their p-values are less than 0.05 level of significance, the study rejected the null hypothesis and accepted the alternative hypothesis with the conclusion that that there is bi-directional relationship between electricity consumption and manufacturing sector growth in Nigeria. Furthermore, the F-statistic of the granger causality test between foreign portfolio bond investment and real gross domestic product had probability values of 0.013 and 0.001 respectively.

Conclusion and Recommendation

Based on the findings, increase in electricity consumption led to increase in contribution of manufacturing sector to Gross Domestic Product in Nigeria. As a result, electricity consumption had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in electricity consumption led to increase in manufacturing sector growth in Nigeria within the study period. The increase in electricity generation led to increase in contribution of manufacturing sector to Gross Domestic Product in Nigeria. As a result, electricity generation had a significant negative effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in electricity generation led to increase in manufacturing sector growth in Nigeria within the study period. As such, increase in private capital investment on electricity generation led to increase in contribution of manufacturing sector to Gross Domestic Product in Nigeria.

As a result, private capital investment on electricity generation had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in private capital investment on electricity generation led to increase in manufacturing sector growth in Nigeria within the study period. In addition, increase in government expenditure on power generation led to increase in contribution of manufacturing sector to Gross Domestic Product in Nigeria. As a result, government expenditure on power generation had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in government expenditure on power generation led to increase in manufacturing sector growth in Nigeria within the study period. More so, increase in electricity consumption bills led to increase in contribution of manufacturing sector to Gross Domestic Product in Nigeria. As a result, electricity consumption bills had a significant positive effect on contribution of manufacturing sector to Gross Domestic Product in Nigeria. Therefore, increase in electricity consumption bills led to increase in manufacturing sector growth in Nigeria within the study period. Finally, there was a bi-directional relationship between electricity consumption and manufacturing sector growth in Nigeria

The following policy recommendations were made based on the findings. These include;

Government should ensure that there is increase in electricity generation to boost electricity consumption towards enhancing the contribution of manufacturing sector to Gross Domestic Product so as to improve manufacturing sector growth in the Nigerian economy. Government should make sure that adequate provisions are made to enhance her expenditure on power generation and encourage private capital investment on electricity generation towards boosting contribution of manufacturing sector to Gross Domestic Product so as to achieve desired level of manufacturing sector growth in Nigeria. And, Government should ensure that the amount of electricity consumption bills is reduced to the barest minimum level that could be efficiently and effectively affordable to improve the contribution of manufacturing sector to Gross Domestic Product so as to achieve desired level of manufacturing sector growth in Nigeria.

REFERENCES

Adegbemi O.O & Babatunde O. O. (2013) Electricity consumption and Nigerian economic growth: an empirical analysis. European Scientific Journal. Vol. 9, 25-40.

Aliyu S. B., Lawal, A. D & Beki O. D (2018). An examination of Electricity consumption and Economic Growth in Nigeria. International Journal of Economics and Business Management 4(6), 47-64.

Aliyu Mukhtar Shehu and Rosli Mahmood (2014): An Empirical Analysis of Market Orientation and Business Performance Relationship in the Context of Developing Economy. International Journal of Academic Research in Business and Social Sciences, vol. 4, issue 9, 219-232

Arnold S., Kohlin D., & Persson V., (2006). Electricity consumption and Economic Growth in Nigeria: A Causality Analysis. Journal of Economics and Sustainable Development, Vol.6, No.13, 42 2015

Babatunde O.O. (2016). Relationship between electricity consumption and economic growth in Nigeria. Sustainable development and energy security level after shutdown. Technological and Economic Development of Economy, 17 (1):5–21.

Behara A. (2015). Electricity consumption and economic growth in India. Pakistan Journal of Social Sciences (PJSS), 32 (2), 371-382.

Bennett, J. (2000). The agency of assemblages and the North American blackout. Public Culture, 17, 445.

Echeta, Igwemma & Nwosu (2014) Examined access to energy and productivity of firms using a comparative analysis of two industrial clusters in South-eastern Nigeria

Erbaykal, E. (2018). Disaggregate electricity consumption and economic growth: Evidence from Turkey: International Research Journal of Finance and Economics. Vol. 20, pp. 172-179.

Esso, L. J. (2010). Threshold cointegration and Causality Relationship between Energy Use and growth in seven African countries. Energy Economics, Elsevier, 32 (6) 1383-391.

Hosier, R. H. and Kipondya, W. (1993): Urban household energy use in Tanzania: Prices, substitutes and poverty Energy Policy, Elsevier, vol. 21(5), pages 454-473, May

International Energy Agency (2018). Renewables in Global Energy supply: An IEA Facts sheet. www.iea.org

Mahedi M. (2012). Electricity Consumption and Economic Growth in Bangladesh: Co-Integration and Causality Analysis. Global Journal of Management and Business Research. 12(11), 47-57.

Mahmood S. & Kanwal Y. (2017). Relationship between energy efficiency and economic growth in Pakistan. The Lahore Journal of Economics 7(2), 45-58.

Majeed E. & Siddique J. (2016). Relationship between electricity consumption and economic growth of Pakistan. Journal of Economic Studies, 37 (1): 53-95.

Masera, O. R., Saatkamp, B. D., & Kammen, D. M. (2000). From linear fuel switching to multiple cooking strategies: A critique and alternative to the energy ladder model. World Development, 28, 2083–2103.

Mustapha S. & Fagge C. (2015). Relationship between electricity consumption and economic growth in Nigeria. Journal of Energy and Development, 3(2), 34-56.

National Bureau of Statistics (2010). Annual Abstract of Statistics, Federal Republic of Nigeria.

Neuhaus B. (2016). Renewable electricity consumption economic growth nexus in Sub-Saharan African countries. International Business & Economics Research Journal, 4 (12), 45-67.

Nicolai, S and Fiona, Z (2008): Market Barriers to Clean Cooking Fuels in Sub-Saharan Africa: A Review of Literature. Sweden: N. p., 2008 web

Olusanya, S. O. (2012). Long run Relationship between Electricity consumption and Economic Growth: Evidence from Nigeria. Journal of Humanities and Social Science, 3 (3), 40–50.

Olusegun, O. A. (2019). Electricity consumption and economic growth in Nigeria. A bound testing cointegration approach, Journal of economic Theory 2(4). Pp 118 – 123.

Ouedrago, I.M. (2013). Electricity consumption and economic growth in Burkina Faso: A co-integration analysis. Review on Energy Economics, 32, 524-531.

Oyaromade R, Mathew A and Abalaba B.P (2014): Energy Consumption and Economic Growth in Nigeria: A Causality Analysis. International Journal of Sustainable Energy and Environmental Research, Conscientia Beam, vol. 3(1), pages 53-61.

Sheilah M and Alison B (2003): Energy, Poverty and Sustainable Urban Livelihoods

Stern, D.I (2004): The Rise and Fall of the Environmental Kuznets Curve. World Development Vol. 32, No. 8, pp. 1419–1439, doi:10.1016/j.worlddev.2004.03.004

World Bank (2011). Renewable Electricity consumption and Economic Growth: The Case of 7 Asian Developing Countries. American Journal of Scientific Research, 4(6), 146-152.

World Bank (2018). Nuclear electricity consumption and economic growth in nine developed countries. Review on Energy Economics, 550-556.