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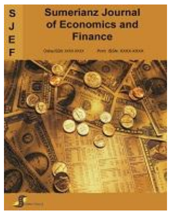

Original Article Open Access

The Impact of Power Outages on the Performance of the Manufacturing Sector in Nigeria. (1980-2018)

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Abstract

This paper examined the impact of power outages on the performance of the manufacturing sector in Nigeria from 1980 to 2018. The data used was secondary data sourced from the Nigerian Electricity Regulation Commission (NERC) monthly bulletin and the central Bank of Nigeria statistical bulletin of various issues. The paper emphasized the need for the correct specification of the model on the basis of which estimation would be valid. The study carried out stationarity and cointegration tests. The result showed that exchange rate (EXR), electricity distribution loss (EDL), capacity utilization (CPU) and Government capital expenditure (GCE) are the significant variables that influence performance of the manufacturing sector in Nigeria. One strong outcome of the study is that despite the poor state of electricity supply, it still influences economic development in Nigeria. It is recommended that efforts be geared towards stabilizing the exchange rate in order to avoid fluctuations that affect prices of energy generating agencies by ensuring periodic replacement of worn out equipment and necessary tools in order to drastically reduce power losses.

Keywords: Power outages, Manufacturing sector, Exchange rate, Government capital expenditure, electricity distribution loss, capacity utilization, Nigerian Electricity Regulatory Commission.

1. Introduction

Olayemi (2012), observes that one of the essential requirements for output growth in the manufacturing sector is adequate electricity supply. He stresses that the power sector is a key source of electricity generation and supply, which muscle the machines and equipment for production of various types of goods for consumer wants. The importance of the power sector is emphasized by Hirschman in his theory of unbalance growth, when he proposed investment in strategic selected sector such as electricity to boost and trigger investment such as the manufacturing industries in order to pave way for economic development (Jhingan, 2008). Accordingly, in his stages of growth theory, Rostow (1960) stresses the development of the manufacturing industries as a leading sector that will bring about high growth rate in the economy. In this regard, (Kniivila, 2008) posits that the role of the manufacturing sector cannot be underestimated, as it has been recognized and advocated as one of the drivers of high economic performance in some growing countries of the globe, especially the Asian Tigers; Taiwan, Korea, Malaysia, and Indonesia .These countries have achieved this, based on the strong power sector that support the vibrant manufacturing sector, thereby making it capable to generate employment opportunity, reduce poverty and help these nations to possess high growth statistics (Ellahi, 2011). Also, the sector has attracted special attention, as it has the capacity to improve the balance of payments account, increase exportable goods produced and encourage import substitution (Saeed and Waters, 2002).

In recognition of the vital role of the manufacturing sector in nation building, the Nigeria government since independence has implemented several policies, schemes and incentive to promote the subsector. Such policies includes: the 1960s import substitution strategy, 1972 indigenization policy, 1986 structural adjustment programme (SAP), establishment of Bank of industry in 2000, the small and medium scale equity investment schemes (SMEIS) which was meant to reduce credit problems confronting entrepreneurs and the just adopted National Integrated Industrial Development (NIID) blueprint in 2007 (Enang, 2010).

In spite of these policies, schemes and reforms, statistics have revealed that, the manufacturing sector has been witnessing sluggish output growth. Iwayemi (2008), notes that one constraint for this decline is erratic electricity supply. The study carried out by the Manufacturing Association of Nigeria (MAN) in 2005 and in the first half of 2006 shows a depressing picture of the Nations' industrial sector. For instance, the study revealed that, only ten percent of manufacturing concerns could operate at 48.8 percent installed capacity, 30 percent have shut down while approximately 60 percent of operating companies cannot cover their Average Variable Costs (Enang, 2010). The same report shows that almost all the industrial estates in the nation suffer on the average of 14.5 hours power blackout as against 9.5 hours daily supply. Similarly, the expenditure incurred for generating power supply by companies for productivities (output) constitute nearly 36 percent of the total cost (TC) of production (Enang, 2010; Udeajah, 2006). Equally, other reports have shown that some small Nigerian firms have committed a huge amount of their aggregate capital expenditure to provide 50 percent of their electricity requirements while most of

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the big firms relied fully on self-generated electricity to ensure 100 percent reliability for production to be uninterrupted (Iloeje *et al.*, 2004), "Nigeria's Electricity Sector," 2006. This and other minor constraints have caused the uninspiring performance of the manufacturing sector in the Nigeria economy.

Against this backdrop, the key research issue to be addressed by this paper is: what is the effect of power outages on the manufacturing sector performance in Nigeria. Interestingly, so much has been written on poor electricity supply, cost, consumption and factors affecting capacity decision in Nigeria and quite a number of issues have been noted to be responsible for the erratic electricity supply, which include obsolete equipment, lack of personnel training, corruption, lack of funds, etc. (Adegbulugbe and Akinbami, 2002; Isola, 2007; Iwayemi, 2008; Ubi *et al.*, 2012). Therefore, this work seeks not only to contribute to the bodies of studies on erratic electricity supply in Nigeria but also to carry out a robust empirical analysis to investigate the relationship between erratic electricity supply and manufacturing sector performance in Nigeria from 1980- 2018. On the basis of the evidence from these empirical analyses, conclusions would be drawn and thus solutions proffered towards achieving a sustainable electricity supply to the nation.

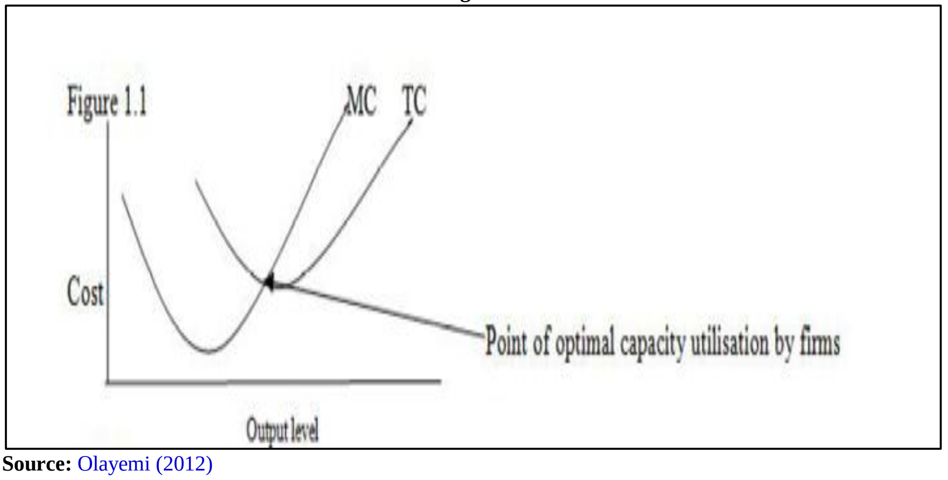
2. Theoretical Framework

2.1. Theory of Electricity

2.1.1. Traditional Cost Theory

This research seeks to adopt the Traditional Cost Theory, which is classified into the short run and the long run periods. In the short run (SR) period, some factors such as entrepreneurship and capital equipment are usually considered to be fixed, while in the long run (LR) period; all the factors of production are considered to vary. In this regard, we are taking both terms as a whole, by examining the output level that is obtainable, given a single level of output that rises above the increases in costs. Consequently, we say, the output level of the firms is completely utilized at that point, where the curve of the Marginal Cost (MC) cuts the curve of the Average Total Cost (ATC) at its minimum point as the marginal cost start to rise (see figure 1.1).

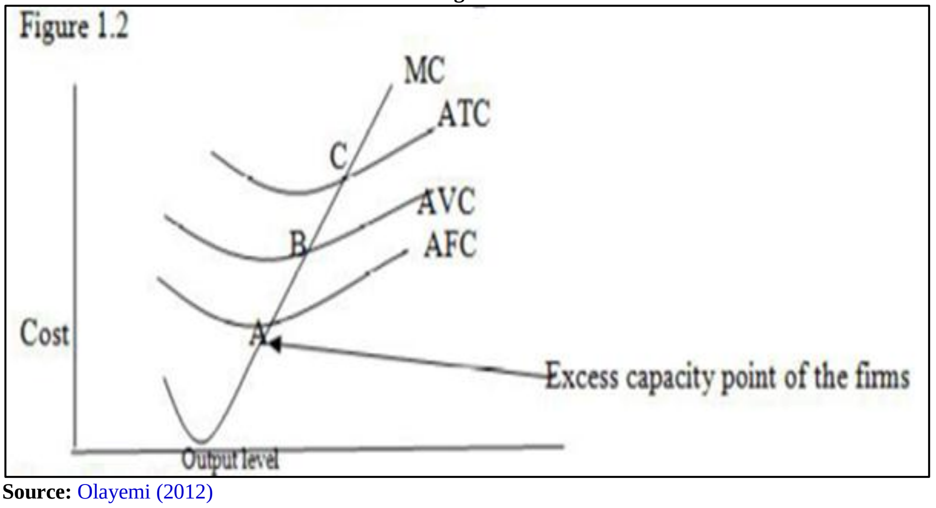
Fig-1.1



Source: Olayemi (2012)

Under this theory, it is assumed that firms in the industry do not build plants with changing productive capacity, but often experience the phenomenon of excess capacity. Excess capacity is defined as the differences between the maximum amounts of output that a firm can produce and the actual amount produced, given the assumption that, resources are unemployed. Excess capacity of firms is depicted in figure 1.2, below.

Fig-1.2



Source: Olayemi (2012)

Given the above discussed theory, it is observed that the cost is split into two (2), the total fixed cost and the total variable cost. The total fixed cost covers items such as salaries and wages, depreciation on land maintenance, depreciation on equipment repairs etc. and total variable cost covers items such as cost of raw materials, cost of direct labor and cost of maintenance, servicing and repairs of equipment. The theory focuses on the major problem being faced by the manufacturing industries, which is erratic power supply, and this has prompted manufacturers to source for alternative power supply such as generators, and the cost of buying fuels and diesel for these generators which increases the cost of production of goods. This issue has forced many manufacturers out of business. **192**

2.2. Empirical Literature

In a study of Malawi by Jumbe (2004), in which the Granger causality and error correction method (ECM) were used to test bilateral causality between electricity consumption and GDP, it revealed a bi-directional causality between electricity consumption and GDP. The error correction models results showed a one-way causality running from GDP to electricity consumption which suggests that a permanent rise in GDP may cause a permanent growth in electricity consumption, and to sustain this growth, Government should encourage high investment opportunities in the power sector to meet economic needs.

Furthermore, Riker (2012) applied price elasticity theory to examined the impact of energy price on non-petroleum manufacturing exports in USA using time series data between 2002 and 2006.The result revealed that, prices of energy have significant impact on U.S manufacturing sector. There was a decline of $11.5 billion per year under the reviewed periods. Finally, the study called for subsidy in the usage of industrial energy as well as development in the national energy resource that will impact on the prices of energy used by industries.

Also, Nyansu (2016), using the Ordinary Least Square (OLS) method and chi square to investigate the effective power supply to industries in Ghana revealed that the constant power outages had forced firms to adopt alternative strategies to generating power in order to cope with the poor public supply of electricity to power their businesses. Nyansu (2016), further states that this has led to higher costs of goods and services and also loss of revenue. He advocates that Government should do all that is necessary to ensure adequate power supply to the industrial sector.

Several research on insufficient electricity supply have recently been done on this subject in Nigeria. For instance (Edet, 2016), using the contemporary economic approach of error correction mechanism (ECM) to investigate the electricity supply growth in Nigeria maintain that manufacturing industries are only encouraged when there is constant supply of electricity. He emphasizes that persistent black outs may phase out these industries and thus the inefficient power supply would lead to slow growth of the nation.

Sharing the same view, (Ologundudu, 2014), in his research to test empirically the causal and long run relationship between economic development, industrialization and electricity supply using the auto-regressive distributed lag (ARDL) bounds test approach to co-integration, insists that the supply of electricity in Nigeria is bedeviled with constant crisis as shown by such indicators as electricity black outs and persistence on self-generating electricity. The causality result showed very strongly that electricity supply is crucial in stimulating economic growth and development. He insists that PHCN must upgrade their equipment to be able to meet up with the demands of its numerous customers for better service.

Likewise, (Ogbuagu *et al.*, 2010) attempted an analysis of the factors affecting electricity supply and capacity utilization in Nigeria using descriptive and ordinary least squares analysis and discovered that epileptic power supply had a dampening effect on the efficiency of the manufacturing sector. They suggested that Government should encourage more private participation in order to improve power supply in the nation.

In the same vein, (Usman, 2013), using the fuzzy entropy method and evaluation based on weighted rank average, emphasized that for rapid growth and development, the constant power outages experienced must be reduced to its barest minimum because of the pressure it exerts on the manufacturing sector. He explains that most industries have to source for alternative power and thus increasing their overhead cost of production and by implication, this gives rise to higher costs of goods and service which does not promote growth and development.

Olayemi (2012), utilized the modern and traditional theories of cost to study the impact of electricity crisis on productivity of manufacturing sector in Nigeria using time series data from 1980-2008. The outcome using multiple regressions shows that electricity generation and supply have negative impact on productivity growth of manufacturing sector. The poor performance of the power sector is attributed to government expenditure on the unproductive sectors. The study recommended for independent power project as advocated by some state in Nigeria. The major recommendation is that electricity problem should be fixed to improve industrial growth.

Mojekwu and Iwuji (2012), investigated the impact of power supply and macro-economic variables on manufacturing sector performance in Nigeria, using time series data from 1981-2009. The multiple regression analysis (MRA) showed that power supply positively have significant impact on capacity utilization, while interest and inflation rate have adverse impact on capacity utilization in Nigeria. The R^2 of 88.54 percent shows changes in capacity utilization as a result of the predictor variables. It was recommended that, the on-going power reform of privatization of the subsector should be fully undertaken by the government and a single digits lending and inflation rate should be adequately sustained.

Ndebbio (2006), argued that electricity supply drives industrialization process. He stressed that one important indicator whether a country is industrialized or not is the megawatt of electricity consumed. He further argued that a country's electricity consumption per-capita measured in kilowatt hours (KWH) is proportional to the state of Industrialization of that country.

Also Adenikinju (2005), analyzed the economic cost of power outages in Nigeria. Using the revealed preference approach on business survey data. Adekininju estimated the marginal cost of power outages to be in the range of of

$0.94 to $3.13 per kWh of lost electricity. Given the poor state of electricity supply in Nigeria, (Adenikinju, 2005) concluded that power outages imposed significant costs on business. Small-scale operators were found to be most heavily affected by the infrastructure failures.

Ukpong (1976), established the existence of a positive relationship between electricity consumption and economic development. In addition, he submitted that the expansion of energy sector on the demand side is important factor in accelerating the growth of the industrial sector.

Earlier, Ukpong (1973), had carried out a study on the cost of power outages to the industrial and commercial sector in Nigeria. He used the production function approach to evaluate the power outage cost between 1965 and 1966, with selected firms. From his estimate, he discovered the unsupplied electrical energy to be 130Kwh and 172Kwh between the periods. The corresponding costs of the power outage to the industrial sector in the two years were estimated at N1.68million and N2.75million respectively. The unsupplied electrical energy according to Ukpong, has a negative implication on the manufacturing productivity growth in Nigeria.

2.4. Review of Related Literature

Electricity consumption across the world reflect a great imbalance compared to what is obtainable in Nigeria, for instance, Libya, with a population of only 5.5 million has generating capacity of 4,600 megawatts, approximately the same as Nigeria, which has a population of about 140 million (Lohor and Ezeigbo, 2006). South Africa, with a population of only 44.3million, has a generating capacity of 45,000MW almost eleven times the generating capacity in Nigeria which has three times the population of South Africa (Agbo, 2007).

Studies and experiences have shown that power generation in the country has been dismal and unable to compare with what obtains in smaller Africa countries. In order to capture the seriousness of the matter and present a scope on the economic consequences of constant power outages, recent developments have shown that some companies in Nigeria have started relocating elsewhere, especially to neighboring countries, where power is not only provided constantly, but there is just enough to grant its affordability. Elkan (1995), reports that these costs could have been indirectly borne by the government if an efficient system of power infrastructure was provided to these firms. Most companies have to bear the heavy cost of installation and maintenance of infrastructural facilities in Nigeria. In terms of numbers, and according to the manufacturing association of Nigeria (MAN) as reported by Mayah (2010), 820 manufacturing companies closed shop between the years 2000 and 2008. In a similar instance (MAN) again did a survey in January 2010 and Adeloye (2010) reported that a total of 834 manufacturing companies closed shop in the year 2009 alone. This increase is extremely alarming because it surpassed the cumulative 8 years, from 2000-2008 value in just a single year (2009). The survey which usually covers five manufacturing enclaves into which the country is divided, in terms of their manufacturing activities, include 214 companies in Lagos, 176 in the North, 178 in the South East, 46 in the South-South and 225 in the South –West areas.

Examples of big companies that have relocated or closed business include Dunlop Nigeria PLC, Coca-Cola, Michelin, Cadbury Nigeria PLC, Unilever PLC, Patterson Zochonis (PZ). Guinness Nigeria PLC, International Institute of Tropical Agriculture, OK Foods Group etc, Mayah (2010).

Apart from squandering the benefits of goods and services produced and/or rendered by this companies within the shores of the country (Nigeria), in terms of cost and customer utility, it is also painful to mention the indirect loss of millions of earnings by Nigeria to these other countries who have Capitalized on these self- induced woes to boost their economy. One survey conducted by the Central Bank of Ghana revealed that Nigeria was one of the 10 sources of Foreign Direct Investment

(FDI). To this end, Nigeria placed ninth with a contribution of 2.1 percent of the GHC 1.5 billion invested in Ghana in 2007, Daily Trust (2010).

A closer analysis reveal greater overflow of economic implication, from the statistics of manufacturing companies closing their businesses in Nigeria. For instance, it was reported by Mayah (2010) that the 5% quota that the manufacturing sector contributed to Nigeria's GDP in 1999 shrunk to 4.9% by the year 2000, Also, these large numbers of closed manufacturing companies in recent times have worsened Nigerian's growing unemployment rate. (Adeloye, 2010) painted a scary picture of it when he was reported to have used a simple calculation to explain the terrible spillover effect that closing of manufacturing companies have on employment generation in Nigeria. The estimation revealed that when a company stops operation, its workforce immediately became frontline victims, like in the 834 firms submitted by MAN to have closed shop in 2009 alone, it can be speculated that less than 83,400 jobs were lost.

This submission is based on the assumption that the firms were medium sized manufacturing firms, with each having at least 100 workers. The pointer in all of the submissions by Mayah (2010) is that poor power supply has been identified as the major factor responsible for these unfortunate trends which carry such economic repercussions. According to the Manufacturing Association of Nigeria's (MAN) survey in 2005, only 10 percent of industries operated. But then, the 10 percent could, on the average, only function at 48.8 percent of their respective installed capacities, According to the survey, 60 percent of the companies were in comatose while another 30 percent had completely closed down. The following year, 2006; a survey conducted by MAN in the first quarter indicated that most of the industrial areas around the country suffered an average of 14.5 hours of power outage per day as against 9.5 hours of supply. Further, the figure released by the MAN indicated that the cost of generating power supply accounts for 36 percent of production. About 1500 firms 160 percent; of the association's 2,500 members are in dire strait principally because of the additional operating cost of alternative power generation, (Adegbamigbe, 2007; Udeajah, 2006).

As a result power supply and other related factors, industrial sector contribution to the Gross Domestic Product (GDP) has continued to drop since 1990 from 8.2 per cent, got to 4.7 percent in 2003: 4.06 percent in 2004 and 4.2

percent in 2005, the lowest figure since the country got independence in 1960 (Ajanaku, 2007). The poor power supply situation has made almost all manufacturing companies that have remained in business run private power plant at great cost and this is evident on the amount spent on the importation of generators into Nigeria. A London based magazine, African Review of Business and Technology in its April 2006 edition revealed that Nigeria topped the list of generator-importing countries for the fourth year in a row, having surpassed others since 2002. According to the report, Nigeria accounted for 35 per cent or $152 million of the total $432.2 million spent by African countries on generator imports in 2005. The Report, which focused on diesel generator of between 2,000KVA and 5,000KVA capacity, said the country imported three times as many generators than the closest Africa importers Sudan and Egypt – that spent $40.6 million and $32 million respectively on the product in 2005 (Atser, 2006a).

In buttressing the above report, a survey conducted in Lagos showed that the British America Tobacco (BAT) Plc spent about N67.5 million in 2005 on diesel and maintenance of its private power generation plant. Dunlop Nigeria Plc similarly spent N96 million on annual average, while West African Portland Cement spent N90 million on the average. Others are Friestland Foods PLC, N50 million; Nigerite PLC, N36million and Cadbury Nigeria Plc: N49 million. By MAN's statistics, nine companies within its fold spent a total sum of N69.5 billion to generate their power (Odiaka, 2006; Oke, 2006). Against the backdrop of the epileptic power supply and the desire of the companies to remain in the business, some multinational companies have devised other alternative sources of power generation. In recent times quite a number of multinational companies operating in Nigeria generate own power through Independent Power Project (IPP) (Udeajah, 2006). However, even with this situation it is on record that some of these companies have continued to post impressive profits and meeting the obligations of their shareholders. But such performance is a reflection of the fact that more and more of production costs are shifted to the final consumers most of whose disposable incomes have declined steadily as a result of inflation generated by government's tough economic policies. This has the tendency to reduce consumers' effective demand and may force some companies to close shop or even relocate to a more investment friendly environment on the long run as recently demonstrated in the case of Michelin (Ogunjobi 2007).

A critical assessment of the performance of the power sector by the World Bank best captures its implication for industrial sector in Nigeria. Mayah (2010), on the nation's difficult investment climate states; Manufacturing firms in Nigeria consider inadequate infrastructure, particularly power supply, as their most severe constrain. Dealing with the inadequate power supply and other infrastructure problems absorbs for more of management's attention than any other business problem.

3. Research Methodology

This research work utilizes annual time series data on the Nigerian economy for analysis, the secondary data were sourced from Central Bank of Nigeria Statistical Bulletins and World Bank's World Development Indicators. The study covered the period 1980 to 2018.

3.1. Data Technique

The secondary data will be analyzed based on both statistical and economic criteria. The statistical criteria is provided via analysis of the time series data using statistical techniques like the multiple regression modelling and model estimation based on contemporary econometric estimation methods of the Ordinary Least Squares. Stationarity and co-integration tests will be carried out as well. The model will be estimated in the context of the Error Correction Mechanism.

Stationarity tests assures non-spurious results, co-integration captures equilibrium long run relationship between (co-integrating) variables and Error Correction Mechanism is a means of reconciling the short run behavior of an economic variable with its long run behavior (Gujarati and Sangeetha, 2007).

3.2. Model Specification

The regression model specified for this study intends to capture how electricity distribution loss measured in percentages (EDL), capacity utilization in percentage (CPU), Government Capital Expenditure (GCE) and exchange rate (EXR), have all influenced index of manufacturing production in percentage (IMP), for the period specified.

The model adopted for this study is derived from previous studies (Enang, 2010; Ndebbio, 2006), but with a little modification. The model is modified to capture the relationship between electricity distribution losses and manufacturing sector performance in Nigeria. The variables in their studies include: the index of manufacturing production (IMP), electricity generated or supplied (EGI), Capacity utilization (CPU), and exchange rate (EXR) etc. From the existing works, the selected variables for this paper will be stated as: index of manufacturing production in percentage (IMP), electricity distribution loss measured in percentages (EDL), and capacity utilization in percentage (CPU), Government Capital Expenditure (GCE) and exchange rate (EXR).

The index of manufacturing production (IMP) is utilized in the model to capture the volume of production, as well as the direction of manufacturing sector. The indicator measures the amount of output from the manufacturing industries annually. Electricity distribution loss measured in percentages (EDL) is the aggregate amount of loss from electricity distribution by the electricity distribution companies in Nigeria to the industrial sector in megawatts per hours (MW/H). Furthermore, Government Capital Expenditure (GCE) is used to capture expenditure made on infrastructural development by the government to enhance the growth of the manufacturing and other sectors in the economy. The exchange rate (EX) is the rate at which the naira is exchanged to the dollar or other currency, this affects output of manufacturing sector, as manufacturers incur higher cost importing plants and spare parts.

From the reviewed work of Ndebbio (2006), that adequate and regular supply of power stimulates industrialization process form the basis of the model of this study. The work further expresses manufacturing productivity index as a function of megawatt of electricity generated or supplied, i.e. MPI = f (EGI). Therefore, from the existing model of Ndebbio (2006), the study specifies the following model;

$MPI = \alpha_0 + \beta_1 EDL + \beta_2 CPU + \beta_3 GCE + \beta_4 EXR + Ui$

Where;

MPI = Manufacturing productivity index;
EDL = Electricity distribution loss;
CPU = Capacity Utilization;
GCE = Government Capital Expenditure;
EXR = Exchange rate;
Ui = Stochastic error term

In estimating the parameters of the model, ordinary least squares (OLS) multiple regression technique was employed. The data for all the variables stated in the model were extracted from various editions of Central Bank of Nigeria Statistical Bulletin over the period of 38 years and the expected results of the relationship from the specified model are as follows;

3.3. Apriori Expectation

This criterion is regarded as a theoretical criterion which is asserted by economic theory and refers to sign and size of the coefficient. They are defined in the first stage of econometrics research i.e. in the specification of the model. The expected signs of the coefficient of the explanatory variable are expressed in the table below;

Table-1.

Variable	Expected Sign
1. Electricity distribution loss [EDL]	-
2. Capacity Utilization [CU]	+
3. Government Capital Expenditure [GCE]	+
4. Exchange rate [ER]	-

The Electricity distribution loss [EDL] shows an inverse relationship, meaning that a drop in electricity loss would trigger a rise in the Manufacturing productivity index (MPI), the Capacity Utilization [CU] on the other hand should have a positive relationship, showing that an improvement in Capacity Utilization would automatically trigger a rise in the Manufacturing productivity index (MPI), This also applies to Government Capital Expenditure [GCE], as an increase in Government spending in the manufacturing industry should attract an increase in the Manufacturing productivity index (MPI). Finally, Exchange rate [ER] shows an inverse relationship, meaning that as the rate drops –depicting currency appreciation- manufacturing firms are able to source cheaper raw materials and thus the cost of production drops and the Manufacturing productivity index (MPI) rises.

4. Data Analysis and Findings

Here we present the regression results as well as the interpretation and data used to empirically analyse the impact of power outages on the performance of the manufacturing sector in Nigeria. (1980- 2018)

4.1. Data Presentation

The data is presented as appendix 1 in the appendix section.

4.2. Unit Root Analysis

The unit root analysis helps to establish the stationerity or non stationerity of the time series data. (Gujarati, 2003) The outcome of working with non-stationary variables lead to spurious regression results from which further results may be meaningless. The result of the unit-root test are presented below:

Table-4.1. Unit Root Test Results in Levels and Difference

Series	ADF Test Levels	ADF Test Statistics (Diff)	1% Critical Value	5% Critical Value	10% Critical Value	Order of integration
MPI	-2.057905	-5.518779	-4.234972	-3.540328	-3.202445	1(1)
EDL	-3.052492	-9.413219	-4.234972	-3.540328	-3.202445	1(1)
CPU	-4.647201	-	-4.243644	-3.544284	-3.204699	1(0)
GCE	-5.836010	-	-4.339330	-3.587527	-3.229230	1(0)
EXR	-1.492603	-4.551959	-4.234972	-3.540328	-3.202445	1(1)

Series	Phillip Peron Test Levels	Phillip Peron Test Statistics (Diff)	1% Critical Value	5% Critical Value	10% Critical Value	Order of integration
MPI	-2.131640	-5.518779	-4.234972	-3.540328	-3.202445	1(1)
EDL	-3.022801	-9441915	-4.234972	-3.540328	-3.202445	1(1)
CPU	-2.698077	-3.893581	-4.234972	-3.540328	-3.202445	1(1)

GCE	-2.698077	-3.893581	-4.234972	-3.540328	-3.202445	1(1)
EXR	-1.637353	-4.553308	-4.234972	-3.540328	-3.202445	1(1)

The apriori expectations when using the Augmented Dickey-Fuller (ADF) and Phillip Peron test is that a variable is stationery when the value of the Augmented Dickey-Fuller (ADF) and Phillip Peron test statistics is greater than the critical value at 1%, 5% and 10%. The result above shows that for the Augmented Dickey-Fuller (ADF), the variables MPI, EDL and EXR are stationery at 1st difference except for CPU and GCE which re stationery at levels. Results of the Phillip Peron show that all the variables were stationery at 1st difference. Hence the results from the estimation of the model are not likely to be biased and inconsistent.

4.3. Johansen Cointegration Analysis

The relationship between economic variables in the long run is very important for the purpose of policy making. If variables have a causal relationship that allows them to move in perfect harmony in the long run, policy making and implementation become less worrisome. In the light of this, the Johansen cointegration which employs two tests, the trace and the max eigen statistics was conducted to determine if this type of relationship exists amongst the variables under consideration in the study.

Table-4.2. Johansen Cointegration Test Result

		Co-integrating Vector		
		Mpi Edl Cpu Gce Exr		
Null hypothesis	Trace statistics	**MacKinnon Prob. value	Max eigen statistics	**MacKinnon Prob. value
r=0	123.4492	0.0000**	44.53109	0.0086**
r≤1	78.91815	0.0016**	31.60102	0.0577**
r≤2	47.31714	0.0170**	24.36873	0.0768
r≤3	22.94840	0.1108	12.80512	0.3440
r≤4	10.14328	0.1208	10.14328	0.1208

Source: Author's extraction 2018 (from E-views 9.0 output)

The table 4.2 reports the test statistics for determining the co-integrating relations in the model. The result indicate that the null hypothesis of no co-integrating among the variables (r=0) is rejected at 5% level by the trace statistics and at 1% level by the maximum eigen statistics. Similarly, the hypothesis of at most one co-integrating relation (r≤1) are rejected at the 1% level by the trace statistics, the hypothesis of at most two co-integrating relation (r≤2) are rejected at the 5% level by the trace statistics alone.

4.4. Ordinary Least Square (OLS) Result

Table-4.3. Dependent variable MPI

Variable	Coefficient	Std. Error	t-statistics	Prob.
C	4.637543	0.617894	7.505408	0.0000
EDL	-0.208704	0.067469	3.093334	0.0042
CPU	0.502026	0.122933	-0.423207	0.6751
GCE	0.052410	0.022547	-2.324453	0.0268
EXR	-0.809789	0.028338	3.168547	0.0034
R-squared	0.545330	F-statistics	9.295331	
Adjusted R-squared	0.486663	Prob(F-statistics	0.000047	
		Durbin Watson stat	1.880523	

MPI = 4.637543 – 0.208704*EDL + 0.502026*CPU + 0.052410*GCE – 0.089789*EXR

The result shows that the ratio of electricity distribution loss (EDL) is inversely related to the manufacturing productivity index (MPI). This is in line with apriori expectations, meaning that a unit rise in EDL leads to 0.208 drop in MPI. Also the result of CPU is in line with apriori expectations meaning that a unit rise in CPU causes a 0.502 rise in MPI. This is also true of GCE, the result shows that a unit rise in GCE will cause MPI to increase by 0.052 units. EXR is also in tandem with apriori expectations and this means a unit rise in EXR causes MPI to drop by 0.809 units.

From the above illustration, EXR and EDL are statistically significant at 1% for the period under review. On the other hand, GCE is statistically significant at 5%, but capacity utilization is not statistically significant. R^2 with the value of 0.545330 implies that only about 54.5% of the total variation in MPI is explained by the explanatory variable. Thus the model has goodness of fit.

5. Summary, Conclusion and Recommendations

5.1. Summary

This study examined the impact of electricity Power outages on the performance of the manufacturing sector in Nigeria. The result revealed that EDL has a positive impact on MPI and statistically significant at 1%. The result also indicated that CPU had a positive impact on MPI, but not statistically significant as the probability was greater than 5%. Furthermore GCE was statistically significant at 5% with a positive relationship with MPI. EXR too was revealed to be statistically significant at 1% for the period under review. The resultant effect of electricity outage is sourcing for alternative electricity power supply by manufacturers, this process increases the cost of production, making goods more expensive in the domestic and international market.

5.2. Conclusion

From the research findings, the study concludes with empirical evidence that electricity distribution loss (EDL), capacity utilization (CPU), Government capital expenditure (GCE) and exchange rate (EXR) all have significant impact on the manufacturing sector in Nigeria for the period under review and if properly managed are most likely to have larger effect on the manufacturing productivity index (MPI).

Recommendations

Based on the above analysis, the following recommendations were made:

1. The inelastic impact of electricity loss on the manufacturing productivity index (MPI) as obtained in the analysis calls for government to strengthen the effectiveness of electricity power agencies to ensure periodic replacement of worn out and damaged equipment in order to reduce electricity loss.
2. There is need for government to reduce its budgetary allocation to recurrent expenditure on the electricity sector and place more emphasis on capital expenditure so as to accelerate economic growth in Nigeria through the manufacturing sector output.
3. Government must endeavor to keep the exchange rate stable in orderto discourage fluctuations that may affect prices of equipment, spare parts and raw materials.

References

Adegbamigbe, A. (2007). Obasanjo’s Legacies. *The News*, 28(21): 68-70.

Adegbulugbe, A. and Akinbami, J. (2002). Policy options for the attainment of sustainable electricity supply in Nigeria. *Central Bank of Nigeria Bullion*, 26(4): 3-12.

Adeloye, L. (2010). *Harsh operating environment claims834 Nigerian manufacturing companies investigation.* Sunday PUNCH Newspapers.

Adenikinju, A., 2005. "Analysis of the cost of infrastructure failures in a developing economy: The case of the electricity sector in Nigeria." In *African Economic Research Consortium (AERC) Research paper.* pp. 112-54.

Agbo, A. (2007). Ending the power nightmare. *TELL, May*: 28-3.

Ajanaku, L. (2007). *Battling with darkness.* Special Edition ednTELL. 31-33.

Atser, G. (2006a). *Power shortage takes toll on economy.* The Punch. 8: 28.

Edet, O. A. (2016). Power sector reforms and electricity supply growth in Nigeria. *Asian Journal of Economics and Empirical Research*, 3(1): 94-102.

Elkan, W. (1995). *An introduction to economics.* Prentice Hall: London.

Ellahi, N. (2011). Testing the relationship between electricity supply, development of industrial sector and economic growth: An empirical analysis using time series data for Pakistan. *International Journal of Management Science and Engineering Management*, 6(4): 272-77.

Enang, B. U. (2010). Industrial development, electricity crisis and economic performance in Nigeria. *European Journal of Economics, Finance and Administrative Sciences*: Available: www.eurojournals.com

Gujarati (2003). *Basic econometrics.* 4th edn: McGraw-Hill: New York.

Gujarati and Sangeetha, N. (2007). *Basic econometrics.* 4th edn: Tata McGraw-Hill: New Delhi.

Iloeje, O. C., Olayinde, S. O. and Yusuf, A. O. (2004). *Report on an indicative survey of sectoral energy consumption in Nigeria.* Energy Commission of Nigeria: Abuja.

Isola, W. A., 2007. "Developments in the Nigerian electricity sector." In *A paper presented at the 50th anniversary of the Nigerian Economic Society, September 8th, Abuja, Nigeria.*

Iwayemi, A., 2008. "Investment in Electricity generation and Transmission in Nigeria: Issues and options." In *International Association for Energy Economics.* pp. 137-421.

Jhingan, M. L. (2008). *The economics of development and planning.* 39th edn: VRINDA Publications (P) Ltd.: India.

Jumbe, O. (2004). Co-integration and causality between electricity consumption and gdp: Empirical evidence from Malawi. *Energy Economics*, 26(1): 61-68.

Kniivila, M. (2008). *Industrial development and economic growth: implication for poverty reduction and inequality.* UN publications for Industrial Development.

Lohor, J. and Ezeigbo, O. (2006). *Nigerian population is 140 million.* ThisDay Newspaper. 14.

Mayah, E. (2010). *Nigeria to witness Rujugiro’s success story.* Daily Sun Newspapers.

Mojekwu, J. N. and Iwuji, I. I. (2012). Factors affecting capacity decision in Nigeria: A time-series analysis. *International Business Research*, 5(1): Available: www.ccsenet.org/ibr

Ndebbio, J. E. U. (2006). *The structural economics dimensions of underdevelopment, Associated vicissitudes and imperatives: Agenda for positive change. 33rd inaugural lecture.* Saesprint: Calabar.

Nyansu, F. (2016). *Effect of Power supply on the performance of small and medium size enterprise: A comparative analysis between SME’s in Tema and the Northern part of Ghana.* Munich personal RePE archive: Ghana.

Odiaka, P. (2006). *Power sector reforms Still a Reign of Blackout.* The Guardian. 15.

Ogbuagu, U., Ubi, P. and Effiom, L. (2010). The structure of electricity supply in Nigeria. The Leajon. *Academic Journal of Interdisciplinary Studies*, 2(1): 42-48.
Oke, O. A. (2006). Impact of energy on the manufacturing sector in Nigeria. Available: http://www.fypower.org/pdf/mfg_NAM_NASE.pdf
Olayemi, S. O. (2012). Electricity crisis and manufacturing productivity in Nigeria (1980-2008). *Developing Country Studies*, 2(4): 16-21.
Ologundudu, M. M. (2014). The Epileptic nature of Electricity supply and its consequences on industrial and economic performance in Nigeria. *Global Journal of Researches in Engineering*, 14(4): Available: https://globaljournals.org/item/4116-the-epileptic-nature-of-electricity-supply-and-its-consequences-on-industrial-and-economic-performance-in-nigeriaerror-correction-modelapproach
Riker, D. (2012). Energy costs and export performance. Manufacturing and services economics brief no.7, office of competition and economic analysis of the international trade administration's manufacturing and services unit. Available: www.trade.gov/mas/ian
Rostow, W. W. (1960). *The five stages of growth-a summary. The stages of economic growth: A non-communist manifesto.* Cambridge University Press: Cambridge. 4–16.
Saeed, S. and Waters, G. P. (2002). Export education: Perceptions of sporadic and regular exporting firms. *International Marketing Review*, 19(1): 80-97.
Ubi, P. S., Effiom, L. and Okon, E. O. (2012). An econometric analysis of the determinants of electricity supply in Nigeria. *International Journal of Business Administration*, 3(4): Available: https://www.researchgate.net/publication/267426550_An_Econometric_Analysis_of_the_Determinants_of_Electricity_Supply_in_Nigeria
Udeajah, G. (2006). *Industrial firms Lose N38 billion to power outage.* The Guardian. 29.
Ukpong, I. I. (1973). The economic consequences of electric power failures. *Nigerian journal of Economics and Social Studies*, 15(1): 53-74.
Ukpong, I. I. (1976). An analysis of causes of power shortage in Nigeria. *Nigerian journal of Economics and Social Studies*, 18(1): 34-49.
Usman, A. (2013). Determinants of electricity consumers satisfaction in selected electricity distribution zones in Nigeria: Implications for regulatory activities. *Journal of Asian Business Strategy*, 3(6): 103-24.

Appendix
Regression Analysis (Double Log)

Dependent Variable: LOG (MPI(-1)
Method: Least Squares
Date: 05/06/18 Time: 03:44
Sample (adjusted): 1981 2018
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.637543	0.617894	7.505408	0.0000
LOG(EDL(-1))	-0.208704	0.067469	3.093334	0.0042
LOG(CPU(-1))	0.052026	0.122933	-0.423207	0.6751
LOG(GCE(-1))	0.052410	0.022547	-2.324453	0.0268
LOG(EXR(-1))	-0.089789	0.298338	3.168547	0.0034
R-squared	0.545330	Mean dependent var		4.799112
Adjusted R-squared	0.486663	S.D. dependent var		0.213236
S.E. of regression	0.152778	Akaike info criterion		-0.791416
Sum squared resid	0.723575	Schwarz criterion		-0.571482
Log likelihood	19.24548	Hannan-Quinn criter.		-0.714653
F-statistic	9,295331	Durbin-Watson stat		1.880523
Prob(F-statistic)	0.000047			