The nexus between electricity generation, supply and manufacturing sector performance in Nigeria (1975-2011)

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Abstract

Several studies have emphasised the significance of regular and adequate electricity supply in boosting manufacturing sector productivity in Nigeria. In accordance with this, this paper investigates the relationship between electricity generation/supply and manufacturing sector performance in Nigeria using time series data from 1975-2011. The variables utilised include: index of manufacturing production, electricity generation, government capital expenditure, inflation rate, exchange rate and capacity utilisation. The work employed the correlation analysis, Granger Causality test and Johansen Co-integration test for the empirical analysis. The correlation result revealed a weak positive nexus between electricity generation and index of manufacturing production in Nigeria. The Granger Causality test showed a unidirectional causality between electricity generation and index of manufacturing sector production. Further test shows three co-integration equations at five percent level for the trace statistics, but no co-integration at five and one percent level for the Max-Eigen test. In view of the findings, it has been observed that, irregular electricity supply has been a major bane to output growth in the manufacturing sector; therefore, it is recommended that the power sector by means of guided private sector initiative should be given more attention for the growth of the nation's economy.

Keywords: Electricity generation and supply, manufacturing performance, Nigeria.

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1. Introduction

One of the essential requirements for output growth in the manufacturing sector is adequate electricity supply. 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 consumers wants (Olayemi, 2012). The importance of the power sector is emphasise by Hirschman's in his theory of unbalance growth, when he proposed investment in strategies 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's (1960) stresses the development of the manufacturing industries as a leading sector that will bring about high growth rate in the economy. With this regard, the role of the manufacturing sector cannot be underestimated, as it has been recognise 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 (Kniivila, 2008). 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 rate 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 import substitution (Saeed & 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 indigenisation 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. A look at figure 1.1 (see appendix) has shown the fluctuating and depressed picture of production in the sector. One constraint for this decline is erratic electricity supply. The study carried out by Manufacturing Association of Nigeria (MAN) in 2005 and in the first half of 2006 shows a depressing picture of the Nation 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 (Adegbamigbe, 2007; Enang, 2010; Udaejah, 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 the big firms relied fully on self-generated electricity to ensure 100 percent reliability for production to be uninterrupted (Iloeje, Olayinde, & Yusuf, 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 nexus between electricity generation, supply and 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 (see Adegbulugbe & Akinbami, 2002; Ayodele, 2001; Isola, 2007; Iwayemi 2008; Ubi, Effiom, & Okon, 2012) - ranging from corruption and inadequate funding. Likewise, Ogbuagu, Ubi, and Effiom (2010) and Iwuji (2014) attempted an analysis of the factors affecting electricity supply and capacity utilisation in Nigeria using descriptive and ordinary least squares analysis without any econometric tests of the degree of association of the time series properties of the data. It is widely acknowledged that such analysis leads to spurious and nonsensical results. 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 using Pearson correlation analysis, Granger Causality technique and the Johansen co-integration test to investigate the relationship between electricity supply and manufacturing sector performance in Nigeria from 1975-2011. On the basis of the evidence from these empirical analyses, conclusions would be drawn and policy-formulation will be proffered.

The study is divided into five sections. Section one contains introduction, section two deals with literature review, while section three presents the theoretical background, model specification and methodology. Result presentation is in section four as section five is conclusion and recommendations.

2. Literature review

2.1 Structure of power sector in Nigeria

All over the world, electricity is seen as one of the cheapest form of energy that is obtainable by industries and domestic users, because it serves both the function of diesel and fuel to operate machinery (Ellahi, 2011). For developing nations, the growth in the utilisation of energy is directly and closely related to expansion in industrialisation (World Bank, 2005). However, electricity generation and supply (distribution) in Nigeria has not really expanded industrialisation as perceived by World Bank (2005). Before now (October 1, 2013), the power sector was solely control and owned by the government, which is nearly absolute monopoly. Prior to mid-18th Century (1866), 2 set of generators were installed to supply electricity to Lagos Colony (Hart, 2000). About a century after, precisely in 1951, the government established the Electricity Corporation of Nigeria (ECN) through an act of parliament to provide power supply in the country. In 1962, the nation experienced the establishment of Niger Dam Authority (NDA), which is charged with the responsibility of developing hydroelectric power project located in Kainji on the River Niger. The two power stations; Electricity Corporation of Nigeria (ECN) and Niger Dam Authority (NDA) were operating as separate entities till 1972, when they were integrated to form the National Electric Power Authority (NEPA).

This new body was granted the monopoly to generate and distribute electricity in the whole of Nigeria. As part of the on-going reform of the federal government, the Electric Power Sector Reform Act 2005 was enacted. Based on this, the National Electric Power Authority (NEPA) was known as Power Holding Company of Nigeria (PHCN), while the Nigeria Electricity Regulatory Commission (NERC) was established in 2005 to regulate the functioning of the sector. The reform paved the way for National Electric Power Authority to be sub-divided into 18 companies. This includes: 11 distributing companies, 6 generating companies and 1 transmission company. The generating companies comprise 4 thermal (gas based) and 2 hydro stations (Towards Appropriate Energy," 2012).

In spite of the subdivision of NEPA into 18 companies' to tackle power crisis, the state of electricity generation and supply is appalling. As at December 2011, the installed capacity (1C) was not up to 10,000 megawatts and electricity generated (EG) in megawatts per hours (MW/H) was below 3100 MW/H (figure 1.2). In comparison of these figures to the installed capacity of Egypt, Algeria and South Africa which is above 10,000 MW shows that the nation still has a long way to go in addressing this issue (table 1.2).

The hindrance of adequate electricity generation and development has been ascribed to a number of constraints. These includes: (i) Mismanagement of funds by government officials (ii) corruptions and inefficiency in management and (iii) the installed plants that were available in the 1980s were not functioning in the 1990s and 2000s (Mojekwu & Iwuji, 2012). See table 1.1 in the appendix. From table 1.1, it is observed that a total of seventy six (76) installed units were put in place in 1980 and only 22 units were available in 2004. These produced an aggregate capacity of 2716.6, while the actual capacity obtained was 2278MW. For instance, Delta station has 3 working generating plants out of the 20 installed plants in 1980. The available capacity (320MW) and actual generated capacity (291) were far lower than Egbin station's available capacity of 880MW with actual generated capacity of 825

MW/H. The generated loss as a result of this is 29MW for Delta and 57MW for Egbin. Also, a report shows that, as at December 2005, the installed capacity of PHCN was 4,200 MW and the estimated demand were 6,500 which have caused a generating deficit of 2,300 MW (Power Holding," 2005).

The consequence of this outcome is power outages due to load shedding, system collapses and demand for additional and alternative source of power. A survey of electricity generation and consumption in Nigeria revealed that, actual consumption of electricity was estimated to be 29,945 GWh, this is about 1.96 times the total electricity generated for that period. The excess generation was provided by self-generation, particularly by industries, high income households and service (Iloeje et al., 2004).

The immediate and reasonable response to this imbalance of power demand and supply bounced on load shedding among industries, service and individuals households. Herein, those who do not have their own standby generators or plants will not have steady power supply when needed. This situation has an adverse impact on the Nigerian economy, especially the local manufacturing industries, making them un-competitive internationally.

2.2 Electricity generation, supply and manufacturing sector performance

Quite a number of studies have been carried out on the impact of electricity generation on manufacturing and industrial growth. For instance, Ukpong (1993) applied production function approach to investigate the impact of erratic power supply on selected firms in commercial and industrial sectors in Nigeria from 1965-1966. His finding shows that about 130 KW/H and 172KW/H were not supplied to the firms in the two periods. The estimated cost of this is N1.68 million in 1965 and N2.75 in 1966. By implication, he noted that erratic power supply has adverse impact on productivity growth of manufacturing sector in Nigeria. In contrary, Meadows, Riley, Rao, and Harris (2003) and Tarun, Uddin, &and Ambarish (2013) studies, confirmed electrification to have a positive significant impact on the growth of SMEs as well improves the performance of new commercial establishments (as cited in Maleko, 2005).

Correspondingly, Ketelhout (2008) utilised primary data and descriptive analysis on 72 SMEs in Cape Town of South Africa to examine the impacts of electricity shortage on the performance of Small and Medium Enterprises (SMEs). The policy options revealed that high prices of electricity, rebates/refund for energy savers and behaviour of electricity consumers do not have significant impacts on SMEs growth (Ellahi, 2011). Ibrahim (2008) carried out his study on factors affecting Small and Medium Scale enterprises (SMEs) in Borno state of Nigeria using 30 firms of SMEs. Ibrahim noted that, inadequate infrastructure such as power supply was a key factor confronting SMEs. He suggested that there should be improvement in power supply and other social amenities to help the subsector to grow.

As a follow up, Ellahi, (2011) investigated the relationship between electricity supply, development of industrial sector and economic growth using Endogenous growth theory for the period 1980-2009. The result using Auto Regressive Distributed Lag (ARDL) shows that productivity level of the industrial sector in Pakistan is declining as a result of power shortage. The major recommendation is that electricity problem should be fixed to improve industrial growth. Corroborating the work of Ellahi, (2011), 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 utilisation, while interest and inflation rate have adverse impact on capacity utilisation in Nigeria. The R^2 of 88.54 percent shows changes in capacity utilisation as a result of the predictor variables. It was recommended that, the on-going power reform of privatisation of the subsector should be fully undertaken by the government and a single digits lending and inflation rate should be adequately sustained.

Olayemi, (2012) utilised 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. 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.

3. Theoretical background and model specification

This work will review three theories that relate electricity utilisation to manufacturing sector performance. These include: the traditional cost theory, modern cost theory, Liberalised Electricity Market Theory (LEMT). The LEMT describes how firms have the options to invest on different power plan size in order to produce electricity at diverse levels of marginal cost since electricity cannot be store at any cost. Therefore, it is vital for firms to invest in a number of different portfolios of technologies, so as to meet up with fluctuating demand. In the Nigeria contexts, prior to the privatisation of NEPA, the regulated and guided monopolist determine the pricing and output strategies. As privatisation takes place in October 1, 2013, the regulated and guided monopolist has been transformed into a number of firms in different regions of the nation and it determined electricity generated, supply and pricing.

It is important to discuss the traditional cost theory, which is classified into the short run and the long run periods. In the short run period (SR), some factors such as entrepreneurship and capital equipment are usually considered to be fixed, while in the long run period (LR); 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 utilised 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). Under this theory, it is assumed that firms in the industry do not build plants with changing productive capacity, but often experienced 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 produce, given the assumption that, resources are unemployed. Excess capacity of firms is depicted in figure 1.2, below.

Figure 1.1

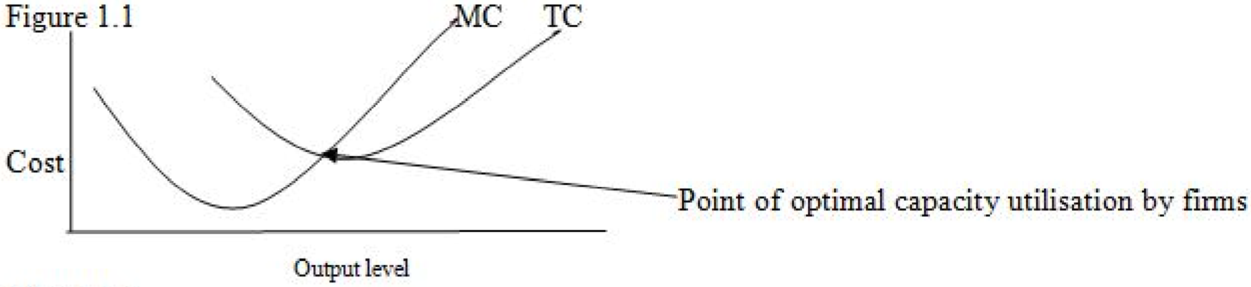
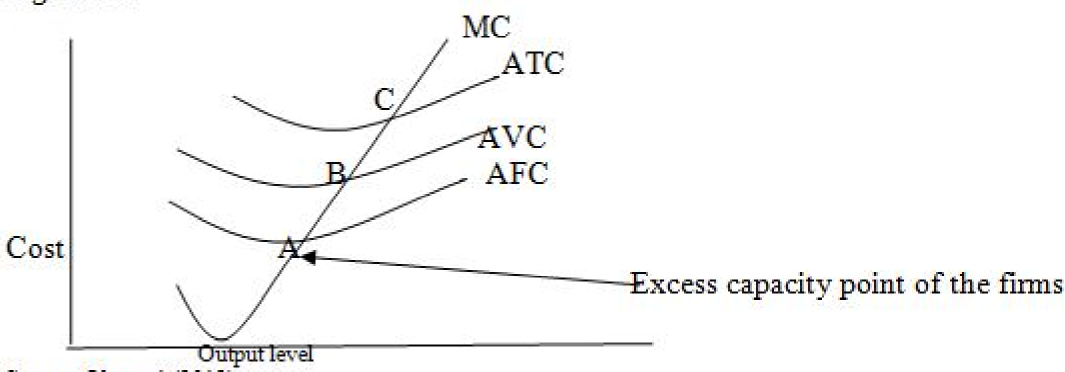


Figure 1.2



Source: Olayemi (2012).

Furthermore, the modern cost theory is constructed on the assumption that firms have right to build their own plants size with certain level of flexibility in their productive level, thereby making it possible for the firms to possess reserve capacity. The theory is of the view that firms, which used about T! and approximately 3 quarters of their adequate electricity supply are regarded to be resourceful and efficient. Under this theory, it is suggested that, reserve capacity of firms implies that some levels of output can be created with a single cost.

Given the above discussed theories, it is observed that each analysed theories was not sufficient enough to bridge the gap between manufacturing sector performance and electricity generation and supply in developing nations, especially Africa and Nigeria in particular. The long-lasting solution is the complete revolution and privatisation of the power sector. This step taken will enhance the optimum utilisation of the equipment and tools of the manufacturing industries, thereby increases productivity. A major problems being faced by the manufacturing industries is erratic power supply, which has prompt manufacturers to source for alternative power supply such as generator, and the cost of buying fuels and diesel increases the cost of production of goods. This issue has forced many manufacturers out of businesses. Based on this, the present dispensation of President Goodluck Jonathan has taken the bold step to privatise the power sector for efficient and effective management. This move is still early for Nigerians to evaluate the impact of the sector on the economy.

4. Methodology

The models adopted for this study are derived from previous studies (Enang, 2010; Ndebbio, 2006; Olayemi, 2012; Ubi, 2012). The models are modified to capture the relationship between electricity generation, supply and manufacturing sector performance in Nigeria. The variables in their studies include: the index of manufacturing production (IMP), electricity generated or supplied (EGI), Capacity utilisation (CPU), government capital expenditure (GCE) 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 generation in megawatts per hours in MW/H (EG), inflation rate (IR), and capacity utilisation in percentage (CU).

The index of manufacturing production (IMP) is utilised 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 generated and supplied (EGI) is the aggregate amount of power generated and supply by the Power Hold Company of Nigeria (PHCN) to the industrial sector in megawatts per hours (MW/H). In the Nigeria context, electricity generated is also used to capture supply to the end users. The exchange rate (EX) is the rate at which the naira is exchange to the dollar or other currency. This affect output of manufacturing sector, as manufacturers incur high cost importing plans and generators to augment the poor electricity supply in the country. Inflation rate (IR) measures the percentage increase in the price level of goods and services, usually yearly. That is, it examines the general level of prices for goods and services as it is rising, and, subsequently, purchasing power is falling. The present of Capacity utilisation (CU) in the model, measures the extent in which the manufacturers use their production potential. Capacity utilisation can be defined as the percentage of total capacity that is actually being achieved in a given period. 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

Based on the above discussion, three tests will be carried out in this study: Pearson correlation analysis, Granger Causality (GC) and Johansen Co-integration tests. Firstly, the descriptive statistics which shows the percentage increases and the relationship that exist among several variables. Secondly, the ‘GC’ test is a form of statistical hypothetical test that is employed to determine whether one time series variable can be employ to predict another. A time series variable ‘P’ is noted to Granger cause variable ‘Q’ if it can be revealed through a series of statistical f-test and t-tests on lagged values of ‘P’ (with the lagged values of ‘Q’ also included), that values of ‘P’ provide statistical significant information regarding the future values of variable ‘Q’. The Granger Causality model

that is adopted from existing work such as Enang (2010) and postulated by this paper is given as:

$IMP_t =$ “$a_{oi}EG_{t\cdot 1}$ + “âj $IMP_{t\cdot j}$ + U_{1t} …………… Equation 1

$EG_t =$ “$a_{oi}IMP_{t\cdot 2}$ + “âj EG_{t-j} + U_{2t} …………….. Equation 2

$IMP_t =$ “$a_{oi}GCE_{t\cdot 3}$ + “âj $IMP_{t\cdot j}$ + U_{3t} …………… Equation 3

$EG_t =$ “$a_{oi}IMP_{t\cdot 4}$ + “âj GCE_{t-j} + U_{4t} …………….. Equation 4

Thirdly, the Johansen Co-integration test that explores the long run relationship that exists among the time series data employed. The data for the empirical analysis are source from CBN annual reports from 2004 to 2011 editions. The period under study is from 1975-2011. The E-view 7.0 will be the software that will be employed for the empirical analysis.

5. Empirical results

The result of the descriptive test is depicted in table 4.0. The results provided some insight about the mean (average), standard deviation (degree of dispersion), minimum and maximum tests for each of the computed variables. The variables are in logged form. The range of LOGGCE and LOGEX are substantial, as LOGINF, LOGIMP, LOGCU and LOGEG appear to be lesser. The outcome shows that LOGINF has the lowest mean (2.605294) and median (2.615204). The LOGGCE has the maximum value of 15.70900 and the LOGEX recorded the minimum figure of -0.521639. The variables LOGIMP and LOGGCE have the lowest (0.218862) and highest (2.591127) standard deviation in the result.

In addition, the correlation result depicted in table 4.1 revealed that, three of the variables: LOGEX (0.435134), LOGGCE (0.177108) and LOGINF (0.020408) have a weak positive relationship with LOGIMP. The other outcome shows a fairly positive nexus between LOGEG (0.592975) and LOGIMP, while a relatively negative correlation between LOGCU (-0.637670) and LOGIMP.

To examine the causal nexus between index of manufacturing production (LOGIMP), electricity generation (LOGEG), inflation rate (LOGIR), exchange rate (LOGEX), government capital expenditure (LOGGCE) and capacity utilisation (LOGCU), the Granger Causality test is adopted in this paper. As depicted in table 4.2, there is unidirectional causal relationship that runs from LOGCU to LOGIMP after lagging the variables for 1, 2 and 3 periods, though without any feedback from LOGIMP to LOGCU. However, after 4 and 5 lags of both variables, there exists a bi-directional relationship between both variables. Similarly, there is unidirectional causal nexus that occurs between LOGEG and LOGIMP after lagging the variables for 3, 4 and 5 periods. This implies that LOGEG Granger cause LOGIMP to change, but there is no feedback effect from LOGIMP to LOGEG. Also, after lagging LOGIMP and LOGGCE for 4 years, it was observed that, unidirectional relationship runs from LOGIMP to LOGGCE without feedback result from LOGGCE to LOGIMP. This study finds no Granger causal relationship between LOGIMP and LOGGEX on one hand, and LOGIMP and LOGINF on the other hand.

The next task is to discuss the Johansen co-integration result. The main aim of this test is to establish if all the variables employed in this analysis have long run relationship. If co-integration exists, then we have to accept the alternative hypothesis, which postulates that, there is a long run relationship among all the variables. The tests statistics (Trace and Maximum Eigenvalue) are depicted in table 4.3. From the trace statistic result, the test rejects the null hypothesis of no co-integration and in favour of the alternative hypothesis, which shows three co-integration equations at five percent level. However, the Max-Eigen statistic rejects the alternative hypothesis; thus, there is no co-integration at five and one percent level.

6. Discussion of results

The correlation result revealed so far showed a positive relationship between index of manufacturing production and electricity generation; this is contrary to the findings of Olayemi, (2012), Lee and Anas (1992) who observed an inverse nexus between electricity generation and index of manufacturing production. The implications of this findings is that, an increase in electricity generated and supply will bring about rise in index of manufacturing production, on the contrary, erratic electricity supply will translate to decline of the latter. In Nigeria, the epileptic electricity supply explains the reasons why manufacturers opt for alternative power supply, this scenario upsurge the cost of production and doing business. The situation is so appalling that, the nation has an aggregate installed generating capacity of 8,227 MW in 2009 and the maximum available generating capacity is estimated to be 5482MW, while the actual demand is projected to be above 30,000MW (Aderibigbe, 2010).

Also, the result of inverse relationship between capacity utilisation and index of manufacturing production conformed with previous studies of Ukpong (1993) and World Bank (1993b), but contrary to Olayemi, (2012) studies. Thus, the findings support the view that, rising capacity utilisation is due to inadequate electricity supply to the manufacturing sector. The nexus between government capital expenditure and index of manufacturing production meet up with the positive sign, which implies that, if more funds are being allocated for infrastructural development, this will enhance the growth of the manufacturing industries vice versa. The Nigeria experiences have shown that, budgetary allocations that have been channelled for various capital projects from each successive government (General Ibrahim Babangida since 1984 to President Goodluck Jonathan, 2014) have gone down the lane to other government official private projects and this affect the development of the power sector, as well as the growth of output of manufacturing sector in the society.

Furthermore, one would have expected exchange rate to be inversely related to index of manufacturing production, but the reverse was the case. This can be attributed to the long period of erratic power supply, which has encourage rapid importation of generator plans by manufacturers, in order to increase productivity, as such increase the demand for foreign exchange at all cost. As well, the inflation rate variable revealed a positive correlation with index of manufacturing production; this can be attributed to the unstable monetary policy that has been operational during the period under review.

The result of the Granger causality tests conform with the work of Enang (2010), who found a unidirectional causality that runs from electricity generation to industrial production, without feedback effect. This is in line with Ajanaku (2007) statement, that unstable electricity supply and other key factors have hindered the performance of the industrial sector in Nigeria. The causal relationship between capacity utilisation and index of manufacturing production is explained on the ground that, epileptic power supply has forced manufacturers to increase capacity utilisation to enhance productivity.

The co-integration result relatively conform with the work of Canning & Pedroni, (2004), who observed that, energy infrastructure (electricity) and output of manufacturing sector are co-integrated. The co-integrated outcome of our findings reflect the long run unreliable and unstable electricity supply, which has transcended into fall in productivities in the manufacturing sector from the early 1970’s till date. The resultant effect of electricity outrage, is sourcing for alternative power supply by manufacturers, this process increases the cost of production, making our goods more expensive in the domestic and international market, by implications discourage export in favour of import in Nigeria.

7. Conclusion and recommendations

This study examine the nexus between electricity generation/supply and manufacturing sector performance in Nigeria using time series data from 1975-2011. A brief history of various policies enacted by the government to encourage the growth of the manufacturing sector were discussed and the structure of electricity company in Nigeria was well analysed. Further, the study applied the descriptive analysis, correlation, Granger causality and Johansen co-integration to carry out the empirical analysis. One key finding is that, the pitiable state of the power sector in the country accounts for adverse and decline in productivity of the manufacturing sector. The power sector has been faced with continuous dearth of investment pooled with poor management/maintenance culture that has led to decline in available capacity. Available report has shown that as at April, 2010, the actual peak generated was estimated to be 3666.7 MW, which is just 61 percent of the targeted 6000 MW that was expected to generate as at December, 2009 (Aderibigbe, 2010). The unstable electricity supply bane has brought about the acquisition of expensive power backup in the forms of plans, generators, inverters, etc. This is a scenario where firms have to spent approximately 20 -30 percent of their initial investment on acquisition of various form of facilities to augment stable electricity supply (Adenikinju, 2005). The aftermath effect is on cost competitiveness in the manufacturing industries.

Therefore, there is the need for the government to invest on infrastructural development not only on facilities that will set the paste for the new power sector investors to functions, but also on other keys sectors, such as inter state and city railways, roads, etc. These in no small way will help trigger the growth of the manufacturing sector, as well as other sub-sectors. Also, this study suggests the establishment of a world class research and development centre, taking example from the developed nations (Canada, USA, Germany, Switzerland, etc) where new ideas, techniques and innovations for local manufacturers can spring forth.

Furthermore, from the results and policy suggestions, the government has a strong role to play in curbing erratic electricity supply and addressing the issues of fluctuating macro-economic variables, especially on output of manufacturing sector. Particularly, the government should ensure that the new 17 successor companies that are presently in charge of the power sector should be adequately monitored to ensure that stable electricity supply should commence full operation at the stipulated month (June, 2014), a document must be sign by agents of the government, the investors and other noble bodies for record purpose.

More so, the tariff charged by this investors (electricity supply companies) must be affordable by an average Nigerian, and the government must put in mind that the goals of an investor is profit making at the expense of peoples' welfare. Likewise, the government should encourage the manufacturing sector by giving tax holiday to indigenous infant industries and subsidising tariff plan (high electricity bills) for investors in the manufacturing sector to produce at a low cost. The above raised points are significant, if Nigeria must achieve the vision 2020 goals of being listed among the first-twenty industrialised nations of the globe by the year 2020. Lastly, this work has thrown more light on the issue of electricity generation/ supply and index of manufacturing production; this study will be beneficial for policymaking. Further studies need to address the issues of demand and supply of electricity in the face of privatisation and its impact on productivity of manufacturing industries in Nigeria.

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Table 1.1 : Nigeria Power Stations and their Generation Capabilities

S/n	Station	Installed unit (1980)	Available unit (2004)	Installed available unit (MW)	Actual capacity generated (MW)	Generation loss
1	Kainji	8	3	260	186	74
2	Jebba	6	4	385.6	269	16.4
3	Shiroro	4	2	450	425	25
4	Egbin	6	3	880	825	57
5	Sapele	10	2	360	253	107
6	Afam	18	3	40	30	101
7	Delta	20	3	320	291	29
8	Ijora	3	1	20	0	20
9	Calabar	1	1	1	1	0
	Total			2716.6	2278	1338.6

Source: Iwuji & Mojekwu (2012)

Table 1.2: **Installed power capacity in selected Nations from 1980-2010**

Years	Nigeria	Egypt	Algeria	South Africa
1980	224	4867	2185	18383
1990	496	11474	4657	31015
2000	585	17861	6044	39817
2004	5888	17958	6468	40481
2009	8815	24673	10380	44260
2010	9287	26912	11332	44260

Source: Iwayemi, (2008), EEHC (2008) and www.eia.gov/cfappslipdbproject/TEDindexs.cfm

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Figure 1.1 : Growth rate of output in the Nigeria manufacturing sector

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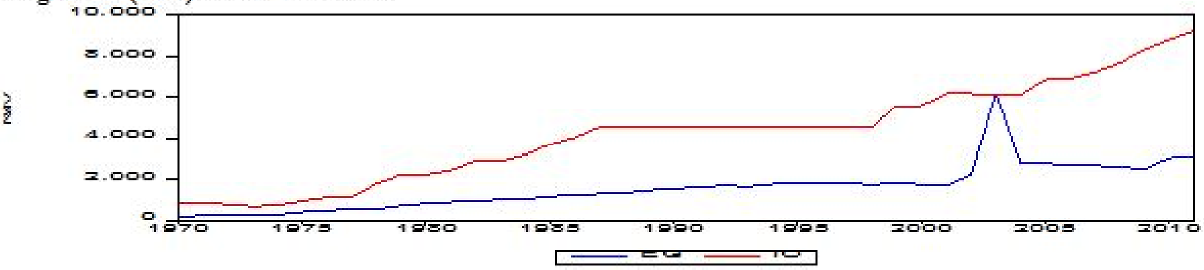
Figure 1.2: Total Electricity generation (EG) in Megawatts (MW per Hours) and Installed Capacity (IC) in Megawatts (MW) from 1970-2011.



APPENDIX ONE

Obs	EX	CU	EG	GCE	IMP	INF
1975	0.616000	76.60000	395.4000	2242.100	43.90000	43.47000
1976	0.626000	77.40000	468.7000	3131.100	54.10000	12.12000
1977	0.647000	78.70000	538.0000	3949.500	57.50000	31.27000
1978	1.606000	72.90000	522.7010	3883.600	65.80000	6.180000
1979	0.596000	71.50000	710.7000	3425.400	97.30000	8.310000
1980	0.546000	70.10000	815.1000	8437.700	102.4000	16.11000
1981	0.610000	73.30000	887.7000	4928.300	117.4000	17.40000
1982	0.673000	63.60000	973.9000	3510.800	132.8000	6.940000
1983	0.724000	49.70000	994.6000	3317.200	94.80000	38.77000
1984	0.765000	43.00000	1025.500	893.9000	83.40000	22.63000
1985	0.894000	38.30000	1166.800	2046.700	100.0000	1.030000
1986	2.021000	38.80000	1226.900	1755.300	96.10000	13.67000
1987	4.018000	40.40000	1286.000	2778.800	128.4000	9.690000
1988	4.538000	42.40000	1330.400	3854.700	135.2000	61.21000
1989	7.392000	43.80000	1462.700	5771.100	154.3000	44.67000
1990	8.038000	40.30000	1536.900	5581.700	162.9000	3.610000
1991	9.909000	42.00000	1617.200	4636.700	178.1000	22.96000
1992	17.29800	38.10000	1693.400	4469.300	169.5000	48.80000
1993	22.88600	37.20000	1655.800	21920.00	145.5000	61.26000
1994	21.88600	30.40000	1772.900	32097.20	144.2000	76.76000
1995	21.88600	29.30000	1810.200	52364.80	136.2000	51.59000
1996	21.88600	32.50000	1854.200	126485.9	138.7000	14.32000
1997	21.88600	30.40000	1839.800	176515.0	138.5000	10.21000
1998	21.88600	32.40000	1724.900	224227.5	133.1000	11.91000
1999	21.88600	34.60000	1859.900	340834.3	137.7000	0.220000
2000	109.5500	36.10000	1738.300	139473.1	138.2000	14.52000
2001	112.4860	42.70000	1689.900	313093.8	142.2000	16.50000
2002	126.4000	54.90000	2237.300	247800.7	146.3000	12.19000
2003	135.4060	56.50000	6180.000	153718.1	148.0000	23.79000
2004	132.3760	55.70000	2763.600	197794.4	145.0000	10.01000
2005	130.4000	54.80000	2779.300	336395.9	145.9000	11.60000
2006	128.5000	53.30000	2650.200	340888.6	89.20000	8.500000
2007	120.9705	53.38000	2670.000	499000.0	90.40000	5.400000
2008	132.5600	53.84000	2593.000	1056500.	92.70000	11.50000
2009	149.5800	54.30000	2493.000	6648077.	93.60000	12.50000
2010	150.6600	56.20000	3031.100	5595087.	93.70000	13.80000
2011	158.2700	56.90000	3086.100	4785385.	101.2000	10.90000

APPENDICE TWO

Table 4.0: Descriptive statistics

	LOGIMP	LOGCU	LOGEG	LOGEX	LOGGCE	LOGINF
Mean	4.825922	3.788780	7.502992	2.949573	10.87841	2.605294
Median	4.914124	3.754199	7.460663	3.085847	11.74700	2.615204
Maximum	5.182345	4.294561	8.729074	5.064302	15.70900	4.340684
Minimum	4.423648	3.377588	6.788634	-0.494296	6.795000	-1.514128
Std. Dev.	0.218862	0.240544	0.417574	1.915505	2.591127	1.180107
Skewness	-0.429510	0.034504	0.577635	-0.521639	0.170869	-1.456046
Kurtosis	1.830470	2.065852	3.714515	2.001369	1.917880	6.480482
Jarque-Bera	2.719884	1.133302	2.383360	2.694020	1.663368	26.60064
Probability	0.256676	0.567423	0.303711	0.260017	0.435316	0.000002
Sum	149.6036	117.4522	232.5928	91.43675	337.2308	80.76410
Sum Sq. Dev.	1.437019	1.735844	5.231029	110.0748	201.4181	41.77955
Observations	31	31	31	31	31	31

Table 4.1: Correlation output

	LOGIMP	LOGCU	LOGEG	LOGEX	LOGGCE	LOGINF
LOGIMP	1.000000	-0.637670	0.592975	0.435134	0.177108	0.020408
LOGCU	-0.637670	1.000000	-0.397089	-0.319461	-0.109768	-0.001667
LOGEG	0.592975	-0.397089	1.000000	0.889237	0.754856	-0.077478
LOGEX	0.435134	-0.319461	0.889237	1.000000	0.877663	-0.045350
LOGGCE	0.177108	-0.109768	0.754856	0.877663	1.000000	-0.189983
LOGINF	0.020408	-0.001667	-0.077478	-0.045350	-0.189983	1.000000

TABLE 4.2: Granger Causality Tests Result.

Null Hypothesis:	Obs	F-Statistic	Prob.
Pairwise Granger Causality Tests. Date: 01/04/14 Time: 21:06. Sample: 1975 2011. Lags: 1			
LOGEG does not Granger Cause LOGIMP	36	0.95254	0.3362
LOGIMP does not Granger Cause LOGEG		0.39571	0.5336
LOGGCE does not Granger Cause LOGIMP	36	1.19791	0.2817
LOGIMP does not Granger Cause LOGGCE		0.00061	0.9804
Pairwise Granger Causality Tests. Date: 01/04/14 Time: 21:09. Sample: 1975 2011. Lags: 2			
LOGEG does not Granger Cause LOGIMP	35	0.28862	0.7514
LOGIMP does not Granger Cause LOGEG		0.09029	0.9139
LOGGCE does not Granger Cause LOGIMP	35	0.55666	0.5789
LOGIMP does not Granger Cause LOGGCE		0.09195	0.9124
Pairwise Granger Causality Tests Date: 01/04/14 Time: 21:16. Sample: 1975 2011. Lags: 3			
LOGEG does not Granger Cause LOGIMP	34	2.83520	0.0569
LOGIMP does not Granger Cause LOGEG		0.05020	0.9848
LOGGCE does not Granger Cause LOGIMP	34	1.23544	0.3162
LOGIMP does not Granger Cause LOGGCE		0.64648	0.5919
Pairwise Granger Causality Tests. Date: 01/04/14 Time: 21:27. Sample: 1975 2011. Lags: 4			
LOGEG does not Granger Cause LOGIMP	33	3.23264	0.0295
LOGIMP does not Granger Cause LOGEG		0.27778	0.8894
LOGGCE does not Granger Cause LOGIMP	33	0.72483	0.5836
LOGIMP does not Granger Cause LOGGCE		2.63757	0.0589
Pairwise Granger Causality Tests Date: 01/04/14 Time: 21:52. Sample: 1975 2011. Lags: 5			
LOGEG does not Granger Cause LOGIMP	32	4.24429	0.0080
LOGIMP does not Granger Cause LOGEG		0.20621	0.9562
LOGGCE does not Granger Cause LOGIMP	32	1.14333	0.3690
LOGIMP does not Granger Cause LOGGCE		1.81551	0.1533

Table 4.3: Johansen Co-Integration Test

Date: 01/04/14 Time: 15:03	
Sample (adjusted): 1977 2011	
Included observations: 35 after adjustments	
Trend assumption: Linear deterministic trend	

Series: LOGIMP LOGCU LOGEG LOGEX LOGGCE LOGINF						
Lags interval (in first differences): 1 to 1						
Hypothesized		Trace	5 Percent	1 Percent		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value		
None **	0.669709	116.1986	94.15	103.18		
At most 1 **	0.566818	77.42631	68.52	76.07		
At most 2 *	0.506065	48.14543	47.21	54.46		
At most 3	0.303931	23.45811	29.68	35.65		
At most 4	0.185532	10.77740	15.41	20.04		
At most 5	0.097607	3.594681	3.76	6.65		
Trace test indicates 3 cointegrating equation(s) at the 5% level						
Trace test indicates 2 cointegrating equation(s) at the 1% level						
*(**) denotes rejection of the hypothesis at the 5%(1%) level						
Hypothesized		Max-Eigen	5 Percent	1 Percent		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value		
None	0.669709	38.77233	39.37	45.10		
At most 1	0.566818	29.28088	33.46	38.77		
At most 2	0.506065	24.68732	27.07	32.24		
At most 3	0.303931	12.68071	20.97	25.52		
At most 4	0.185532	7.182715	14.07	18.63		
At most 5	0.097607	3.594681	3.76	6.65		
Max-eigenvalue test indicates no cointegration at both 5% and 1% levels						
*(**) denotes rejection of the hypothesis at the 5%(1%) level						
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):						