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The Determinants of Capacity Utilization in the Nigerian Manufacturing Sector.

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Abstract
This study empirically investigated the determinants of capacity utilization in the Nigerian manufacturing sector between 1975 and 2008. The study used capacity utilization as the dependent variable while its determinants such as Real Manufacturing Output Growth Rate (MGDP), Real Interest Rate (INTR), Consumer's Price Index (CPI), Fixed Capital Formation in Manufacturing Sector (CPF) and Electricity Generation on Rate(ELEGR)(Proxy for energy) were used as independent variables. Cointegration and Error Correction Model(ECM) were employed as the estimation techniques so as to study the time series properties of the variables and to ascertain the existence of long-run relationship between capacity utilization and its determinant indicators. Structured questionnaire was administered to assess the operational materials and the performance of the selected firms. The findings of the study revealed that there is positive relationship between consumer's price index, Fixed capital formation in manufacturing sector and capacity utilization. The study also showed that there is negative relationship between Electricity Generation, Real Manufacturing Output Growth Rate and Capacity Utilization which resulted in low manufacturing productivity growth rate in Nigeria. Based on the findings, the study strongly recommended that government should make adequate provision of infrastructural facilities especially Electricity Generation to boost production.
Keywords: Capacity Utilization, Real Manufacturing Output Growth Rate, Electricity Generation, Co-integration and Error Correction Mechanism and the use of descriptive survey type

1. Introduction

The Manufacturing sector is regarded as a very important sector in an economy because of its capacity to foster wide and efficient backward and forward linkages among different sectors of the economy. In fact, Kayode (2000) described the manufacturing sector as the engine room for any economy. More specifically, the subject of capacity utilization, especially industry has attracted attention in recent years. This is as a result of the realization that there exists a positive correlation between capacity utilization on one hand and output growth. According to Fabayo (1981) the level of capacity utilization does not determine how much more output can be obtained by fuller utilization of existing capacity, but also define the required expansion of capacity for a targeted output. He further stated that there exists a positive correlation also between capacity utilization and employment via shift work operation, price stability and industrial growth, on the other hand. In the same vein, Capacity utilization, according to Fabayo (1981), is an important determinant of economic development and growth and a priori reason for its (Capacity utilization) analysis in a developing economy becomes evident. In a developing economy, the economic resources (especially capital and skilled labour) which are needed for rapid economic development are both scarce and expensive and cannot easily be augmented of financial resources, technical know-how and element of time factor. They are also paradoxically grossly underutilized. Shortly before Nigerian adopted Structure Adjustment Programme (SAP) as a means of escaping from the economic woes of mid 1980s. The countries foreign exchange earning had declined significantly owing to the ailing manufacturing industry. On this note, the adoption of SAP as a means of revamping the moribund manufacturing sector became imperative. It is adoption of the Structure Adjustment Programme of 1986 which was aimed at laying an enduring foundation for future expansion of the productive capacity of the economy, achievement of high economic growth through increase in the share of manufacturing value added, increase in export of manufacturing, diversification of industrial activities and improvement in the living standard of Nigerians.

Adenikijiu (1996) noted that although several incentives were not in place to enhance manufacturing productive efficiency during SAP period, the impact on the sector was not commensurate with the efforts. Nigerian's manufacturing sector has over the years been bedeviled by a myriad of challenges. The manufacturing capacity utilization has reduced from 75.4 percent in the 1975-1979 periods to an all time low of about 30 percent in the late 1990's from Akingbola's (1992) report of the Manufacturing Association of Nigerian (MAN'S) meeting in may, 1992, it was observed that the capacity utilization rate of the industrial/ manufacturing sector fell from 57 percent to 40 percent estimate in 1998 to 30 percent in 1999 before picking up again in 1990 to the peak of 37 percent. Equally, manufacturing capacity utilization has reduced from over 70 percent in the past to just above 44 percent at the end of the second quarter of 2006, the fall still continues till date.

Akinpelu (2003) in a seminar tagged 'Enhancing capacity utilization in food, Beverage, Tobacco industry through increased local content' held in Lagos stressed that the fortunes of the manufacturing sector over the past

four year have been mixed. This has been attributed to several factors which include; unstable exchange rate, infrastructural inadequacies and deficiencies, sharp and persistent rise in production cost, increased smuggling activities, anomalies in custom tariffs on raw materials, increase in taxes and levies by various tiers of government, inconsistencies in government policies. He noted that the above mentioned factors and many more have affected the manufacturing sector, thus depriving it of being the engine of growth in Nigerian economy. This research work aims to know the impact of capacity utilization in Nigerian manufacturing sector and economic growth. The gross under-utilization of resources in the Nigerian Manufacturing Sector has been attributed to frequent power outages, lack of adequate funds to procure inputs and fallen demand for manufactured goods. Therefore, Anyanwu (2000) regards the declining capacity utilization as a threat to the survival of the major firms in the manufacturing industry.

Over the years, there have been empirical works around the issues of capacity utilization in Nigeria. For instance, Fabayo, (1998) and Ukoha (2000) study the measurement and determinants of capacity utilization in the manufacturing sector respectively. While Fabayo was more interested in how output gap could be used to measure capacity utilization, Ukoha based his own on exchange rate and federal government capital expenditure. Studies like, Meade (1998), Gordon (1993), Michael (1998) and Obi (1999) based their measures on inflation and unemployment rate. Apart from this, it has been observed that several models of the past researchers, for example, Iyoha and Ekanem (2002), Fabayo (1998) Obi (1999), Nkoha (2000), Gordon (1993) and some others have failed to include energy indicator which Anyanwu (2000) has described as a very important determinant. Again well–articulated and careful implemented policies have accounted for boosting of manufacturing output through capacity utilization in the developed countries which was obviously absent in Nigerian economy. This study tends to fill these gaps.

The broad objective of this study is to examine the determinants of capacity utilization in the Nigerian manufacturing sector while specific objectives are to analyse the operational relationship among raw materials, machinery, spare parts and the operator's performance of selected firms as well as to access the adequacy of operation maintenance and replacement cost in the selected firms.

The rest of the paper is organized as follows: section two is on literature review. This is followed by the research methods and discussion of results in section three and four respectively. Section five concludes the paper.

LITERATURE REVIEW

Brief conceptual issues

Capacity utilization is a concept in Economics, which refers to the extent to which an enterprises or a nation actually uses its installed productive capacity. Thus, it refers to the relationship between actual output produced and potential output that could be produced with installed equipment if capacity was fully used. Capacity utilization in industry is described as "the level of utilization of an industry's installed productive capacity" (Okpaleye, 1988). An industry would be said to be performing optimally when its installed production capacity is fully utilized. By contrast, in the cost approach, capacity output is an optimum level of output at which an additional unit of output would well exceed the output range. This capacity stock and the level of production inputs (Hanis and Taylor, 1988). Given capacity output as that maximum attainable level of output at any given time period, if an inputs available are fully utilized, capacity utilization is expressed as the ratio of actual output (A_0) to capacity output (C_0) multiplied by 100 i.e. A_0/C_0 X 100. Lund (1981) once called for the distinction between "capital utilization" and "capacity utilization". He argued that while capacity utilization is a measured of a realized output relative to potential output, capital utilization ratio is a measured of utilized inputs of capital relative to available inputs of capital. Berndt (1990) defined capital utilization as the ratio of the desired stock of capital (given output quantity and input prices) to the actual stock of capital. Fa Berndt and Fuss (1989) pointed out that two measured of utilization coincide only if there is one fixed input (capital) and if production is characterized by constant returns to scale. The concept output is essentially a production concept in an industrial process. It refers to the production flow that is associated with the input of fully utilized manpower, capital and other relevant factors of production. The difference between capacity output and the actual output flow is regarded as the "output gap" while the ratio of the latter to the former is an index measure of the rate of capacity utilization (Fabayo, 1979).

Brief Empirical Literature

Many studies had pointed out that capacity in any establishment is usually a function of so many factors. In a typical input-output model, Meade (1998) modeled prices using Leontief input and output method to measure the effects of capital and capacity utilization on prices in manufacturing industry and concluded that, part of the determinants of price are returns to capital and capacity utilization rate. Also, he established the relationship between output gap (using GNP), unemployment rate and capacity utilization. In the studies of aggregate inflation, various measures of "tightness" were used to determine the "disequilibrium" components of inflation according to Shatz (1930). The three main measures of tightness used by Meade (1998) are the unemployment rate, the output or GNP gap, and some measures of capacity utilization. From his result, it was apparent that capacity utilization is highly correlated with the acceleration of inflation. Both the output gap and the unemployment rate also follow this pattern. This also tallies with the findings of Franz and Gordon (1993), who found that inflation depends more

closely on capacity utilization than on unemployment in both the US and Germany. Concluding from his findings, Meade (1998) logically deduced that an excellent way to model the patterns of price change at the industry level would be to use an industry capacity utilization measure as an explanatory variable, along with other variable for money supply growth relative to GDP, and perhaps a supply shock variable. Michael (1986) undertook a survey of the American economy. He made use of a panel data collected on various sub-sectors in the American industrial sector. The focus of the research work was the comparison of the impact of capacity utilization on the American industrial sector carried a great deal of extra capacity running to about 80% and that since this period firms have scrapped much of other most inefficient capacity. As a result, 80% capacity utilization now would be equivalent to a historical level of 70%.

The UNDP (2000) studies the rate of usage of both human and physical capital in the sub-Saharan Africa. The study used across the industrial sectors of some selected Sub-Saharan African countries. The survey showed that both human and physical capital are grossly underutilized in the countries sampled. But the Southern Africa appeared to yield a moderately impressive result when compared to other countries. The report generated by the organization adduces good infrastructural facility especially power as the main reason why the southern African countries enjoyed the highest rate of capacity utilization among the nations sampled.

In the analysis of determinants and effects of capacity utilization in manufacturing sector in Nigeria, Osoba (1977) identified the following factors and measured their effects on capacity utilization. The variables are the level of output, average basic hourly rate of pay of workers in each establishment, the shift ratio, age of the establishment and the size of each establishment in terms of unemployment. Using a recursive simultaneous model formulated in a double logarithmic functional form of which parameters were estimated. The result showed that the elasticity of output with respect to the rate of capacity utilization was 3.87. Thus, the output of an establishment would be expected to rise as the rate of capacity utilization increases. Also, the result obtained from the data for 68 firms in Nigeria showed that the elasticity of utilization with respect to the wage rate is positive, but less than unity in the manufacturing industry in Nigeria.

Akinlo (1996) draws attention to the performance of the manufacturing sub-sector before and after SAP. It was observed that the manufacturing industries of Nigeria was relatively insignificant at independence in terms of contribution to the Gross Domestic Product (GDP) because most of the earliest manufacturing industries established by the colonial trading companies concentrated on the production of light industrial commodities such as detergent, soft drinks, leatherwork, and confectionaries. He opined that pre and post-colonial production policy occasioned in the sector was as a result of neglecting research and excessive reliance on foreign input. According to him, distortions affected the performance of output in the manufacturing sector in terms of its contribution to the gross domestic products, employment generation, capacity utilization and value added adversely. Despite the economic adjustment reforms initiated in 1986, the manufacturing sector is still characterized by distortion. He concludes that these, need to be eliminated if the sector is to experience substantial growth.

Adenikiju (1998) used an empirical model to investigate and analyze the impact of government investments on manufacturing performance and found that inefficient investment in economic infrastructure has a negative effect. He opined that the weak state of basic infrastructure; for instance, fuel shortage has forced industries to incur huge man hour losses arising from absence of workers from work, raw material spoilage and extra investment in fuel pumps.

Fabayo (1998), used the concept of capacity output to measure, the capacity utilization level of some selected Nigerian manufacturing industries. He sees capacity output as the production flow that is associated with the input of fully utilized manpower, capital, price of capital and other relevant factors of production, the difference between capacity output and actual output flow is regarded as the 'output gap' and the ratio of actual output to capacity output measures the capacity utilization rates.

Obi (1999) performed his own study of capacity utilization of industries under Structural Adjustment Programme (SAP) 1986. He included variables like interest rate, output exchange rate in his model that measures capacity utilization in Nigeria manufacturing sector. After the analysis through ordinary least square method he found out that capacity utilization can best be appreciated if expressed both quantitatively and qualitatively within the first twenty four months of its enunciation as a national economic policy. Between January and May, 1987, his surveys of 120 manufacturing industries were operating between 27 percent and 30 percent of their installed capacities. Another study by NISER (2000) conducted on the manufacturing sector. They found that the local sourcing of production machinery has been decreasing continually. To quote NISER "what this finding suggests is that manufacturing firms are actually loosing enthusiasm to source their machinery locally. The net effect of this revelation is that even the gains made in the past couple of years are being reversed and production configuration is becoming more import oriented". In 1998, Nigerian adopted the vision 2010 report. In that report, Nigeria set herself a vision that by the year 2010 Nigeria should become great nation exerting great influence on the world economy.

In another study by Abiola (2002) output gap was estimated following the study of Mwega (1994) by first regressing actual output in the economy (real GDP) on time and the lags of real GDP for 1, 2 and 3 years to

estimate the potential output. Output gap was obtained by subtracting the actual output from the estimated potential output for each year. Vielorose (2002) in a survey of the industrial sector with special emphasis on manufacturing sector. From the data he collected which he estimated via percentages, he observed that manufacturing industries in Nigeria have some existing capital that is not utilized at full level. He found that the level of capacity utilization in Nigeria, majorly manufacturing industries ranged from 21 percent to 28 percent. He went further to analyze the capacity utilization of one main bakery industry across the region of the country and found where the highest ratio was recorded. This was in the mid-west region that has a ratio of 6.99 percent in the whole country. He found out that the level of capacity utilization was just 45 percent in bakery industry in the country. He also computed the coefficient between utilization of machinery and the relative level of profit and participation of foreign capital and found that none of these was significant. This implies that utilization of machinery and equipment is not dependent on their relative of profit participation of foreign capital or relative level of capital expenditure.

Vielrose study can be viewed assuming that machinery or equipment is the only source of capacity that those industries are taking as factor inputs. There are other resources that the industries are taking as factor inputs. There are other resources that the industries can utilize like labour and materials. However, apart from bringing out the existence of capacity under utilization in Nigerian firms, Vielrose study also points to the fact that improvement on such utilization does not necessarily mean we have embarked on needed investment.

Also, Ukoha (2002) investigated the determinants of manufacturing capacity utilization in Nigeria between 1970 and 1998 using multiple regression analysis. He noted that the exchange rate federal government capital expenditure on manufacturing and real per capital income have positive effects on manufacturing capacity utilization. However, inflation, loans and advances to manufacturing were found to have negative effect.

Odiaka (2002) in his own study, writes that until the nation industries are restored to full capacity utilization, the economy will continue to depend on foreign goods at the expense of Nigeria's foreign reserves. He supports the statement of Fabayo that "if attention is paid to enhance and move efficient utilization area of factor input in the production process, it will yield more returns in accelerating economic growth through the provision of larger output".

Dauda and Risikat (2008) also made use of ordinary least square and examined critical variables influencing manufacturing output performance in Nigeria between1972-2002. They realized that index of openness, exchange rate deregulation policy, domestic capital formation are positively related to manufacturing value added. They also found out that manufacturing capacity utilization has a significant negative impact on the growth performance of the manufacturing sector. In conclusion, all the studies enumerated above were based on purely secondary data which could not adequately explore the negligible variables of the manufacturing firms. Therefore, this study applied triangulation method by employing both descriptive survey type and econometric analysis to investigate the capacity utilization and its determinants in the Nigerian manufacturing sector.

RESEARCH METHODS OF ANALYSIS

The section made use of both primary and secondary data. The primary data was used to capture the assessment of operators' performance in the Nigerian Manufacturing sector while secondary data was employed to analyze the relationship between the key determinants of capacity utilization in Nigeria's Manufacturing sector. The survey method presents research design, population, sample and sampling technique, research instrument, validity of the instrument, and reliability of the instrument, and data analysis. The sample for this study comprises of three states (Lagos State, Ekiti State and Ondo State) in the South West of Nigeria. Two firms were selected from each of the three states giving a total of six firms for this study and 10 respondents from each of these firms. The firms are Greenline Printing Press and J.K. Furniture Company in Ado Ekiti were sampled in Ekiti State, Emzor Pharmaceuticals Industry in Akure and Stanmark Cocoa Processing Industry in Ondo Town were selected in Ondo State. While Unilever Nigeria Plc and PZ Industry Plc were sampled in Lagos State. stratified and simple random sampling techniques were employed as the sampling techniques. The major instrument used for this study is questionnaire. The questionnaire was titled "capacity utilization and its determinants in Nigerian manufacturing sector". The research instrument is subject to content and face validity. The instrument was presented to experts in Economics and industries respectively for refinement and suitability. The reliability of the instrument employed was Half-split reliability method for internal consistency. The reliability coefficient was determined using pearson product moment correlation coefficient. The data were analyzed using descriptive and inferential statistics. The statistical tools that were employed for data analysis are chi-square(x^2) and ANOVA method. Frequency counts and percentage were used to analyze a Bio-data and general questions of this study. Secondly, the empirical investigation in this section focuses on model specification, a prior expectation, estimating techniques and sources of data.

Model Specification

The model for this study follows the work of Ukoha (2000) and Fabayo (1998), which took its roots from the theory of Berndit and Morrison. Therefore, rate of electricity generation in Nigeria (proxy for energy) is included

in the determinants as a modified factor in the model. Therefore, the model for this study is specified below:

CU = f(MGDP, INTR, CPI,CPF, ELEGR)

$CU = \alpha_o + \alpha_1 MGDP + \alpha_2 INTR + \alpha_3 CPI + \alpha_4 CPF + \alpha_5 ELEGR + \mu t$ where

CU = Capacity utilization in the Nigerian Manufacturing Sector
MGDP = Real Manufacturing Output Growth
INTR = Interest Rate
CPI = Consumer's Price Index
CPF = Fixed Capital Formation in manufacturing sector
ELEGR = Electricity Generation Rate (proxy for energy)
μt= Stochastic Variables

A priori expectation

A positive relationship is expected among all the variables except interest rate with negative expectation. These expected relationships are represented symbolically as follows:

$\frac{\partial CU}{\partial MGDP} > 0, \frac{\partial CU}{\partial INTR} < 0, \frac{\partial CU}{\partial CPI} > 0, \frac{\partial CU}{\partial CPF} > 0, \frac{\partial CU}{\partial ELER} > 0$

Model Estimation Technique

The estimation procedures employed in this empirical investigation is based on co-integration analysis and the Error Correction Model. The choice of this technique is informed by the need to determine the time series characteristics of the variables that are used in the study. The first step is to determine and test the stationarity of the data. The second step after testing for stationarity is the establishment of long-run relationship among the variables. After the order of integration of the variables are ascertained, that the long-run relationship among the variables can be determined. Therefore, Co-integration Analysis and Error correction Model (ECM) would be formulated and estimated.

SOURCES OF DATA

Data needed for this research work were secondary in nature. It was sourced from the various versions of the Central Bank of Nigeria statistical bulletins and National Bureau of Statistics.

RESULTS AND DISCUSSION

DESCRIPTIVE ANALYSIS

The socio- economic characteristics of this study including age distribution, gender distribution, marital status and educational qualification distribution. To analyze the data, frequency count and percentage were used in analyzing the variables for the questions.

Table 1-4: Distribution of the socio-economic characteristics

Table 1: Age Distribution

Age distribution	Categories	Frequency	Percentage %
A	Below 18	-	Nil
B	18-24	15	25
C	25-40	25	41.67
D	41-60	15	25
E	61 and above	5	8.33
Total		60	100

Source: Field survey (2015)

Table 1 showed that workers between the age bracket (18-24) are 15(25%), workers between the age bracket (25-40) are 25(41.67%), workers between the age bracket (41-60) are 15(25%), workers above 60 are 5(8.33%).This indicates that majority of these workers are adult and mature.

Table2: Gender Distribution

Gender Distribution			
A	Male	44	73.4%
B	Female	16	26.6%
Total		60	100

Source: Field survey (2015)

The table 2 showed that 44(73.4%) are male while 16(26.6%) are female. This implies that the majority of the workers in the firms under review are male

Table3: Educational Level

Educational level	Categories	Frequency	Percentage %
A	Informal Education	4	6.67%
B	Primary Education	10	16.67%
C	Secondary Education	20	33.4%
D	Tertiary Education	24	40%
E	Other specify	2	3.33
Total		60	100

Source: Field survey(2015)

The table 3 revealed that the informal education is 4(6.67%), the primary Education is 10(16.67%), the secondary Education is 20(33.4%), the tertiary Education is 24(40%). This implies that majority of staff in these firms are educated who can read and write.

Table 4: Marital Status

Category	Frequency	Percentage %
Single	32	36.67%
Married	18	46.67
Widow/ Widower	5	8.33
Divorce	5	8.33
Others	-	-
Total	60	100

Source: Field survey (2015)

Table 4 reveals that 46.6% are married, 36.67% are single, both widow and divorce are 8.33% respectively. This table confirms that most of the workers are married people and they are mature and responsible.

ANALYSIS OF INFORMATION CONCERNING FIRM

In this section B, the following information were analyzed concerning the firms: category of sub-sectors of the firms, ownership of the firm, location of the firm and the proportion of skilled labour to total employees of the firms.

Table 5-8: Information concerning Firm

Table5- Category of sub-sectors

Group	Items	Frequency	Percentage %
Category of sub-sectors			
A	Food & beverage	10	16.6%
B	Chemical & Pharmaceutical	18	30%
C	Plastics & Rubber Products	10	16.6%
D	Paper/ Printing/ furniture	22	36.6%
E	Textile	-	-
F	Other (Specify)	-	-
Total		60	100

Source: Field survey (2015)

The table 5 above showed that most of the sub-sectors of the manufacturing firms are paper/printing and furniture which is above 36.6%, while chemical and pharmaceutics is 30%, food/beverage is 16.6% and plastics and rubbers products in 10% respectively, None is Textile because almost all textile industries in Nigeria are moribund.

Table 6: Ownership of firms

Ownership of firms	Items	Frequency	Percentage %
A	Private	50	83.33
B	Public	10	16.67
Total		60	100

Source: Field survey (2015)

Table 6 revealed that majority of these firms under review are private firms because of the motive of the profit maximization.

Table 7: Location of the firms

Location of the firms	Items	Frequency	Percentage %
A	Rural Area	-	
B	Urban Area	60	100
Total		60	100

Source: Field survey(2015)

Table 7 revealed that majority of these firms under review are urban based firms which is in conformity with one of the features of manufacturing firms in Nigeria.

Table 8: Firm's Age in years

Firm's age in years	Items	Frequency	Percentage %
A	Age ≤ 5	Nil	-
B	6 < age ≤ 15	10	16.6%
C	15 < age ≤ 25	20	33.4%
D	Age > 25	30	50%
Total		60	100

Source: Field survey (2015)

Table 8 showed that most of the firms under review are long –aged firms which have been in operation more than 15 years age.

ANALYSIS OF INFORMATION ON PRODUCTION AND COST OF PRODUCTION

In the section, the variables to be deemed dealing with are cost of raw materials, cost of fuel per month, cost of the spare parts, cost of maintenance per month and cost of depreciation of machines. The following questions would be equally discussed: Is supply of raw material adequate?, how is the maintenance of firm's machinery? Does the firm make spare parts available when necessary?

Table 10-13: Information on Production and the cost of production

Table 10: costs of production

S/N	VARIABLE	HIGH PERCENTAGE	LOW PERCENTAGE
A	Cost of raw materials	40	20
B	Cost of fuel per month	45	15
C	Cost of spare parts	35	25
D	Cost of maintenance per month	46	14
E	Cost of Depreciation of machine	20	40
Total		186	114

Source: Field survey (2015)

Table10 revealed that there is high cost of raw materials, spare parts, fuel and maintenance which may be as a result of inflation and increased foreign exchange rate.

Table 11: Is supply of raw material adequate?

Respondents	Frequency	Percentage
Yes	22	36.6%
No	38	63.4%

Source: Field survey (2015)

Table 11 showed that 63.4% of the respondents indicate that the supply of raw materials is inadequate against 36.6% of respondents that agreed on adequate supply of raw materials. This is pointing to the fact that some of the raw materials used in the selected firms are imported.

Table 12: How is the maintenance of firm's machinery?

Respondents	Frequency	Percentage
Very Regular	15	25%
Fairly Regular	25	41.7%
Occasionally	10	16.7%
Not regular	10	16.7%

Source: Field survey (2015)

The table 12 above showed that the maintenance of the firm's machinery is fairly regular in order to maintain effective and steady production.

Table 13: Does the firm make spare parts available when necessary?

Responses	Frequency	Percentage
Yes	27	45%
No	33	55%
Total	60	100

Source: Field survey (2015)

The response of respondents is a little bit negative which indicates that there is difficulty in getting some of the spare parts. This is attributed to the fact that there are import-oriented spare parts which are not easily available in Nigeria

TEST OF HYPOTHESES

This section tests the hypotheses proposed in chapter one of this study with statistical tools through the use of chi-square(x^2) and ANOVA methods.

4.5.1. RE-STATEMENT OF HYPOTHESES

HYPOTHESIS 1

H_0: There is no significant relationship between raw materials, machinery and spare part and the operators' performance of the selected firms.

H_I: There is significant relationship between raw materials, machinery and spare part and the operators' performance of the selected firms.

HYPOTHESIS 2

H_0: There is no significant difference between the cost of production and performance of the selected firms.

H_I: There is significant difference between the cost of production and performance of the selected firms

For hypothesis 1, responses of questions in table 11,12 and 13 was used to analyze the ANOVA

ANOVA Table

Variable	DF	SS	MS	F-ratio(cal.)	F-ratio(tab.)
Operational materials	2	3330	1665	0.4047	4.74
Error	7	28800	4114		
Total	9	32130	5779		

Source: Field survey (2015)

DECISION RULE

The rule of thumb here is that if F-cal. is greater than F-tab., the null hypothesis is rejected and vice versa. From the analysis above, it was discovered that F-cal is less than F-tab., therefore, the null hypothesis is accepted and alternative is rejected. This implies that there is no significant relationship between operational materials and operational performance of the firms.

For hypothesis 2, responses of questions in table 10 and Chi-square table in the appendix was used to analyse chi-square(χ^2)

Decision rule = Reject H_0 if $\chi_c^2 > \chi_t^2$, Accept H_1 if $\chi_t^2 < \chi_c^2$

The rule of thumb here is that if χ_c^2 is greater than, χ_t^2, the null hypothesis is rejected and vice versa. From the analysis above, it was discovered that χ_c^2 is greater than χ_t^2 therefore, the null hypothesis is rejected and alternative is accepted. This shows that there is significant difference between the cost of production and operational performance of the selected firms. The implication is that there is high cost of production which mitigate the performance of the selected firms and as well, the capacity utilization.

Secondly, from the empirical analysis dimension, this chapter concentrates on the presentation of the empirical results which comprise of the unit root test, co-integration analysis and error correction mechanism test.

4.2 TIME SERIES PROPERTIES OF THE VARIABLE

To ascertain that the study is free from problem of spurious regression, the study examines the time series properties of the variables. In economic literature, most time series variables are non-stationary and including non-stationary variables in the model can lead to spurious regression co-efficient estimate (Granger & Newbold, 1977).

Table 4.2.1 Augmented Dickey- Fuller Test Result

VARIABLE	ADF STATISTICS	CRITICAL VALUE @ 5%	ORDER OF INTEGRATION	REMARKS
CU	-3.350811	-2.957001	I(0)	Stationary
ELEGR	-6.477039	-2.957110	I(0)	Stationary
MGDP	-3.734618	-2.957110	I(0)	Stationary
CPI	-3.279473	-2.960411	I(0)	Stationary
CPF	-6.343130	-2.957110	I(0)	Stationary
INT	-5.900700	-2.957110	I(0)	Stationary
ECM	-3.297297	-22.957710	I(0)	Stationary

Sources: Author's computation, 2014

The table 4.2.1 above presents the results of the Augmented Dickey-Fuller test. The test however, indicates that all the variables were stationary at levels. This means all the variables such as CU, ELEGR, MGDP, CPI, CPF and INT are integrated of order zero. The implication of this is that the variables considered in the model for the purpose of this study do not contain a unit root and it permits to proceed to co-integration test and also meet the condition for Johansen co-integration.

Johansen co-Integration Result

The results emanating from the unit root test indicates that the variables were stationary at levels. The implication of this is that parameter estimates using ordinary least square regression may be misleading and therefore may not serve the purpose of the study. To determine the number of co-integrating vectors from the results we consider the maximum eigen value test using the more critical values of Mackinnon Haug – Michelis (1999).

Table 4.2.2 Johansson Co-interaction Result

Hypothesized No of CE (s)	Eigen Value	Trace Statistics	Critical Value @ 5%	Prob**
None	0.761688	127.1104	95.75366	0.0001
At most 1*	0.660108	82.65107	69.81889	0.0034
At most 2*	0.563632	49.19814	47.85613	0.0372
At most 3*	0.309484	23.49078	29.79707	0.2228
At most 4*	0.184250	12.01089	15.49471	0.1564
At most 5*	0.167901	5.697906	3.841466	0.0170

Source: Author's computation 2015.

N.B; * Denotes rejection of the Hypothesis at the 0.05 level

** Mackinnon – Haug – Michel is (1999) P-values.

The table 4.2.2 above presents the results of the Johansen co- integration estimates. The long run test identifies three (3) integrating equations at 5% critical value.

From the estimates of this study, the normalized co-integrating co- efficient with the highest log-likehood ratio in absolute term is chosen as the long-run equilibrium equation. The equation is thus presented as follows;

CU = -102.2242ELEGR – 79.45698 MGDP + 152.651141CPI + 3.696358 CPF + 40.37311 INT

(29.7335) (18.9281) (19.0929) (2.00720) (16.5263)

N:B Standard Error are in parenthesis

The normalized equation above represents the long-run equilibrium equation. The equation revealed that exogenous variables of ELEGR and MGDP maintained negative long-run relationship with the dependent variable, capacity utilization (CU). This implies that in the long-run, the level of electricity generated in Nigeria (ELEGR) will pull down the capacity utilization (CU) in Nigeria by about 102%. Also going by the level of manufacturing share of the GDP in (MGDP) in Nigeria today, the level of capacity utilization in the country will be pulled down by about 79%. While on the other hand, the consumer price index (CPI), and interest rates (INT) maintained positive long-run relationship with level of capacity utilization in Nigeria. The results showed that the CPI, CPF and INT will improve the level of capacity utilization in the country by about 152.65%, 3.7% and 40.4% respectively in the long-run. Thus, CU, ELE, MGDP, CPI, CPF, INT co-integrate in the long-run which implies that capacity utilization and the functional components of the determinants of capacity utilization maintained a long run relationship.

ERROR CORRECTION MODEL

When co-integration exists, the Engle-Granger theorem establishes the encompassing power of the Error correction Mechanism (ECM) over other forms of dynamics specifications. In order to capture the short run deviation that might have occurred in estimating the long run co-integrating equations, a dynamics error correction model is formulated. Both the over-parameterized and parsimonious error correction models would be reported. The error correction term ECM (-1) would however depict the speed of convergence to equilibrium once the equation is

shocked (Oladele, 2009). The table below shows the result of the initial over parameterized error correction model.

Table 4.2.4: Over parameterized Error Correction Model

Variable	Co-efficient	Std-Error	t-Stat	Prob 1
C	-0.873693	0.873693	-0.925010	0.3748
D (Cu) (-1)	0.454079	0.265589	1.709705	0.1153
D(CU) (-2)	0.20109	0.265482	0.075746	0.9410
D(ELE) (-1)	6.453336	12.29494	0.524877	0.6101
D(ELE) (-2)	4.316863	8.573268	0.503526	0.6245
D(MGDP)(-1)	-2.271533	7.747669	-0.293189	0.7748
D(MGDP)(-2)	1.691080	6.383189	0.264927	0.76960
D(CPI)(-1)	-0.488868	8.068750	-0.060588	0.9528
D(CPI)(-2)	0.020458	9.182535	0.002228	0.9983
D(CPF)(-1)	0.355088	0.809337	0.436440	0.6693
D(CPF)(-2)	0.040783	O.596548	0.068364	0.9467
D(INT)(-1)	2.483017	7.604296	0.326528	0.7502
D(INT)(-2)	-0.398130	5.551618	-0.071714	0.9441
ECM (-1)	-0.246768	0.112857	-2.186544	0.0513

$R^2 = 0.687404$ D.W = 1.907567

Adjusted R-square=0.175883

F- stat: 1.343842

Prob (F-Stat): 0.313700

The table 4.2.3 above presents the results of the unrestricted error correction model. The model shows that the ECM (-1) co-efficient is -0.24678 (negative as expected) but statistically significant going by the probability value (5%,1% & 10%) of the ECM (-1) co-efficient from the result emanating from the above unrestricted, we will now specify a restricted or parsimonious where non-significance or too far from significance variables will be removed.

Table 4.2.5: parsimonious Error correction model

Variable	Co-efficient	Std-Error	t-Stat	Prob.
C	-0.573549	0.616407	-0.930472	0.3618
D(CU)(-1)	0.505873	0.1321878	3.807053	0.0009
D(ELE)	10.60250	3.807053	2.818958	0.0097
D(MGDP)	-5.953061	3.016176	-1.97311	0.0605
D(CPI)	0.941125	4.030019	0.233529	0.8174
D(CPF)(-1)	0.143036	0.293340	0.487610	0.6304
D(INT)	2.303936	2.414657	0.954977	0.3495
ECM(-1)	-0.213616	0.059949	-3.563312	0.0017

$R^2 = 0.628706$

F-stat = 5.563645

prob F-stat = 0.000762

D.W = 1.962191

The table 4.2.4 above presents the results of the parsimonious error correction model. The results indicate that the ECM (-1) co-efficient is (-0.213616) negative as expected. This means that 21.4% of the disequilibrium will be corrected each period. The probability value (0.0017) of ECM (-1) co-efficient also confirm its statistical significance. It is further revealed in that one period lag of CU, the present value of ELE, current value of the CPI, and one period lagged of CPF, and present value of the INT maintained a positive relationship with the present dynamic value of capacity utilization in Nigeria. While on the other hand, present value of the MGDP is negatively related to the current value of capacity utilization in Nigeria. The co-efficient of multiple determinations (R^2) of the model is 0.6287 which implies that about 62.9% of the total variation in the present dynamic value of capacity utilization in Nigeria is being explained by the joint variation in the dynamic variables of the restricted model as presented above. Also, the test for serial correlation among the successive error term in the model shows that the test is free from the problem of autocorrelation.

Concluding Remarks

The study was set out to examine the determinants of capacity utilization in the Nigerian manufacturing sector. From the analysis done so far, it was concluded from the survey analysis that there is low production in the manufacturing sector in Nigeria as a result of high cost of imported raw materials, machinery, and spare parts owing to increased interest rate and exchanged rate. It was deduced from the analysis that poor performance of infrastructural facilities mainly frequent distortion in electric power rendered a reduction in capacity utilization. The empirical study found that some of the determinants of capacity utilization such as CPF and CPI have positive

long-run relationship with capacity utilization which implies that CPF and CPI are promoting capacity utilization. There is negative relationship between electricity generation (ELE) and real manufacturing output growth which inferred that there is low power generation and low manufacturing productivity growth rate in Nigeria respectively. This verifies the result obtained in the test of hypothesis. There is a positive long run relationship between interest rate and capacity utilization but statistically insignificant. This has resulted to high cost of production as in conformity with the field survey results.

Policy Recommendations

Based on the findings from this study, the following recommendations are suggested. Putting the economy back to the trajectory of growth and development, government should make adequate provision of infrastructural facilities especially electricity generation. Relevant measures to enhance policy coordination and structural institutions among the various arms of government should be put in place. This would proffer solutions to the policy inconsistencies that result to macro economic instability which is creating high interest rate. Government should enact laws that can guarantee financial discipline in Nigeria. Despite the huge amount of money government is investing in the energy sector to ensure adequate provision of electricity, it has been resulting to exercise of futility as a result of corruption on the part of government officials. Firms have to pay more attention to Research and Development (R&D) activities, while policies that can improve the competitiveness of local substitutes for imported raw materials should be implemented.

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APPENDIX 1

Calculation of Sum of squares

TSS=EEY^2- C.F where C.F=Correction Factor

C.F=EEY^2/N=$(180)^2$/12=27O

TSS=EEY^2-C.F=$(180)^2$-270=32400-270=32130.

SS_E=EY^2/n-C.F=$(60)^2$/3 + $(60)^2$/3 +$(60)^2$/3 -270=3330

ESS=TSS-SS_E=32130-3330=28800

APPENDIX 2

S/N	VARIABLE	HIGH PERCENTAGE	LOW PERCENTAGE
A	Cost of raw materials	40	20
B	Cost of fuel per month	45	15
C	Cost of spare parts	35	25
D	Cost of maintenance per month	46	14
E	Cost of Depreciation of machine	20	40

Source: Author's Computation

Formula for Chi-Square(χ^2)=χ_C^2 =$\frac{E(O-E)^2}{E}$

Where O=Observed frequency, E=Expected frequency, χ_c^2=chi-square calculated, χ_t^2 =chi-square tabulated. Degree of freedom=(C-1)(R-1), Where C=Number of Columns, R=Number of Rows. DF=(2-1)(5-1)= 9.46

Chi-Square table

O	E	(O-E)	$(O-E)^2$	$(O-E)^2/E$
40	37.2	2.8	7.84	0.21
20	22.8	-2.8	7.84	0.34
45	37.2	7.8	60.84	1.64
15	22.8	-7.8	60.84	2.67
35	37.2	-2.2	4.84	0.30
25	22.8	-2.8	4.84	0.21
46	37.2	8.8	77.44	2.08
14	22.8	-8.8	77.44	3.40
20	37.2	-17.2	295.84	7.95
40	22.8	17.2	295.84	12.98

x_c^2 = 31.78

x_t^2 = 9.46