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Impact of Manufacturing Capacity Utilization on the Nigerian Economy

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Abstract

This paper examines the manufacturing capacity utilization on Nigeria's economy using Gross Domestic Product (GDP). The study further looked at the relation between capacity utilization (CU), manufacturing productivity index (MPI) and gross domestic product in the period under review. Secondary data were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin and other relevant government agencies for the period covered in the study, 1981-2021. The data were analyzed using econometric model with the aid of E-views 8. The results showed that a strong positive and significant relationship exist between economic growth and manufacturing capacity variables used. However, it was recommended that the government should hereby embark on core industrial project to facilitate local supply of raw materials and intermediate products that would bring about the much-needed backward integration in the economy. Improved local sourcing of raw materials will undoubtedly reduce cost of production and boost employment generation, thereby making locally manufactured products' price competitive, both in the local and international markets.

1. Introduction

Growing the economy has become the major objective of most government in the developing economies of the world. Over the years, these governments have adopted a number of measures aimed at accelerating growth in their domestic economy. The need to improve the living standard of the citizen, reduce unemployment, increase capacity utilization which leads to increased productivity as well as increase in Foreign Exchange Earnings, etc. has led to the introduction of vibrant economic policies in Nigeria [1].

There's a common belief among economists that when there's slack in the economy that is, when labor and capital are not fully employed it will lead to inflation. One measure of the intensity with which labor and capital are used in producing output is the capacity utilization rate. According to some economists, when capacity utilization is low, firms can increase employment and their use of capital without incurring large increases in the costs of production [2]. So, firms will not be forced to raise prices in order to make profits on additional output.

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 [16] 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 was as a result of the realization that there exists a positive correlation between capacity utilization on one hand and output growth. Manufacturing productivity growth and capacity utilization are two major phenomena that are intertwined such that the higher the capacity utilized, the larger the outputs that are produced and the faster the growth of manufacturing productivity which leads to an increased economic growth.

Manufacturing involves the conversion of raw materials into finished consumer goods or intermediate goods. It also denotes the fabrication or assembling of components into finished products. The output of the manufacturing sector contributes a specific share in the Gross Domestic Product of the nation. Its contribution and that of other sectors of the economy collectively determine the national income for a particular year and also the per capita income when gross domestic product is averaged with the population figure. The manufacturing sector plays a catalytic role in a modern economy and has many dynamic benefits that are crucial for economic transformation [7]. That is, the manufacturing sector serves as a catalyst for economic growth and development, as well as the bedrock of every economy. In an advanced economy, the manufacturing sector is a leading sector in many respects. It is an avenue for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment and per capita income, which widen the scope of consumption in dynamic patterns. Furthermore, it promotes the growth of investment at a faster rate than any other sector as well as wider and more efficient linkage among different sectors [2,11,12].

Capacity utilization is an important concept for any business and plays a big role in the cost of production for any given product as well as the profit that can be made on the sale of that product. Just about any business has a capacity, whether it is for manufacturing products, serving customers or completing projects. It is how this capacity can be utilized or maximized that is ultimately most important to making a business more profitable [1]. The term capacity utilization is often used to describe the extent to which firms use the installed productive capacity of their plants and machineries during the creation of utilities. In essence, it represents the fraction of installed capacity or output that a firm actually produces from its potential output level, in line with prevailing economic fundamentals. Capacity utilization is an important determinant of economic 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 [3,13,14,15].

Capacity utilization rate is a metric which is used to compute the rate at which probable output levels are being met or used. The output is displayed as a percentage and it can give a proper insight into the general negligence that the organization is at a point of time. Capacity utilization rate is also called as operating rate [22,23]. The capacity utilization rate provides with the value of production capacity which is actually being utilized over a specified period, and by providing the output in percentages, it can provide you a clearer idea of the total utilization of resources and how better the production company can fare in case the total output is increased without it effecting the cost of production to the company [26,27]. Although capacity utilization rate is important for several business decisions, it is still not enough to provide with the actual feedback necessary for economic and market conditions at a given particular time. The decrease in the capacity utilization rate

percentage denotes an economic slowdown, an increase shows economic expansion [6,7,9]. Hence, an economic measure of capacity output is characterized by the steady state or long run level of output, given the existing levels of capital and exogenous input prices. The major factors that influences the level of capacity utilization are inflation rate, exchange rate, interest rate, loan and advances, per capital income, electricity etc. based on the finding that government should concentrate on macroeconomics stability that relatively low are of inflation [8,16,18].

On the other hand, exchange rate has a direct or positive relationship with capacity utilization in manufacturing sector, this means that deregulation of the exchange rate policy of the government really favored the manufacturers to have favored capacity utilization in this sector, availability of foreign exchange to manufacturing sector improves capacity utilization hence; shortage of foreign exchange reduced capacity utilization in this sector. The coefficient of interest rate showed a negative relationship. This means that if interest rate is reduced, productivity will increase, as many manufacturers we like to borrow and therefore capacity utilization will also increase. Also, if the interest rate is increase productivity will reduce and capacity utilization in manufacturing sector will also reduce because the manufacturers are discouraged to borrow.

Roller and Sickles [24] pines that, one of the constraints of capacity utilization of the manufacturing sector is poor performance of infrastructure such as road, transport, water, electricity etc. Therefore, low power generation reduced capacity utilization. Government should give relief to manufacturer and improve infrastructure to restore the glory of the nation's manufacturing sector, and government should adopt trade restriction on imported goods that are locally produced [28,29].

Capacity utilization is the amount of manufacturing capability a company is using at any given time [9]. If a company has the ability to run three manufacturing shifts per day, it has a capacity utilization rate of 66.66 percent. This rate can also be calculated in number of units, so a company that can produce 10,000 pieces per day, bit is only producing 8,000, has a capacity utilization rate of 80 percent. This production capacity measures takes into account fixed costs, such as factories and equipment. It does not include variable costs such as labor and materials. Thus, if a company reaches full capacity, it will have to increase its fixed costs by buying more equipment or building new factories in order to produce more goods. It is difficult to operate a business at full capacity on a consistent basis, because problems can arise and the product might suffer. Capacity utilization is about utilizing most of this capacity, which typically gives a business the best opportunity to turn a profit and the most efficient use of resources, equipment, space and staffing.

Dauda and Risikat [11] also made use of ordinary least square and examined critical variables influencing manufacturing output performance in Nigeria between1981-2016. 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. Malik et al. [18] opines that manufacturing sector capacity utilization can only improve in a good investment environment with physical infrastructure financial markets and creation of the enabling environment for real investment, which will create jobs and expand businesses. Anyanwu [3] argue that the level of capacity utilization rate in Nigerian manufacturing sector is between 30 and 40 per cent, indicating gross underutilization of resources. This has been blamed largely on frequent power outages, lack of funds to procure inputs and high interest rate. Lack of funds has made it difficult for firms to make investments in modern machines, information technology and human resources development which are critical in reducing production costs, raising productivity and improving competitiveness. Anyanwu [3] concluded that Information on manufacturing productivity is scanty in Nigeria and there are indications that it has been very low, owing to numerous problems.

According to Olorunfe et al. [22] there is a positive association between manufacturing performance and capacity utilization. As the capacity utilization is high the level of manufacturing will also increase. They conclude by arguing that the key to reversing the poor performance of Nigerian manufacturing is an increase in its investment, adequate capacity utilization, and importation of technology to boost local manufacturing, export and exchange rate. The study is limited to the nexus between capacity utilization and manufacturing productivity growth in Nigeria between 1981 and 2016. Electricity supply is included as part of the independent variables because manufacturers need stable electricity to turn their primary products into finished and consumable goods.

The erratic supply of electricity has discouraged both local and foreign firms from engaging in production such firms have to pay heavily for diesel or petrol to fuel their plants. In addition, government expenditure is included because as government spends more on procuring new or maintaining old infrastructure such as roads, electricity and water, manufacturers and other industrialists are encouraged to produce more output and capacity utilization rises. Moreover, exchange rate is also included as a variable in the study because most manufacturers source their inputs such as capital and expertise from abroad; they therefore have to pay for such transactions with other currencies. An appreciation of the naira makes imports cheaper and more purchases of capital goods are made possible while the depreciation of the naira, such as the continuous slide in the value of the naira against the dollar, makes foreign transactions a bit difficult while domestic production is discouraged [30,31,35].

One of the major problems facing manufacturing sector in Nigeria is the frequent rate of liquidation of small and medium scale industries as well as many indigenous owned large scale production firms. Many attributed the cause of this national menace to lack of technological know-how, shortfall inutility and inadequate government policies. Aluko et al. [2] commented that one of the greatest problems of the Nigerian economy is the problem of capacity utilization in the manufacturing sector.

Governments after governments have failed to pursue policies that could create a vibrant real sector with the result that the impact of the manufacturing sector has steadily declined over the years and its contribution to national growth and development has been disappointingly low [10,17,19,20]
Some of the factors that exert profound negative influence on manufacturing sector include; institutional framework and management strategies; inflation rate, trends and outcomes of exchange rate management strategies, poor or inadequate infrastructural facilities especially electricity power supply and thus have significant effect on the growth of Nigeria, which led to problem of economic diversification to other sector of the economy.

Power infrastructure has been a major challenge facing Nigeria's economy, even as privatization of the power sector is yet to yield the desired result to resolve perennial electricity shortage in the country. Currently, the power generation capacity stands at between 4,000 and 5,000mega watts, which are quite insufficient for a population of over 160million. To further improve power supply and sustainability, the Federal Government has approved N3.9billion for power transmission infrastructure. The greatest challenge, especially for the manufacturing sector, is power crisis, which is why local manufacturers cannot compete with their foreign counterparts [21,24,25].

Simon- Oke [8] showed that one of the constraints of capacity utilization of the manufacturing sector is poor performance of infrastructure such as road, transport, water, electricity etc. Therefore, low power generation reduced capacity utilization. Government should give relief to manufacturer and improve infrastructure to restore the glory of the nation's manufacturing sector, and government should adopt trade restriction on imported goods that are locally produced.

Government should grant manufacturers licenses to generate their own power, because refusal to give them approval to generate electricity for their own use is affecting their operations. Aside from that, each state should generate its own power, rather than depending on the Federal Government. The 36 states must be involved in electricity generation and distribution for us to have constant power supply. Scholars like Olorunfe et al [22] critically indicated that the level of manufacturing industry in Nigeria is concentrated in the southern and some eastern part of the country and that the spatial pattern could change if the industrialists adopt the strategy of industrial linkage. This finding did not support any school of thought as it suggested that policy on privatization of industry in Nigeria should be enhanced. Rasheed [37] investigated the productivity in the Nigerian manufacturing sub-sector using co-integration and an error correction model. The study indicated the presence of a long-run equilibrium relationship index for manufacturing production, determinants of productivity, economic growth, interest rate spread, and bank credit to the manufacturing sub-sector, inflation rates, foreign direct investment, exchange rate and quantity of graduate employment. This finding has research gap on the area of factors that affect manufacturing sector in Nigeria.

Capacity in manufacturing has grown slowly in recent years at only a 2.8 percent annual rate since 1969. This has resulted in operating rates today being significantly higher than we might expect especially in the light of appreciable growth rate in industrial output over the same period.

Marris [19] conducted empirical research in the 1950's where he presumed that firm managers when planning their portfolio investments, usually form a mental idea of the number of productive hours their equipment and machinery are meant to work. Thus, he argues that firms choose to operate at excess capacity, which will depend on the interaction between resilience and durability of the use of mechanization. According to Owen et al [26] about 80 percent of manufacturing companies merely operate on survival fringe because a further adverse policy push can be the final blow- an unfortunate regular phenomenon in the nations' polity. It is also disheartening to note with dismay that while the fortunes of the manufacturing sector of the economy continue to dwindle, past and current government administrations have paid little to this situation rather had inadvertently taken to superficial policies, setting up agencies overseen by corrupt and ill-qualified officials , usually to settle political favors and motives.

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 [26] 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 gaps (using GNP), unemployment rate and capacity utilization. In the studies of aggregate inflation, various measures of "tightness" were used to determine the "disequilibrium". The three main measures of tightness used by Meade [20] 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. Meade [20] 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. The main objective of this study is to ascertain the impact of capacity utilization of manufacturing industries on the economic growth. The specific objectives were to; examine the relationship between capacity utilization and manufacturing sector in Nigeria and to identify the impact of capacity utilization in manufacturing sector to the economic growth of Nigeria.

2. Materials and method

2.1 Model Formulation

The study adopted a multiple regression equation made up of Gross domestic product (GDP) as a function of the independent variables (i.e., Capacity utilization (CUR), and Manufacturing productivity index (MPI) as stated in Equation 1.

$\text{RGDP} = \beta_0 + \beta_1 \text{CU} + \beta_2 \text{MPI} + \mu$ Equation 1 [12]

Where;

RGDP = Real Gross domestic product
CU = Capacity utilization
MPI = Manufacturing production index
U = Error term.

2.2 Estimation Technique

Here, the multiple regressions of Ordinary least squares was used to analyze the impact of monetary policy as well as its tools on economic growth in Nigeria and as well the long run and short run relationships between the macro-economic variables. The T-test and the F- test was used to determine the individual and overall significance of the parameters of the regression. In order to facilitate the estimation of the time series data generated for the study, the Ordinary Least Square method for multiple regressions shall be employed. This method of analysis is employed because it is unbiased, it is fairly simple to understand. The general purpose of multiple regressions is to learn more about the relationship between several independent variables and a dependent variable.

Secondary data that was obtained from the central bank of Nigeria (CBN) statistical bulletin and National Bureau of Statistic (NBS) Annual Abstract of Statistics ranging from 1981 to 2021 was used in the study.

3. Results and discussion

3.1 Presentation and Analysis of Regression Results

3.1.1 Pre-estimation test

The Stationarity Test

The stationarity test is used to determine whether the variables in the model possess constant mean or constant variances over time. The Augmented Dickey-Fuller (ADF) test will be employed to test for stationarity.

Table 1

Variable	ADF Test Statistic	Elliot-Rothenberg-Stock test statistics	Mackinnon Critical Value at 5%	Order of Integration	Assessment
GDP	-3.086821	-	-2.951125	I(1)	STATIONARY
CU	-3.361684	-	-2.951125	I(1)	STATIONARY
MPI	-4.216641	-	-3.548490	I(1)	STATIONARY

Cointegration Test

The cointegration test was conducted to test whether there is a long run relationship between the dependent and the independent variables in the model. It is also used to test if the variables would be fit for the model when tested jointly. The cointegration equation is specified thus;

$\text{LOGGDP} = \beta_0 + \beta_1 \text{LOGMPIt} + \beta 2\text{CUt} + \mu$ Equation 2

The residual for the equations above was obtained and the ADF test was also employed to test for cointegration among the variables in the model.

Result for the cointegration test showed that there is no presence of cointegration among the explanatory variables, because ADF test statistics is less than the ADF critical value at 5% level of significant.

3.2 Discussion

The estimates from the regression results were analyzed and presented in the study. The estimates of these models were also subjected to economic, statistical and econometrics tests. The results of the ordinary least square (OLS) were presented in Table 2.

Table 2: Dependent Variable: LOGRGDP

Variables	**Coefficient**	**Standard Error**	**T-Value**	**Probability**
CONSTANT	0.728282	0.131000	5.559385	0.0000
CU	0.007888	0.002623	3.007094	0.0050
MPI	1.160429	0.014701	78.93426	0.0000
R-squared			0.995372	
Adjusted R-squared			0.995091	
F-statistic			3548.415	
Durbin-Watson stat			0.594861	

3.2.1 Evaluation Based on Economic Criteria

i. Capacity utilization (CU) has a coefficient of 0.007888. This implies that a unit change in CU will bring about an increase in the gross domestic product 0.007888 units.

ii. Manufacturing productivity index (MPI) is seen to have a coefficient of 1.160429. This shows that a unit change in MPI will increase the gross domestic product by 1.160429 units.

iii. The coefficient of the constant is 0.728282 implying that when all other independent variables are held constant, the value of the dependent variable (GDP) will be 0.728282.

3.2.2 Expected and Obtained a prior Signs

Table 3

Variables	**Expected Signs**	**Obtained Signs**	**Remarks**
CU	Positive (+)	Positive (+)	Conforms
MPI	Positive (+)	Positive (+)	Conforms

The above table shows that all the explanatory variables, conform to our expected economic a priori.

(i) Evaluation based on the R^2.

From the result of our regression R^2 is 0.995372. This shows that almost 99.53% of the changes in the dependent variables were captured by the independent variables in the models.

(ii) Evaluation based on student t-test.

In this section, the t-test is used to judge the statistical reliability of the estimates of the regression coefficients.

Table 4

Variables	T-cal	T-tab	Conclusion
CONSTANT	5.5593	2.0518	Statistically significant
INDPR	3.0070	2.0518	Statistically significant
M2	78.934	2.0518	Statistically significant

(iii) Evaluation Based on F-test.
The f-test statistic is carried out to test for the overall significance of the model.

Table 5

F-cal	F-tab at 0.05 significant level	Decision
3548.415	2.96	Reject Ho and accept H1

From the result, 3548.415 > 2.96, we reject Ho and accept H1, concluding that the overall regression is statistically significant.

3.*3 Post Estimation Test*
The econometric criteria or second order test is carried out to test whether the assumptions of the classical linear regression model stated in the chapter three of this work are satisfied. The tests are as follows;

Normality Test
The normality test is used to test whether or not the error terms are normally distributed. The Jarque Bera (JB) test will be used. This follows a Chi-Square distribution with 2 degrees of freedom.
Since 0.682095 < 5.99147 that is $\chi^2_{cal} < \chi^2_{tab}$, we do not reject the null hypothesis (H_0) and thus conclude that the error terms are normally distributed.
Multicollinearity Test
The multicollinearity test is used to test the linear collinearity between the variables of interest. The correlation matrix would be employed.

3.4 Result of the Correlation Matrix for Multicollinearity

Table 6

Variables	Correlation Coefficient	Conclusion
LOGMPI and CU	0.315697	NM
CU and LOGMPI	0.315697	NM

From the correlation Table 5, it was observed that there was no presence of multicollinearity among the different explanatory variables. (Where NM Means No Multicollinearity While M Means Presence of Multicollinearity).

3.5 Test for Heteroscedasticity
The heteroscedasticity test is used to determine whether there is constant variance. This test is carried out using the White general Heteroscedasticity Test (with cross terms). The test asymptotically follows a Chi-square distribution with degrees of freedom equal to the number of explanatory variables (excluding intercept term). Since $n.R^2 < \chi^2_{0.05}$ that is 34.8355 > 31.4104, we rejected the null hypothesis (H_0) and thus concluded that there is presence of heteroscedasticity in the model.

3.6 Test for Autocorrelation

The Durbin-Watson test was used. The study compared the Durbin-Watson lower limit (dl) and the Durbin-Watson upper limit (du) based on 5% level of significance and k- degree of freedom. Where k= number of explanatory variables excluding constant. Since the computed Durbin-Watson value is less than the Durbin-Watson lower bound, that is, since 0.594861 < 1.144, we reject the null hypothesis (H_0) and thus conclude that there is no statistically significant evidence of autocorrelation.

3.7 Specification Test

The specification test was used to determine whether the model is under-specified, over-specified or has a functional form specification problem. The Ramsey-Reset test would be employed in testing for specification bias in the model. The value of f-statistics from the specification test result is 11.84. Since the probability f-value is greater than 5%, we do not reject the null hypothesis (H_0) and thus conclude that there is no specification bias in the model. This means that the model is correctly specified.

Capacity utilization (CU) has a coefficient of 0.007888. This implied that a unit change in CU brought about an increase in the gross domestic product 0.007888 units. Manufacturing productivity index (MPI) was seen to have a coefficient of 1.160429. This showed that a unit change in MPI will increase the Gross Domestic Product by 1.160429 units. The coefficient of the constant is 0.728282 implying that when all other independent variables are held constant, the value of the dependent variable (GDP) will be 0.728282.

Augmented Dickey Fuller (ADF) tests for stationarity indicated that LOGGDP, CU and LOGMPI were integrated at order 1. The univariate analysis of the non-stationary series indicate that these variables can be characterized as I(1) processes. The table below shows the result of the stationarity test for all the variables used after comparing the ADF value against the Mackinnon critical value at 5% as specified in table 1 above. Following Engle – Granger (1987), we obtained the result of the cointegration estimation using the Johnsen Cointegration procedure which is presented in table 2. Given that the residuals from the co-integrating regression are stationary, and that the variable are not co-integrated, then we proceed to estimate model.

The result of the impact of manufacturing capacity utilization on economic growth were considered which revealed that there is positive and significant relationship between MPI, CU and GDP. A 1% change in manufacturing productivity index and capacity utilization lead to 1.160429 and 0.007888 changes in economic growth. Considering the t-values, the estimate is statistically significant.

The coefficient of multiple determination which explains the explanatory power of the model implies that 99 percent variation in the economic growth is accounted for by variations in MPI, CU. The overall statistical significance of the model indicates that the model specified is appropriate. This is indicated by the large value of F-statistic which is 3548.415. It shows that the estimate is statistically different from zero at 5 percent level of significance. This implies that manufacturing productivity index and capacity utilization have significant impact on economic growth in Nigeria.

4.0 Conclusion and Recommendation

After examining the issue of manufacturing capacity utilization in the industrial sector of Nigeria, it was deduced that there are still some relatively high rates of capacity under-utilization or idle capacity. This has greatly affected the contribution to economic growth. The manufacturing sector is known to have contributed to a large extent to the industrial development and gross domestic productivity (GDP) of the Nigerian Economy, and as well serves as one of the highest employers of labour. Distortions such as high reliance on foreign inputs and the neglect of research still

characterize the Nigerian manufacturing sector, even after the implementation of SAP. The structure and performance of the sector have not changed dramatically from the pre-SAP era which has greatly contributed to low-capacity utilization and subsequently retard industrial development in Nigeria. Also, the different components of the industrial sector suffer weak technical and functional linkages not only with each other but also with the rest of the economy. Productivity in Nigerian industrial sector has been low because of a variety of factors which include serious infrastructural problems (electricity, water, transport and communication), lack of raw materials, etc.

Based on the findings, the study recommended that efforts should be made at rehabilitating the power generating units. Moreover, necessary actions to objectively privatize these services should be intensified to ensure greater efficiency. This will serve as a solid foundation for industrial take off. Secondly, since capacity utilization also has a weak positive influence on economic growth, the government should hereby embark on core industrial project to facilitate local supply of raw materials and intermediate products that would bring about the much-needed backward integration in the economy. Improved local sourcing of raw materials will undoubtedly reduce cost of production and boost employment generation, thereby making locally manufactured products' price competitive, both in the local and international markets.

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