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Electricity Supply and Productivity of Micro, Small and Medium-Scale Enterprises in Nigeria

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Abstract

The role electricity supply and consumption play in economic growth and development cannot be overstressed, especially for the manufacturing and services sectors of any society. This study examines the impact of electricity supply on productivity of micro, small and medium-sized enterprises in Nigeria from 1980 – 2019 using the Ordinary Least Square (OLS) technique. Empirical results showed a positive and significant impact of electricity supply on productivity of micro, small and medium-scale enterprises in the manufacturing and service sectors. It was also found that domestic investment had positive and significant impact on the productivity of the MSMEs in the manufacturing and service sectors. Also, Banks' credit to the private sector had positive impact on productivity of theMSMEs in the manufacturing and service sectors, but the impact was significant only for the manufacturing sector. Stable and sufficient power supply especially for micro, small and medium-scale enterprises in the manufacturing and service sectors is recommended. At such, in addition to increasing the power generation and supply, an effective energy policies and regulatory frameworks would be needed to guide energy wastages by consumers occasioned by the default or estimated billing system adopted by power distribution companies.

Keywords: *Electricity, FDI, MSMEs, Manufacturing Sector, Service Sector*.

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Background to the Study

It is a macroeconomic objective of every society to achieve economic growth and sustainable development. This can be better achieved through development and encouragement of Micro, Small and Medium-scale Enterprises (MSMEs) in such economies. Nigeria as a developing country is very much desirous of economic growth and sustainable development. This could be better achieved through the development and support of the MSMEs. One way that could motivate MSMEs is electricity supply which could bring aboutMSMEs productivity. MSMEs productivity could economically improve welfare for an individual and the larger society in general. With the productivity growth of the MSMEs, individual welfare, household welfare and national welfare will be affected (Nwokoye, Metu, Aduku and Eboh, 2020; and Krokeyi, Aduku and Anyanwu, 2021).

In Nigeria, for instance, manufacturing sector and the service sectors are two key sectors that the MSMEs are found to be dominant. Manufacturing is the production of merchandise through the use of tools labour, machine, chemical and biological formulation. It can also be viewed as a handicraft of human activities and high technology transformation of unfinished goods to finished goods. Most of the transformation in the sector is carried out by the MSMEs, thereby dominating the sector's activities (Afolabi and Laseinde, 2019). The service sector concerns itself with producing and offering services. The services sector is widely recognized as making up the majority of the Nigerian economy. There is also widespread recognition that the sector in Nigeria is dominated by the MSMEs and the sector's contributions to the share of national output is significant. In essence, poor electricity supply or lack of access to steady power supply could hinder the MSMEs productivity (Nyanzu and Adarkwah, 2016). Several efforts have been made by government, both past and present in encouraging the MSMEs in Nigeria.

The issues of the MSMEs financing, in particular, have been given considerable attention through the provision of low interest or interest-free loans. Several agencies including the Bank of Industry (BOI), Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), and the National Guarantee Scheme for SMEs collateral were established to support the growth of the MSMEs and to facilitate their productivity as well as the Small and Medium Enterprises Credit Guarantee Scheme (SMECGS) fund. Also, training programmes have been made available for several MSMEs to support them build entrepreneurial skills.

However, effective electricity supply has not been given due attention (Gado and Obumneke, 2019; and Adaramola, 2012). This means that 40% of the power generated is lost, which is quite enormous. It is estimated that out of the 60% access, 86% is accessed in the urban centres, while 34% is accessed in the rural areas of the country (Power Africa Fact Sheet, 2021). The electricity generation and consumption seem to be retrogressing. Between the periods from 2007 to 2010, there was an increase in generation by 2.35%, while consumption also increased by 11.71% in the same period. From 2015 to 2019, the average electricity generation dropped by 8.34% and consumption also falls by 35.78% (African Development Bank – ADB, 2021). The poor electricity infrastructure raised concern about its impact on the MSMEs productivity. The study, therefore, examined the impact of electricity supply on

productivity of micro, small and medium-sized enterprises (MSMEs) in Nigeria, particularly in the manufacturing and service sectors.

Literature Review

Theoretical Literature

Schumpeter's Theory of Entrepreneurship

Joseph Schumpeter, an Austrian economist in 1949, propounded this theory. It is sometimes called the theory of innovation and entrepreneurship. Schumpeter's theory of entrepreneurship described entrepreneurs as agents of change, such that through their actions could bring about economic growth and development. In his theory, Schumpeter distinguishes between innovation and invention, pointing out that entrepreneurship comprises of creating innovations and, that the actual status of entrepreneurs can only be achieved through innovation.

Joseph Schumpeter sees the entrepreneur as a prime mover in the development of an economy based on his function to innovate or conduct new combinations. He differentiates between an innovator and an inventor, which according to him, an inventor finds out new methods and new materials. Whereas an innovator is someone who uses or applies inventions and discoveries to make new combinations, an inventor is focused on inventing while the innovator (entrepreneurs) changes the inventions into economic performance; going the additional mile to commercially exploiting the invention.

They have peculiar characteristics, which are their inherent ability to make correct choices, energy, will and mind overcoming challenges and ability to withstand social opposition. Joseph Schumpeter's theory, in other words, is of the view that money is not what motivates entrepreneurs to go into entrepreneurship, therefore, seen entrepreneurs as non-economic men in the theoretical perspective. Joseph Schumpeter's theory of entrepreneurship is criticized on this basis. Money is in fact, a major driver for entrepreneurial operations. The majority of entrepreneurs, especially at present days see entrepreneurship mostly in the informal sector as a source of livelihood. Therefore money represents the only driver for entrepreneurship.

Empirical Literature

The impact of electricity supply and consumption have been examined from different perspectives. For example, Ahadu (2019) examined electricity and productivity relationship in metal and woodworks in Nifas Silk Lafto Sub-city. Questionnaire was used as instrument of data collection alongside semi-structured interviews. The qualitative technique of the frequency and duration of power outage. Property damage, ability to meet contract deadline and the availability of backup generator to deal with power reliability concerns was used to analyze the data. The results showed that electric blackout affects SMEs productivity negatively. This study was conducted in Addis Ababa, Ethiopia. While our study focused in Nigeria.

Cissokho (2019) studied the productivity effects of power outages on manufacturing Small Scale Enterprises (SMEs) in Senegal. The study used panel data on manufacturing firms. Data envelope analysis technique was used in the study. The results showed that power outages had a negative impact on the productivity of SMEs. However, about 4.3 % of medium firms were found to be less affected than 5% of small firms. Cissokho used panel data on manufacturing firms in a study conducted in Senegal, however, our study differs from Cissokho's study in two perspectives. One, our study was on micro, small, and medium scale enterprises (MSMES) in Nigeria, particularly in the manufacturing and service sectors.

Olatunji (2019), analysed the effect of electricity insecurity on the performance of small scale businesses in the Akoko area of Ondo State, Nigeria. The study employed multiple regression techniques. It was found that the capacity of electricity supply, duration of electricity supply and reliability of electricity supply had a positive correlation with the performance of small businesses. Olatunji conducted the study in Akoko area of Ondo state. We appreciate this study, however, Ondo state is just one out of 36 states in Nigeria. Hence, the need to examine electricity supply effects on MSMEs in all states in Nigeria.

Nyanzu and Adarkwah (2016) employed the chi-square and t-test to analyse the effect of power supply on the performance of SMEs. Data were collected from the World Bank (2013) Enterprise Survey on Ghana with 403 sampled firms. The study employed the Ordinary Least Square (OLS) technique. The study found that power outages affected a firm's performance (profitability). Also, it was found that power outages affected SMEs located in the Northern part of Ghana than SMEs located elsewhere. The study of Nyanzu and Adarkwah was conducted in Ghana in 2016. The gap identified is in two-fold. The location and time frame of 1980-2019.

Data and Methodology

Data

The data used are time-series which are Electricity Supply (ELECTRIC), Foreign Direct Investment (FDI), Gross Fixed Capital Formation (GFCF), Banks' Credit to the Private Sector (BCTP) from 1981 to 2019. The data were sourced from various issues of the Statistical Bulletin published by the Central Bank of Nigeria (CBN), and the World Development Indicators (WDI).

Model Specification

The functional form of the model for objective one is:

$$MPROD = (ELECTRIC,\ FDI, GFCF, BCTP) \qquad (1)$$

Where;
MPROD = measured by the ratio of output as a percentage of the labour force
ELECTRIC = electricity supply
FDI = foreign direct investment
GFCF = gross fixed capital formation
BCTP = banks' credit to the private sector

The model for estimation is:

$$MPRODt = \alpha_0 + \alpha_1 ELECTRICt + \alpha_2 FDIt + \alpha_3 GFCFt + \alpha_4 BCTPt + \varepsilon_{1t} \quad (2)$$

Where:

ε_1 = the stochastic error term

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, and\ \alpha_4$are parameters to be estimated and other variables remain as defined previously.

However, to capture objective two, the following functional model is specified:

$$SPROD = (ELECTRIC,\ FDI, GFCF, BCTP) \quad (3)$$

Where;
SPROD = productivity of MSMEs in the service sector, measured by the ratio of output as a percentage of the labour force
ELECTRIC = electricity supply
FDI = foreign direct investment
GFCF = gross fixed capital formation
BCTP = banks' credit to the private sector

The model for estimation is:

$$SPRODt = \beta_0 + \beta_1 ELECTRICt + \beta_2 FDIt + \beta_3 GFCFt + \beta_4 BCTPt + \varepsilon_{2t} \quad (4)$$

Where;

ε_2 = the stochastic error term

$\beta_0, \beta_1, \beta_2, \beta_3, and\ \beta_4$are parameters to be estimated and other variables remain as defined previously.

Estimation Technique

The regression equations are estimated using the Ordinary Least Square (OLS) technique.

The ADF Unit Root Test

A unit root test is a stationarity test of variables in a research study. This study employs the Augmented Dickey-Fuller unit root test procedure. Unit root test usually starts with the equation

$$yt = \beta + \delta t + \rho y_{t-1} + \varepsilon_t, \qquad -1 < \rho < 1\ and \varepsilon_t \sim iid(0, \sigma^2) \quad . \quad . \quad . \quad (5)$$

Cointegration Test

If two or more variables under study are co-integrated, it means that there is a meaningful long-run relationship between them. Johansen's cointegration test is used in this study because there are more than two variables in our model and there is also the possibility of having more than one cointegration equation.

Results and Discussion

Analysis and Discussion of Results

Descriptive Statistics of the Variables

The variables were examined in order to have some background knowledge on the dataset.

The result is presented in Table 1.

Table 1: Descriptive Statistics

Variable	Obs	Mean Value	Standard Deviation	Min	Max	Skewness	Kurtosis
MPROD	39	50.76977	34.07458	17.61291	121.2887	0.0041	0.9913
ELECTRIC	39	2.2500	4.2400	1.2300	13789	0.0008	0.5166
FDI	39	2.7500	2.5200	1.8900	8.9100	0.0047	0.5447
GFCF	39	35.7896	19.49967	14.16873	89.38613	0.0085	0.1954
BCTP	39	40968.81	25982.34	10747.89	123932.1	0.0048	0.0644
SPROD	39	288.6168	212.5449	92.43067	680.1974	0.0328	0.0578

Source: Authors' Computation, 2022

The mean values of the data for the productivity of Micro, Small and Medium-Scale Enterprises in the manufacturing sector, electricity supply, foreign direct investment, and domestic investment are close to their respective standard deviation values. This means that the series are close to their mean values respectively. In other words, there are no issues of outliers in the data values.

For the skewness, the probability values of the variables are all significant. Since the skewness probability values are all significant, the null hypothesis of normal distribution is rejected. This means that the variables respectively either skewed to the right or to the left. They are not symmetrical in distribution. For the Kurtosis, on the other hand, an insignificant probability values showed up for all the variables.

Unit Root Test

Unit root is a test for stationarity of variables in a regression equation.

Table 2: Augmented Dickey-Fuller and Philips–Perron unit root test results

Variable	Augmented Dickey-Fuller Result		Philips–Perron Result		Lag order	~I(d)
	Level	1st Difference	Level	1st Difference		
MPROD	-1.037	-3.921*	-1.309	-5.757*	2	I(1)
ELECTRIC	-1.817	-3.826*	-2.027	-6.441*	2	I(1)
FDI	-0.925	-4.228*	-1.534	-7.326*	2	I(1)
GFCF	-1.651	-4.634	-2.230	-5.312*	2	I(1)
BCTP	-1.641	-3.823*	-1.630	-4.318*	2	I(1)
SPROD	-1.841	-3.641*	-1.490	-5.650*	2	I(1)

* indicates significance at 5%; rejection of null hypothesis of the presence of unit root. Optimal lag length of 2 was chosen based on Akaike's Final Prediction Error (FPE), Akaike's information criterions. The ADF 5% critical value at levels is -3.556, but at 1st difference is -3.560. The Philips–Perron critical value at levels and 1st difference are -3.548 and -3.552 respectively. A trend was included in both the Augmented Dickey-Fuller and Philips–Perron unit root test models estimated.

Source: Authors' Computation, 2022

Impact of Electricity Supply on the Productivity of Micro, Small and Medium-Scale Enterprises in the Manufacturing Sector

Objective one is to examine the impact of electricity supply on the productivity of Micro, Small and Medium-Scale Enterprises in the manufacturing sector.

Table 3: Johansen Cointegration Test

Maxi Rank	Eigen Value	T- Statistics	5% Critical Value
0	-	113.2885	82.49
1	0.71036	67.4407	59.46
2	0.46234	44.4809	39.89
3	0.44405	22.7593*	24.31
4	0.31686	8.6605	12.53
5	0.13414	3.3314	3.84

Source: Authors' Computation, 2022

In comparing the respective trace statistics with the 5 per cent critical values, three significant trace statistics were found. This means that we have three cointegration equations among the variables in the regression equation (3.2). Therefore, the null hypothesis of no cointegration is rejected at the 5 per cent level. This also means that the variables in equation (3.2) have long run relationship.

Table 4: Estimates of the impact of electricity supply on the productivity of MSMEs in the manufacturing sector

MSPG	**Coefficient**	**Standard Error**	**t-statistic**	**P-value**
ELECTRIC	1.3000	0.4407	2.95	0.000
FDI	-1.1200	2.4800	-0.45	0.655
GFCF	1.4086	0.3500	4.02	0.000
BCTP	2.0003	0.8659	2.31	0.017
_cons	111.5777	20.76977	5.37	0.000
R-Squared	0.7058			
Adj-R-Squared	0.6476			
F (4, 28)	8.70 (0.0001)			
Durbin-Watson d-statistic (5, 39)	2.1827			
Breusch-Godfrey LM chi3	0.353 (0.1901)			

Source: Authors' Computation, 2022

The coefficient for electricity supply is 1.3000, t-value is2.95. The implication of t-value of 2.95 higher than 2 in absolute term indicates that electricity supply has no significant impact on the productivity of micro, small and medium-scale enterprises in the manufacturing sector is rejected using the 2-t rule of thumb. This, therefore, mean that electricity supply significantly affects productivity of the MSMEs in the manufacturing sector. Specifically, an increase in electricity supply brings about 1.30 per cent significant increase in productivity of the MSMEs in the manufacturing sector.

Banks' credit to the private sector has positive and significant impact on the productivity of micro, small and medium-scale enterprises in the manufacturing sector. An increase in the banks' credit to the private sector results to a significant increase in the productivity of micro, small and medium-scale enterprises in the manufacturing sector by 2.00 per cent. The significant t-value and p-value guides us to reject the null hypothesis at the 5 per cent level.

The coefficient of determination (R^2) measures the explanatory power of the independent variables. The R^2 from our result is 0.7058, which means that the variables in the model could explain 70.58 per cent change in the productivity of micro, small and medium-scale enterprises in the manufacturing sector. The F-statistics (4, 28) value of 8.70 (0.0001) is significant, since the probability value is less than 0.05. Thus, we say that the variables in the model jointly significantly affect the productivity of micro, small and medium-scale enterprises in the manufacturing sector. The Durbin-Watson d-statistics (5, 39) value is 2.1828. Since this value is approximately 2, we therefore conclude that the variables in the model have no autocorrelation. Also, the Breusch-Godfrey LM chi2 test with a test statistic and insignificant probability value of 0.353 and 0.1901 confirmed that the variables have no autocorrelation.

Table 5: Result of Johansen test for cointegration

Maxi Rank	Eigenvalue	T- Statistics	5% critical value
0	-	69.0890	59.46
1	0.5545	39.1678*	39.89
2	0.4419	17.5920	24.31
3	0.3135	3.6739	12.53
4	0.0945	0.0000	12.53
5	0.0000	-	-

Source: Authors' computation, 2022

The result showed one trace statistic greater than the 5 per cent critical value. Meaning that no cointegration of the variables in the model is rejected. This means that the variables in the model have long run relationship. Table 4.8 shows the impact of electricity supply on the MSMEs productivity in the service sector.

Table 6: Electricity supply andMSMEs productivity in the service sector

SPROD	Coefficients	Standard Errors	t-stat	P-value
ELECTRIC	5.8000	2.0789	2.79	0.000
FDI	8.0100	3.0808	2.60	0.004
GFCF	8.2896	1.8805	4.41	0.000
BCTP	0.0010	0.0010	1.00	0.323
_cons	592.5005	111.5948	5.31	0.000
R-Squared		**0.8333**		
Adj. R-Squared		**0.7902**		
F (4, 28)		**14.68 (0.0000)**		
Durbin-Watson d-statistic (5, 39)		**2.1533**		
Breusch-Godfrey LM chi3		**0.449 (0.2209)**		

Source: Authors' computation, 2022

An increase in electricity supply bring about 5.80 per cent increase in productivity of the MSMEs in the service sector. Therefore, electricity supply has impact on productivity of the MSMEs in the service sector. The significant probability value of 0.000 also corroborates rejection of the null hypothesis. This, therefore, means that electricity supply has a significant impact on the productivity of the MSMEs in the service sector.

Gross fixed capital formation has 8.29 per cent impact on productivity of the MSMEs in the service sector. The impact is statistically significant at the 5 per cent level, given by the significant t-value of 4.41. The p-value of 0.000 is also less than 0.05, therefore, indicating that it is statistically significant. This suggests the rejection of the null hypothesis that gross fixed capital formation has no statistically significant impact on Micro, Small and Medium-Scale Enterprises in the service sector.

Banks' credit to the private sector had a coefficient of 0.001 with a t-value 1.00. This shows that an increase in banks' credit to the private sector leads to an increase in the productivity ofthe MSMEs in the service sector by 0.001. The t-value of 1.00 is less than 2 in absolute sense. Therefore, banks' credit to the private sector having an insignificant impact on the productivity ofthe MSMEs in the service sector is accepted at 5 per cent level. The insignificant probability value of 0.323 indicates no significant error in accepting the null hypothesis. Thus, banks' credit to the private sector positively and insignificantly affects the productivity of Micro, Small and Medium-Scale Enterprises in the service sector.

The R^2 based on our result is 0.8333, which means that the variables in the model explain about 83.33 per cent change in the dependent variable. The F-value of 14.68 (0.0000) means that the variables in the model jointly affect the MSMEs productivity in the service sector. The Durbin-Watson d-statistics (5, 33) value is .153307. Since this value is approximately 0, we conclude determine the presence or absence of autocorrelation. But, the Breusch-Godfrey LM chi2 test with a test statistic (and significant probability value) of 0.449 (0.2209) suggests the rejection of the null hypothesis of no serial correlation.

Conclusion and Recommendations

Conclusion

The paper concludes that electricity supply and domestic investment are significant in determining productivity ofMSMEs in both the manufacturing and the service sectors. This finding agrees with the work of Olatunji (2019) who employed multiple regression technique to study the effect of electricity insecurity on the performance of small scale businesses in Akoko area of Ondo State, Nigeria. The result showed that electricity supply duration and reliability had a positive correlation with the performance of small businesses. Similarly, the work of Nyanzu and Adarkwah (2016) who found that power outages affected SMEs in Ghana supports our findings, However, foreign direct investment hinders productivity of the MSMEs in the manufacturing sector.

Recommendations

Based on the findings, the study recommends that:

1. Government of Nigeria should as a matter of urgency declare state of emergency on the power sector in order to improve on the electricity supply. This recommendation is made because of the positive and significant impact of electricity on productivity of the MSMEs in the manufacturing sector in Nigeria. Furthermore, cement and building materials, food and beverages, chemicals and fertilizers, wood and textiles etc. shall be greatly encouraged and employment shall be created which will eventually reduce poverty and insecurity in Nigeria. And reduction of poverty and insecurity would further have strengthened the manufacturing and services sectors in Nigeria.
2. Government efforts should be supported by private organizations in improving electricity generation and supply because the study found a positive impact of electricity on productivity of the MSMEs in the service sector. This recommendation when implemented, would encourage the service sector which include but not limited

to education, health, finance, transportation, trade, banking, communication, tourism, media and entertainment. All these could reduce the high level of unemployment and insecurity situation in Nigeria.

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