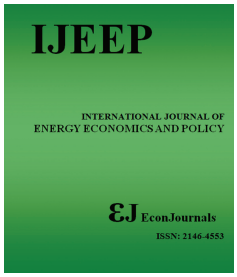

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Electricity Supply and Business Performance in a Nigerian Private University

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ABSTRACT

There has been a consistent argument in the literature as regards the impact of electricity consumption on economic growth with most studies focused on developed economies. However, little is known on impact of electricity consumption on business performance in a university system. This study examines the short-run and long-run impact of electricity supply on business performance in a Nigerian private university. The study adopted Engle and Granger approach to co-integration. The result reveals that in the long run, a negative relationship exist between electricity supply and turnover. However, cost of sales and wages have positive relationship with turnover. In the short-run, electricity supply has negative relationship with business performance. In addition, the cost of sales is not statistically significance with turnover. The findings of the study are in line with the principle of labour marginal productivity both in the short and long-run. Therefore, the study recommended need to consider alternative source of power supply most especially in the long-run in order to maximize the aggregate benefit on the business performance.

Keywords: Electricity Supply; Education; Business Performance
JEL Classifications: Q4, H51, O4

1. INTRODUCTION

The growth rate for electricity consumption is very germane for business performance. This is in line with the United Nations Sustainable Development Goals 7, 9, 11 and 12 (United Nations, 2015; Asaleye et al., 2020). This goals have important implication on business performance because lack of electricity supply will lead to over reliance on alternative source of energy which can be more expensive, like solar, coal, generator. When a firm depends mainly on alternative source of energy, this will have a significant effect on their profit declining. Ultimately, this will affect the rate of employment due to the firm not been able to meet up the same level of output. Hirsh and Koomey, (2015) opined that there is a sold connection between electricity consumption and prosperity, that is an economy cannot grow at a rate much higher than the rate of increase in energy supply. One of the major goals of the United Nations of Sustainability of Energy is to ensure energy supply adequacy. However, Nigeria as a developing country have been experiencing poor access to electricity which have been a major impediment to its economic growth. In response to this goal, the ministry of Works, Power and Housing in Nigeria has embarked on tireless effort in improving electricity supply across the country. This was validated in the speech made by the current minister of power asserting that some states in Nigeria can account for almost 24 h' power supply (Ministry of Power, Works and Housing, 2019). This study therefore becomes imperatives in examining the

short-run and long-run relationship between electricity supply and business performance in a Nigerian private university. Education system has the ability to develop skills, provide employment, promote research and development. Nigeria is a country that is characterized with low productivity, high unemployment rate and poverty rate (Asaleye et al., 2018; Asaleye et al., 2018; Falaye et al., 2019; Arisukwu et al., 2019; Aremu et al., 2018).

Funding in every educational sector is very important and huge, moreso private university where there is no government backup for funding since it's owned and controlled by an individual or group of individuals. In other to meet their daily running expenses and seek for growth opportunities, they seek for internally generated funds (IGR) by embarking into several business ventures. However, the cost of electricity in Nigeria is huge and affect the profit margin that might be generated from this business ventures. This serve as the motivation to this study. Here, we used one of the fastest growing private university in Nigeria that has investment into several business ventures.

Extant literature has carried out various studies to examine the relationship between electricity consumption and human capital development (Matthew et al., 2018; Popoola et al., 2019); social capital and business performance, manufacturing sector and capital, among others (Adama et al., 2018; Akintimehin et al, 2019; Asaleye et al., 2018; Adama et al., 2018; Otekunrin et al., 2018; Uwuigbe et al.; 2018; Okere et al., 2019; Oladipo et al., 2019a) energy consumption and economic growth (Adhegaonkar, 2015; Hirsh and Koomey, 2015; Ogundipe and Apata, 2013; Olaniyan et al., 2018; Onakoya and Odedairo, 2015; Ozcan and Ozturk, 2019; Chaudhry et al., 2012; Ogundipe et al., 2019); energy consumption and school building (Borgstein and Lamberts, 2014; Ouf and Issa, 2017). The research gap identified in this study is the lack of empirical evidence regarding the impact of electricity supply and performance of business in Nigerian private university. The closest to this study is (Hagan et al., 2018) who assessed the energy saving role of bank performance in Sub-Sahara Africa. However, this study is criticized based on the fact that the 43 Sub-Saharan African countries considered in the study does not have the same growth rate, population rate and performance indicators.

Motivated by the above, this study therefore aims to examine the short-run and long-run impact of electricity supply on business performance in a Nigerian private university. The importance of educational sector in an economy cannot be overemphasized as they are seen as the enabler of economic growth and empowers it citizens with required knowledge. We hypothesize that an improvement in electricity supply will have significant effect on business performance. To achieve this objective, we used Turnover as an indicator of performance. The remainder of this study is structured as follows; section 2 reviews various literature on this subject matter; section 3 discusses the methods and materials used in the study; section 4 presents the result and discussions of findings and section 5 shows concluding remarks and recommendations.

2. REVIEW OF RELATED STUDIES

Empirical findings on the impact of electricity consumption on economic performance of various countries remains mixed in literature. Borgstein and Lamberts (2014) examined the impact of energy consumption in Brazil bank buildings using a sample linear regression model. They found that energy consumption and bank buildings are statistically related and this consumption reduce as bank activities increase. Ouf and Issa (2017) applied time series technique to examine the energy consumption analysis of school buildings in Canada. They found that electricity consumption of these Canadian school are lower and are statistically significant for universities.

Ozcan and Ozturk (2019) assessed the relationship between energy consumption and economic growth in 17 emerging countries using bootstrap panel causality test. Findings from the data spanning between 1990 and 2016 reveals that energy consumption does not have any significant impact on growth rate of 16 countries out of 17 that was sampled. The exception was Poland where energy consumption policies is found to have detrimental influence on the country economic performance. However, the result of Hirsh and Koomey (2015) is consistent with that of (Ozcan and Ozturk, 2019) where the relationship between energy consumption and economic growth in Poland was assessed for 2000-2012. The result show that a causal relationship exists between energy consumption and economic growth in both short and long-run. In Pakistan, Chaudhry et al. (2012) used time series technique to investigate the casual relationship between energy consumption and economic growth. Result show that the consumption of electricity has significant impact on economic growth in Pakistan. The study concluded that there should be a shift from a more expensive energy source to available alternative source of energy like gas or coal so as to balance economic growth.

In Nigeria context, Onakoya and Odedairo (2015) examined the casual relationship between energy consumption and economic growth in Nigeria using data from 1986 to 2011. Applying granger causality test and co-integration test, the findings show absence of causality between energy consumption and economic growth. This means that electricity consumption does not have long-run impact in economic growth. In contrast to this, Ogundipe and Apata (2013) used vector error correction model (VECM) to examine the casual relationship between energy consumption and economic growth in Nigeria. The study found the existence of a unique co-integrating relationship amidst variables, that is energy consumption impact economic growth in both short and long-run.

Spanning across empirical literature, there is dearth of literature regarding the impact of electricity supply on business performance in a university setting. Most studies focused on the relationship between energy consumption and economic growth in a wide-country context. Following the identification of this research gap, this paper aims to examine the short-run and long-run impact of electricity supply on business performance in a Nigerian private university. We contributed to energy and policy literature as follows: (1) provides the first empirical evidence on the effect of electricity supply on business performance in a Nigerian private university, (2) develop a theoretical framework that links an energy indicator to business performance, and (3) provides recommendation on the alternative source of energy that will improve business performance.

3. THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

3.1. Theoretical Framework

Following the study of Hagan et al. (2018), the theoretical framework model adapted in this work is based on neoclassical model of frim maximization of profit. This also agrees with Agency theory (Eluyela et al., 2018a; 2018b; Ademola et al., 2020; Adegboyegun et al., 2020; Ozordi et al., 2020) where managers seek to maximize the profit in order to achieve shareholders goal. To attain this, firm choose the optimal level of input which includes energy, labor and capital input.

Therefore, by assuming Cobb-Douglas production function, we have:

$$Max \rightarrow \pi = PY - P_a E - Z \qquad \text{profit function} \quad (1)$$

Subject to: $$Y = AE^{\alpha} Z^{\beta} \qquad \text{production function} \quad (2)$$

Where; π, PY, P_a, E and Z are firm's profit, output price, price of energy, energy input and composite input (whose price is normalized to one) respectively. From equ (2), Y represents total production (output), A is the total factor productivity, E is energy supply, Z denote labor input, α and β shows output elasticity of capital and labor.

3.2. Model Specification

The implicit form of our empirical model adapted from the work of Ozcan and Ozturk (2019) is:

$$TURN = \beta_0 ELEC^{\beta_1} COSA^{\beta_2} WAGES^{\beta_3} \quad (3)$$

The explicit form of the model after including time series model properties is presented in equ (4):

$$TURN_t = \beta_0 + \beta_1 ELEC_t + \beta_2 COSA_t + \beta_3 WAGES_t + \mu_t \quad (4)$$

Where *TURN* is turnover of the business enterprise, *ELEC* represent electricity cost borne by the enterprise, *COSA* is cost of sales, *WAGES* is wages paid by the enterprise. t is the time trend and $\propto_t$ is the error term. The study used time series weekly data. We have 64 weeks consisting of data between January 2017 and August 2017 and 2018 respectively. We assumed 7-working days per week. The rationale for adopting time series methodological approach is that it can be used for explanative analysis (Ozordi et al., 2019; Ashraf et al., 2016; Oladipo et al., 2019b; Umukoro et al., 2020). Here, we used it to examine the short-run and long-run behaviour between the dependent and independent variables (Michieka, 2015).

In the result and implication section, first, we present preliminary test showing the unit root test for each variables. The unit root test is considered as the pretest and essential in order to determine the most appropriate technique to be utilized in the empirical analysis (Adhegaonkar, 2015; Eluyela et al., 2019a; 2019b; Kumar et al., 2010; Popoola et al., 2018). Since the data in this study is a time series data, we used Augmented Dickey-Fuller (ADF) and Philip-Peron (PP) criterion in determining the stationarity of our variables. Some of the advantage of ADF and PP criterion over other criterion are; (1) helps to avoid spurious regression in the time series data (Cui, 2017); (2) helps to correct any serial correlation and heteroskedasticity in the error term (Hassapis et al., 1999). The model for the unit root test is shown in equ (5).

$$X_t = \alpha + \beta_t + X_{t-1} + \sum_{t=1}^{P} u_t \Delta x_{t-1} + \mu_t \quad (5)$$

Where; $\Delta x_t = x_t - x_{t-1}$, is the constant term, t is time trend, μ_t is the error term. The parameters of α, β and x are assumed to be zero. Then testing the unit root of the constant, time trend and error term. P is the number of lagged entry which is assumed to be (5) so as to make the error term and white-noise sequence. According to Jin and Kim (2018), a white noise exist when all variables have the same variance and each value has a zero correlation with all other values in the series. The optimal lag length of P is determined automatically using Schwarz Information Criterion (SIC).

Following the preliminary test, we examined the long-run and short-run behaviour using error correction model (ECM) by adopting the Engle and Granger approach to co-integration (Engle and Granger, 1993; Ikegami and Wang, 2016; Pettenuzzo, 2013). The error correction model (ECM) was used to identify the speed of adjustment from disequilibrium to equilibrium in the long-run (Dash et al., 2018). For a long-run behaviour to exist among variables, it is assumed that the error correction term (ECT) should be significant and have a negative sign (Maharjan, 2018). By applying an error correction model (ECM) in which all variables are assumed to be stationary at I(1), we adopted the test of Westerlund (2007) in analyzing whether co-integration exist. To achieve this, we check whether error correction is present for each individual series. Therefore, the estimated model for the error correction model (ECM) is presented in equ (6).

$$\Delta TURN = \beta_{at} + \phi_t ECT_{t-1} + \beta_{a1p} \Delta ELEC_{t-p} + \beta_{a2p} \Delta COSA_{t-p} + \beta_{a3p} \Delta WAGES_{t-p} + \mu_t \quad (6)$$

Where Δ denote the first difference, is time trend of the regression, P is the lag length used for the difference explanatory variables from $t-1$ to $t-p$; β_a is the constant term. β_{a1p}, β_{a2p}, β_{a3p} shows the coefficients of the independent variables. ϕECT_{t-1} is the error correction term.

Lastly, diagnostic check on the series was presented. The diagnostic check is used to know if the model specified in this study is correct. We used three diagnostic checks in this study. These are Serial correlation, histogram normality and heteroskedasticity. The serial correlation test shows whether the residual of the series is serially correlated. The histogram normality shows whether the series in this study is normally distributed. While the heteroskedasticity test show whether the variance of the residual is constant over term. Hence, we establish the following hypothesis for each diagnostic checks. These are:

H_1: The residual of the series is serially correlated.
H_2: The residual is not normally distributed.
H_3: The variance of the residual is not constant over time.

4. DISCUSSION OF RESULT AND IMPLICATION

4.1. Discussion of Result

Table 1 shows the preliminary test for this study. We based our panel unit root result on Augmented Dickey Fuller (ADF) and Philips-Perron (PP) criterion. All variables were significant at 1st difference using 1% and 5% probability level. Since all variables are significant at I(1), we used Engle and Granger approach to examine the long-run and short-run behaviour among the dependent and independent variables.

Table 2 present result on long run behaviour between electricity supply and business performance in a Nigerian private university. Our R-squared (coefficient of determination) is 87%. This means that the variation in dependent variables in explained by 87% of the variation in the independent variables. The Adjusted R-Squared of 77% is lower than the R-Squared because it takes into consideration the degree of freedom. Furthermore, examining the individual variables, electricity supply (ELEC) has a negative coefficient of −0.112071 and probability value of 0.0000, which is statistically significant at 5%. This means that 1% change in electricity supply will lead to 11% change in business performance. However, this relationship is negative.

Cost of sales (COSA) has a coefficient of 0.864484 and probability value of 0.0000 which is statistically significant at 5%. This denote that 1% change in cost of sales will result to 86% change in business performance. Since cost of sales are directly related cost to production processes, holding all other variables constant, the higher a business venture spend on cost of sales, the higher the profit. Lastly, Wages has a coefficient of 0.105347 and probability value of 0.0482 which is statistically significant at 5%. This means that 1% change in wages will result to 10% change in business performance.

Table 3 show the result from the short run behaviour between the dependent and independent variables. Electricity supply (ELEC) has a negative coefficient of −1.210918 and probability value of 0.0000, which is statistically significant at 5%. This means that 1% change in electricity supply will lead to 11% change in business performance. Also, in the short run, the variable COSA (cost of sale) is not statistically significance with turnover. The variable WAGES is statistically significance with turnover; one unit in wages in lead to about 1.15 increase in the turnover.

Table 4 shows the residual stationarity result. Since the residual has a probability value of 0.0022 at level, this means that residual is stationary at levels. Then, we can proceed to use the Engle and Granger approach to co-integration.

Table 5 present the result from the diagnostic checks. We used these tests to know the fitness and correctness of our model. For serial correlation, the observer r-squared is 10.72534 with a probability value of 0.9060 which is >0.05 level of significant. We reject the hypothesis which state that the residual of the series is serially correlated. This means that there is absence of serial correlation among our variables.

Table 1: Unit root test

Variable	Criterion	Level	First difference
TURN	ADF	0.4083	0.0149**
	PP	0.2925	0.0477**
ELEC	ADF	0.8651	0.0000*
	PP	0.3013	0.0002*
COSA	ADF	0.1869	0.0092*
	PP	0.3308	0.0195**
WAGES	ADF	0.1025	0.0274**
	PP	0.2673	0.0022*

* and ** represent that variables are stationary at 1% and 5% respectively. Source: Authors' Compilation (2019)

Table 2: Long run behaviour

Dependent variable: TURN				
Series	**Coefficient**	**Standard Error**	**t-statistics**	**Probability**
ELEC	-0.112071*	0.020785	−5.391902	0.0000
COSA	0.864484*	0.029314	29.49033	0.0000
WAGES	0.105347*	0.052226	2.017141	0.0482
Constant	1.145375	0.181819	6.299537	0.0000
R-Squared: 0.872866		F-statistic: 717.0854		
Adjusted R-Squared: 0.771509		Prob. (F-statistic): 0.000000		
Durbin-Watson Stat: 1.730224				

Source: Authors' Compilation (2019)

Table 3: Short run behaviour

Dependent Variable: D(TURN)				
Series	**Coefficient**	**Standard Error**	**t-statistics**	**Probability**
D(ELEC)	−1.210918*	0.044585	−25.14093	0.0000
D(COSA)	−0.032063	0.058704	−0.546171	0.5870
D(WAGES)	1.155527*	0.038857	29.73828	0.0000
ECM	0.010512*	0.004154	−2.530132	0.0234
Constant	−0.000972	0.001985	−0.489665	0.6262

Source: Authors' Compilation (2019)

Table 4: Residual stationarity result

Null hypothesis: ECM has a unit root			
Exogenous: Constant			
Lag length: 5 (Automatic - based on SIC, max lag=10)			
		t-statistic	**Prob.***
Augmented Dickey-Fuller test statistic		−4.074946	0.0022
Test critical values:	1% level	−3.548208	
	5% level	−2.912631	
	10% level	−2.594027	

Source: Authors' Compilation (2019)

Table 5: Diagnostic checks

Test	Jarque-Bera	Obs.* R-squared	Probability
Histogram normality	4.549501	-	0.102823
Serial correlation LM	-	10.72534	0.9060
Heteroskedasticity	-	7.368050	0.0766

Source: Authors' Compilation (2019)

The histogram normality has a Jarque-Bera of 4.549501 and a probability value of 0.102823 which is higher than 0.05 level of

significant. We reject the null hypothesis that the residual is not normally distributed. This denote that all series in this study is normally distributed. Lastly, heteroskedasticity has an observer r-squared is 7.368050 with a probability value of 0.0766 which is >0.05 level of significant. This implies that the variance of the residual is constant over time. Hence, we reject the null hypothesis that the variance is not constant.

4.2. Implication of Findings

This study examines the long run and short run implications of electricity supply on business performance in a Nigerian private university. This is necessary due to huge amount of electricity consumption in a university system. The long-run equation shows that electricity supply has a negative relationship with turnover. The implication of the result indicates that the electricity expenditure increases as the scale of economics increase. Therefore, there is need to consider an alternative means of power supply to maximise the benefit in the long-run. The long-run increase of electricity expenditure is may be due to many factors among include increase in usage of power supply as a result of increase in capacity, mismanagement in usage, non-economic and economic factors. Likewise, the cost of sales and wages have positive relationship with turnover. This result indicates that the supply of the services can be increase over time due to adequate demand as the university progress. However, there is need for proper regulation to ensure that welfare in maximized. The positive relationship between wages and turnover is economic significance; this is supported from marginal productivity of labour, which stressed that there is positive relationship between output and wages. This principle was as well used as the foundation of efficiency wage theory.

In the short-run, electricity supply has negative relationship with business performance. In addition, the cost of sales is not statistically significance with turnover. There are various stage in business cycle, it is expected that the early stage could incur additional expense; however, as a result of increase in economics of scale, it is believe that there should be a significant reduction in expense in relation to the turnover rate. Therefore, the negative relationship and insignificant of the variable proxy by the cost of sales could be as a result of this factor, among others. The variable WAGES is statistically significance and has a positive with turnover. This indicates that the principle of marginal productivity of labour applies both in the short and long-run. The study also carries out diagnostic checks such as serial correlation test, normality test and heteroskedasticity test to ensure the model is correctly specified (Asaleye et al., 2019; Obadiaru et al.,2018.). The outcome of the diagnostic checks show that the model is correctly specified.

5. CONCLUSION AND RECOMMENDATIONS

The usage of power supply is mandatory in all business organization irrespective of education or manufacturing or agricultural sector. However, questions have been raised about proper management of power supply in educational sector and its implications on aggregate turnover, most especially in private system that lacks support from the government. Likewise, other secondary cost and benefit are associated, for example, this could affect the rate of employment due to the firm not been able to meet up the same level of output.

Hence, this study examines the short-run and long-run impact of electricity supply on business performance in a Nigerian private university. The long-run equation shows that electricity supply has a negative relationship with turnover. Likewise, the cost of sales and wages have positive relationship with turnover. The general implication from the long run result is that there is need to consider an alternative means of power supply to maximise the benefit in the long-run. Some of the factors that may be attributed for this among others include: increase in usage of power supply as a result of increase in capacity; mismanagement in usage, non-economic and economic factors. The short-run equation shows electricity supply has negative relationship with business performance while the cost of sales is not statistically significance with turnover. The variable WAGES is statistically significance and has a positive with turnover. One of the factors that may be responsible is the business cycle stages. Finally, the positive relationship between wages and turnover in the short and long-run is in line with principle of marginal productivity of labour. Based on the outcome of the findings, the study recommended need to consider alternative source of power supply most especially in the long-run in order to maximise the aggregate benefit on the business performance. This study only focused on a private university in Nigeria. It is suggested that future study should consider the implications of electricity supply on any public university. This would help to understand if the behaviour is common to public setting as in case of a private sector. Also, subsequent study can examine the short and long run behaviour of electricity consumption on other aspect of performance in a university system. Other aspect that can be consider includes; academic performance, employees' productivity.

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