Electronic Journal of Business and Management
Vol. 10, Issue 1, 2025, pp. 65-76
e-ISSN:2550-1380-ISSN
doi: https://doi.org/10.65136/ejbm.v10i1.9

Electricity Supply and Firm Sustainability: Evidence from Small Medium Enterprises in North-Western Nigeria.

Olusegun Kazeem Lekan [1*], Nasiru Musa Yauri [2]

[1] Department of Business Management, Faculty of Management Sciences, Federal University Dutsin-Ma, Katsina, Nigeria
[2] Department of Business Administration, Faculty of Management Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria

[*]Corresponding Author: kolusegun@fudutsinma.edu.ng

Abstract

This study is in furtherance of investigation into the nexus of electricity supply and SMEs sustainability in Nigeria. Anchored on system theory, we proposed that electricity supply is significantly related to SMEs sustainability (profitability and liquidity) when firm characteristics are controlled. To test this assumption, we applied multiple linear regression analysis on the cross-sectional survey data collected through mailed questionnaire administered to 225 SMEs owners operating in the cities of Kaduna, Kano, Katsina, Kebbi, Jigawa, Sokoto and Zamfara States in Northwest Nigeria. The SMEs are spread across manufacturing, hotel & restaurant and wholesale & retail sectors. The study employs multi-stage sampling techniques to collect data. Findings from the study show evidence of positive and statistically significant relationships between SMEs profitability and electricity supply whereas a weak but positive relationship exists between electricity supply and firm liquidity. On the basis of the findings, the study recommends that Nigeria should find a sustainable solution to its energy crisis in order to enhance sustainability of enterprises and by extension the economy. Increasing electricity access should involve optimal production and utilization of generation capacity and/or reduction of transmission and distribution losses. More importantly, reliable load shedding schedules should be provided to plan production around outages in order to reduce technical faults in existing transmission and distribution infrastructure so as to increase generation capacity. Above all, SMEs villages/clusters should be built to promote industrial activities on the basis that access to reliable electricity supply is collectively and affordably provided by the relevant host authorities to investors and operators.

Keywords: *Electricity supply, SMEs sustainability, firm age, firm size, leverage.*

1. Introduction

Electricity supply is central to industrial development of any nation because it is a crucial engine of industrial production and operations. There is scarcely any aspect of industrial growth that does not require modern energy supply in one way or the other. Energy aids the basic needs of businesses. For instance, it is used for varied purposes ranging from production, storage, operation processes, powering of offices and factories equipment and product display (Energy Commission of Nigeria and United Nations Development Programme, 2015). Energy is an important factor input for production, conversion,

processing and commercialization in all sectors. This makes electricity an essential commodity for all industrial types – manufacturing, services and distribution. Hence, increased energy consumption is an index of increase in industrial activities, and by inference an improvement in economic development. Electricity consumption will increase productivity and therefore growth is achieved. The productivity and growth come with multiplier effect, that is, business expansion or birth of new firms (Dickson, 2011). This, in itself, is a basis for increased revenue for Nigeria's federating states and more wealth for the nation. Availability of electricity is premised to reduce the cost of capital thereby attracting more investments and more employments.

In the development literature, reliable electricity supply is an important infrastructure in accelerating the growth of industries and by extension the economy. Hence, most economists today agree that modern energy is a necessary ingredient for stimulating the emergence, growth and continued development of small scale businesses subsector in all societies (IAEA, 2011; Muzammil & Waseems, 2013. Small and medium enterprises (SMEs) growth and continuity is the wish of both the entrepreneurs and the state, because of the important role SMEs play in the economic development of the individual and the nation at large. In Nigeria, small and medium enterprises (SMEs) are described as the heart of the economy, catalysts for technology development through innovation and indigenous technology, as well as the backbone of the nation. They play an important role in the world economy and contributes substantially to income, output and employment (Organization for Economic Co-operation and Development, 2012).

Despite the key role of SMEs in national development, the contribution of SMEs to economic growth in Nigeria has remained at a low rate due to a number of factors; top among them is the epileptic nature of electricity supply (World Bank Business Report, 2019). Among the major challenges Nigerian SMEs face is the persistent reliance on self-generated electricity resulting in a sharp increase in the cost of doing business. (George & Oseni, 2012; Oji et al., 2012). A survey by the National Bureau of Statistics (NBS, 2018) indicates that power outages annually cost manufacturing SMEs thirty-six per cent of their production cost leading to loss of revenue as much as twenty per cent. At macro level, the implication is deteriorating on business sustainability. Between 2000 and 2008 around eight hundred and twenty (820) manufacturing firms were closed down, with the figure moving up to eight hundred and twenty four (824) in the following year, all because of inadequate electricity supply and high cost on the alternative energy supply (Manufacturers Association of Nigeria, 2009). In another survey by the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), the number of SMEs in Nigeria stood at thirty-nine (39) million as at 2021, as compared to forty-one (41) million in 2017 and forty-five (45) in 2010. SMEs were projected to crash further in the subsequent years. Presently, Nigerian SMEs has dropped from thirty-nine (39) million to thirty-one million two hundred thousand between 2021 and 2023 (SMEDAN, 2023). This historical data indicate that small and medium scale industries in Nigeria are collapsing largely due to the detrimental effect of lack of electricity on productivity and profitability which in turn reduces the growth potential of the Nigerian economy.

Various attempts have been made to determine the contribution of electricity to SMEs sustainability. A large volume of the published studies around the subject reveal that the energy-business nexus is inconsistent. A considerable amount of the earlier studies showed that significant direct relationships do exist between the study variables while some studies argued to the contrary. We observe that earlier works have not studied the electricity-sustainability nexus while also observing the moderating effects of firm size, firm age and leverage. There may also be additional implication when the relationship is observed amongst firms in the Northwest region of Nigeria. Specifically, the study seeks to address the following research questions:

(i) To what extent does electricity supply relate to SMEs profitability in the study area?
(ii) What is the relationship between electricity supply and SMEs liquidity in the study area?

Consistent with the research questions, this study postulates that: Electricity supply is not significantly related to SMEs profitability in the study area; electricity supply is not significantly related to SMEs liquidity in the study area. The outcomes of this research are expected to further highlight the electricity-business sustainability paradigm as well as provide explanation for policy on SMEs in Northwest Nigeria.

2. Literature Review

2.1. SMEs Sustainability

The word 'sustainability' originates from the verb 'to sustain.' This verb, literally means to "keep (something) going over time or continuously". In relation to management, sustainability is defined as integrating the efficiency and liquidity orientation of traditional management with broader considerations of the company's internal and external stakeholders and its environmental impact (Kleindorfer et al. 2005). Sustainability covers three poles: environmental, social and economic/financial.

Financial sustainability is the focus of this study. It has received considerable attention among practitioners and researchers (Lujie, 2015; Kranja & Karuti, 2014; Peninnah, 2014). According to Shimeche and Josphat (2013), financial sustainability can be gauged objectively or subjectively by an organization's efficiency i.e. net income (the surplus of revenues over expenses); liquidity (the cash available to pay bills); and solvency (the relationship of assets and debt or liabilities). In objective measurement, these variables are analyzed from financial statements; such as balance sheet and income statement while the subjective measurements rely on the perception of firm managers or owners. Both measurement approaches have been criticized in the literature. Consequently, profitability and liquidity dimensions of financial sustainability using subjective approach are adopted so as to be able to clearly determine enterprises profitability and ability to meet short term financial obligations.

2.2. Electricity Supply

Diverse definitions on electricity abound in the literature. According to Hickling (2006), electricity is the quantity of electrical power produced and delivered to residential, commercial and industrial consumers measured in units of power called watts. A kilowatt represents 1,000 watts. Megawatt-hour (MWh) is the standard unit of electricity for a country-wide measurement. In the view of Louw, Craigwell and Moore (2008), the term electricity refers to the movement of electric charges. Holtedhl and Joutz (2004) defined electricity as a fundamental form of energy observable in positive and negative forms that occurs naturally as in lightning or is produced as in a generator and that is expressed in terms of the movement and interaction of electrons.

Lin and Quising, (2003) conceptualized the term electricity as the flow of electrical power or charge. Lehr et al. (2008) described electricity as what happens when charge carriers, called electrons, accumulate. Sambo (2005) views electricity as a type of energy that consists the movement of electrons between two points when there is a potential difference between them, making it possible to generate what is known as an electric current. Notwithstanding the earlier understanding of this important concept, Hickling (2006) electricity definition is adopted for this study as it reveals the multi-dimensional nature and measures of the electricity concept in multi-item scale.

2.3. Firm Characteristics

Firm characteristics are factors that are mostly under the control of management. Firm characteristics are those incentives variables that affect the firm's decisions both internally and externally. They refer to ownership structure, levels of diversification, financial leverage, board size, liquidity and firm sector (Lang & Lundholm, 2013). Shehu (2012) refers to firm characteristics as the attributes which a particular firm possesses that defines its activities. According to Stainer (2006), firm characteristics are the behavioral patterns of a company's operation which enables it to achieve its objectives throughout the period of its operations. Company characteristics vary from one business entity to another. These

characteristics can be determined based on the relevant information disclosed in financial statements for a particular accounting period. The firm characteristics include firm size, liquidity, leverage, sales growth, and firm age. The specific area of concern has been to establish if firm characteristics have an impact on firms' sustainability. A plethora of researches around the subject unveil that firm characteristics have significant effect on financial sustainability of firms (Dogan, 2013; Nunes et al., 2009; Wiklund& Shepherd, 2005; Yazdanfar, 2013). The firm characteristics incorporated in this study includes firm size, firm age and leverage.

2.4. Empirical Review

Research evidence from a collection of studies (Doe & Asamoah, 2014; Wang, 2002; Lai, Yik& Jones, 2008; Braimah & Amponsah, 2012; Kooijman-van Dijk, 2012; Mchopa, Kazungu & Moshi, 2014; Sing'andu, 2009; Rud, 2012; Grimm et al. 2012; Lumka, Imannuel, Nozuko, & Zukile, 2021; Ahmed & Mallo, 2015; United Nations Industrial Development Organizaton, 2009; Raymond, 2013; Abdulrahman, Issa & Ismaila, 2017; Reinikka & Svensson, 2002) on the link between electricity supply and firm sustainability have established mixed findings; positive, negative, significant and insignificant results have been reported between the variables. For instance, Doe and Asamoah (2014) used cross-sectional survey involving mixed method approach for a sample of 70 Ghanaian SMEs to study the effect of electric power fluctuations on the profitability and competitiveness of firms within Accra business district of Ghana. The study reported that unreliable electricity is negatively related to profitability (ROA and ROI). Wang (2002) found negative correlation between frequent (announced) power fluctuations and unannounced power outages with ROA and ROI for 25 listed firms in Ghana.

In the same vein, Lai et al. (2008) incorporated stochastic production frontier and a two-tail Tobit models to examine the impact of power outages on production efficiency of firms in Africa. The finding shows that the number of power outages experienced in a typical month has a negative impact on the production efficiency of firms in Africa while Ahmed and Mallo (2015) and Braimah and Amponsah (2012) found no evidence that electricity affected firm sustainability but concludes that uninterrupted electricity supply is vital for the effectiveness of businesses. Lumka et al. (2021) revealed that profitability, liquidity, efficiency, and solvency of South African SMMEs are adversely influenced by load shedding. However, some studies are of the view that poor electricity supply generally may not always impact negatively on firm's sustainability, as Cissokho and Seck (2013) found a positive effect of power outages on firms' productivity in Senegal. Aligned with the study of Cissokho and Seck (2013), Meadows et al. (2003), Tarun et al. (2013), and Maleko (2005) confirmed electricity outage to have non-significant impact on sustainability of SMEs.

The energy-business literature analyzing the energy-firm sustainability nexus is generally inconclusive, there seems to be no consensus on the existence or direction of correlation between electricity and enterprises sustainability. Besides, there is a noticeable absence of control variables in the relationship between electricity and firm sustainability. The research implication is that holistic relationships between the dependent and independent variables may be blurred and drawing clear-cut conclusion might be complicated. These contradictory findings have necessitated the importance of research into the controlling effect of firm characteristics in the electricity-enterprises sustainability in the current study.

2.5. Theoretical Review

Several theories are available on the study of electricity-firm sustainability. These theories include the balance scorecard (BSC) theory, performance prism (PP) theory, activities based costing (ABC) theory and system theory (ST). This study is anchored on system theory because it satisfies more SMEs sustainability requirements than other theoretical approaches. For instance, BSC does not examine many competitive and external factors, and does not fit the flexible environment of enterprises because of its inherent mechanization and inflexibility (Kaplan & Norton, 1996).

Similarly, PP does not also fit into flexible environment and lack dynamic adaptability. Besides, it lacks both internal and external determinants measurement (Neely & Adam, 2002). The very same benefits that make the performance prism a strong and comprehensive model, however, also make it difficult to easily utilise while ABC theory is difficult to measure external factors because it lacks flexibility and dynamic adaptabilities. In addition, ABC approach does not reflect competitive performance or respond to strategic development (Turney, 1992). However, ST is sufficient to help SMEs to set-up a dynamic and flexible sustainability measurement system which can measure both internal and external factors, including competitive performance and respond quickly to strategic development. System theory sees an organisation as a holistic system in which each part of the organisation contributes to the survival and continuity of the whole (Jackson, 2000).

3. Methods

3.1. Research Design

The survey research design was adopted to investigate the relationship between electricity and firm sustainability in Northwest Nigeria. The design was cross-sectional in nature because data was collected at one time. In order to collect data, we constructed a structured questionnaire and distributed across the selected respondents while multiple linear regression model was employed to test relationship between the study variables.

3.2. Population, Sample and Sampling Technique

The target population for this study comprises SMEs in Kaduna, Kano, Katsina, Kebbi, Jigawa, Sokoto and Zamfara state, which total 3,506 enterprises according to the national MSME collaboration survey, 2022. The enterprises are those in manufacturing, hotels and restaurants, and wholesale and retail sectors. These sectors are included in this study because their businesses depend heavily on electricity supply. The sectors also contribute significantly to the SMEs sector GDP (SMEDAN, 2022).

A multi-stage sampling technique is adopted for the research sample selection. In the first stage, purposive sampling is used in selecting SME sectors to be studied. Three out of the eleven SME sectors whose businesses depended heavily on electricity supply to survive are selected for the study that is manufacturing, hotels and restaurants, and wholesale & retail trade. Similarly, four states out of the seven states in the Northwest region were selected for this study because of homogeneity characteristics among the states. For this reason, Kaduna, Kano, Katsina and Sokoto states constitute sampled states for this study with a total final target population size of two thousand nine hundred and twenty one (2,921) SMEs. The next stage of the sampling technique involves stratified sampling. SMEs are stratified based on two criteria: sectors (manufacturing, hotels and restaurants, and wholesale & retail trade) and states (Kaduna, Kano, Katsina and Sokoto). The proportion of enterprises by sector and state is maintained to determine the sample size which is three hundred and forty (340) SMEs found by Krejcie and Morgan (1970) model.

3.3. Research Instrument and Method of Data Analysis

Data from both primary and secondary sources were collected to conduct this research. A structured questionnaire with closed ended questions is used to gather the study primary data on a five-point rating scale. Out of the three hundred and forty (340) questionnaires distributed only two hundred and forty four (245) questionnaires were returned, which showed that seventy two percent (72%) of the respondents answered the questionnaires. Due to incomplete responses for some of the questions, twenty (20) questionnaires were not analyzed. The final analysis was performed for only two hundred and twenty-five (225) questionnaires.

The four part questionnaire comprises of a section that collects data on demographic characteristics of the entrepreneurs and the enterprises. Section two contains twenty-three (23) items of firm sustainability (profitability and liquidity) adapted from Wiklund and Shepherd, (2005), Yazdanfa (2013), and Vodova

(2013) while part three and four cover ten (10) items and fourteen (14) items to measure reliability of electricity supply and firm characteristics.

The data on the number of registered SME in the manufacturing, hotel and restaurant, and wholesale and retail trade sectors within the study area were generated from secondary sources. Both subjective and objective methods were used to test for validity and reliability of the questionnaire. Before the questionnaire was put to use, its face, content, construct validity were tested. In order to ensure the face and content validity, questionnaire was proofread and approved by a panel of industry, academic and language experts during the process of pilot study. The experts were asked to judge the questionnaire in terms of understandability, important, relevance, and length. Based on the experts' judgments, some of the questions were removed, others were modified and new questions were added to some of the research variables. On the other hand, Cronbach Alpha is employed to check the reliability of the research instrument. The internal reliability is achieved at a Cronbach Alpha 0.70. Finally, mean, standard deviation and correlation as well as a multiple linear regression model were utilized to establish the relationships between the study's variables.

4. Results

The internal consistency coefficients (Cronbash Alpha) for electricity supply, firm profitability and liquidity were 0.853, 0.757, and 0.935 respectively. The results of Alpha Coefficients are satisfying and fit with standard threshold value of 0.70. In addition, statistical evidence validates the model collinearity as the tolerance values lie above 0.2 and VIF values situated below 10; therefore this study safety conclude that there is no multi-collinearity within the data. In addition, the Durbin-Watson value of model 1 was 2.239 and model 2 was 1.659, indicating no evidence of auto-correlation of the errors. The value of cook's distance of model 1 and model 2 were 0.121 and 0.213 both less than 1.00 suggesting that there is no potential problem with the outliers.

4.1. Descriptive Analyses of the Variables

The summary as depicted in Table 1 shows the sample's means, standard deviations, and bivariate correlations for all variables. The figures offer a quick snapshot of central tendency, dispersion, and how the variables move together.

Table 1. Descriptive Statistics.

		Mean	Std Deviation	Profitability	Liquidity	Elect Supp	Age	Size	Leverage
Profitability	Pearson Correl			1					
	Sig. (2 tailed)								
	N	28.716	6.6728	225					
Liquidity	Pearson Correl			.384**	1				
	Sig. (2 tailed)			.000					
	N	22.498	9.7976	225	225				
Elect Supp	Pearson Correl			.733**	.425**	1			
	Sig. (2 tailed)			.000	.000				
	N	19.276	6.5037	225	225	225			

Age	Pearson Correl			.649**	.226**	.543**	1		
	Sig. (2 tailed)			.000	.001	.000			
	N	7.067	1.5000	225	225	225	225		
Size	Pearson Correl			.389**	.175**	.342**	.352**	1	.
	Sig. (2 tailed)			.000	.009	.000	.000		
	N	7.560	1.5944	225	225	225	225	225	
Leverage	Pearson Correl			.130	.408**	.071	-.014	.006	1
	Sig. (2 tailed)			.052	.000	.291	.834	.925	
	N	9.018	3.0178	225	225	225	225	225	225

Table 1 depicts the mean, standard deviation and Pearson correlation between the study variables. The total sample selected from the population of this study consists of two hundred and twenty five (225) SME. Profitability had a mean of 28.71 which indicates relatively low extent of resources utilization efficiency. The standard deviation of 6.67 shows a low variability to the profitability average of sample firms. This implies that profitability mean is a good representation of sample data. Liquidity recorded the lowest mean of 22.49 with a standard deviation of 9.79.

The results further indicate that during the period of study, availability per hour of electricity supply had a mean of 19.27 with a standard deviation of 6.50. Low variability of standard deviation implies that electricity supply average is a true representation of the sample mean. However, mean value of 19.27 reflects that the present capacity of electricity supply fall short of requirement. This creates serious problems for electricity-reliant firms. In terms of firm years of operation, the mean and standard deviation are 7.06 and 1.50 while the mean and standard deviation are 7.59 and 1.59 for firm size respectively. This signifies that the firms were dominated by younger SME. It is also revealed that leverage has a mean of 9.01 with a standard deviation of 3.01. This indicates a weak gearing position by the firms with a relatively low variability which could be attributed to the high cost of borrowing as a result of prevailing high interest rates in Nigeria.

Table 1 further provides a matrix of the correlation coefficients for the study variables. Each variable is perfectly correlated with itself and so r = 1 along diagonal of the table. All the correlations were significant at 0.05 level. For instance, there was a significant and strong positive correlation between electricity supply and profitability with Pearson correlation coefficient of r = 0.733 and a weak and positive correlation between electricity supply and liquidity with Pearson correlation coefficient of r = 0.425. The results suggest that electricity supply is vital for SMEs sustainability in terms of profitability and liquidity. It is further shown that positive relationships exist between SMEs sustainability and firm characteristics. The relationships were significant at 0.05 level. The SMEs profitability had a weak but positive correlation (r = 0.130) with firm leverage, fairly weak correlation (r = 0.389) with firm size and a strong correlation (r = 0.649) with firm age while liquidity revealed a weak correlation (r = 0.175) with firm size, fairly weak correlation (r = 0.226) with firm age and moderate correlation (r = 0.408) enterprises leverage.

4.2. Test of Hypotheses

Electricity was run against SMEs profitability while firm characteristics were included as control variables on two hundred and twenty five (225) observations.

Table 2: Multiple Regression Analysis.

	Model 1. Dependent Variable: Firm Sustainability (Profitability)				Model 2. Dependent Variable: Firm Sustainability (Liquidity)				
	B	Std. Error	Beta	t		B	Std. Error	Beta	t
Constant	2.990	1.767		1.692	Constant	-2.035	3.569		-.570
Elect Supp	.522	.050	.509	10.374	Elect Supp	.569	.102	.378	5.595
Age	1.516	.218	.341	6.941	Age	.087	.441	.013	.197
Size	.396	.183	.095	2.158	Size	.236	.370	.038	.637
Leverage	.217	.089	.098	2.429	Leverage	1.239	.181	.382	6.865
	$R^2 = .644$					$R^2 = .326$			
	F statistics = 99.424, Sig = .000					F statistics = 26.601, Sig = .000			
	Durbin Watson = 2.239					Durbin Watson = 1.659			
	Tolerance value = 0.673, VIF = 1.486					Tolerance value = 0.673, VIF = 1.486			

The result revealed in Table 2 that model 1 had an R square equal to 0.644 indicating that 64.4% of the variations in SMEs profitability are explained by the four variables entered in the model (electricity supply, firm size, firm age and leverage). Similarly, the F-statistics (ANOVA) of the model equals 99.42, with a p-value equal to 0.000 implying the overall model is a significant predictor of the SMEs profitability. The results further indicate individual contribution of each predictor to the t-test model. The slope that is b-values show the relationship between SMEs profitability and each predictor. For these data, all the four predictors have positive b-values signifying positive relationships. So, as electricity supply increases by one unit, SMEs profitability increase by 0.522 units provided the effect of firm characteristics that is firm age, firm size and leverage held constant. Besides, every additional firm age increase is associated with an extra 1.516 provided electricity supply, firm size and leverage are held constant, Beta weight under unstandardized coefficient also indicated that a unit increase on both firm size and leverage can expect addition of SMEs profitability of 0.396 and 0.217 respectively provided other predictors are held fixed. For this model, electricity supply and firm age were significant predictors of SMEs profitability. Electricity supply t (245) = 10.374, $p < 0.001$; firm age t (245) = 6.941, $p < 0.001$; firm size t (245) = 2.158; and leverage t (245) = 2.429, from the magnitude of the t-statistics, electricity supply had the greatest impact followed by firm age whereas both firm size and leverage had similar less impact.

However, in order to evaluate the strength of each predictor variable in the model, it is important to use the standardized coefficients (beta). The beta weight indicated that electricity is the strongest predictor ($\beta = 0.509$, P = 0.000), followed by firm age ($\beta = 0.341$, P = 0.000) next is the firm size ($\beta = 0.095$), and finally, firm leverage ($\beta = 0.098$). These values indicate that as each explanatory variable increases by one (1) standard deviation, SMEs profitability increases by the product of its standard deviation and the respective explanatory variables standardized beta coefficient. Consequently, the null hypothesis (H_{01}) that, electricity supply is not significantly related to SMEs profitability is rejected and this study concludes that, electricity supply is significant related to SMEs sustainability (profitability).

In model 2, the regression result revealed that the model had an R square of 0.326 indicating that 32.6% of the variations in SMEs liquidity is attributed to the four explanatory variables that is electricity supply, firm size, firm age and leverage. The result further showed that from the magnitude of the t-statistics, electricity supply had the greatest impact followed by firm leverage whereas both firm age and size had similar less impact. In addition, the standardized beta weight indicated that electricity supply is the

strongest predictor ($\beta = 0.378$, $P = 0.000$) followed by leverage ($\beta = 0.382$, $P = 0.000$), and firm age and firm size with (($\beta = 0.013$) and ($\beta = 0.038$) respectively. Therefore, the null hypothesis (H_{02}) that, electricity supply is not significantly related to SMEs liquidity is rejected while the study concludes that, electricity supply is significant related to SMEs sustainability (liquidity).

5. Discussion

The results of this study lends credence to the claims of several prior writings on the importance of electricity supply to SMEs sustainability both in the developed and developing countries such as Lumka, Imannuel, Nozuko and Zukile (2021); Foster and Steinbuks (2009); Rud (2012); Harsdorff and Bamanyaki (2009); Grimm et al. (2012); Ahmed and Mallo (2015); United Nations Industrial Development Organizaton (2009); Raymond (2013); and Abdulrahman, Issa and Ismaila (2017). At the same time, this study is also divergent with several other researches that the net effect of electricity on business sustainability is non-significant. The suggested explanation for these contradictory findings is the remarkable lack of control variables in the previous studies regardless of the methodological differences, variables measurement and unit of analysis adopted by the studies. Therefore, this study resolves these contradictory findings by providing a more comprehensive investigation that control firm characteristics in the energy-business sustainability relationships.

6. Conclusion

Research in developing countries has paid rapt attention to the role of electricity in firm performance as well as in economic development. Various studies have tried to establish the depth of the problem caused by inadequate and unstable electricity supply in these economies. This study, in its contribution, has found that electricity supply is significantly related to SMEs sustainability, specifically registering statistically significant effect on their profitability and liquidity. Although differences were identified in terms of the effect due to the size and age of the SME studied, policy makers will do well to pay attention to the need to address the energy crisis in Nigeria. Interactions with the SME owners point to the need to not only address the stability of electricity supply but its affordability amongst struggling SME in Nigeria.

References

Abdulrahman, M., Issa, A., & Ismaila, Y. (2017). Impact of electricity service quality on both financial and non-financial performance of manufacturing small and medium enterprises in Nigeria. *Journal of Business and Social Review in Emerging Economies, 3*(1), 21–34. https://doi.org/10.26710/jbsee.v3i1.40

Ahmed, A., & Mallo, M. (2015). Impact of deficient electricity supply on the operations of small scale businesses in North East Nigeria. *International Journal of Business and Economic Development, 3*(1).

Braimah, I., & Amponsah, O. (2012). Causes and effects of frequent and unannounced electricity blackouts on the operations of micro and small scale industries in Kumasi. *Journal of Sustainable Development, 5*(2), 17–26. https://doi.org/10.5539/jsd.v5n2p17

Chong, H. G. (2008). Measuring performance of small- and medium-sized enterprises: The grounded theory approach. *Journal of Business and Public Affairs, 2*(1), 1–10.

Chow, C. W., & Van der Stede, W. A. (2006). The use and usefulness of nonfinancial performance measures. *Management Accounting Quarterly, 7*(3), 1–9.

Cissokho, L., & Seck, A. (2013). Electric power outages and the productivity of small and medium enterprises in Senegal. *Investment Climate and Business Environment Research Fund (ICBE-RF),* Research Report No. 77/13. https://www.tralac.org/documents/resources/africa/2300-icbe-research-report-77-13-electric-power-outages-and-the-productivity-of-small-and-medium-enterprises-in-senegal/file.html

Dickson, O. (2011). Government should implement energy reform aggressively. *ThisDay* (Nigeria).

Doe, F., & Asamoah, E. S. (2014). The effect of electricity power fluctuations on the profitability and competitiveness of SMEs: A study of SMEs within the Accra Business District of Ghana. *Journal of Competitiveness, 6*(3), 32–48. https://doi.org/10.7441/joc.2014.03.03

Dogan, M. (2013). Does firm size affect firm profitability? Evidence from Turkey. *Research Journal of Finance and Accounting, 4*(4).

Energy Commission of Nigeria (ECN) & United Nations Development Programme (UNDP). (2015). *Renewable Energy Master Plan: Final draft report*.

George, E. O., & Oseni, J. E. (2012). The relationship between electricity power and unemployment rates in Nigeria. *Australian Journal of Business and Management Research, 2*(2), 10–19. https://doi.org/10.52283/nswrca.ajbmr.20120202a02

Grimm, M., Hartwig, R., & Lay, J. (2012). How much does utility access matter for the performance of micro and small enterprises? *World Bank Policy Research Working Paper* (No. 77935). https://documents.worldbank.org/en/publication/documents-reports/documentdetail/612651468139487717/how-much-does-utility-access-matter-for-the-performance-of-micro-and-small-enterprises

Hickling, R. (2006). Electricity consumption in New South Wales: An application of cointegration techniques to energy modelling and forecasting. *TransGrid Economics Information Paper, 4*.

Holtedahl, P., & Joutz, F. L. (2004). Residential electricity demand in Taiwan. *Energy Economics, 26*(6), 849–865. https://doi.org/10.1016/j.eneco.2003.11.001

International Energy Agency. (2011). *Energy for all: Financing access for the poor (Special early excerpt of the World Energy Outlook 2011).* OECD/IEA. https://www.iea.org/reports/energy-for-all-financing-access-for-the-poor

Jackson, M. C. (2000). *Systems approaches to management*. Kluwer Academic/Plenum. https://doi.org/10.1007/b100327

Karanja, J. G., & Karuti, J. K. (2014). Assessment of factors influencing financial sustainability of non-governmental organizations in Isolo County, Kenya. *International Journal of Economics, Commerce and Management, 2*(9).

Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. *Harvard Business Review, 74*(1), 75–85.

Kleindorfer, P. R., Singhal, K., & Van Wassenhove, L. N. (2005). Sustainable operations management. *Production and Operations Management, 14*(4), 482–492. https://doi.org/10.1111/j.1937-5956.2005.tb00235.x

Kooijman-van Dijk, A. (2012). The role of energy in creating opportunities for income generation in the Indian Himalayas. *Energy Policy, 41,* 529–536. https://doi.org/10.1016/j.enpol.2011.11.013

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Lai, J. H. K., Yik, F. W. H., & Jones, P. (2008). Expenditure on operation and maintenance service and rental income of commercial buildings. *Facilities, 26*(5/6), 242–265. https://doi.org/10.1108/02632770810865014

Lang, M., & Lundholm, R. (1993). Cross-sectional determinants of analyst ratings of corporate disclosures. *Journal of Accounting Research, 31*(2), 246–271. https://doi.org/10.2307/2491273

Lehr, U., Nitsch, J., Kratzat, M., Lutz, C., & Edler, D. (2008). Renewable energy and employment in Germany. *Energy Policy, 36*(1), 108–117. https://doi.org/10.1016/j.enpol.2007.09.004

Lin, B., & Quising, P. (2003). *Electricity demand in the People's Republic of China: Investment requirement and environmental impact* (ERD Working Paper Series No. 37). Asian Development Bank. https://www.adb.org/sites/default/files/publication/28329/wp037.pdf

Louw, D., Craigwell, R., & Moore, W. (2008). Price reform and household demand for electricity. *Eurojournal, 4,* 181–203.

Lumka, M., Imannuel, T. H., Nozuko, P. N., & Zukile, O. B. (2021). Load shedding and its influence on South African small, medium and micro enterprise profitability, liquidity, efficiency and solvency. *Journal of Business Management, 4*(3), 28–42.

Maleko, G. C. (2005). Impact of electricity services on microenterprise in rural areas in Tanzania (Master's thesis, University of Twente). https://www.eepco-tz.org/wp-content/uploads/2011/09/Thesis-Godwin-Maleko-2005.pdf

Mchopa, A., Kazungu, I., & Moshi, J. (2014). Power rationing dilemma: A blow to small & medium enterprises (SMEs) performance in Moshi Municipality, Tanzania. *International Journal of Economics, Commerce and Management, 2*(7), 1–14.

Meadows, K., Riley, C., Rao, G., & Harris, P. (2003). *Modern energy: Impacts on microenterprises. A literature review into the linkages between modern energy and microenterprises (DFID Project Report No. KaR-R8145).* UK Department for International Development. https://assets.publishing.service.gov.uk/media/57a08cd040f0b652dd001861/R8145_modenenergylitreview.pdf

Muzammil, K., & Waseems, A. (2013). Energy crisis and performance of industry of Pakistan: An empirical study of KSE listed companies. *International Journal of African and Asian Studies, 2*(2), 50–55.

National Bureau of Statistics. (2018). *CBN/SMEDAN survey report on micro, small and medium enterprises (MSMEs) in Nigeria.*

Neely, A., & Adams, C. (2002). *The performance prism: The scorecard for measuring and managing business success.* Financial Times/Prentice Hall.

Nunes, P. J. M., Serrasqueiro, Z. M., & Sequeira, T. N. (2009). Profitability in Portuguese service industries: A panel data approach. *The Service Industries Journal, 29*(5), 693–707. https://doi.org/10.1080/02642060902720188

OECD. (2012). *The impact of the global crisis on SMEs and entrepreneurship financing and policy responses.* Organisation for Economic Co-operation and Development.

Oji, J. O., Idusuyi, N., & Kareem, B. (2012). Coal power utilization as an energy mix option for Nigeria: A review. *American Academic & Scholarly Research Journal, 4*.

Peninnah, M. M. (2014). An investigation into the factors influencing financial sustainability of women-owned SMEs in Kenya: A case of Machakos County (Master's dissertation, University of Nairobi).

Raymond, F. Y. (2013). Effect of national grid connection to the SMEs in Mbita Town in Kenya. *Journal of Advanced Manufacturing Systems, 8*(2), 247–.

Reinikka, R., & Svensson, J. (2002). Coping with poor public capital. *Journal of Development Economics, 69*(1), 51–69. https://doi.org/10.1016/S0304-3878(02)00052-4

Rud, J. P. (2012). Electricity provision and industrial development: Evidence from India. *Journal of Development Economics, 97*(2), 352–367. https://doi.org/10.1016/j.jdeveco.2011.06.010

Sambo, A. S. (2005). Renewable energy for rural development: The Nigeria perspective. *ISESCO Science and Technology Vision, 1*(May), 12–22.

Shehu, U. H. (2012). Determinants of capital structure in the Nigerian listed insurance firms. *International Journal of China–USA Business Review, 10*(12), 81–89.

Shimeche, I. S., & Josphat, K. (2013). Strategic management practices and corporate entrepreneurship: A cluster analysis of financial and business services firms in South Africa. *African Journal of Business Management, 7*(16), 1522–1535.

Sing'andu, N. (2009). An assessment of the impact of ZESCO power rationing on firm productivity and profitability: A case of selected Lusaka-based manufacturing firms (MBA thesis, Copperbelt University).

Small and Medium Enterprises Development Agency of Nigeria (SMEDAN). (2022, 2023). *Survey report on micro, small and medium enterprises (MSMEs) in Nigeria: Preliminary report (National MSME Collaborative Survey).*

Stainer, L. (2006). Performance management and corporate social responsibility: The strategic connection. *Strategic Change, 15*(5), 253–264. https://doi.org/10.1002/jsc.761

Tarun, B. K., Uddin, M. D. R., & Mondal, A. (2013). Impacts of electricity access to rural SMEs. *International Journal of Managing Value and Supply Chains, 4*(4), 17–28. (Open-access PDF: https://airccse.org/journal/mvsc/papers/4413ijmvsc02.pdf)

Turney, P. B. B. (1992). What an ABC model looks like. *Journal of Cost Management, 5*(4), 54–60.

United Nations Industrial Development Organization (UNIDO). (2009). *Scaling up renewable energy in Africa.* 12th Ordinary Session of the African Union, January 2009, Addis Ababa. https://www.uncclearn.org/wp-content/uploads/library/unido11.pdf

Vodová, P. (2013). Determinants of commercial bank liquidity in Hungary. *e-Finanse: Financial Internet Quarterly, 9*(3), 64–71. (Open-access version: https://www.econstor.eu/bitstream/10419/147078/1/785661964.pdf)

Wang, J. E. (2002). Outage costs and strategy analysis for hi-tech industries: A fuzzy multiple-goal approach. *International Journal of Quality & Reliability Management, 19*(8/9), 1068–1087. https://doi.org/10.1108/02656710210438131

World Bank. (2019). Energy available statistics.

Wiklund, J., & Shepherd, D. (2005). Entrepreneurial orientation and small business performance: A configurational approach. *Journal of Business Venturing, 20*(1), 71–91. https://doi.org/10.1016/j.jbusvent.2004.01.001

Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper & Row.

Yazdanfar, D. (2013). Profitability determinants among micro firms: Evidence from Swedish data. *International Journal of Managerial Finance, 9*(2), 151–160. https://doi.org/10.1108/17439131311307565