Research Article

Power Supply and the Performance of Small and Medium Scale Enterprises in Rivers State, Nigeria

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Abstract: This research looks at power supply small and medium scale enterprises in Rivers State, Nigeria. Primary and secondary source of data were the source of data for the study, the study aims at examining the effect of power (electricity) on SMEs, the impact of power supply on the profitability of SMEs and the effect of power (electricity) on the sales and income of SMEs in the state of Rivers. Survey method was employed in this study and Cochran's sample size formula was used as the sampling strategy since the study's population size was limitless thereby leading to a sample size of 384. Power supply indicators are used as explanatory factors in the models, whereas performance indices are used as dependent variables. Questionnaires were developed by the researchers to get the necessary information from the respondents and the data was analysed using the discrete response approach and the logistic model. The findings of the study showed that SMEs' storage of goods, productivity, and revenue were all negatively impacted by the short duration of public power supply and it serve as a bottle neck that limit the profit, sales and revenue generation of SMEs in Rivers State, Nigeria. Therefore, in order to boost productivity, profitability, and job creation in the state of Rivers, the research suggests that more electric power should be directed to the industrial region of Port Harcourt particularly during the day, money collected from SMEs in form of tax should be wisely put to use for the benefit of the general public.

Keywords: power; electricity supply; small and medium scale enterprises (SMEs); revenue; profitability

1. Introduction

In order to achieve productivity, steady development, and an improvement in people's quality of life, the economy—a complex dynamic—needs more study and better management. There has been an emphasis on small and medium scale enterprises (SMEs) as a growth engine for economies and industrial sectors in especially since the 17th century, when attempts to boost economic growth first gained traction (Adeyemi, 2011). SMEs play an increasingly important role in Nigeria's economy. This is because SMEs are the primary vehicles for the creation of the resources necessary for industrialization and consumer spending, both of which contribute to a nation's overall prosperity. Aderemi et al. (2020). Due to their diverse customer base and rapid impact on achieving macroeconomic goals (e.g., equal income distribution, full employment, etc.), SMEs play an essential role in Nigeria's economic growth. In any economy, small and medium-sized businesses have great potential for growth, both in terms of creating jobs and money. In many states, small and medium-sized businesses have provided job opportunities and improved per unit of invested capital more than larger corporations. This explains why, beginning in the 1970s, developing countries have taken such an active interest in fostering SMEs growth.

Additionally, there are a number of obstacles that have prevented SMEs in Nigeria from reaching their full potential in terms of contributing to the country's economic growth and development. These include a lack of access to long-term capital, insufficient funding, a lack of information available to potential investors, incompetent management, a lack of entrepreneurial skill, an overly burdensome regulatory and operational environment, unfavourable tariff policies, and infrastructure deficiencies like an unreliable power supply. Particularly for Nigerian SMEs these limitations reduce their performance. Despite the

common belief that access to capital is the single most important factor affecting the success of SMEs, research has shown that many of these businesses fail due to issues unrelated to money, such as poor infrastructure, lack of reliable electricity is one of the infrastructure facilities that hinders the efficiency of SMEs businesses throughout the nation. In spite of their limited financial resources, almost all SME participants now have backup power sources to keep their operations running smoothly. According to Soludo (2005) the high cost of manufacturing was a direct outcome of this circumstance. Consequently, a reliable supply of power is crucial for SMEs to make cost-effective investments.

Since Rivers State is second only to Lagos in terms of commercial activity in Nigeria, it is necessary to objectively evaluate the effect of power (electricity) supply on the efficiency of small and medium-sized businesses operating there. There are several challenges faced by the small and medium-sized businesses in Rivers State and Nigeria's industrial growth, notwithstanding the importance of these businesses. Inadequate capital and unfavourable tariff policy are two of the many variables impacting the success of the SMEs subsector. While many things work against the success of small and medium-sized businesses in Nigeria, a major one is the country's inadequate electricity infrastructure. The whole country is still plagued by power shortages and blackouts, even though the previous administration invested much in the power industry to address the dire electricity situation. Despite efforts to privatise the power industry and make the country's electricity infrastructure more reliable, the national power grid's capacity fell from 4,100 MW in 1999 to 1,300 MW in 2014 (Amadi, 2014). Power plays a very important part in the development and improvement of Nigeria's economy. Reducing SMEs' alternative cost is dependent on their access to a steady supply of power (Ofosu-Ahenkorah, 2008). Reason being, almost every industry in Nigeria need access to power. Actually, the majority of small enterprises rely on electricity as a primary resource (Watson et al., 2002). But most sectors have found that the very high incidence of power instability in Nigeria throughout the years is a real problem. Many small and medium-sized businesses have to buy costly standby generators because of the unreliable power supply, although they are still more expensive than grid energy. Along with a steady supply of fuel and replacement components, operating a generator also requires a certain level of technical knowledge.

Despite this, there has been an uptick in the amount of electricity that businesses generate on their own in recent years, particularly in sub-Saharan Africa. Businesses who have looked into alternate power sources have found that running on a steady generator power supply is costly and, in most instances, capital heavy. As an aside, customers in Nigeria essentially have no option but to pay for the critical service of electricity, which is protected from competition (Chau, 2009; Watson et al., 2002). From an economic perspective, this means that any disruptions in the electrical supply chain could potentially dampen the nation's economic growth and development, and secondly, that the general public's interests, particularly those of individuals who depend heavily on electricity, could be jeopardised due to price increases and the "degradation of quality of supply and customer service" (Chau, 2009). The above points to the need of researching how electricity supply affects the efficiency of SMEs before taking any kind of policy decision in this area. Reliability issues with the electricity supply have persisted, leading to more frequent power outages, load shedding, and rationing.

Many companies have resorted to buying expensive private generators due to the unpredictable and intermittent power supply. According to Adeyemo (2001), the private generating facilities have a capacity of more than 250 mm, which is about half of the available capacity of the Power Holding Company of Nigeria (PHCN). The capacity of a country to generate competitive businesses is directly related to the reliability and availability of its electrical supply, as this factor has a significant impact on the success of small and medium-sized businesses worldwide. Thus, the purpose of this research is to assess how the availability of electricity affects the productivity and financial health of SMEs in Rivers state, Nigeria, as well as how this factor affects the revenue and sales generated by these businesses.

Research Questions:

In an effort to find out how the availability of power (electricity) affects the efficiency of SMEs in Nigeria, this study aims to address the following research questions:

1) How does the availability of power (electricity) affect the efficiency of SMEs in the state of Rivers?

2) How much of an impact has the availability of power (electricity) had on the bottom lines of SMEs in Rivers state?

3) How does the availability of power (electricity) affect the sales and income of SMEs

in the state of Rivers?

Research Hypotheses:

The following hypotheses were made for the study:

Ho1: There is no significant relationship between power (electricity) supply and productivity of SMEs in Rivers state.

Relationship between power (electricity) supply and profitability of SMEs

Ho2: There is no significant relationship between power (electricity) supply and profitability of SMEs in Rivers state.

Relationship between power (electricity) supply and revenue /sales of SMEs

Ho3: There is no significant relationship between power (electricity) supply and revenue /sales of SMEs in Rivers state.

2. Conceptual Literature Review

2.1 Electricity Supply

James Watt (1736) defined electricity supply as the amount of electrical energy given to residential, commercial, and industrial customers. The installation of Nigeria's first producing power plant in the city of Lagos in 1898 marked the beginning of the country's electrical history (Modi & Adamu, 2016). Between then and 1950, the distribution pattern of electrical power was dispersed throughout the communities. The public works department of the federal government oversaw most of the few projects, with some being carried out by local and others by indigenous communities. Currently, out of the Power Holding Company Nigeria Entitles, which are known as Local Distribution Companies in different areas, the National Privatisation Council has reserved bidders for five producing companies and eleven distribution companies. The following distribution companies were operational in April 2014: Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port Harcourt, and Yola. All other system operations rely heavily on electricity, which is a fundamental physical facility that is part of the infrastructure (Adeyemo, 1979). Development as a crucial stimulant to development, economists stress the importance of increasing power production. It is well acknowledged that studying economic growth always includes an examination of electricity (Ukpong, 1976). The movement of a charge or electrical power is known as electricity. It is obtained via the process of converting other energy sources, known as primary sources, such as coal, natural gas, oil, nuclear power, and other natural resources. As a result, it is considered a secondary energy source. Although renewable and non-renewable energy sources may provide electricity, the energy itself is neither. We rely on electricity, which is both a natural phenomenon and a major energy source for our daily lives.

2.1.2 Small and Medium Scale Enterprise

There is no agreed-upon definition of SME in Nigeria, according to an analysis of historical descriptions of the term. In particular, CBN defined a small or medium firm (SME) as any business with an asset base of up to 200 million naira (not including land and working capital) and no minimum or maximum number of employees in its 2005 guideline on the Small and Medium firm Investment Scheme (SMEIS). According to the European Union, when a company has fewer than 250 people and a final maximum of EUR 50 million, it is considered a medium size corporation. On the other hand, a small firm is defined as one with less than 50 employees and a financial ceiling of EUR 10 million (European-Union, 2022). Companies in the US with 500 or less workers are considered SMEs. Manufacturing, wholesale, and retail SMEs were the three categories used by Japan. Businesses in the following categories: manufacturing, wholesale trade, and retail and service trades with capital amounts below ¥300 million (US$3.6 million), ¥100 million (US$1.2 million), and ¥50 million (US$600,000), appropriately. According to the federal government's 1990 budget for commercial bank loans, SMEs were defined as those with a yearly turnover below 500,000 naira and, in the case of merchant bank loans, a capital expenditure of no more than 2 million naira (excluding land costs) /a maximum of 5 million naira. SMEs were recently classified by the Financial System Strategy as businesses with fewer than 300 workers or a yearly revenue of less than 100 million naira (Banji, 2020).

2.2 Theoretical Literature

The following theories are theories that helped the study:

2.2.1 Energy Rebound Theory

One argument that opponents of energy efficiency initiatives seldom use is the energy

rebound notion. There is a tendency for energy efficiency policies to increase energy consumption, which in turn leads to economic growth and development and more CO_2 emissions. This is because efficiency policies reduce energy use and emissions, which is less than expected due to the induced behaviour adjustment of relevant economic agents (Lu, 2017). When energy production and consumption are more efficient, the economy grows and develops. Ekpo (2008) observed that the most critical aspect of infrastructure to investment is power (electricity) supply which unfortunately had been on the low side in Nigeria and statistics from state owned electricity utility firm (PHCN) showed that electricity supply is about 3400 megawatts in a country of over 200million people. He went further to conclude that fixing power (electricity) will spur economic growth and make our industries more competitive. However, when this leads to more emissions and greater environmental damage, the gains in efficiency are offset.

2.2.2 Keynesian theory

This research also considers Keynesian theory to be relevant. When it comes to regulating the supply of power to SMEs, this theory provides helpful insight into the effects of government action. This theory's strength lies in the fact that it highlights the significance of government intervention in economic affairs. According to Keynesians, private sector actions may have inefficient effects on the economy as a whole, hence they propose a mixed economy where the private sector is dominant but the public sector and government also play significant roles. Lack of government involvement in economic activities will always be a barrier to the establishment of SMEs, even in countries like Nigeria where the public and private sectors are strongly complementary. Consequently, the expansion of SMEs is highly dependent on government involvement. When seen through the lens of this research, this becomes a very significant matter.

2.3 Empirical Literature Review

The impact of power distribution on the efficiency of SMEs in southern Taraba State is studied by Arumdeben et al.(2023). The research's stated goals are to (1) determine the impact of power supply stability on the performance of SMEs in the study region and (2) determine the cost-effect of power supply on SMEs' performance. Primary data was collected by open-ended questionnaires and used in the research. Fourteen hundred and eleven managers from SMEs in the Southern Zone (IBI, Wukari, Donga, Takum, and Ussa) were interviewed using a simple random selection method. Out of the total number of questionnaires distributed, only 105 (or 92.12%) were complete and usable for the research. Ordinary least squares and descriptive statistics were used in it. Power supply reliability and cost had a favourable and statistically significant influence on the performance of SMEs in the research area. Researchers in Southern Taraba state came to the conclusion that SMEs benefit from increased power distribution. Consequently, it was suggested that in order to boost the profitability of SMEs in Nigeria, the government should provide a consistent and reliable supply of power and lower energy rates for SMEs.

In their study, Adanlawo and Vezi-Magigaba, (2021) looked at how power interruptions affected the work and economic contributions of SMEs in Nigeria. Therefore, the consequences of power supply on the expansion of SMEs in Nigeria were assessed in the research. The report looked at the potential problems that a lack of power may cause for SMEs. One hundred and ten SME operators from the Lagos state, Nigeria, LGAs of Mainland, Shomolu, and Agege were surveyed using a standardised questionnaire. To examine the data that was obtained, descriptive statistics were used. The hypothesis that was formed was tested using a chi-square approach. Electricity disruptions significantly impact SMEs in Nigeria, according to the findings.

In a study spanning 1986–2010, Nkoro and Okeke (2019) examine the relationship between Nigeria's small and medium-scale companies' power supply and their performance. Secondary data was gathered and empirical analysis was performed in order to accomplish these goals in this research. The data was anglicised using multiple regression. The researcher employed an econometric model to assess and test two hypotheses on the significance of power supply changes in Nigeria. The researcher validates that power supply variations negatively affect Nigerians and uses Ordering Least Square (OLS) to display the model's outcome. That the Nigerian GDP and balance of payment are positively affected by a one-unit adjustment in electricity supply. The report's conclusions informed a number of policy suggestions, one of which was that the government step up its fight against corruption and fraud.

Electricity supply and its effect on the efficiency of Mubi's small and medium-sized businesses was the subject of a research by Modi and Adamu (2016). The data were derived via questionnaires, which were considered primary sources. Data utilised in the coding process comes from surveys that asked about several SME-related topics in Mubi, such as their monthly turnover, the number of workers, tax information, earnings and salaries, years in operation, and spending on alternative power sources. A measure of performance was the monthly turnover, whereas a measure of power supply was kilovolt. Descriptive statistics, correlation analysis, and regression analysis were all used in the research. An inverse relationship between power supply and the efficiency of SMEs was found by the research. Regression analysis, however, revealed that electrical supply positively affects the performance of Mubi's small and medium-sized businesses. Providing a consistent source of energy was one of the study's main recommendations for helping new companies get off the ground and running.

Using data collected from 1993 to 2011, Eze and Okpala (2015) analyse how SMEs affected the rate of economic development in Nigeria. Multiple regression based on the ordinary least squares methodology was the econometric strategy used for the investigation. Nevertheless, the results of the ADF test showed that the variables are integrated of order two, 1(2), which should be sufficient to prevent erroneous estimates. It was found using the Johansen test that there is a long-term equilibrium link between growth in the economy and small and medium size businesses. The output of SMEs in Nigeria, however, is not currently contributing much to the country's economic development. The research found that bribery and corruption, a lack of entrepreneurial development centres, bad infrastructure, and ineffective tariff and incentive policies all work against SMEs in Nigeria. The research concluded that governments should work towards the following goals: microfinance institutions to help SMEs get loans easily; financial literacy programmes in schools; entrepreneurial development centres to help SMEs build their skills; adequate infrastructure, particularly in the areas of power and roads; and lastly, agencies to combat corruption and bribery.

From the above empirical literature review above, it has been seen that none of the study talks about the impact of power supply on SMSEs revenue and sales in Rivers, based on this the purpose of this research is to assess how the availability of electricity affects the productivity and financial health of SMEs in Rivers state, Nigeria, as well as how this factor affects the revenue and sales generated by these businesses.

3. Materials and Methods

The researcher used survey research design in the study. More specifically, cross sectional survey was adopted because it determines the impact of inadequate power supply on SMEs in Rivers State. According to Gaumnitz and Lere (2002), a survey undertakes the study of a large population by describing it through a close study of a representative sample that has been selected from the target population. They also stated that cross-sectional survey is concerned with what is happening at the moment and recognize the fact that a particular condition may change with the passage of time. Gaumnitz and Lere (2002) observed that for an effective conduct of cross-sectional survey, research questionnaire was required for data collection. Since there is no accurate data on the numbers of SMEs in Rivers state, Cochran's sample size formula was used as the sampling strategy since the study's population size was limitless which brings about a sampling size of 384 SMEs, three local government areas were randomly chosen from each of the three senatorial districts in Rivers state making it a total of nine LGA's. Primary and secondary data were both used and data was collected using the questionnaire which the researchers will administer face to face to the respondent. The researchers made use of primary data which enabled the researcher to personally visit the field to collect the necessary data from the respondents, and this will contribute to the results and findings of the study. Data for the study will be collected through administration of questionnaires titled the effects of power supply on medium and small businesses evaluation survey to selected SMEs in the selected LGA's of Rivers state and be retrieved at the spot. The researchers drafted samples of the questionnaire and send to some lecturers in economics department of Ignatius Ajuru university of Education who are expert and also to a lecturer in measurement and evaluation department who examined each item in terms of relevant clarity and appropriateness of language. Their comment incorporates in the correction and modification of the instrument. The measuring instrument was constructed in a way that the questionnaire item was used to measure a particular hypothesis and relevant variable that leads

the respondent to answer the question. 5likert scale with a mean criterion of 3.0 were used and Logit models were employed, while the hypothesis was tested with the use of Likelihood Ratio (LR) test, Hosmer and Lemeshow's (HL) test and pseudo R-squared to check the goodness of-fit of the model.

Here is the statement of the Cochran's sample size technique:

$$n = \frac{Z^2 . Pq}{\varepsilon^2} - (1)$$

Where

n = Sample Size

z= 95% confidence level = 1.96

ε = Sampling Error at 5% =0.05

p = maximum variability of the population at 50%, that is (0.5)

q = 1 – p = 0.5

Given the values of the parameters then,

$$n = \frac{Z^2 . Pq}{\varepsilon^2} = 384$$

Based on the result the researcher distributed 384 questionnaires to the staffs and owner of the selected SMEs in the three senatorial regions of Rivers State. Table 1 shows sectorial distributions of the questionnaires.

Table 1. Sectorial Distributions of the Questionnaires

Senatorial District	No. of L.G.A	Names of L.G.A	No. of L.G.A	Names of Selected L.G.A
Central Senatorial District	8	Emohua	3	Port Harcourt
		Ikwerre		Obio/Akpor
		Etche		Emohua
		Omuma		
		Port Harcourt		
		Obio/Akpor		
		Ogu/Bolo		
		Okirika		
West Senatorial District	8	Bonny	3	Bonny
		Degema		Ogba/Egbema/Ndoni
		Asari-Toru		Ahoada West
		Akuku Toro		
		Ogba/Egbema/Nd		
		oni		
		Ahoada East		
		Ahoada West		
		Abua/Odual		
South East Senatorial District	7	Andoni	3	Eleme

Opobo/Nkoro	Khana
Gokana	Oyigbo
Khana	
Eleme	
Oyigbo	
Tai	

Source: Authors Computation, 2023.

4. Results

4.1 The Model

$$\Pr\left(Y = \big| X\right) = k(a_0 + a_1 X_1 + a_2 X_2 + \cdots + a_n X_n) - - - - - - - (1)$$

The equation above defines the conditional probabilities of Y=1 (i.e. Y occurring) given X.

Y = the dependent variables which measure performance of SMEs, includes revenue/storage, productivity and profits

X = Explanatory Variables (hours of power supply and cost of power (electricity tariff)).

HRS = Hours of Power Supply

PRF = Profitability of SMSEs

REVS = Revenue/Storage

PCOST = Cost of Public Power Supply

COSTP = Cost of Private Power Supply

$a_0, a_1, a_2, , , , , \beta_n, are\ the\ paremeter\ estimated\ in\ the\ models$

For a more compact representation:

$$\Pr\left(Y = \big| X\right) = g(Xa) - - - - - - - - - (2)$$

In the Logit model, $\wedge(Xa)$ can be expressed as:

$$\wedge(Xa) = \frac{exp(Xa)}{1 + exp(Xa)} \quad - - - - - - - - - - - -(3)$$

The equation above is the cumulative (logistic) distribution function (cdf) and it ranges between zero and one for all values of (Xa).

$\wedge$ is a non-linear function of (Xa) and hence, we cannot use OLS.

The errors follow standard logistic distribution leading to the use of the Maximum Likelihood estimator in Qualitative Response Models.

We estimated for the following parameters:

Odd Ratios, Marginal Effects & Conditional Probability in our models

Odds Ratio: It is the ratio of probability of

Y=1 to the probability that Y=0.

• This is given as:

$$Odd\ Ratios = exp(Xa) - - - - - - - - - - - (4)$$

$$L = a_0 + a_0 * \ddot{X}_1 + a_2 * \ddot{X}_2 + a_3 * \ddot{X}_3 + a_n * \ddot{X}_n - - - - - - - (5)$$

4.2 Data Presentations

In line with the study's aims, data were analysed. The data was analysed at three different levels: primary, secondary, and tertiary. Participants were characterised by certain demographic variables in primary analyses. All demographic factors, such as age, gender, marital status, duration of service, etc., were summarised using percentages. Means, standard deviations, and logistic regression were used for descriptive statistics in the secondary analyses. Table 2 demonstrated distribution and retrieval of questionnaires.

**Table 2.** Distribution and Retrieval of Questionnaires

S/N Regions/LGAs	Questionnaire Distributed	Questionnaire Retrieved	Questionnaire Not Retrieved	Percentage of Retrievals
Central Senatorial district				
Port Harcourt	43	42	1	97.67
Obio/Akpor	43	43	0	100.00
Emohua	42	39	3	92.85
Sub-Total	128	124	4	96.87
West Senatorial district				
Bonny	43	40	3	93.02
Ogba/Egbema/Ndoni	43	37	6	86.05
Ahoada West	42	34	8	80.95
Sub-Total	128	111	17	86.72
South/East Senatorial district				
Eleme	43	42	1	97.67
Khana	42	36	6	85.71
Oyigbo	43	43	0	100.00
Sub-Total	128	121	7	94.53
TOTAL	384	356	28	92.71

Source: Authors Computation, 2023.

Each of Rivers State's three senatorial districts has three LGAs that received the survey. The senatorial district's commercial cities were the sites of questionnaire distribution throughout the chosen LGAs. Out of 384 questionnaires that were given, 356 were collected and filled out in full, accounting for 92.71% of the total.

According to Table 1 and figures 1–4, a total of 43 questionnaires were delivered to each of the three local government areas, with the exception of the Emouaha, Ahoada, and Khana LGA, which received 42 surveys. With 124 fully completed and returned surveys, the central senatorial district had the highest response rate of 96.87%. Among the senatorial districts in Rivers Central, the response rate was 100% in Obio/Akpo and 80.95% in Oyigbo; in contrast, Ahoada had the lowest percentage of response.
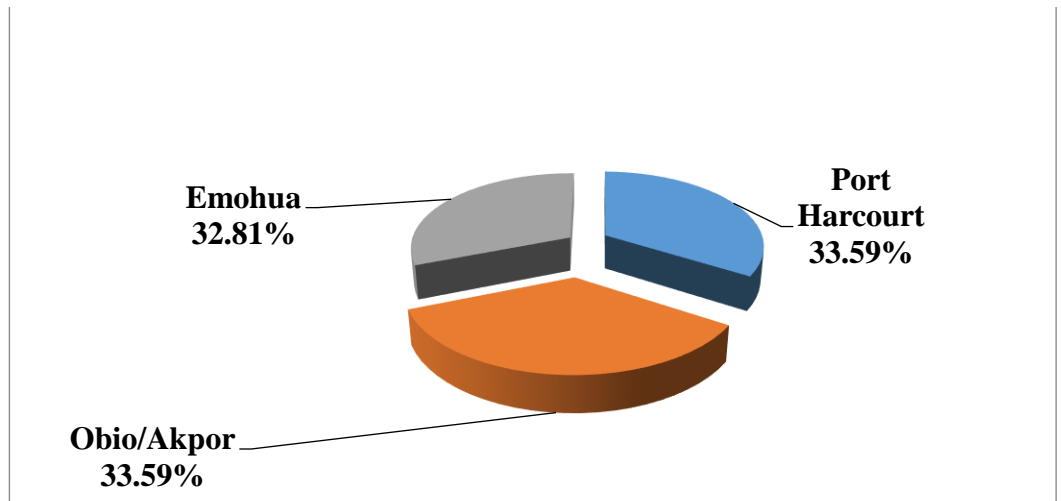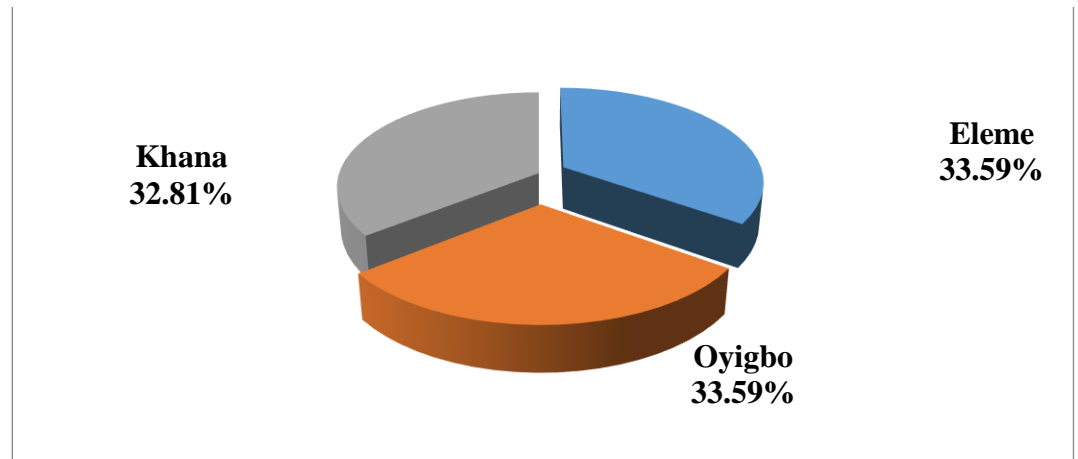
Figure 1. Percentage Distribution of Questionnaires in the LGAs in Central Senatorial District

Out of 129 questionnaires sent, about 111 individuals in the Rivers West Senatorial district filled out the survey in its entirety, yielding an overall response rate of 86.05%. Similarly, the centre senatorial district and the West Region also had the lowest response rates. With a rate of 93.12%, Bonny Local Government had the best response rate in the Rivers West Senatorial district, while Ahoada West Local Government Area had the worst, at about 70.07%.
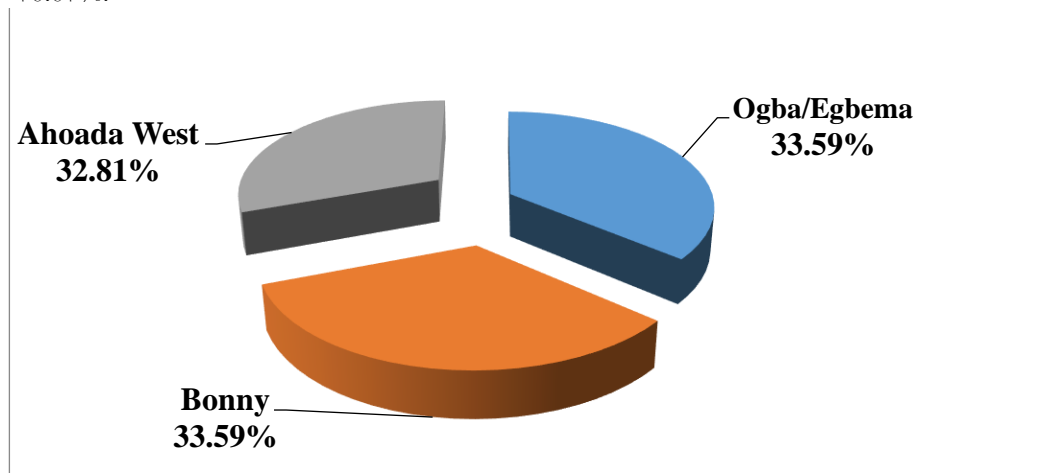
Figure 2. Percentage Distribution of Questionnaires in the LGAs in West Senatorial District

After the Central senatorial district, the Rivers South/East senatorial district performed well. Out of 129 questionnaires, 121 were recovered, representing about 93.80% of the total in the Rivers South/East senatorial constituency. Oyigbo had the best response rate in the area, with all of the given questionnaires returned in full, while Khana local government area had the lowest participation percentage at 83.21%.

Figure 3. Percentage Distribution of Questionnaires in the LGAs in South/East Senatorial District

Obi/Akpor and Oyigbo were the only local governments to receive all of the surveys, according to the distribution summary, while Ahoada West had the lowest response percentage, at about 79.07%.
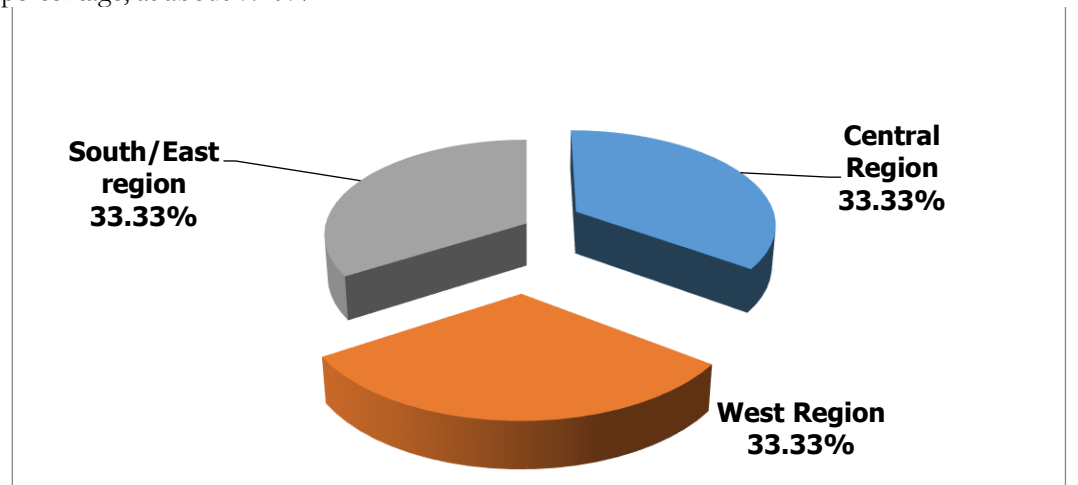
Figure 4. Percentage Distribution of Questionnaires in the LGAs in Three Senatorial Districts

Table 3. Demographic Characteristics

Details	Classifications	Frequency	Percent	Cumulative Percent
Gender	Males	238	66.85	66.85
	Females	118	33.15	100

Source: Authors Computation, 2023.

Table 3a. Demographic Characteristics

Details	Classifications	Frequency	Percent	Cumulative Percent
Age	20-29 yrs	51	14.33	14.33
	30-39 yrs	140	39.33	53.66
	40-49 yrs	165	46.34	100

Source: Authors Computation, 2023.

Table 3b. Demographic Characteristics

Details	Classifications	Frequency	Percent	Cumulative Percent
	Married	211	59.27	59.27

Marital Status	Single	145	40.73	100

Table 3c. Demographic Characteristics

Qualifications	B.SC/HND	169	47.47	47.47
	M.SC/Phd	43	12.08	59.55
	Other Degrees	144	40.45	100

Source: Authors Computation, 2023.

Table 3d. Demographic Characteristics

Details	Classifications	Frequency	Percent	Cumulative Percent
Length of Years in Business	1-5 yrs	56	15.73	15.73
	6-10 yrs	79	22.19	37.92
	11-15 yrs	87	24.43	62.35
	16-20 yrs	40	11.23	73.58
	Above 20 yrs	94	26.42	100

Source: Authors Computation, 2023.

Table 3 displays the responder demographics from each of the nine LGAs. There were 66.85 percent male responders and 33.15 percent female respondents. Only one-third of women in the Rivers States are business owners, according to the data, suggesting that men and women contribute equally to the growth of the economy there. A large portion of the participants were in the age group of 40 and above; specifically, 165 people (or 46.34 percent of the total) fell into this category, while 51 people (or 14.33 percent) were in the 20-to-29 age range. Overall, young people made just under half of the responses. This suggests that American young are not engaged in the pursuit of entrepreneurship but are instead looking for white-collar professions, or they are just sitting about and trying to find political role models. Among the respondents, 211 (or 59.27%) are married men and women from the same household, whereas 145 (or 40.73 percent) are unmarried women and men. Marriage is not considered a top priority for the majority of the state's inhabitants, according to the data. The majority of the single residents in the Rivers Senatorial district may be found in the Port Harcourt and Obio/Akpor Local Government Areas. With a bachelor's degree in law (LLB), a bachelor's degree in education (B.Ed., B., or Eng.), a higher national diploma (HND), or some combination of these, 169 people (or 47.47%) have completed their undergraduate studies. 12.08% of the participants have Master's degrees or Doctor of Philosophy degrees, which is higher than a Bachelor of Science, Bachelor of Education, Bachelor of Engineering, LLB, or Higher National Diploma. 144 people, or 40.45% of the total, hold degrees lower than a Bachelor of Science or Higher National Diploma. They have a variety of credentials, like SSCE, OND, Vocational Skills, or Known, but they also possess abilities for which certifications were not awarded. Among the businesses that were part of the study, 26.42% have been around for 20 years or more, 24.43% for 11–15 years, 22.19% for 6–10 years, 15.73% for 1–5 years, and 11.23 for 16–20 years. According to the data, 84.27 percent of the businesses that were looked at had been around for over five years.

Table 4. Respondents by Business Types

Types of Business	Frequency	Percentage
Boutiques	27	7.58
Recording Studios	5	1.40
Manufacturing firms	53	12.64
Cold Room	25	7.02
Restaurant	21	5.90
Night & Drinking Bars	30	8.43

Tailoring Shop	29	8.15
Timber	15	4.21
Hair Dressing	25	7.02
Phone Technicians	20	5.62
Furniture	19	5.34
Painting Firm	13	3.65
Poultry/Fish Farm	49	10.95
Pharmacy/Super Store	53	12.08
TOTAL	384	100.00

Source: Authors Computation, 2023.

Table 4 provides a concise overview of the types of enterprises that SMEs are involved in. The study found that the most common types of enterprises are poultry and fish farms, manufacturing organisations, and pharmacy and superstores, with respective shares of 10.95%, 12.64%, and 12.08%.

4.3 Data Analysis

Data from table 5-7 analyse the impact of power (electricity) supply on productivity, profitability, revenue/sales of SMEs in Rivers state. The data were analysed using 5likert scale with a mean criterion of 3.0 where SA – strongly agreed, A – Agreed, UD – Undecided, D – Disagree and SD – Strongly Disagreed. A mean criterion below 3.0 indicate that the respondents anonymously disagree in their collective response to the item in that particular question while a mean criterion of 3.0 and above indicate that the respondents agreed anonymously.

Table 5. Responses to the Questionnaires on the impact of power (electricity) supply on productivity of SMEs

ITEMS/SENATORIAL DISTRICT	SA	A	UD	D	SD	TOTAL	MEAN	DICISION
Central Senatorial district								
The erratic power supply has led to a decrease in our profit margin.	32	67	12	10	3	124	3.90	AGREED
We will produce/sell more goods and services if we had regular power supply	11	73	22	14	4	124	3.54	AGREED
Our business will make more profit if we had regular & reliable power supply.	30	71	14	6	3	124	3.93	AGREED
We would have made more profit if we had not been spending much on alternative power supply.	40	68	10	4	2	125	4.20	AGREED
West Senatorial district								
The erratic power supply has led to a decrease in our profit margin.	16	58	28	8	1	111	3.72	AGREED
We will produce/sell more goods and services if we had regular power supply	21	44	18	19	9	111	3.44	AGREED
Our business will make more profit if we had regular & reliable power supply.	24	63	10	8	6	111	3.82	AGREED
We would have made more profit if we had not been spending much on alternative power supply.	24	63	10	8	6	111	3.82	AGREED
South/East Senatorial district								

The erratic power supply has led to a decrease in our profit margin.	38	51	13	11	8	121	3.83	AGREED
We will produce/sell more goods and services if we had regular power supply	43	56	9	7	6	121	4.02	AGREED
Our business will make more profit if we had regular & reliable power supply.	18	41	39	12	11	121	3.36	AGREED
We would have made more profit if we had not been spending much on alternative power supply.	32	63	14	9	3	121	3.93	AGREED

Source: Authors Computation, 2023.

Table 6. Responses to the Questionnaires on the impact of power (electricity) supply on profitability of SMEs in Rivers State, Nigeria

ITEMS/SENATORIAL DISTRICT	SA	A	UD	D	SD	TOTAL	MEAN	DICISION
Central Senatorial district								
We would open more branches if we had reliable and regular power supply.	38	67	1	10	8	124	3.92	AGREED
We would expand our business to other parts of the country if we had regular power supply.	20	53	16	26	9	124	3.31	AGREED
We had closed down all/part of our branch operations due to the erratic power supply	0	26	18	60	20	124	2.39	AGREED
The duration of power supply influences the productivity of our business	57	60	0	7	0	124	4.30	AGREED
West Senatorial district								
We would open more branches if we had reliable and regular power supply.	78	32		1	0	111	4.68	AGREED
We would expand our business to other parts of the country if we had regular power supply.	34	69	3	5	0	111	4.19	AGREED
We had closed down all/part of our branch operations due to the erratic power supply	10	31	22	44	4	111	2.99	AGREED
The duration of power supply influences the productivity of our business	44	51	7	9	0	111	4.17	AGREED
South/East Senatorial district								
We would open more branches if we had reliable and regular power supply.	47	71	0	3	0	121	4.34	AGREED
We would expand our business to other parts of the country if we had regular power supply.	11	61	33	16	0	121	3.55	AGREED
We had closed down all/part of our	13	28	26	54	0	121	3.00	AGREED

branch operations due to the erratic power supply							
The duration of power supply influences the productivity of our business	34	69	15	3	0	121	4.11	AGREED

Source: Authors Computation, 2023.

Table 7. Responses to the Questionnaires on the impact of power (electricity) supply on revenue/sales of SMEs in Rivers State, Nigeria

ITEMS/CENTRAL SENATORIAL DISTRICT	SA	A	UD	D	SD	Total	Mean	DECISION
Central Senatorial district								
We will employ more workers if we had regular & reliable power supply	39	67	1	10	7	124	3.91	
We had to lay-off some of our workers because of the energy crisis	21	53	16	25	9	124	3.39	
The duration of power supply affect the revenue/sales of our business	0	26	19	59	20	124	2.37	
The erratic power supply causes a reduction in our revenue generation due to the usage of other sources of electricity.	57	60	0	7	0	124	4.30	
West Senatorial district								
We will employ more workers if we had regular & reliable power supply	78	32		1	0	111	4.68	
We had to lay-off some of our workers because of the energy crisis	34	69	3	5	0	111	4.19	
The duration of power supply affect the revenue/sales of our business	10	31	22	44	4	111	2.99	
The erratic power supply causes a reduction in our revenue generation due to the usage of other sources of electricity.	44	51	7	9	0	111	4.17	
South/East Senatorial district								
We will employ more workers if we had regular & reliable power supply	47	71	0	3	0	121	4.34	
We had to lay-off some of our workers because of the energy crisis	11	61	33	16	0	121	3.55	
The duration of power supply affect the revenue/sales of our business	13	28	26	54	0	121	3.00	
The erratic power supply causes a reduction in our revenue generation due to the usage of other sources of electricity.	34	69	15	3	0	121	4.11	

Source: Authors Computation, 2023.

5. Hypotheses Testing and Discussions of Findings

Table 8. Summary of Diagnostic Test

Hypothesis Test (the hypothesis tested are in null form)	Test Statistics	Productivity Model_1	Profitability Model_2	Revenue Model_3	Remark
The models are correctly Specified	Hat	1.0587***	0.9830***	1.5164***	Accept
	Hat_{sq}	-0.0716	0.0005	0.0117	
the overall models are statistically significant or have Goodness-of-fit test	LR	74.09***	45.00***	1145.13***	Accept
	HL	5.0838	9.7190	11.8656	
		[0.7486]	[0.2853]	[0.1265]	
	Pseudo R²	0.1331	0.2043	0.1954	

Source: Authors Computation, 2023.

*Note that the probability of HL is in square bracket and *** indicates significance at 1%*

The validity of our study depends on whether or not our models meet the requirements of the QRM. Biassed coefficient estimations or excessively high standard errors for regression coefficients are examples of issues that could arise if QRM's assumptions aren't satisfied, rendering statistical conclusions useless. So, it's important to make sure our models fit well. The analysis is considered legitimate if the Hat-statistic and Hat-square-statistic are significant or insignificant, respectively, and if the Likelihood Ratio (LR) test statistics are significant but the HL test statistics are not. According to Table 8, 'hat' has a substantial statistical value but 'hat-square' does not. The accurate specification of the models being the null hypothesis, we so accept it. Our models have goodness-of-fit, and the analysis is legitimate, as the LR statistic is significant and the HL chi-statistic is negligible. Hence, we accept the null hypothesis. Assuming that a high pseudo R-squared may reflect the goodness-of-fit of the model, the nature of the models' pseudo R-squared presents a significant challenge to this study. With R-squared values below the average of 50% (13.31% for model_1, 20.45% for model_2, and 19.54% for model_3), our model's pseudo R-squares are very low. But according to Frost (2017), R-squared values below 50% are common in fields that try to forecast human conduct. This is because, unlike physical processes, human behaviour is notoriously difficult to predict.

Table 9. The effects of Power Supply on the Performance SMEs

	Panel I: Model One		Panel II: Model Two		Panel III: Model Three	
Variable	Coefficients	OR	Coefficients	OR	Coefficients	OR
C	-4.4683***	0.0113	3.4199***	30.5947	-4.1991***	0.1479
HR	0.1603***	1.1744	0.6114***	1.8437	0.2946***	1.3434
Pcost	-0.0447*	1.0478	-0.0916*	1.0951	-0.0104*	1.0042
CostP	-0.1264**	0.8764	-0.2157***	0.8052	-0.0878**	0.9089
	1.4404		1.7026		1.3047	

Source: Authors Computation 2023.

*Note that OR=the coefficients of the Odd Ratio whereas ** and *** denotes the significance of the coefficients at the 5% and 1% respectively.*

Table 10. Mean Values of the Index of Power Supply

HOUR	COSTE	COSTA
8.3664	6123.09	9369.98

Source: Authors Computation, 2023.

The findings are laid up in tabular form. The summary of the respondent's average replies using the five-point Likert scale is shown in Table 4. According to the technique's creator, respondents are in support of the questions posed if the computed average has a

criterion mean of 3.0 or above. The resultant means, as shown in tables 5–7, are 4.00, 4.11, 4.06, and 4.25, respectively. This indicates that the respondents were in agreement that the length of time power is available has a significant impact on company productivity, revenue, and profitability. Additionally, they were in agreement that power from sources other than public utilities also had an impact. The rates of change in the performance of SMEs and electricity supply in Port Harcourt are explained using the odd ratios. Using equation 5, we can get the odds ratio for the individual rates of change in the performance indices and power supply indexes. Equation 6 is used to determine the odd ratios of the models' cumulative effects. In order to examine the effect of electricity supply on the performance of SMEs in Rivers state, we constructed three quantitative response models and used odds ratio analysis to interpret our findings.

5. Discussions

Model One: Productivity of SMSEs and the Indexes of Power Supply

Panel from Table 9 Increasing the number of hours that the public power supply is on by one will have a positive effect on the productivity of SMEs in Port Harcourt. The odds ratio favouring SMEs' productivity increases by 1.1744, or 17.44%. This means that there is a 17.14% higher chance that SMEs will be productive for every hour that the public power supply is increased by one. Increasing the durations of public electricity supply improves the productivity of SMEs in Rivers state, according to the research, as the coefficient is statistically significant at the 5% level, rejecting the null hypothesis. The odds ratio favouring SMEs' productivity drops by 1.0478, or 4.78%; put another way, for every unit rise in the cost of public power supply bills, the likelihood that SMEs' productivity will fall, or at least be lower, by 4.78%. The analysis fails to reject the null hypothesis and concludes that SMEs in Rivers state would see a major loss in productivity due to an increase in the bills of public electricity supply. This conclusion is based on the fact that the coefficient is statistically insignificant at the 5% level. The odds ratio favouring SMEs' productivity drops by 0.8764, or 12.36%; this means that for every unit rise in the cost of private power supply bills, the likelihood that SMEs' productivity will fall or might fall by 12.36%. The research concludes that a rise in the bills of private power supply would substantially reduce the productivity of SMEs in Port Harcourt as the coefficient is statistically significant at the 5% level, rejecting the null hypothesis. Based on the averages, we find that the power supply has a 1.4404, or 44.03%, positive effect on the performance of SMEs in the state of Rivers.

Model Two: Profitability of SMSEs and the Indexes of Power Supply

As shown in Table 9, panel II, there is a positive correlation between the number of hours of public power supply and the profitability of SMEs in Port Harcourt. Specifically, for every one-hour increase in the number of hours of public power supply, the odds ratio favouring SME profitability increases by 1.8437, or 84.37%. Put another way, SME profitability is more likely to occur with a unit increase in public power supply. The research concludes that increasing the durations of public electricity supply would greatly boost the profitability of SMEs in Rivers state as the coefficient is statistically significant at the 5% level. It rejects the null hypothesis. A rise of one unit in the cost of public power supply bills reduces the chances of profitability of SMEs by 9.51%. This means that for every unit increase in the cost of these bills, the probabilities of profitability of SMEs fall by 1.0951. Researchers in Rivers state were unable to reject the null hypothesis—that is, that SMSE revenues would fall sharply as a result of higher public electricity bills—because the coefficient is not statistically significant at the 5% level. For every one unit rise in the cost of private power supply bills, the odds ratio in favour of SMEs' profitability decreases by 0.8052, or 19.48%. This means that the likelihood of SMEs' profitability will reduce, or might decrease, by 19.48%. The analysis rejects the null hypothesis and concludes that SMEs in Rivers state would have a considerable loss in profitability due to a rise in the bills of private power supply. This conclusion is based on the coefficient, which is statistically significant at the 5% level. Using the averages, we find that the power supply has a positive effect on the performance of SMEs in Rivers state, with a logarithmic value of 1.7026, or 70.26 percent.

Model Three: Revenue / Sales of SMEs and the Indexes of Power Supply

In panel III of Table 9, it is shown that for every one-hour increase in public power supply, the outcome of revenue/sales for SMEs in Rivers state will be higher. The odds ratio for this outcome is 1.3434, or 34.34%, meaning that there is a 34.34% higher probability of revenue/sales for SMEs for every one-hour increase in public power supply. The analysis concludes that extending the duration of public electricity supply would considerably boost

the revenue/sales of SMEs in Rivers state as the coefficient is statistically significant at the 5% level. Hence, the null hypothesis is rejected. A rise of one unit in the cost of public power supply bills reduces the chances of revenue/sales of SMEs by 0.42%, as the odds ratio favouring profitability of SMEs decreases by 1.0042, or 0.42%. The analysis was unable to reject the null hypothesis and indicate that a substantial loss in revenue/sales of SMEs in Rivers state would occur due to a rise in the bills of public electricity supply, since the coefficient is statistically insignificant at the 5% level. The odds ratio favouring SMEs' revenue/sales drops by 0.9089, or 9.11%; this means that for every unit rise in the cost of private power supply bills, the likelihood of SMEs' revenue/sales falling or possibly falling by 9.11%. This analysis rejects the null hypothesis and concludes that SMEs in Rivers state would have a substantial drop in revenue/sales due to an increase in the bills of private power supply. The coefficient is statistically significant at the 5% level. The findings demonstrate that the power supply influences the performance of SMEs in Rivers state by a logarithmic amount of 1.3047, or 30.47%, based on the mean values.

6. Conclusions

This study examines the impact of power (electricity) supply on SMEs in Rivers state. From the findings of the study, it could be seen that the performance of SMEs in Rivers state is dependent on the level of electricity. Improving the power supply may boost productivity and profitability at small and medium-sized businesses, which in turn can increase job opportunities and the economy's overall development in Nigeria. This is why studying the impact of power supply on SME performance is so important. In light of the above, the study's authors draw the conclusion that SMEs in Rivers state would benefit from an increase in enterprise power supply, which would decrease their reliance on private power sources while simultaneously increasing their productivity and profitability. Additionally, companies are less negatively impacted by increases to public power rates compared to increases to private power prices.

6.1 Recommendations

The research concludes that the following actions should be taken by the government of Rivers state to enhance the health of SMEs, generate revenue and employment:

i) improve the length of electricity provided to the business environment with a minor increase in bills.

ii) The government should provide a reliable supply of energy, or power, since it is essential to the existence of many people and the backbone of many companies, particularly micro, small, and medium-sized ones in Nigeria.

iii) Taxes paid are a key indicator of how well SMEs in Nigeria are doing; hence, it is important that the money collected from these businesses be wisely put to use for the benefit of the general public. This will encourage tax payers to uphold their civic duty.

iv) To alleviate young unemployment and give more tax money for development initiatives, the government could provide SME loans to them with lenient terms.

v) To address the gender gap in company ownership in the state, the government should provide financial incentives to women so that they may start their own firms.

vi) In order to boost production, profitability, and job creation in Rivers state, more electricity should be dedicated to the industrial region throughout the day.

References

Adanlawo, E. F., & Vezi-Magigaba, M. (2021). Electricity outages and its effect on small and medium scale enterprises (SMEs) in Nigeria. *The Business and Management Review, 12*(1), 98-105.

Aderemi, T. A., Efunbajo, S. A., Amusa, B. O. and Rasheed, O. I., (2020): 1. Does entrepreneurship financing contribute to poverty eradication in Nigeria? Evidence from small and medium scale enterprises. *Journal of Academic Research in Economics, 12*(2), 312-322.

Adeyemi, F. U. (2011) Small and medium scale enterprise as an employment generation in Nigeria. *Journal of Sustainable Development, 1*(2).

Adeyemo, A. M. (1979) Electricity supply on the performance of small and medium scale enterprises.

Adeyemo, S. B. (2001), Energy potentials of organic wastes. Proceedings of the first national conference (pp. 55-61).

Amadi, S. (2014). Regulating Nigeria's Power Sector: Opportunities, Challenges and Prospect. Premium Times Nigeria. www.premiumtimes.com.

Arumdeben, G., Rimamnde, D. R., & Samaila Wajim, A. (2023). Effect of electricity disstirbution on small and medium enterprises in Southern – Tababa State. *BW Academic Journal, 12.* Retrieved from https://bwjournal.org/index.php/bsjournal/article/view/1322

Central Bank of Nigeria. (2010). 200 Billion small and medium enterprises (SMEs) credit Guarantee Scheme (SMECGs) Guidelines. Development Finance Department, CBN Abuja.

Chau, V. S. (2009) Benchmarking Service Quality in UK Electricity Distribution Networks. *Bench marking: An international Journal,16*, 47-69. http://dx.doi.org/10.1108/14635770910936513

Ekpo, A. H. (2008). Decentralization and service delivery: A framework. African Economic Research Consortium (AERC), Nairobi, Kenya.

Eze, T. C., & Okpala, C. S. (2015). Quantitative analysis of the impact of small and medium scale enterprises on the growth of Nigerian economy: (1993-2011). *International Journal of Development and Emerging Economics, 3*(1), 26-38.

Frost, J. (2017). How to Interpret Adjusted R-Squared and Predicted R-Squared in Regression Analysis. http://statisticsbyjim.com/regression/interpret-adjusted-r-squared-predicted-r-squared-regression/

Gaumnitz, B. R., & Lere, J.C. (2002). Contents of Codes of Ethics of Professional Business Organizations in the United States. *Journal of Business Ethics 35*, 35–49. https://doi.org/10.1023/A:1012718103007

Kayanula, D., & Quartey, P. (2000). The policy environment for promoting small and medium-sized enterprises in Ghana and Malawi. http://www.man.ac.uk/idpm.

Lu, W. (2017). Electricity consumption and economic growth: Evidence from 17 Taiwanese Industries. *Sustainability, 9*(50), 1-15

Modi, A., & Adamu, J. (2016) Impact of power (electricity) supply on the performance of small and medium scale enterprises in Adamawa state: case study Mubi North Local Government Areas. *International journal of humanities and social science research, 2*(1), 4-13.

Nkoro, I.-J., & Okeke, A. (2019). Power Supply and the Performance of Small and Medium Scale Enterprises (SMSEs) in Rivers State. *Journal of Business Ecosystem and Strategy, 1*(1), 54-61.

Ofosu-Ahenkorah, A. K. (2008). Ghana's Energy Resource Options: Energy Conservation in Energy and Ghana's Socio-economic Development, Development and Policy Dialogue Report One, George Benneh Foundation, Accra (pp. 51 - 65).

Soludo, C. (2005) Impact of Small and Medium scale Enterprises on the Nigerian Economy. *International Journal of management, 2*(3), 26-28.

Ukpong, I. I. (1976). An analysis of the causes of power shortage in Nigeria. *The Nigeria Journal of Economic and Social Studies, 18*, 34-49.

United Nations Development programme. (2010). Energizing the millennium development goals, a guide to energy role in reducing poverty. https://www.undp.org/publications/energizing-mdgs-guide-energys-role-reducing-poverty

Watson, A., Viney, H., & Schomaker, P. (2002). Customer attitudes to utility products: A consumer behaviour perspective. *Marketing Intelligence and Planning, 20*(7), 394-404. DOI:10.1108/02634500210450837