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Power supply and the performances of small and medium scale enterprises (SMSEs) in River State: A qualitative response model approach

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ABSTRACT

This paper used durations of public power supply, bills paid for public power and cost paid for private power supply as measures of power supply on the performances index of the SMSEs in Port Harcourt. The performance indexes are employed in the models as the dependent variables while the power supply indexes are the explanatory variables. The data were sourced primarily through a well-structured questionnaire and the samples determined by the Cochran sampling techniques. The data were analysis with the Qualitative Respond Model. It was revealed that lower duration of public power supply significantly reduces the profitability, productivity and revenue as well as storage of products of the SMSEs examined. Hence, the study recommended among others that there is need to allocate more electric power to the industrial area of Rivers state- Port Harcourt, especially in the day light to encourage productivity, profitability and employment generation in the state.

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1. Introduction

H Electricity played a significant role in economic growth and development of advanced nations. The need for a reliable supply of electricity to Small and Medium Enterprises (SMEs) is indeed essential for their good performances and economic growth of the nation (Viney & Schomaker 2002) as it serves as an input for most businesses. However, power supply in Nigeria has been very unstable which causes poor performances of most small businesses. It has also resulted to increased capital flight through the high rates of importations of self-power supply mechanism in many small and medium – scale enterprises in the country.

Due to unstable power supply, firms have resulted to alternative sources of power (self-power supply mechanism) which is quite expensive operating on a constant basis. Maintaining steady power supply using alternative sources (generators) has serious implication on firms' investment cost. With this, the interest of the general public, especially those who rely significantly on electricity has been put to risk through incessant price hike and degradation of quality of supply and customer service (Chau, 2009). Incidentally, this has been the case in Nigeria as many businesses hardly survive and others closed down under this unfriendly circumstance. Economically, this unstable power supply has resulted to high investment cost causing the nation's growth and development to be vulnerable.

This study investigated the effect of power supply on the performance of small and Medium Scale enterprises (SMEs) in Port Harcourt which is one of the major commercial cities in Nigeria. Apart from the introductory section, the paper is divided into four sections. Section two focuses on the literature review. Section three discusses the variables and highlights the methods of the analysis. Section four looks at the empirical results and the discussion of the findings while the last section deals on conclusion of the study.

2. Literature review

According to Ologundudu (2014) there are superfluity of literature on the interaction of power supply and its effect on small and medium scale industries development. However, there is no enough literature on the impact of power supply on small and medium scale enterprise development in Nigeria.

From a study carried out by Modi, & Adamu (2016) impact of power (electricity) supply on the performance of small and medium scale enterprises in Adamawa State; case study Mubi North Local Government Area, discussed extensively on the importance of the power supply on small and medium scale enterprises in the state. The study uses simple percentages, tables and a chi-square model of estimation to analyze its results. The study concluded that there is a positive significant relationship between power supply, small and medium scale industries and development in the state. Odell (2012) argued that for Columbia to be industrialize, electricity supply and demand are paramount and must be factored in, in the process of industrialization or development.

Reinikka & Svensson (2002) found in their studies that unreliable and inadequate electric power supply (which compelled firms to invest in backup generations) greatly reduces firms' investment in other productive activities. In Nigeria, it has been estimated that firms firm's self-power generation at a cost that ranges between 16 to 30 times higher than the publicly provided electricity (Reinikka & Svensson, 2002).

Thus, the unreliable supply of electricity imposes enormous costs on the firm. Such costs include raw materials damages, equipment spoilage and loss of productive man-hours and forgone sales, disruption of production, reduced profits and management attention among others. As a strategy of mitigating the costs of unreliable or inadequate power supply firms invest in backup facilities to generate owned electricity in their industrial yardAs a result many firms are forced to maintain backup generation capacity. However self-generation of electricity generally costs differential limits the potentials of self-generation as a permanent substitute or solution to power supply unreliability (United Nations Development programme 2010; Ahmed & Mallo (2015) attributed the non-competitiveness of Nigeria's export goods to poor infrastructure especially electricity supply, which drives the running cost of firms.

The literature that seeks to examine the effects of power (electricity) supply on the performance of small and medium scale industries in Port Harcourt city has not been without criticism. In explaining the phenomenon of divergence in the provision of social infrastructure, the Oke (2017) opined that government intervention in the regulation of the economy is mandatory in terms of supply of electricity to the small and medium scale enterprise in the country.

Modi & Adamu (2016), Ologundudu (2014) and Ndebbio (2006) observed that electricity supply drives industrialization process. They submitted that a country's electricity consumption per capita in kilowatt hours (KWHs) is proportional to the state of industrialization of that country.

The empirical papers reviewed have focused on the impact of power (electricity) supply on the performance of small and medium enterprises in Nigeria. However, the studies on both phenomena appear to be scarce and this work will add to the few existing literature on the subject matter.

3. Research and methods

The paper focused on the effect and analysis of power supply on the performance of the SMSEs in Port Harcourt Metropolis. Selected performance indicators such as revenue, productivity and net profit were used to measure the performance of the SMSEs while hours of power or electricity available and cost of electricity or power are use as the measurement of power supply index. The cost of electricity or power supply is divided into public and privates sources.

The samples were selected randomly and are determined with the Cochran's sample size formula. The formula is used because there are no accurate records showing the total population of SMSEs in the metropolitan, hence, the population of the study is unknown. The Cochran's sample size technique is stated as follows:

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

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,

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

384 questionnaires were randomly distributed to the staffs and owner of the selected SMSEs.

3.1 Data analysis

In achieving the prior conceived objectives of the paper, a combination of qualitative and quantitative method of analysis was used(Keynes, 1936; McFadden, 1984; Maddala, 1983; Dhrymes, 1984; Manski & Thompson, 1986; Maddala & Flores-Lagunes, 2001; Agresti, 2002; Cameron, 2009; Greene, 2008; and Hensher & Greene, 2009). The models showing the effect of power supply on the performance of SMSEs was developed with the Discrete Response techniques. The Discrete Response technique was applied because the responses of the dependent variables are binary and involve a non-linear estimation. It follows the analogy of Logistic regression instead of the Ordinary Least Square (OLS) because the responses are non-normal and therefore, the linear estimators such as OLS are not applicable. Its error term tends to exhibit heteroscedasticity. Thus, the application of OLS will bias the standard errors and hence inferential statistics using the standard errors such as the t-values will be Is it invalid or validated or will be useful in the analysis. Thus, the Logit models are employed to resolve the highlighted problems inherent in the use of linear estimators.

3.2 The model

$$\Pr\left(Y = \middle| X\right) = k(\alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \cdots + \alpha_n X_n) \quad (3)$$

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

Y = the dependent variables which measure performers of SMSEs, they 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

$$\alpha_0, \alpha_1, \alpha_2, , , , , \beta_n, are\ the\ paremeter\ estimated\ in\ the\ models$$

For a more compact representation:

$$\Pr\left(Y = \middle| X\right) = g(X\alpha)$$

In the Logit model, $\wedge(X\alpha)$ can be expressed
as

$$\wedge(X\alpha) = \frac{\exp(Xa)}{1 + exp(X\alpha)}$$

The equation above is the cumulative (logistic) distribution function (cdf) and it ranges between zero and one for all values of$(X\alpha)$.
$\wedge$ is a non-linear function of$(X\alpha)$ 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:

$$Odd\ Ratios = exp(X\alpha)$$

$$L = \alpha_0 + \alpha_0 * \ddot{X}_1 + \alpha_2 * \ddot{X}_2 + \alpha_3 * \ddot{X}_3 + \alpha_n * \ddot{X}_n$$

The data were analysed in-line with the objectives of the study. Three levels of data analysis were adopted viz primary, secondary and tertiary analyses. The primary analysis described participants based on specific demographic characteristics. Demographic characteristics were summarized using percentages for all variables including: age; gender; marital status and length of service, etc. The secondary analyses involved descriptive statistics using means, standard deviations, and the test of hypotheses using logistic regressions. The tertiary analysis involves the diagnostic and robustness check of the estimated models.

4. Results and discussion

384 questionnaires were distributed and 88 percent were retrieved and completely filled. Eighty eight or 337 are considered enough for the research.

$$Valid = \frac{337}{384} x100\% = 88\%$$

Table 1: Demographic Characteristics

Details	Classifications	Frequency	Percent	Cumulative Percent
Gender	Males	220	65.2819	65.2819
	Females	117	34.7181	100
Age	20-29 yrs	58	17.21068	17.21068
	30-39 yrs	129	38.27893	55.48961
	40-49 yrs	150	44.51039	100
	Married	233	69.13947	69.13947
Marital Status	Single	104	30.86053	100
Qualifications	B.SC/HND	171	50.74184	50.74184
	M.SC/Phd	35	10.38576	61.1276
	Other Degrees	131	38.8724	100
Length of Years in Business	1-5 yrs	48	14.24332	14.24332
	6-10 yrs	74	21.95846	36.20178
	11-15 yrs	91	27.00297	63.20475
	16-20 yrs	35	10.38576	73.5905
	Above 20 yrs	89	26.4095	100

Source: Researcher Computation, 2019

The analysis uncovered that the distribution of the ownership of SMSEs between man and women are uneven as more men are discovered to own majorities of the businesses interviewed. Also more businesses in the city have lasted for more than 10 years, showing the level of consistence and productivity in the area.

Table 2: Major Source of Power

	1-5 Hours	6-10 hours	10 Hours and above
Public	214	81	42
Private	176	133	28

Source: Researcher Computation, 2019

Table 2 above shows that 214 of the business reveals that the duration of power supply within business periods are 1 to 5 hours daily and majority of the SMSEs argued that they use more of private sources of power supply for their business than public source.

The firms enjoying public power supplies for the duration of 1 to 5 hours a day are more implying that the rest working and business hours are powered through private sources.

Table 3: Respondents by Business Types

Types of Business	**Frequency**	**Percentage**
Boutiques	27	8.01
Recording Studios	3	0.89
Manufacturing firms	42	12.46
Cold Room	21	6.23
Restaurant	21	6.23
Night & Drinking Bars	30	8.90
Tailoring Shop	29	8.61
Timber	11	3.26
Hair Dressing	23	6.82
Phone Technicians	17	5.04
Furniture	19	5.64
Painting Firm	11	3.26
Poultry/Fish Farm	39	11.57
Pharmacy/Super Store	44	13.06
TOTAL	**337**	**100.00**

Source: Researcher Computation, 2019

Table 3 summarizes the nature of businesses the SMSEs are operating. It was uncovered that Poultry/Fish Farm;manufacturing firms; and Pharmacy/Super Stores account for 11.57, 12.46 and 13.06 percent of the major businesses studied.

4.1 Data analysis and hypotheses testing

Table 4: Index of Power Supply and SMSEs Performance Indicators in Port Harcourt

Questions	**SAD 5**	**AD 4**	**UD 3**	**DA 2**	**SD 1**	**Total**	**Mean**
Does the duration of power supply influences the productivity of your business	104	180	18	30	5	337	**4.00**
To what extent does the duration of power supply affect the revenue/sales of your business	98	213	10	12	4	337	**4.11**
Does other sources of power outside public sources affect:							
Productivities	112	177	27	16	6	337	**4.06**
Profitability	109	208	11	8	1	337	**4.25**

Source: Researcher Computation, 2019

Table 5: 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 model statistically significant or have Goodness-of-fit test	LR	74.09***	45.00***	1145.13***	Accept
	HL	5.0838 [0.7486]	9.7190 [0.2853]	11.8656 [0.1265]	
	Pseudo R^2	0.1331	0.2043	0.1954	

Source: Researcher Computation, 2019 Note that the probability of HL is in square bracket and *** indicates significance at 1%

In order for our analysis to be valid, our models have to satisfy the assumptions of the Qualitative Response Model (QRM). If the assumptions of the QRM are not met, we may have problems, such as biased coefficient estimates or very large standard errors for the regression coefficients, and these problems may invalidates the statistical inferences. Therefore, the need to check that our models are fits sufficiently well.

The assumption is that if the hat-statistics and hat-square-statistics are significant and insignificant respectively and that the Likelihood Ratio (LR) test statistics is statistically significant and the Hosmer & Lemeshow's (HL)test statistic is not significant, then the analysis are valid.

Results from table4shows that the 'hat' is statistically significant and 'hat-square' is not. Thus, we accept the null hypothesis that the models are correctly specified. Since the LR statistic is significant and the chi-statistic of HL is insignificant we therefore accept the null hypothesis and conclude that our models have Goodness-of-fit and that the analysis are valid.

The major constraints face in this research work is the nature of the Pseudo R-square of the models, the assumption is that a high Pseudo R-Squared may suggest goodness-of-fit of the model. The Pseudo R-squares of our models are very low since the R-squares of model_1, model_2 and model_3 are 13.31%, 20.45% and 19.54% respectively which are below the average R-square of 50%. Nevertheless, Frost (2013) argued that any field that attempts to predict human behavior, typically has R-squared values lower than 50% because human behavior are simply harder to predict than, say, physical processes.

4.2 Logit models estimation

Table 6:the effects of Power Supply on the Performance SMSEs

	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 2019. Note that OR=the coefficients of the Odd Ratio whereas ** and *** denotes the significance of the coefficients at the 5% and 1% respectively.

Table 7: Mean Values of the Index of Power Supply

HOUR	COSTE	COSTA
8.3664	6123.09	9369.98

Source: Authors Computation 2019

The results are presented in tables. Table 4 shows the summary of the average responses from the respondent using the five point Likert average. The originator of the technique argued that if the calculated average is greater than the criteria mean of 2.5 the respondent responses are in favor of the said questions.

The calculated mean as summarize on table 4 are 4.00, 4.11, 4.06 and 4.25 indicating that the respondent agreed that the duration of power supply influences the productivity of businesses in Port Harcourt, that is, the duration of power supply affects the revenue/sales of the business immensely. Also, it shows that other sources of power outside the public sources affected productivity and profitability immensely.

The odd ratios are used for the explanation of the rates of change in SMSEs performance and power supply in Port Harcourt. The odds rations for individual rates of change in the performance indexes and power supply indexes are calculated using equation 5. The odd ratios of the cumulative effect of the models are calculated with equation 6.

Three Quantitative Response Models were developed and, results were interpreted based on the odds ratio to see the impact of power supply on the performance of Small and Medium Scale Enterprises in Port Harcourt.

Model One: Productivity of SMSEs and the indexes of power supply

Table 6, panel I shows that a unit increase in the hours of public power supply will increase the outcome of productivity of the SMSEs in Port Harcourt, the odds ratio in favour of productivity of the SMSEs increase by 1.1744 or 17.44%; that is a unit increase in the hour of public power supply increase the probability of productivity of the SMSEs or may increase the probability of productivity of the SMSEs by 17.14%. Given the mean values the results shows that the Log of odd in favour of power supply influencing the performance of the SMSEs in Port Harcourt is 1.4404 or 44.03%.

Model Two: Profitability of SMSEs and the indexes of power supply

Table 6, panel II shows that a unit increase in the hours of public power supply will increase the outcome of the profits of the SMSEs in Port Harcourt, the odds ratio in favour of Profitability of the SMSEs increase by 1.8437 or 84.37%; that is a unit increase in the hour of public power supply increase the probability of the profits of the SMSEs or may increase the probability of Profitability of the SMSEs by 84.37%. Given the mean values the results shows that the Log of odd in favour of power supply influencing the performance of the SMSEs in Port Harcourt is 1.7026 or 70.26%.

Model Three: Revenue /Storage of SMSEs and the indexes of power supply

Table 6, panel III shows that a unit increase in the hours of public power supply will increase the outcome of the Revenue /Storage of the SMSEs in Port Harcourt, the odds ratio in favour of Revenue /Storage of the SMSEs increase by 1.3434 or 34.34%; that is a unit increase in the hour of public power supply increase the probability of the Revenue /Storage of the SMSEs or may favor the probability of Revenue /Storage of the SMSEs by 34.34%. Given the mean values the results shows that the Log of odd in favour of power supply influencing the performance of the SMSEs in Port Harcourt is 1.3047 or 30.47%.

The results shows that the firms interviewed suffers from insufficient power from the states, leading to them looking elsewhere for alternative power which have dear implications on their productivity, revenue and profitability. The chances for increasing productivity and profitability of the firms are heavily dependent on states power. Also, the mean of the Likert scale indicates that lower durations of public power supply is what leads to alternative or private power supply; and that private sources of power supply contributed to the increase in the cost of production and reduces the revenue as well as profitability of the SMSEs. Lower duration of public power supply significantly reduces the profitability, productivity and revenue as well as storage of products of the SMSEs examine. A private source of power increases the cost of productions and reduces profitability significantly as shown on Table 6. This have contributed to low productivities of the firms and affected their contributions to economic growth and development of the Nigerian economy. This study has revealed the urgent needs for sincerity from the states in their investment in the power sector. It has shown how insufficient powers have weakened the contributions of the SMSEs to economic growth in Rivers States.

5. Conclusions

The analysis of power supply on the performance of the Small and Medium Scale Enterprises is very crucial as it investigated how improvement in power supply can trigger the productivities and profitability of the firms and as well as enhance employment generation and economic growth of the Nigeria economy. Following the findings above the study therefore concluded that improve in the supply of public source of power to SMSEs will reduce the dependency of the firm on private source with it numerous environmental degradation and enhance the productivity and profitability of SMSEs in Port Harcourt. Also the paper is of the opinion that public power supplier should try and increase the duration of power daily as this may channel income from the external sector to the government. Finally we observed that the increased in the bills of public power supply is not as detrimental to the healthiness of the business as the increase in the cost of private sources of power supply. Base on the findings the paper suggested that

i. The government of Rivers state should improve on the duration of power supplied to the business environment with an insignificant increased in bills as this will improved the healthiness of the SMSEs as well as generating income and employment.
ii. There is need to reallocate more power to the industrial area of Rivers state, especially in the day light to encourage productivity, profitability and employment generation in the state.

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