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ASSESSMENT OF THE EFFECT OF POWER SUPPLY OUTAGE ON SMALL AND MEDIUM ENTERPRISES PERFORMANCE (A CASE OF METAL FABRICATION IN BIRNIN KEBBI METROPOLIS)

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ABSTRACT
This research aims to analyze the effect of power supply outages on the productivity and profitability of small and medium enterprises. This research is a cross-sectional survey. A sample of 32 SMEs was selected using a non-probability sampling procedure in the form of purposive sampling techniques. The criteria for selecting the SMEs include their location within the Birnin Kebbi metropolis and electricity use in the business operation. A structured questionnaire was used to collect the data for the study. MRM in the form of OLS was employed. StataCorp 14.0 (2015) was used to analyze the data. The result of the finding reveals that 90.91% of the enterprises studied indicated that power supply outage was the major constrained to their productivity and profitability, with an average of 180 hours of power outages per month lasting 6 hours per day, causing the enterprises an average of N240, 000:00 monthly. This study suggested that there was a need for the Kebbi state authority to establish an independent power plant to bridge the gap from the National grid for improved efficiency of SMEs in the metropolis.

Keywords*:* Power Supply Outage, Performance, Productivity and Profitability

INTRODUCTION

In Nigeria, small and medium enterprises form the most significant percentage of businesses, including the manufacturing sector of many countries MAN (2014). SMEs are highly essential for economic development. This is due to their contributions to the economic and social improvement of the nation. Keskin, santur, sunburnt and Kirris (2010) identify several SMEs' contributions to various economies, including increasing employment, export promotion and enhancement of entrepreneurship. Ayanda and Adeyemi (2011), in a research conducted on survival strategy for employment generation in Nigeria, add that SMEs also assist in reducing poverty, creating wealth and reducing income disparity through their income distribution role. Also, Rasak (2012), in his research on Small and medium enterprises as a panacea for economic growth in Nigeria, found that SMEs act as sources of employment for numerous citizens and assist in the process of industrialization, input substitution and export earnings of all countries. It also helps to stabilize income, lessen poverty and unemployment in many developing countries, requires a minor skill to be established, upturns productivity and aids in the utilization of human and capital resources that would have been left idle if they had to wait for a massive sum of money to start large scale business, Omonigho (2017).

The importance of electricity to the economic development of any nation cannot be overemphasized. Subair and Oke (2008) admitted that electricity supply, mainly used for driving machines for the production of various items, is a strong factor that will enhance the productivity of the manufacturing sector and thereby contribute significantly to the development of the economy. Power supply outage has, over the years, constituted a major source of concern to many developing countries, including Nigeria, Akuru and Okoro (2014); The consequence of it has not only affected the household customers and the service sector alone but also found to have negative impacts on the performance of manufacturing companies Aliyu, Ramli, and Saleh (2013); Gado and Nmadu (2012). An electric power outage, which has many social and, most importantly, economic outcomes, is an undesired and unpleasant event that leads to inevitable damage to society; therefore, since it has so many motivating factors, studying and estimating the outage costs have been an attractive and popular field of study for the recent years. Even with this, although there are many studies and research on reliability cost analysis, the problem is that no rigid and exact method estimates the proper economic outcomes of an outage perfectly, Sinan (2011). Power supply outage is the most significant infrastructure problem confronting the SME sector, and the typical Nigerian firms experience power failure or voltage fluctuations about fifteen times per week, each lasting for about two to six hours, without the benefit of prior warning. This imposes a high cost on the SMEs arising from idle workers, spoiled materials, lost output, damaged equipment and restart costs. Small and medium manufacturing enterprises are the worst affected by these challenges posed by electricity power outage problems Aliyu et al. (2013).

Small and medium enterprises (SMEs); According to the central bank of Nigeria (CBN, 2003), define micro-enterprises as those with less than ten personnel and less than ₦ 500, 000.00k capital base; small enterprises are those that have less than 50 personnel and less than 1 million capital base, while medium enterprises are classified as those that employed between 50 to 99 staff and a capital base of less than N 150 million. According to SMEDAN (2012), Micro, Small and Medium enterprises were defined as follows: Microenterprises: any enterprises employing between 1 to 9 people and having a capital base from ₦ 1 million to ₦ 5 million, excluding the cost of land. Small enterprises: are those that employ between 10 and 49 employees and have a capital base from ₦ 5 million to ₦ 50 million, excluding the cost of land. Medium enterprises: any enterprises that employ 50 to 199 employees and have a capital base from ₦ 50 million to ₦ 500 million, excluding the land cost. This research aims to determine the effect of power supply outage on performance (proxy productivity and profitability) in Metal Fabrication in the Birnin Kebbi metropolis. The hypothesis of the study is stated as follows,

$H_0$1, the electricity power supply outage cost does not significantly affect the SME's performance in the study areas.

LITERATURE REVIEW

Definitions of Term

Power Supply outage (a power cut, a power out, a power blackout, a power failure, a power loss, or a blackout) is defined as the loss of electrical power network supply to an end user (Wikipedia).

Electricity power supply; according to Adeyemo (2009), electricity is part of the infrastructure, which is the basic physical facility upon which all other system activities significantly depend. It is a factor input in the production process of small and medium enterprises and the manufacturing sector in general. Electricity supplies significantly impact economic activities Velesquez and Pichler (2010). The power supply is the most crucial commodity for a nation's development. With electricity energy, people are empowered to work from the domestic level to the cottage industries, and through the small and medium industries, employment is generated.

Performance; according to Yucesoy and Barabasi (2016), performance represents the totality of objectively measurable achievements in a particular domain of activity, the term "performance" is often used to evaluate the work finished by an enterprise and to measure competitiveness.

Productivity; It is generally defined as the ratio of output produced per unit to resources consumed. It can also be defined as "the rate at which a worker, a company produces goods, and the amount produced, compared with how much time, work and money are needed to produce them" Hornby (2006). Productivity is the efficiency and effectiveness with which inputs (Land, capital, labor, materials, time, energy etc.) are combined and utilized in an environmentally and socially sustainable manner to produce quality goods and services to satisfy human needs Gbenga (2014).

Profitability; Profitability means the ability to profit from all business activities of an organization, company, firm, or enterprise. It shows how efficiently the management can make a profit by using all the resources available in the market. According to Harward and Uptom (1961), “profitability is the “ability of a given investment to earn a return from its use." However, the term ' Profitability is not synonymous with the term efficiency' Profitability is an index of efficiency and is regarded as a measure of efficiency and management guide to greater efficiency.

Relationship between Independent and Dependent variables

Studies have been conducted by many scholars in the field of Development economics on the issues related to power supply outages on small and menterprises'prises performance. Among them are Frederick and Josephine (2016), who studied the effect of power supply outages on the performance of small and medium enterprises in Tema and the Northern part of Ghana, using the Chi-square (X^2) and the ordinary least square method with a sample size of 710 firms. Their research findings reveal that power outages negatively affect SMEs' performances (Profitability),

especially in the Northern part of Ghana. Also, studies conducted by Onwumere and MA (2016) using simple descriptive statistics, correlation, and multiple regression analysis on power switches for SMEs reveal that food services productivity and profitability are more affected by power switches.

According to Andrew et al. (2014), in their studies on how electricity insecurity affects businesses in low-income countries, using secondary data from four selected countries using regression analysis. Their finding reveals that electricity insecurity hurts the total labor productivity in the firms' business activities. A study conducted by Doe and Asamoah (2014) on electric power fluctuation on profitability and competitiveness using a cross-sectional survey and mixed method approach with a sample size of 70 SMEs reveals that without reliable power supply, SMEs are unable to produce an increased quantity and quality product leading to poor sales which at long run affect their profitability.

According to Busani (2012), in his study on Do power cuts affect productivity in manufacturing firms in Nigeria using OLS and Tobit models, his findings revealed that power cuts negatively and significantly affect productivity, particularly for small firms. A study conducted by Lassana (2018) on the cost of power outages of manufacturing SMEs productivity in Senegal using panel data and stochastic frontier model revealed that power outages have a negative significant effect on the productivity of SMEs, and small firms appear to be affected more than the large firms. The finding further reveals that firms with generators were successful in countering the adverse effect of power outages on productivity.

Also, a study conducted by Stephen and Milton (2020) on the cost of power outages on enterprises performance in Kenya investigated the effect of power outages on firm performance using World Bank Enterprises survey data (2018), employing instrumental variables regression as well as between power outages and firm profitability. Also, their finding shows a positive relationship between efficiency levels, energy utilization and firm profit. They recommend that the government increase investment in electricity generation and address inefficiency within the power sector to ensure reliable supply and enhance enterprises' performance. Also, Lassana (2015) conducted a study on the effect of power outages on the productivity of SMEs, in general, using the generalized linear model in his analysis; his results revealed that power outages have a negative active significant effect on productivity and an alternative source of power helps firms to be more productive. Aremu and Adeyemi (2011), in their studies on SMEs' survival strategy for employment generation in Nigeria, their findings revealed that SMEs in Nigeria cannot run profitable businesses on power generating sets in a highly competitive and open economy like Nigeria because of the high cost of fuel and maintenance. A study conducted by Abdisa (2018) on power outages and their economic cost on firm performance in Ethiopia using survey data revealed that power outages affect firms' productivity negatively while large firms are most affected.

METHODOLOGY

Theoretical framework of the study

Making an investment decision is critical to business activities relating to or affecting the overall business objectives. The profitability level of a firm depends on how good or bad its investment decision is. While a sound investment decision increases the profitability and enhances the financial viability of firms, poor choice of investment reduces the financial capability and sometimes causes firms to be liquidated. Investment in fixed capital, often referred to as business fixed investment, has both the relative costs and (expected) benefits that often influence a firm's decision to embark on such spending. The user or rental cost of investment is affected by the price of capital, the real interest rate and the depreciation rate4. The real cost of a unit of capital to a firm is the ratio of the rental cost to the price of a unit output produced from the capital installed.

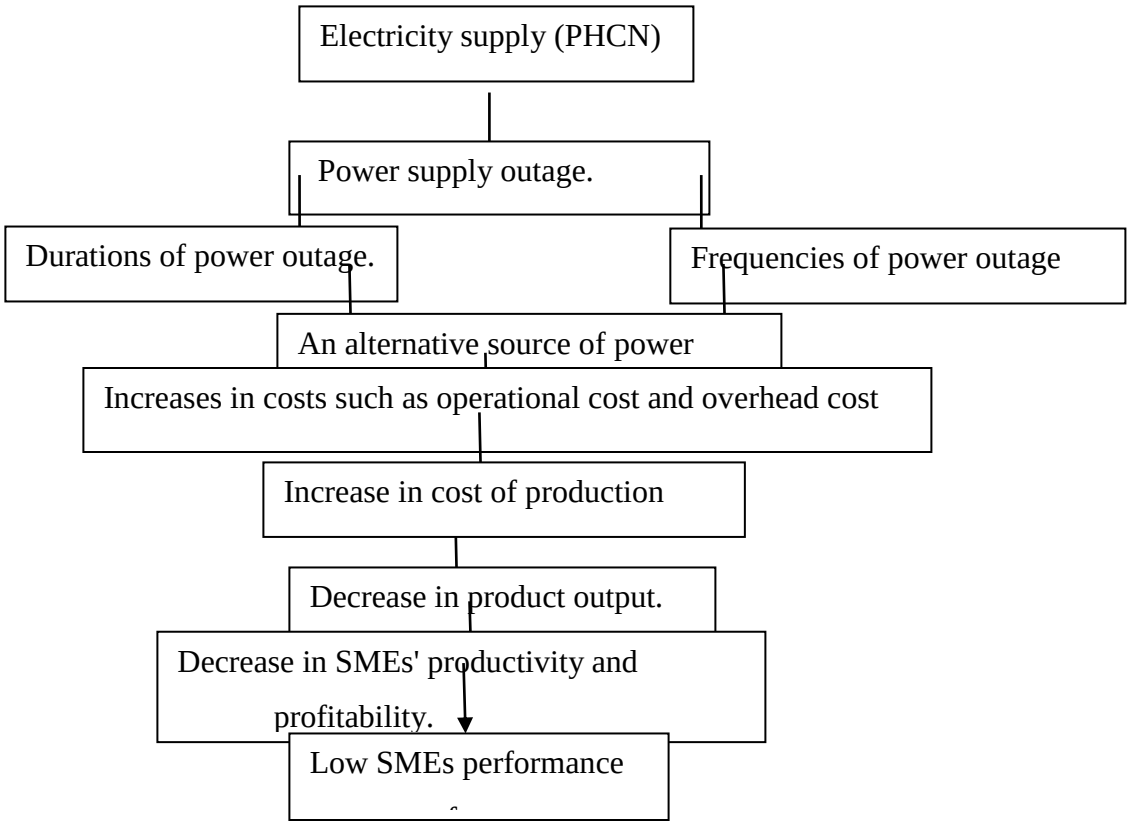
On the other hand, the benefit of a unit of capital is the marginal product of output derived from adding it to the production process. Like the cost, the extent to which a firm benefits from capital investment depends on the existing capital level, labor employed, and technology level. A rational firm will invest in capital if the marginal product of capital exceeds or equals the associated marginal cost and vice versa (Jorgenson, 1963). In other words, firms equate the expected marginal benefit from that investment to the marginal cost in making an investment decision.

Investing in backup generation is relatively inexpensive and therefore has to be taken judiciously. A firm experiencing power outages must consider the marginal benefit of investing in backup and the marginal cost of purchasing and running the plant. For instance, a firm experiencing frequent power outages would have to decide whether (1) to invest in backup generation and be able to continue operations in the event of outages but at the required costs or (2) not to invest in backup generation and shut down operations during power outages. A firm can choose the first option if it considers it to be a rational decision to own a generator in order to be able to continue operations during outages. On the contrary, another firm may consider the second alternative to be its rational and optimal decision. The latter might consider the costs of owning and operating a generator (i.e., the user cost) too high compared to the gain from continuing operations in the event of outages. Investment in new capital stock concerning changes in its determinants may be limited if the fixed adjustment costs are too significant to justify the potential gains (Nickell, 1978).

Therefore, a rational firm would equate the expected cost of generating a kWh of its electricity at the margin to the expected benefit from that kWh (Bental & Ravid, 1982). That gain consists of the continued operation that the self-generated electricity makes possible and the damage to equipment stock that a power outage would have caused. This study is based on investment decision theory.

Conceptual Framework

Figure 1 explains the relationship between the study and the independent and dependent variables.



Author's own from the literature reviewed.

Figure 1 above shows the relationship between electricity supply as the independent variable and SMEs' productivity and profitability as performance (proxy) of SMEs' dependent variable

Model specification

Situating this study into positivist philosophy, which allows for objectivity in explaining the relationships among social processes and between variables, the study estimates the functional form for the study as below:

Y = f (PS, Reg, Z) ---------- (1)

Where the outcome variable is a function of the main explanatory variables and other covariates, the Ordinary Least Square method (OLS) is used to show the relationship between the dependent variables (firm performance) and the explanatory variables (power supply) and other covariates. Equation (1) above evaluates the influence of power supply on firm performance. Where Y is captured as the dependent variable, such as the performance of the firm (measured in terms of the profitability of the firms), and PS is captured as power supply, Reg is represented as the region of the firm, and Z captures the other covariates variables such as FO is

the female ownership, MRK is the market size, LS is the legal status of the firm, and EDU is the education level of workers in the firm.

Empirical model

From equation (1), the empirical model can be specified as follows:

$FP_i = \beta_0 + \beta_{1i} PS + \beta_{2i} FO + \beta_{3i} LS + \beta_{4i} MRK + \beta_{5i} AGE + \beta_{6i} Reg + \beta_{7i} EDU + \mu$ ----- (2)

Where the variables are, as explained before, *FP* is the firm performance, *PS* is the power supply, *FO* is the female ownership, *MRK* is the market size, *and LS* is the firm's legal status. *REG* is the firm's region, *EDU* is the education level of workers and is the error term.

Adopting Frederick and Josephine (2016). We specified our model as,

Y = f (PS, Reg, Z) ---------- (1)

Writing equation (1) as

FP = f (EC, IM) -------- (3)

Where,

FP = firm performance (SMEs) proxy (productivity and profitability).

EC = Electricity supply

IM = other input

EC = f (DPO + FPO + CET) --------- (3.1)

IM = f (OC + CASP + OHC) --------- (3.2)

Equation (3.10.1) and (3.10.2) becomes

Y = f (DPO + FPO + CET +OC + CASP + OHC) ---------- (4)

β_0, β_1, and β_2 are parameters.

When adopting a similar model, the empirical model can be specified as

$FP_i = \beta_0 + \beta_{1i} DPO + \beta_{2i} FPO + \beta_{3i} CET + \beta_{4i} OC + \beta_{5i} CASP + \beta_{6i} OHC + \mu$ ------ (5)

Where,

DPO = Duration of a power outage

FPO = Frequency of the power supply outage

CET = cost of electricity charge (tariff)

OC = Operational cost (fuel and maintenance cost)

CAST = cost of alternative source of power

OHC = Overhead cost (labor cost and wages)

μ = Error term

Source of data, Sample size and Method of data analysis

The study used a non-probability sampling procedure in the form of a purposive sampling technique. Primary data was obtained with the aid of a Structure questionnaire. With a sample size of 32 Metal fabrications from 40 population samples, a random sampling procedure was used in distributing the questionnaires to SMEs in the metropolis so that each enterprise would have an equal chance. This research study used econometric approaches using primary data sources for more reliable results. The model was estimated based on the ordinary least squares

OLS whereby the parameters or the coefficient of the multiple regressions was obtained and their statistical reliability tested based on the t-ratio, Adjusted R2 and F statistic.

DATA PRESENTATION AND ANALYSIS

The regression results are presented and analyzed in this section. The first regression result estimates the relationship between productivity as a dependent variable with the number of hours per day of a power outage (NHDPO), cost of fueling the generator (CEG), Labour Cost (LC), and power.

Holding Company of Nigeria Plc (PHCNC) bill charge (ETC) and Cost Alternative Source of Power (CASP) as independent variables.

Table 4.1; represents the regression result of (productivity)

VARIABLES	Co eff	t-valve	p-valves
CONSTANT	1,55	10.91	0.0000
NHDPO	-0.000	-1.02	0.318
CFG	-3.03e	-1.08	0.933
LG	0.05	0.86	0.396
PHCN	-1.49e	-1.56	0.396
CASP	-2.32e	-0.39	0.131

Source; computation using StataCorp 14.0 (2015)

R^2 = 0.3742 VIF =1.99

F cal = 3.11 Tolerance =0.8

F tab = 0.025

Obs = 32

Analysis of the Result

Table 4.2 shows the multiple regression coefficient of determination (R^2) = 0.37. That is, 37%. This implies that 37 explanatory variables explain variations on the dependent variable. The table also shows the coefficient of other dependent variables.

Firstly, from our findings, it was discovered that the number of hours per day of power outage positively affects productivity. This shows that a decrease in NHPD by 100 can increase productivity. Also, using the t-statistic, the coefficient of NHPD shows that NHPD was not statistically significant.

Second, it was found that the cost of fueling the generators (CFG) hurts the productivity of the enterprises. This shows that an increase in the cost of fueling generators by N100.00 cans decreases productivity by 303%. Also, using t-statistics, the coefficient of CFG shows that the CFG was not statistically significant.

Thirdly, it was also found from our findings that the labor cost (LC) has a positive effect on the productivity of the enterprises. This shows that an increased labor cost of N100.00 can

decrease productivity by 005%. Also, using t-statistics shows that Labour cost is not statistically significant.

Fourthly, it was also found that the cost of alternative power sources harms the productivity of enterprises. This shows that an increase in the cost of an alternative power source by N1000.00 can increase productivity by 174%. Also, using the t-statistic, the coefficient of CASP was not statistically significant.

Finally, it was also discovered that the tariff charge, i.e., the electricity tariff charge by PHCN, has a negative effect on the productivity of the enterprises. This shows that an increase in the electricity tariff charge by PHCN ₦1000.00 can decrease productivity by 232%. Also, using t-statistics, the coefficient of ETC was not statistically significant.

Table 4.2; represents the regression result of (Profitability)

VARIABLES	Co eff	t-valve	p-valve
CONSTANT	24.1669	3.30	0.001
NHDPO	0.000	0.30	0.764
CFG	0.0000	1.18s	0.247
LG	-0.1449	-0.56	0.580
PHCN	-0.0000	-1.50	0.146
CASP	-0.0000	-0.95	0.349

Source; Computation using StataCorp 14.0 (2015)

R^2 = 0.153 VIF =1.99

F cal = 0.93 Tolerance = 0.8

F tab = 0.477

Obs = 32

Analysis of the Results

Table 4.3 shows the multiple regression coefficient of determination (R^2) = 0.153. This implies that 15.3% of the explanatory variable explains the variation in the dependent variable. The table also shows the coefficient of other independent variables.

Firstly, our findings revealed that the number of hours per day of power outage positively affects the enterprises' profitability. This means a decrease in the HNPD by 100 can increase profitability. Also, using the t-statistic ratio, the coefficient of HNPD was 0.764. This shows that NHPD was not statistically significant.

Secondly, from our findings, it was also discovered that the cost of fueling generators has a positive effect on the profitability of the enterprises. This shows that a decrease in the cost of fueling generators can increase profitability by 112.9%. Also, using t-statistics, the coefficient of CFG is 0.247; this shows that CFG was not statistically significant.

Thirdly, it was also found that, based on our findings, Labour Cost has a negative effect on the profitability of the enterprises. This shows that an increase in the LC by N1000.00 can

decrease the profitability by 144.9%. Using t-statistics, the coefficient of LC was 0.580; this shows that LC was not statistically significant.

Fourthly, it was found from our findings that the cost of alternative power sources has a negative effect on the profitability of enterprises. This shows that an increase in the CASP can decrease profitability. Using t-statistics, the coefficient of CASP was 0.146; this indicated that CASP was not statistically significant.

Finally, it was also found from our findings that the electricity tariff charge by PHCN has a negative effect on the profitability of the enterprises. This shows that an increase in the ETC can decrease profitability. Also, using t-statistics, the coefficient of ETC was 0.349. This means that ETC was not statistically significant.

Conventionally, the decision was to accept the F-statistics as a good model if the critical F-value was less than the calculated F-value. From the analysis, the calculated F-valued for productivity was 3.11; Profitability was 0.93, respectively. For productivity, the F-Cal is greater than the F-critical. That is F-cal = 3.11> F-tab $_{(0.05,\ 5,\ 27)}$ = 0.025, and for profitability, F-cal= 0.93 > F-critical $_{(0.05,\ 5,\ 27)}$ = 0.477

Therefore, the power supply outage significantly affects both the productivity and profitability of the SME's performance in the Birnin Kebbi metropolis. Therefore, this allows the researcher to accept the alternative hypothesis on productivity and profitability and reject the null hypothesis. Also, the study used tolerance and vector inflective factors to detect the presence of multi-collinearity among the variables; that is, the closer the tolerance to zero, the greater the degree of collinearity of that variable with the other regressors. On the other hand, the closer tolerance is to 7, the greater the evidence that the variable is not collinear with the other regressors. Using the variance inflective factor (VIF), the greater the value of VIF, the more "troublesome" or collinearity the variable; if the VIF of a variable exceeds 10, that variable is said to be highly collinear (Damodar, 2003).

Hypothesis Testing

To analyze the results obtained from the using software package (StataCorp 14.0 (2015) and obtained the parameters and the values that explained the relationship between dependents, i.e., productivity, profitability and the independent variables.

Result of Test of Hypothesis

S/N	Hypothesis	F-Cal	F-Tab	P-Value	Remark
1.	There is no significant relationship between the power supply outage and the productivity of SMEs in the study areas.	3.11	0.025	0.000	Significant
2.	There is no significant relationship between the power supply outage and the Profitability of SMEs in the study areas.	0.93	0.477	0.000	significant

Hypothesis 1

There is no significant relationship between the power supply outage and the productivity of SMEs in the Brnin Kebbi metropolis.

From Table 4.2.4, the F-calculated on the effect of erratic power supply on productivity was 3.11, with a corresponding P-value of 0.000. From the analysis, the F-calculated value (F-cal = 3.11) was more significant than the F-critical (F-tab = 0.025), that is F-Cal = 3.11 > F-tab $_{(0.05,\ 5,\ 27)}$ = 0.025 at 5 percent significant level. Therefore, we reject the null hypothesis and accept the alternative hypothesis that power supply outage significantly affects SMEs' productivity in the Birnin Kebbi metropolis.

Hypothesis 2

There is no significant relationship between power supply outages and the Profitability of SMEs in the Birnin Kebbi metropolis.

Table 4.2.4, the F-calculated on the effect of power supply outage on profitability was 0.93 with a corresponding P-value of 0.000. From the analysis, the F-Calculated value (F-cal = 0.93) was more significant than the F-critical (F-tab =0.477), that is F-Cal = 69.483 > F-tab= 0..477 at a 5 percent significant level. Therefore, we reject the null hypothesis and accept that power supply outage significantly affects SMEs' profitability in the Birnin Kebbi metropolis.

Discussion of the Findings

From our research study, the inferential statistic/result findings agreed with some of our expectations of the research work that erratic power supply affects the productivity and Profitability of SMEs in the Birnin Kebbi metropolis.

Firstly, in our findings, it was discovered that the cost of fueling generators (CFG) has a negative effect on the productivity of enterprises. This finding agrees with Aremo and Adeyemi (2011), whose study found that SMEs in Nigeria cannot run profitable businesses on power

generating set in a highly competitive and open economy like Nigeria because of the high fuel and maintenance costs. Secondly, it was also found in this research that tariff charges from PHCN negatively affect the enterprises' productivity. This result agreed with Imoro and Owusu (2012), who discovered in 320 selected MSI from three industrial clusters in the Kumasi metropolis that unrealistic tariff rate charges by Public Utility Companies affect the quality of electricity they require. Also, our findings agreed with Frederick and Josephine (2016), who studied the effect of power supply outages on the performance of small and medium enterprises in Tema and the Northern part of Ghana, that power outages have a negative effect on the performances (Profitability) of SME, especially in the Northern part of Ghana.

Finally, our findings also agreed with Lassana (2018), in his study of the cost of power outages of manufacturing SMEs productivity in Senegal using panel data and stochastic frontier model, that power outages have a negative significant effect on the productivity of SMEs,

CONCLUSION

Small and medium enterprises play an essential role in Birnn Debbi and Nigeria regarding wealth, employment generation, poverty alleviation, etc. However, their activities and even survival are hindered by many constraints, including an incredibly erratic power supply.This study concerned how power supply outage affects productivity and profitability in the Birnin Kebbi metropolis. Thirty-two samples (32) of small and medium enterprises were studied. The findings revealed that 90.911 percent of the enterprises indicated that power supply outage was the major constraint to their activities, with an average of 180 hours of power outage lasting 6 hours per day, causing the enterprises an average of N240, 000.00 monthly.

RECOMMENDATION

This research study aimed to provide recommendations for establishing a sound and viable enterprise base and enhancing their productivity and profitability. This research recommended that there is an urgent need for the government to improve the supply and distribution of public power so that SMEs' productivity and profitability can be enhanced. It also recommends that the Kebbi state authority embarks on an independent power project plan to increase the capacity of the megawatts supply by the National grid so that the SMEs in the metropolis will enjoy uninterrupted power supply to enable them to function effectively and efficiently.

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