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The Effect of Electricity Tariff and Self-Generated Power Supply on Business Performance in Nigeria

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Abstract
Industrial development is a process by which a nation acquires a competence in the manufacturing of equipment and products required for sustainable development. Technology is considered the prime factor in this regard; industrial development and technological development are interdependent and interrelated, yet, they both depend on adequate energy supply. The aim and objective of this study is to examine if electricity tariff and self-generated electricity constitutes significant impact on business performance and if there any significant difference between electricity tariff and self – generated source of power on business performance. The research population for this work comprises of all businesses in Ondo State cutting across servicing companies, manufacturing companies and wholesale/retail businesses. The primary source of data collection was employed and the stratified random sampling method was used to select the required sample size. The research instrument used for data collection was questionnaire and One hundred (100) copies of structured questionnaire were administered and eighty- two (82) were returned, representing 82%. The data collected were analyzed through the Ordinary Least Square (OLS) estimation model. From the findings, it was discovered that both high electricity tariff and self- generated electricity cost affect firms' performance, indicating that they have significant impact on business performance. Also the result reveals that there is significant difference between electricity tariff and self- generated electricity on business performance, since a rise in the electricity outage will trigger rises in generator usage. The major recommendation is that, government should immediately provide tax relief for all privately generated power for industrial output, knowing that improvement in the reliability of public power supply is needed to reduce generator usage, and also reduce cost of production, which in turn will enhance price control policy of the government. Though, many firms would still need to maintain their own back-up generators in order to meet international quality standards for participation in export markets.
Keywords: Business, Business Performance, Electricity, Development, Tariff, Self-Generator Electricity.

Introduction

One of the essential requirements for increase in productivities in the manufacturing sector is adequate electricity supply. The power sector is a main source of electricity generation and supply, which power the machines and equipment for production of various types of goods to satisfy consumers wants (Olayemi, 2012). The importance of the power sector is emphasized by Mohammed (2013) in his theory of unbalance growth, when he proposed investment in strategies selected sector such as electricity to boost and trigger investment such as the manufacturing industries in order to pave way for economic development.

Electricity has long been regarded as a catalyst for enhancing economy growth in developing countries. The availability of electricity can drive a country's growth by allowing firms to take advantage of it to increase its productivity enhancing technologies, the bulk of which are reliant on electricity. Such potential benefits of electricity have spurred investment in electricity projects in developing countries with the World Bank's lending for energy projects doubling from $3.9 billion in 2007 to $8.2 billion in 2011 (World Bank, 2012). Although the increased investment in energy has improved electrification rates in most developing countries, electricity costs remain high, especially for firms. In response to high electricity prices, firms may alter their product mix in favour of less technologically intensive products which require less electricity for production (Olawale and Garvwe, 2010).

In most developed countries, industrial users pay lower prices for electricity compared to other users (IEA, 2012). These lower prices reflect the lower cost of supplying electricity to industrial users as a result of their more stable demand patterns for electricity and their ability to use electricity at higher voltages without the power utility incurring the extra cost of stepping down the voltage. In 2011 World Bank survey, Indian manufacturing firms were asked to indicate which element constituted the biggest constraint to their operations, more than 36 percent of firms listing electricity as their biggest constraint (World Bank, 2011).

The survey by the Manufacturing Association of Nigeria (MAN) carried out in the first quarter of 2006 showed a gloomy picture of the challenges in the Nigerian Manufacturing Sector. The study confirmed that only 10 percent of manufacturing concerns in Nigeria could operate at 48.8% of installed capacity, 60 percent of the companies operating were able to cover their average variable costs while 30 percent had to completely shut down due to poor supply of electricity (Ogunjobi, 2015). This was initially emphasized by Enang, (2010) in his study that many industrial estates in the country suffer on the average of 14.5 hours power blackout as against

9.5 hours daily supply. As a result of inadequate supply of electricity, and because insurance contracts for unreliable power supply are not really available in developing countries. Many end users of electricity, from households to large enterprises, now generate their in-house power to boost production. Notwithstanding, the expenditure incurred for generating power supply (in-house) by companies for productivities constitute nearly 36 percent of the total cost (TC) of production (Ogunjobi, 2015). Equally, other reports like Ubi, Effiom & Okon (2012) and Mohammed (2013) have revealed that some small to medium Nigerian firms have invested a huge amount of their aggregate capital expenditure to provide 50 percent of their electricity requirements while most of the big firms relied heavily on self-generated electricity to ensure 100 percent reliability for production to be uninterrupted.

Businesses are faced with the problem of high Electricity tariff (rates). Not minding other challenges that businesses are facing in other developing countries like Nigeria; inadequate capital, poor technical and managerial skills, environmental effects and government rules and regulations which affect the operation of businesses in Nigeria. Regular power supply is the basic mover of technology and social development and hardly any enterprise or indeed any aspect of human development that does not require energy in one form or the other-electricity power (Olawale and Garvwe, 2010).

This and other minor constraints have caused the poor performance of the manufacturing sector in the Nigerian economy. Against this backdrop, the key research issue to be addressed by this study is to compare the cost of generating electricity in- house with that of electricity supply from the public grid and their impact on business performance. Interestingly, so much has been written on poor electricity supply, cost, consumption and factors affecting capacity decision in Nigeria and quite a number of issues have been noted to be responsible for the erratic electricity supply (Ubi, et al, 2012), ranging from corruption and inadequate funding. Likewise, Mojekwu and Iwuji (2012) attempted an analysis of the factors affecting electricity supply and capacity utilization in Nigeria using descriptive and ordinary least squares analysis also Bloom, Eifert, Mahajan, McKenzie and Roberts (2013) gathered data on the severity of shortages across Indian state, and an instrument that addresses the endogeneity of blackouts with respect to growth. Rioja(2003) and Olayemi (2012) in their various studies confirmed the effect of electricity supply and in- house generated electricity on business but with no attempt to find out the degree of association between the electricity tariff, self-generated electricity and business performance and also to justify whether if there is any significant different between them.

Therefore, this work seeks not only to contribute to the bodies of studies on erratic electricity supply and company performance in Nigeria but also to examine and compare the effect of electricity tariff and self-generated electricity on business performance hence, this paper attempts to fill a gap in the literature.

Conceptual Issues

Electricity Tariff and Self- Generated Power Supply

Electricity tariff in this research work refers to rate or cost of the power supply from public grid that is Power Holding Company of Nigeria (PHCN). But due unreliable public supply, self-generated supply has become an increasingly important source of power to business in Nigeria. Power outage refers to fluctuation and persistent decrease in electricity supply by the PHCN. It can also mean total disruption of power supply for a long period of time. According to Ama (2012) power outage (also power cut, blackout, or power failure) is a short- or long-term loss of the electric power to an area. There are many causes of power failures in an electricity network. Examples of these causes include faults at power stations, damage to electric transmission lines, substations or other parts of the distribution system, a short circuit, or the overloading of electricity mains. Power failures are particularly critical at sites where the environment and public safety are at risk. Institutions such as hospitals, sewage treatment plants, mines, and the like will usually have backup power sources such as standby generators, sola and inverter, which will automatically start up when there is power failure (Osobase, Bakare & Tunde, 2014). Therefore the marginal cost of self-generated power may serve as an estimate for the marginal cost of an outage. Self- Generated Power Supply as alternative source of energy refers to any other means (energy) used to power the engines such as: premium motor spirit (PMS), Gas and Coal, and Sola and inverter e.t.c.

The Costs and Benefits of Own-Generation

Mohammed, (2013) used preference approach to analyze the economic costs of own-generation. This approach was based on the presumption that rational, profit-maximizing firms would insure themselves against the risk of frequent power outages. He stressed further that insurance contracts for unreliable power supply are not available in Nigeria; hence, the only way to reduce losses is to acquire backup generating power (in- house). The firm's challenge is to choose the optimal amount of backup power that minimizes the sunk costs incurred by acquiring generation capacity as well as the production crisis that unsupplied power would cause.

Tarun, Uddin, & Ambarish (2013) emphasized that a competitive and risk-neutral firm will tend to maximize expected profits by equating at the margin the expected cost of generating a kilowatt per hour (kWh) of its own power to the expected gain due to that kWh. That gain comprises of the continued production (even if

partial) that the self-generated electricity makes possible, and the avoided damage to equipment that would have been caused by an incessant power failure. For any profit –oriented business under the perfect competitive market, the expected marginal gain from a self-generated kWh is also the expected marginal loss from the kWh that is not supplied by the utility.

Empirical Review

Evidence had showed in the literature that unreliable power supply results in welfare losses (Zuberi, 2012). But the empirical research on the economic costs of power outages and own-generation in developing countries remains limited, as a result of lack of appropriate microeconomic panel data that could be employed to infer firms' and households' response to poor provision of electricity supply. Only two studies have recently been done on this area in Africa. Adenikinju (2005) analyzed the economic cost of power outages in Nigeria. Using the revealed preference approach on business survey data (Ama (2012), Adenikinju estimated the marginal cost of power outages to be in the range of $0.94 to $3.13 per kWh of lost electricity. He concluded that power outages imposed significant costs on business. Small-scale operators were found to be most heavily affected by the infrastructure failures.

Ellahi, (2011) investigated the relationship between electricity supply, development of industrial sector and economic growth using Endogenous growth theory for the period 1980-2009 and Auto Regressive Distributed Lag (ARDL), the result revealed that output level of the manufacturing sector in Pakistan is decreasing owing to power inadequacy. The main recommendation made was that electricity problem should be fixed to improve industrial growth and that the supply of adequate power for domestic and commercial users is of highly vital for sustainable growth of the national economy. Corroborating the work of Ellahi, (2011), Mojekwu and Iwuji (2012) investigated the impact of power supply from the public grid and macro-economic variables on manufacturing sector performance in Nigeria, using time series data from 1981-2010. The multiple regression analysis (MRA) showed that power supply positively have significant impact on capacity utilization, while interest and inflation rate have adverse impact on capacity utilization in Nigeria.

Adebayo, (2012) in his study emphasized that many manufacturing firms in Nigeria operated below capacity because of unstable power supply, high cost of generating in house power and high labour operation costs and hereby advised firms to have back – up power in order to meet their production capacities. Olayemi, (2012) also employed the modern and traditional theories of cost to study the impact of electricity crisis on productivity of manufacturing sector in Nigeria using time series data from 1980-2008. The outcome using multiple regressions showed that electricity generation and supply have negative impact on productivity growth of manufacturing sector, though he noticed without thorough investigation that there might be a significant different between electricity generation and supply from public grid. This negated the report of Rioja, (2003) who observed no significant difference between electricity taxation and in-house electricity generation but confirmed that both of them had impact on manufacturing companies. He suggested that the reason might be as result of availability of power from the public grid in the developed countries while generators were merely served as back-up.

Furthermore, Riker (2012) applied price elasticity theory to examined the impact of energy price on non-petroleum manufacturing exports in USA using time series data between 2002 and 2006.The result revealed that, prices of energy have significant impact on U.S manufacturing sector. There was a decline of $11.5 billion per year under the reviewed periods. Finally, the study called for subsidy in the usage of industrial energy as well as development in the national energy resource that will impact on the prices of energy used by industries. Empirical evidence on electricity infrastructure and manufacturing performance relationship is so overwhelming. While there is concern in the literature on the fundamental positive roles that electricity supply and access have in the growth of manufacturing sector, a wide gap exists on measuring erratic electricity supply – manufacturing performance relationship particularly in developing nations. Some empirical studies have supported a positive impact of infrastructure on sectorial performance and overall output. Indeed, infrastructure was found to be a significant determinant of productivity. Studies have revealed that the contributions of telecommunications, roads and power on industrial output and economic growth cannot be overemphasized (Okafor, 2008).

Equally, other reports have shown that some small Nigerian firms have committed a huge amount of their aggregate capital expenditure to provide 50 percent of their electricity requirements while most of the big firms relied fully on self-generated electricity to ensure 100 percent reliability for production to be uninterrupted (Electric Power sector reform Implementation Committee (EPIC), 2013). This and other minor constraints have caused the uninspiring performance of the manufacturing sector in the Nigeria economy.

The evidence thus suggests that both generator ownership and its capacity are greatly affected by firm characteristics, such as size, sector, corporate structure, and export orientation. Large firms that operate 24hrs per day are more likely than smaller firms to install backup generation capacity compared to smaller firms, which operate only during daylight hours and therefore are less affected by evening blackouts. Mining firms tend to require own power to keep elevators, air pumps, and other safety devices fully operational regardless of the

power supply from public grid (Steinbuks and Foster, 2010).

Steinbuks and Foster (2010) used the revealed preference approach to analyze the economic costs of own-generation. This approach is based on the presumption that rational, profit-maximizing firms will insure themselves against the risk of frequent power outages. Because insurance contracts for unreliable power supply are not available, the only way to minimize losses is to acquire backup generating power. The firm's problem is to choose the appropriate amount of backup power that reduces the sunk costs incurred by acquiring generation capacity. This study attempts to identify and compare the effects of electricity tariff and costs of own generation of electric power on business performance.

Base on the existing literature, most of the researchers whose works were reviewed such as Adenikinju (2005), Adebayo (2012) and Ama (2012) were able to analyze the economic cost of power outages on business in Nigeria while Ellahi (2011) also tested the relationship between electricity supply, development of industrial sector and economic growth. Nevertheless, researchers like Rioja (2003) Enang (2010), Riker (2012), Ubi, et al.(2012) and Olayemi (2012) in their various studies confirmed the effect of electricity supply and in- house generated electricity on business. Olayemi (2012) in his work did not investigate thoroughly into the relationship between electricity tariff and self- generated electricity but in his report suggested that there might be a significant different between electricity generation in house and supply from public grid, while Rioja(2003) only noticed that there was no significant difference between effect of electricity taxation and self- generated electricity on business performance. They all failed to investigate into the in-depth causal link that might exist between self –generated electricity, electricity tariff and business performance and if there is significant difference between effect of electricity tariff and self- generated electricity on business performance.

In view of the above, this study is purposely being carried out to fill these gaps by examining and ascertaining the nature and direction of causality that might exist among electricity tariff, self-generated electricity and business performance and if there is significant difference between them on business performance.

Methodology

The research design adopted in the study was the descriptive survey method. The research population for this work comprises of all businesses in Ondo State cutting across servicing companies, manufacturing companies and wholesale/retail businesses. The primary source of data collection was employed and the stratified random sampling method was used to select the required sample size. The research instrument used for data collection was questionnaire and One hundred (100) copies of structured questionnaire were administered and eighty- two (82) were returned, representing 82%. The data collected were analyzed through the Ordinary Least Square (OLS) estimation model.

MODEL SPECIFICATION

The model used in this study is the Granger Causality Model, that was adopted from existing works such as Enang (2010), Olayemi, (2012) and Ubi, et al.(2012) and postulated by this paper is stated bellow but modified to capture the variables used in the study;

$BPERT = a_1 + b_1 ELECTARF + \mu_1$ 1

$BPERT = a_2 + b_2 SEGELECT + \mu_2$ 2

Where; a_1, and a_2 = intercepts of BPERT

b_1 and b_2 = coefficients of ELECTARF and SEGELECT respectively.

μ_1 and μ_2 = stochastic variables

The dependent variable (BPERT) represents the business performance. The proxies for business performance are Turnover and Investment, while independent variables Electricity Tariff (ELECTARF) and Self-generated Electricity (SEGELECT).

Data Presentation and Result Analysis

This chapter provides the analysis and results of the empirical investigation on the effect of electricity tariff and self generated electricity on business performance. The analysis was done bearing in mind the possibility of up –holding or refuting the assertion that there is no significant difference between electricity taxation and self –generated source of power on business performance

Hypothesis 1

HO_1: There is no significant impact of electricity tariff on the business performance.

Table 1: Impact of Electricity Tariff on Business Performance.

Model	R Square	Adjusted R Square	Std. Error of the Estimate	Df	Sig. F Change	Durbin-Watson
	.952	.951	17896.86624	2	.000	2.668

Source: Field work (2017)

The result from the Table 1 reveals that 95 percent change in business performance is caused by change in Electricity tariff (R^2). The remaining 5 percent is caused by variable that are not included in the model which is

accounted for by the random error term. This implies that electricity tariff has direct effect on turnover and investment. We concluded by rejecting null hypothesis and accepting the alternative hypothesis which states that there is a significant impact of electricity tariff on business performance since the P- Value (0.00) is also less than α (0.05). The Durbin Watson statistic in connection with adjusted R square shows that the regression for the firm is significant.

Hypothesis 2

HO_2: There is no significant impact of self-generated electricity as an alternative source of power on the business performance.

Table 2: Impact of Self-Generated Electricity on Business Performance.

Model	R Square	Adjusted R Square	Std. Error of the Estimate	Df	Sig. F Change	Durbin-Watson
1	.698	.687	82384.8106	2	.000	1.629

Source: Field work (2017)

From the estimated, we noticed that approximately (.698) 70 percent change in business performance is caused by change in amount of money spent on provision of self- generated electricity by the business R^2. The remaining 30 percent is necessitated by variables that are not included in the regression equation which is accounted for by the random terms. Therefore, we reject the null hypothesis and accept the alternative hypothesis which states that there is a significant impact of self- generated electricity on business performance.

Hypothesis 3

HO_3: There is no significant difference between electricity tariff and self- generated electricity on business performance.

Table 3: Independent Samples Test between Electricity Tariff and Self-Generated Electricity

Dependent variable	Independent variables	N	Mean	Std. Dev.	Df	T	P	Remark
	ELECTARF		5149.456	19867.43				
BPERT	SEGELECT	82	6086.549	21340.66	2	.87	.000	S

Source: Field Work (2017)

Decision Rule: Reject Ho if $P < \alpha$, Where $P = 0.00$, $\alpha = 0.05$

Table 3 indicates that there is a significant difference between electricity tariff and self-generated electricity on business performance, since P (0.005) is less than α (0.05). The t-test (.087) indicates that both electricity tariff and self-generated electricity is significant at 95 % level of significant to the business. The result reveals that self- generated electricity has a mean score of 6086.549 which is higher than the electricity tariff (5149.456). This implies that the self- generated electricity has more impact on business performance than electricity from public grid. This is true since a rise in the electricity outage will trigger rises in generator usage and number of businesses that observes power outage as major problems.

Discussion of Finding

It was observed that the rational and profit-maximizing firms will insure themselves against the risk of frequent power outages. Because insurance contracts for unreliable power supply are not available in developing countries especially in Nigeria and particularly Ondo State, the only way to minimize losses is to acquire backup generating power. The firm's problem is to choose the optimal amount of backup power that minimizes the sunk costs incurred by acquiring generation capacity as well as the damage that unsupplied power would cause. In most of the businesses in Ondo State, the average cost of generating electricity in-house is significantly higher than the cost of electricity from the public grid. The implication of the result is that increases in electricity consumed per kilowatt hour by businesses have impact on their performance. From the personal interview, we discovered that most businesses often switch to self- generated electricity only when there was power outage and that the less electricity-intensive industries are also those that are less technologically advanced and show that firms that operate in such industries experience lower productivity growth.

From the results of the three hypotheses presented above, the first hypothesis was rejected. This is because electricity tariff was seen to be highly significant and confirmed with theory 'a priori' expectations. Based on this, we conclude that there is significant impact of electricity tariff on the business performance. This was in agreement with the study by Ellahi, (2011) who on testing the relationship between electricity supply, development of industrial sector and economic growth suggested that the supply of adequate power for domestic and commercial users is of utmost importance for sustainable growth of the firms and national economy. Also the second hypothesis was rejected and conclusion was drawn that there is indeed significant impact of self-generated electricity as alternative source of power on the performance of business. Undoubtedly, this result is corroborating by the views of Olayemi (2012) who confirmed the impact of both electricity supply and in- house generated electricity on business. Also Adebayo, (2010) and Steinbuks and Forstor (2010) in their various studies reported that many manufacturing firms operated below capacity because of unstable power supply, high cost of generating in house power and high labour operation costs and hereby advised firms to have back – up power in order to meet their production capacities.

On the third hypothesis, the result reveals that there is significant difference between electricity tariff and self- generated electricity on business performance. This negates the finding of (Rioja, 2003) who noticed that there was no significant difference between electricity tariff and self- generated electricity on business performance. The results uphold Enang, (2010), Olayemi, (2012) and Osobase *et al* (2014) who failed to investigate but noticed a slight significant different between electricity tariff and own generated electricity on business performance. However, the mean score of self- generated electricity is higher than that of electricity tariff. This shows that indeed self- generated electricity impact or affects businesses more than the electricity tariff.

Conclusion

This paper aims to deepen our understanding of the widespread phenomenon of own generation of electric power by firms, as well as its relationship to unreliable public power supplies. The decision of a firm to maintain its own-generation capability is driven by a variety of factors. Our empirical analysis shows that unreliable public power supplies, though an important constraint to business operations, is far from being the only or the largest factor driving generator ownership. Firm characteristics such as size, age, industrial sector and export orientation all have a major influence. In particular, the probability of owning a generator doubles in large firms relative to small ones. Moreover, evidence shows that the percentage of businesses owning their own generators would remain high even if power supplies were perfectly reliable, we therefore conclude that other factors such as exports, emergency driven back-up requirements or other factors driven quality regulations play a critical role in the decision to own a generator. The costs of own-generation are high, driven mainly by the variable cost of diesel fuel and other petroleum products. Less conservative estimates using the opportunity cost as the measure of the benefit of own generation, show that the benefits of generator ownership outweigh the costs.

Recommendations

The major recommendation is that, government should immediately provide tax relief for all privately generated power for industrial output, knowing that improvement in the reliability of public power supply is needed to reduce generator usage, and also reduce cost of production, which in turn will enhance price control policy of the government. Though, many firms would still need to maintain their own back-up generators in order to meet international quality standards for participation in export markets.

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