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THE IMPACT OF ELECTRIC POWER OUTAGE ON THE PROFITABILITY OF SMALL BUSINESSES IN NIGERIA: A CASE STUDY OF GWAGWALADA TOWN

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Abstract
This study examined the impact of electric power outages on the profitability of small businesses in Nigeria, using 50 randomly selected small businesses in Gwagwalada town as a case study. A Logit regression model was adopted, incorporating a mix of qualitative and quantitative variables. The Maximum Likelihood (ML) estimation method was utilized in estimating the Logit model. Findings from the estimated Logit model showed that electric power outages had a negative impact on the profitability of small businesses in Gwagwalada town, while small businesses' expenses on alternative electricity power supplies had a positive impact on profitability. However, both electric power outages and small businesses' expenses on alternative electricity power supplies in Gwagwalada town had an insignificant impact on the profitability of the small businesses. Based on the findings of the study, it was recommended, among other things, that the government should undertake a national demand study to determine the exact electricity requirements to meet demand in the short, medium, and long terms. Furthermore, an integrated least-cost system expansion plan should be developed for the efficient deployment of the Nigerian electricity industry in the medium and long terms. There is also a need for diversification of electricity generation to improve the security of supply, as well as the development of capacity to generate electricity closer to demand centers to reduce technical losses. Additionally, the government should explore and develop measures to ensure the long-term supply of gas for electricity generation.

Keywords Electric Power, Small Businesses in Nigeria, positive impact on profitability.

INTRODUCTION

Background to the Study

Electric power, a critical component of global energy consumption, has long been the backbone of economic activities worldwide. Its pivotal role as a driver of economic growth and productivity is extensively documented in the literature. Studies have shown that electricity significantly influences productivity across various sectors, underscoring its importance in sustaining economic growth. For instance, sustained economic expansion is largely contingent upon an uninterrupted and reliable energy supply (Atif et al., 2010).

Electricity is indispensable for industrial growth, economic development, and the overall well-being of a nation. Reliable electricity supply is especially vital for the survival and growth of small businesses, with future business expansion relying on affordable and accessible energy sources

(Babatunde & Shuaibu, 2008). Beyond powering industries, electricity drives advancements in communication, fosters innovation in science and technology, enhances healthcare delivery, and elevates living standards. Its impact extends across infrastructure and socio-economic activities, including transportation, communication, and construction, thereby shaping the quality of life (Adedokun, 2014).

In the Nigerian context, electricity plays a significant role in economic development. The nation's economy is heavily reliant on energy, with stable electricity supply deemed essential for Nigeria to achieve its ambition of becoming one of the 20 most developed economies globally. Unfortunately, the persistent electricity crisis remains a significant impediment, with no apparent resolution in sight (Ademola & Afeiwana, 2013). Power outages continue to hinder development, underscoring the inefficiencies in the country's electricity sector (Usunamlele, 2011).

Efforts to reform the electricity sector, such as the privatization and unbundling of the Power Holding Company of Nigeria (PHCN), were expected to enhance efficiency. However, these reforms have yet to translate into adequate and stable electricity supply for consumers (Subair & Oke, 2014). Reliable electricity is central to wealth creation and serves as the engine of growth across all sectors of the economy. Its development and utilization profoundly affect socio-economic activities and, by extension, the living standards of citizens (Adenikinju & Iwayemi, 2012).

The inadequacy of electricity supply and frequent power outages remain among the most frustrating challenges for businesses and society. This situation is paradoxical given Nigeria's abundant primary energy resources, including coal, natural gas, solar, and hydroelectricity. Despite its substantial reserves—35 billion barrels of crude oil, 185 trillion cubic feet of natural gas, and 2.75 billion metric tons of coal—Nigeria suffers from "energy poverty" amidst plenty. Furthermore, while Nigeria is a major exporter of liquefied natural gas (LNG), the country's gas-dominated electricity grid frequently collapses due to inadequate gas supply, compounded by issues such as pipeline vandalism and wasteful gas flaring, which contributes to environmental degradation (Ademola & Afeiwana, 2013).

Billions of dollars have been invested in expanding electricity generation and transmission, yet the outcomes remain poor, with frequent outages and voltage fluctuations. This has led to widespread reliance on polluting generators, which adversely affect environmental quality and public health. Despite decades of reforms, beginning with the Structural Adjustment Program (SAP) in 1986, the electricity crisis persists.

This study seeks to empirically assess the impact of electricity supply fluctuations on the profitability of small businesses in Gwagwalada, providing insights into how power instability affects local economic development.

Statement of the Problem

Despite Nigeria's abundant oil resources, a significant portion of its citizens lack access to reliable and uninterrupted electricity. The country has an installed electric generating capacity of approximately 5,900 megawatts (MW), yet frequent power outages and suboptimal performance have kept the power sector operating well below its potential capacity. A primary issue is the disparity between the installed capacity and the actual generating capacity of the Nigerian power sector, necessitating reforms aimed at improving power generation and distribution.

Key reforms include the establishment of the National Electricity Regulatory Commission (NERC), the unbundling of the Power Holding Company of Nigeria (PHCN), and the introduction

of Independent Power Producers (IPP). These initiatives were designed to enhance power generation and distribution while meeting residential electricity demand. However, the anticipated improvements have not materialized, as power outages continue to hinder the country's development.

Electricity supply in Nigeria remains plagued by frequent power failures and load shedding. Poor access to electricity has been a significant barrier to the nation's economic growth. According to statistics from the National Bureau of Statistics (NBS, 2014), only about one-third of Nigerians, or roughly 40% of the population, have access to electricity. The distribution of electricity is marked by substantial disparities between rural and urban areas, as well as between residential and industrial zones within urban centers (Ali-Akpajiak and Pyke, 2013).

In recent years, the persistently poor quality of electricity supply has become a major constraint on economic performance, particularly for small businesses, which rely heavily on stable and affordable power to sustain their operations.

Research Questions

The following questions has guided this study and the methodology employed to understand the relationship between the variables in this study:

What are the electricity costs of operating small businesses in Gwagwalada town?

What is the impact of electricity fluctuation on level of profit in Gwagwalada town?

Objective of the study

The broad objective of the study is to determine the impact of electric power fluctuation on profitability of small businesses in Gwagwalada town. The specific objectives are to:

- ascertain electricity costs of operating small businesses in Gwagwalada town.
- assess the impact of electricity fluctuation on level of profit in Gwagwalada town.

Hypotheses of the Study

The hypotheses of the study are stated as follows:

H_{0_1}: Electricity costs of operating small business has no significant impact on profitability of small businesses in Gwagwalada town.

H_{0_2}: Electric power fluctuation has no significant impact on

profitability of small businesses in Gwagwalada town.

Significance of the study

This study is significant as it provides an empirical analysis of the impact of electric power fluctuations on the profitability of small businesses in Gwagwalada town. The findings are expected to assist policymakers and energy economists in formulating effective strategies to enhance the performance of Nigeria's power sector.

The study employs the Logit model to empirically examine the relationship between electric power fluctuations and the profitability of small businesses in Gwagwalada. Second, by incorporating time-series variables, the study conducts unit root tests to avoid the issue of spurious regression, ensuring robust and reliable inferences.

Furthermore, the findings aim to contribute to the growing body of literature on the relationship between electric power fluctuations and small business profitability in Nigeria. They also serve as a valuable reference for future research in this area.

Scope of the Study

The study is confined to impact of electric power fluctuation on profitability of small businesses in Gwagwalada town. Fifty (50) small businesses were used as case study.

Organization of the Study

This study is structured as follows: The introduction includes the background to the study, the statement of the problem, research questions, objectives, hypotheses, significance, scope, organization of the study, and an overview of stylized facts about the Gwagwalada Area Council. The literature review encompasses a conceptual review, a theoretical review, an empirical review, and the study's theoretical framework.

The methodology section outlines the sources and methods of data collection, the model specification, the definitions of variables used in the model, and the methods of data analysis. This is followed by the presentation, analysis, and interpretation of results. The study concludes with a summary of major findings, conclusions, recommendations, and a discussion of the study's limitations alongside suggestions for future research.

Stylized Facts about Gwagwalada Area Council

Before the establishment of the Federal Capital Territory (FCT), Gwagwalada was part of the Kwali District under the former Abuja Emirate, now known as the Suleja Emirate. The Gwagwalada Area Council was officially created on October 15, 1984. Its previously reported population of 150,000 has since become outdated. The relocation of Nigeria's capital from Lagos to Abuja in 1992 and the subsequent demolition of illegal structures in the Federal City Center triggered a significant influx of people into Gwagwalada. This influx has made it one of the fastest-growing urban centers in the FCT, with its population increasing to over 1,000,000 as of 2015 (FCTA, 2015).

The rural population in Gwagwalada Area Council relies primarily on subsistence agriculture. Major crops cultivated include sorghum, maize, yam, millet, cassava, rice, and beniseed. The area is also suitable for livestock production due to the availability of vast grazing lands. The headquarters of the Area Council, Gwagwalada town, is strategically located, just a 25-minute drive from Nnamdi Azikiwe International Airport and about 45 minutes from the city center. Its accessibility to neighboring councils like Kuje, Abaji, Abuja Municipal, and Suleja in Niger State further underscores its strategic importance.

Public utilities such as road networks, potable water, electricity, and telephone services are available in Gwagwalada. Additionally, the Area Council hosts notable FCT and federal institutions, including the University of Abuja, a specialist hospital, the Custom, Immigration, and Prisons Pension Board, the Sharia Court of Appeal, the FCT School of Nursing, and the FCT College of Education. There are also more than ten branches of commercial banks operating within the council.

The government's liberal policies have encouraged the establishment of these institutions and supported residents in pursuing economic activities. Plans are also underway to relocate the market for fairly used vehicles (Tokunbo) to Tunga Maje in Gwagwalada, which is expected to further boost economic activities in the area. Moreover, Gwagwalada boasts historical relics, artifacts, and tourist attractions such as Dadabiri Hills, Tsauni Hills, Wumi Natural Forest, the Giri Pottery Center, traditional weaving centers at Angwa Teshi, and calabash crafting centers in Zuba and Gwagwalada.

As designated in the FCT master plan, Gwagwalada is intended to serve as the industrial zone of the territory, making it an attractive location for industries. Small-scale businesses are predominant in Gwagwalada and include hair salons, business centers, cybercafés, supermarkets, printing presses, computer gadget shops, pharmacies, boutiques, fashion design stores, hotels, restaurants, pure water factories, and block-making industries.

The town is home to a mix of residents, including working-class middle-income earners, job seekers,

petty traders, and small business owners. Many businesses depend heavily on the presence of students from the University of Abuja. Until 2014, electricity supply in Gwagwalada was extremely poor, with residents receiving fewer than four hours of power daily. This forced many businesses to close temporarily, especially during university holidays or strikes, due to losses incurred from relying on generators and paying for electricity they did not consume. However, after the privatization of electricity in Nigeria in July 2014, the supply improved significantly to over nine hours per day, providing much-needed relief to residents and businesses.

LITERATURE REVIEW

Conceptual Review

Concept of Small Business

The definition of small-scale business varies by country, but generally, it refers to a privately owned enterprise operated by an individual or a small group, typically employing between 1 and 20 workers. For instance, a business is classified as small-scale when it employs up to 100 workers in the United States, whereas in the European Union, the threshold is 50 employees.

The Oxford English Dictionary defines a small-scale business as a company with relatively small market capitalization. These businesses are often characterized by owner-management, locally sourced capital, and operations confined to specific communities. In more specific terms, a small-scale business is independently owned and managed, financed internally, driven by personalized interests, and operates with a relatively low sales turnover.

Small-scale businesses play a crucial role in national economies by increasing per capita income, fostering competition in the market, and reducing monopolies. They also encourage the use of local resources, help minimize rural-urban migration, and promote the even distribution of industrial activities. Furthermore, they contribute to the development of industrial skills, technology, and leadership in the marketplace (Ijeoma, 2011).

In Nigeria, the definition of small-scale businesses has evolved over time. The 1988 Monetary Policy Circular No. 22 from the Central Bank of Nigeria (CBN) categorized small-scale businesses as those with an annual turnover not exceeding ₦500,000 (approximately €2,269 as of February 6, 2014). Similarly, the Federal Government's 1990 budget defined small-scale businesses as enterprises with an annual turnover of up to ₦500,000 for commercial bank loans or up to ₦2 million in capital investment (excluding land) for merchant bank loans, with a maximum threshold of ₦5 million. By 1992, the National Economic Reconstruction Fund (NERFUND) revised this definition to include businesses with an annual turnover of up to ₦10 million (Ekpenyong and Nyong, 1992).

These definitions, however, present challenges for many Nigerians attempting to establish small businesses, as most small ventures, such as hair salons, barbershops, restaurants, cybercafés, or printing services, do not require or have access to such high levels of startup capital. A more recent industrial policy in Nigeria defines small-scale businesses as those with total investments ranging from ₦100,000 to ₦2 million (approximately €9,076 as of February 6, 2014), excluding capital costs but including working capital (NERFUND, 2005).

The criteria for defining small-scale businesses often vary depending on the perspective of authors, scholars, and policymakers. Factors such as capital outlay, number of employees, sales turnover, fixed capital investment, available plant and machinery, market share, and the country's level of development are commonly used. For example, in the United States, the United Kingdom, and

European countries, small and medium enterprises (SMEs) are primarily defined based on turnover and employee numbers.

In Nigeria, small businesses are classified based on capital employed, turnover, and workforce size. According to the CBN communiqué No. 69 from a special monetary policy committee meeting held on April 15, 2010, a business with an asset base (excluding land) of ₦5 million to ₦500 million and a workforce of 11 to 300 employees falls within the SME sub-sector. This definition was adopted by the Small and Medium Enterprises Credit Guarantee Scheme (SMECGS). For the Small and Medium Enterprises Equity Investment Scheme (SMEEIS), an SME is defined as a business with a maximum asset base of ₦1.5 billion (excluding land and working capital), with no specified limits on staff size.

The National Council on Industry (1992) classified SMEs as businesses with fixed assets exceeding ₦1 million but not exceeding ₦10 million, including working capital but excluding land costs. Medium-scale enterprises were defined as those with fixed assets exceeding ₦10 million but not exceeding ₦40 million, excluding land costs but including working capital. Similarly, the Industrial Development Bank (1996) categorized SMEs as enterprises with total costs (including working capital but excluding land costs) between ₦1 million and ₦40 million, employing 11 to 35 workers. Medium-scale enterprises were defined as businesses with a workforce of 36 to 100 employees and total costs exceeding ₦40 million.

Concept of Electric Power

Electric power is globally recognized as a versatile, relatively affordable, and cost-effective energy source essential for any nation's development. It operates through three main hierarchical stages: generation, transmission, and distribution. As an indispensable driver of industrial and economic growth, electricity plays a pivotal role in advancing modern economies.

Electricity is a crucial energy form driving production and facilitating services. Its flexibility and high demand make it a vital infrastructure component for economic growth. Both households and businesses rely heavily on electricity, with demand driven by factors such as industrialization, urbanization, population growth, and improving living standards. A key policy objective for any nation is to foster sustainable economic growth to enhance the quality of life for its citizens, with electricity serving as a cornerstone in achieving this goal.

In Nigeria, electricity as a commercial energy source remains insufficient to meet the demands of a rapidly growing population. It contributes less than 1% to the nation's GDP, and demand significantly exceeds supply. Currently, fewer than 40% of Nigerians have access to electricity, and the power sector is plagued by high energy losses (30-35%) and low revenue collection rates. This inefficiency stems from aging and damaged infrastructure, vandalism, and poor management typical of public enterprises in Nigeria. Additionally, government energy subsidies, while making electricity more affordable, have hindered revenue generation necessary for maintaining infrastructure and expanding supply.

The unreliability of electricity supply imposes significant economic burdens on the nation. Poor energy quality discourages the adoption of efficient technologies that rely on stable power. Sanchis (2007) highlights the importance of electricity to production, noting its impact on factors of production and capital accumulation. According to his findings, increased electricity availability enhances manufacturing capacity, drives industrial production, increases output, and reduces unemployment. This underscores the importance of prioritizing electricity production in policymaking.

The relationship between the energy sector and economic development has been a subject of analysis since the mid-19th century. Interest in this connection surged during the energy crisis of the 1970s, prompting studies on energy costs in production and their impact on industry and the broader economy (Jiang, Chen, and Zhou, 2011). In the 21st century, energy remains crucial to economic activity, with economic growth strongly influenced by a nation's energy resources (Velasquez and Pichler, 2010).

Electricity and business share a symbiotic relationship, with energy supplies significantly impacting economic activities (Velasquez and Pichler, 2010). Electricity is essential across various sectors, including manufacturing, services, and distribution, for operations such as production, storage, and office functions. It acts as a critical input for production, making it an indispensable resource for all industries. For small and medium-sized enterprises (SMEs), electricity is a standardized input vital for production and meeting customer demands. The reliability of electricity supply directly influences SMEs' ability to operate competitively, highlighting its role in mitigating supply risks and ensuring business continuity (Haanes et al., 2011).

While small-scale businesses are often the foundation upon which larger industries are built, numerous challenges hinder their growth in Nigeria. Issues such as limited access to finance, credit facilities, raw materials, and electricity have slowed their development. Specifically, Nigeria's unstable electricity generation has discouraged small businesses, as acquiring and maintaining self-generated electricity imposes a significant financial burden. This lack of reliable energy creates barriers for small-scale businesses, limiting their capacity to grow and compete effectively in the market.

Theoretical Review

Classical economists did not consider energy a factor of production in the production process, nor did the neoclassical economists. However, Alam (2006), in his work Economic Growth with Energy, found that energy not only serves as a factor of production but also acts as a catalyst for national growth.

In modern economics, models have been developed to incorporate the role of resources, including energy, in the growth process. Time series analyses have demonstrated that energy consumption and Gross Domestic Product (GDP) are co-integrated, and energy use Granger-causes GDP when additional variables such as energy prices or other production inputs are included. The primary driver of economic growth is productivity growth, which is defined as the ratio of economic output to inputs such as capital, labor, energy, materials, and services (KLEMS). This recognition has prompted criticism of neoclassical economic theories and other growth models, particularly regarding their failure to account for the implications of thermodynamics for economic production and the economy's long-term sustainability. Consequently, there has been a paradigm shift toward incorporating energy into modern growth models, reflecting its critical role in the economy. Stern (1999) emphasizes that energy is a non-reproducible factor of production, a sentiment echoed by Hall et al. (2003). In extreme cases, energy use rather than goods output has been proposed as an indicator of economic development, as seen in Kardashev's (1964) framework.

Prior to Romer's (1994) growth theory, several other growth theories were developed, including the Solow-Swan model, also known as the exogenous growth model. This model explains long-run economic growth by focusing on productivity, capital accumulation, population growth, and technological progress. Its foundation

lies in the neoclassical Cobb-Douglas aggregate production function, which connects the model to microeconomic principles (Acemoglu, 2009).

The Solow-Swan model assumes diminishing returns to labor and capital, constant returns to scale, a competitive market equilibrium, and a fixed savings rate derived from the Domar model. A key feature of the Solow model is its explanation of long-run per capita growth as being driven by the rate of technological progress, which is considered an exogenous factor outside the model.

By the mid-1980s, dissatisfaction with exogenous growth theories grew among economists, leading to the emergence of endogenous growth theory. This new approach addressed the shortcomings of exogenous growth models by explicitly incorporating the determinants of growth within the model itself. Romer's (1994) endogenous growth theory posits that economic growth results primarily from endogenous factors such as investment in human capital, innovation, and knowledge, rather than external forces.

Endogenous growth theory emphasizes the significance of positive externalities and spillover effects in a knowledge-based economy as drivers of economic development. Unlike exogenous growth models, which leave the savings rate and technological progress unexplained, endogenous models are grounded in microeconomic foundations. In these models, households maximize utility subject to budget constraints, while firms maximize profits. Human capital and technological innovation are central to these models, serving as the primary engines of growth. The simplest formulation, such as the AK model, assumes constant returns to scale in production, while more complex setups incorporate spillover effects, increasing varieties of goods, and improvements in quality.

A key assumption of endogenous growth theory is that the marginal product of capital does not diminish at the aggregate level, or at least does not approach zero. This does not imply that larger firms are more productive than smaller ones, as diminishing marginal returns to capital still apply at the firm level. Consequently, while endogenous growth models can accommodate perfect competition, many such models relax this assumption, allowing for some degree of monopoly power. This adjustment reflects the real-world dynamics of innovation and market competition.

Empirical Review

There is a substantial body of empirical research examining the impact of electricity on small businesses. Studies such as ADB (1999) and Oshikoya et al. (1999) underscore the critical importance of infrastructure, particularly electricity, in reducing poverty. They argue that new or improved infrastructure can alleviate poverty through direct enhancement of economic activities and indirect improvements in the quality of life.

Findings by the United Nations Industrial Development Organization (UNIDO, 2009) reveal that only 26% of households in Africa have access to electricity, making the continent the lowest globally in terms of electricity penetration. Approximately 547 million people in Africa lack access to electricity. Various factors contribute to this situation, including poor performance in electricity supply and service delivery, an inability to meet the growing demand for electricity, and insufficient managerial and technical skills. Governments across the continent struggle to fund infrastructure expansion or refurbishment and to attract private sector investment in the power sector. Additionally, inadequate maintenance of existing facilities due to financial and technical constraints has led to reliability issues. Politically influenced tariffs, often set below marginal costs, have compounded the problem, as have poor governance, unstable governments affected by

regional and ethnic conflicts, and weak economic conditions, particularly in sub-Saharan Africa. Ineffective revenue collection mechanisms, insufficient rainfall in hydropower-dependent regions leading to power rationing, and other structural problems have all culminated in inadequate electricity supply.

Sambo (2008) emphasizes that adequate and reliable electricity is a fundamental input for socioeconomic development. In his analysis, inadequate electricity supply restricts socioeconomic activities to meeting basic needs, limits economic growth, and adversely affects the quality of life. Several studies have investigated the relationship between energy supply and economic growth. Some, such as Yu and Hwang (1984), found no evidence of causality between growth and energy consumption. Others have demonstrated that developing energy resources can stimulate economic growth through multiplier effects and by providing the infrastructure needed for broader development.

Ukpong (1976), in a pioneering study on electricity consumption in Nigeria, used regression analysis to demonstrate a strong positive relationship between electricity consumption, economic development, and industrialization. However, his study did not clarify whether this relationship was bidirectional. He also noted that the level of electricity supply in Nigeria fell significantly short of potential demand.

Adenikinju (2005) employed surveys and revealed preference approaches to estimate the costs associated with inadequate electricity in Nigeria. He found that unreliable electricity imposes substantial costs on businesses, with firms allocating as much as 20 to 30 percent of their initial investments to acquiring facilities to ensure supply reliability. This situation significantly undermines the cost competitiveness of Nigeria's manufacturing sector.

Alayande and Ekone (2001), using a multivariate approach, observed a unidirectional causality from economic growth to energy consumption but found no evidence of causality in the opposite direction. This suggests that energy consumption does not provide information about fluctuations in economic growth in Nigeria.

Stephen and Wasiu (2013) highlighted the challenges small-scale business operators face due to unreliable electricity supply in Nigeria. Their study found that this issue discourages small businesses from adopting productivity-enhancing technologies, as even generator-powered alternatives often fail to meet energy demands. This inability to meet energy needs has been attributed to deeper structural issues within Nigeria's electricity sector. These include inadequate gas supplies to power plants, labor unrest, insufficient power generation capacity, inefficient utilization of existing capacity, lack of capital for investment, high technical losses, sabotage of power infrastructure, insufficient transmission and distribution facilities, and an inappropriate industry and market structure.

The inadequacy of Nigeria's electricity sector has far-reaching implications, impacting both businesses and the daily lives of Nigerians. The inability to provide reliable electricity for domestic and business needs remains a significant challenge, one that has stifled economic growth and diminished the quality of life for many.

Theoretical Framework

The theoretical framework utilized in this study is the Deadweight Loss Theory. This theory posits that a consumer and producer surplus is lost due to state ownership of infrastructure service providers, primarily because of external factors that impose restrictions on output.

Poor and unreliable infrastructure services lead to increased production costs for firms, either by

forcing them to incur higher expenses in substituting public infrastructure with private alternatives or by causing output losses for firms unable to bear the additional costs. This scenario shifts the supply curve to the left, as illustrated in the diagram below, indicating that producers are only willing to supply each previous level of output at a higher price. Consequently, the higher market price reduces both consumer and producer surplus.

Inadequate and poor-quality infrastructure—such as unreliable electricity—poses a significant barrier to industrial production and overall economic growth. The economic loss caused by such inefficiencies can be conceptualized as a deadweight loss, reflecting the reduction in consumer and producer surplus (Iwayemi, 1991).

Enhancing the quality and quantity of infrastructural services with substantial economies of scale, such as electricity, would shift the supply curve outward and to the right. This improvement would stimulate increased production, lower industrial costs, and create a more competitive industrial environment capable of meeting the challenges of the global market. Firms that are forced to meet infrastructure needs through self-provision face significant expenses. Over time, equipment designed for standby use often requires costly replacements due to continuous operation. These additional costs unnecessarily increase the price paid by consumers (Iwayemi, 1991).

METHODOLOGY

Sources and Methods of Data Collection

The data for this study were obtained from both primary and secondary sources through administered structured questionnaire and available records kept by the small businesses.

The study utilized the investigative survey research approach (ISRA) in collecting relevant data. The ISRA for obtaining data entails the schedule of a series of visits to the small businesses of interest. The tasks accomplished during such visits include the following: interviewing owners of these small businesses, administering structured questionnaires to them and obtaining relevant information from the available records kept by the owners of these small businesses.

Model Specification

To assess the impact of electric power fluctuation on the profitability of small businesses in Gwagwalada town, the study utilized the Logit Probability Model given as follows:

$$L = \frac{In(P)}{In(1-P)} = \beta_0 + \beta_1 EPG + \beta_2 EXP + \mu$$

Here, P= 1, if electric power fluctuation reduces the profitability of small businesses in Gwagwalada town; (1-P), if otherwise. Here, the dependent variable is a dummy variable. The independent variables in the model are admixture of quantitative and qualitative variables, while β_0, β_1 and β_2 are the parameters of the model to be estimated. The error term, μ which represents unobserved values, is assumed to be normally distributed, with zero mean and constant variance.

Definition of Variables used in the Model

Variables	Description
L:	P=1: If electric power fluctuation reduces

the profitability of small businesses in

Gwagwalada town; (1-P), if otherwise.

EPG: EPG=1: If there is constant electric power

fluctuation in Gwagwalada town; EPG=0: If otherwise

EXP: Expenses on Alternative Electricity Power Supply

METHOD OF DATA ANALYSIS

The Maximum Likelihood (ML) method is used to obtain estimates for the specified Logit probability model. The justification for using ML method is due to the fact that neither the ordinary least squares (OLS) nor the weighted least square (WLS) is helpful or adequate for estimating the Logit model. Moreover, that the Logit model is a nonlinear model. The parameter estimates of the specified Logit model are not directly interpretable with respect to magnitudes of effect but only interpretable with respect to the direction of effect on probability (Gujarati, 2003).

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

Data Presentation

In order to assess the impact of electric power fluctuation on the profitability of small businesses in Gwagwalada town, Logit model estimation was carried out using both qualitative and quantitative based on fifty (50) small businesses that served as respondents of the administered questionnaire in appendix II. See also appendix I for the regression table.

DATA ANALYSIS

The estimated Logit regression model is given as follows:

Dependent Variable: L
Method: ML - Binary Logit (Quadratic hill climbing)
Date: 10/19/15 Time: 20:23
Sample: 1- 50
Included observations: 50
Convergence achieved after 4 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.178752	0.780292	0.229084	0.8188
EPG	-0.180206	0.719746	-0.250375	0.8023
EXPP	0.001914	0.001474	1.297906	0.1943

McFadden R-squared	0.832087	Mean dependent var	0.740000
S.D. dependent var	0.443087	S.E. of regression	0.444311
Akaike info criterion	1.229339	Sum squared resid	9.278377
Schwarz criterion	1.344060	Log likelihood	-27.73347
Hannan-Quinn criter.	1.273025	Deviance	55.46693
Restr. Deviance	57.30569	Restr. log likelihood	-28.65285
LR statistic	18.38761	Avg. log likelihood	-0.554669
Prob(LR statistic)	0.000006		

Obs with Dep=0	13	Total obs	50

Obs with Dep=1	37

Source: Computed using E-Views 7 Software

Interpretation of Results

The Logit estimate above revealed that the mean of the dependent variable is 0.740000 while the standard error of regression is 0.444311. These suggest adequacy of the estimated Logit model. More so, the model selection criteria such as Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn criterion (HQC) with respective low values of 1.229339, 1.344060 and 1.273025 indicate that the estimated Logit model is adequately specified.

The likelihood ratio (LR) statistic value of 18.38761 with probability (LR stat) value of 0.000006 which is significant at 5% level of significance, suggests the absence of autocorrelation. The McFadden R-squared value of 0.832087 implies that about 83 percent of the change in the dependent variable was explained by the explanatory variables of the model. It also shows that the model has a good fit.

From the estimated Logit model above, we also observed that electricity power fluctuation (EPG) had negative impact on the profitability of the small businesses in Gwagwalada town; indicating that the probability of change in profitability of the small businesses in Gwagwalada town with respect to changes in electricity power fluctuation (EPG) reduces by 18.03%. On the other hand, small businesses expenses on alternative electricity power supply (EXP) had positive impact on the profitability variable of the small businesses; implying that the probability of change in small businesses' profitability with respect to changes in their alternative electricity power supply (EXP) increases by 4.1%.

Hypothesis testing is based on Z-statistic. The Logit estimates above show that both electricity power fluctuation (EPG) and small and medium scale firms expenses on alternative electricity power supply in Gwagwalada town (EXP) had insignificant impact on the profitability variable of the small businesses. This position is supported by the low Z-value and its corresponding high probability value (i.e., $p>0.05$).

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Major Findings

This study examined the impact of electric power fluctuation on the profitability of small businesses in Nigeria using 50 randomly selected small businesses in Gwagwalada town as case study. Logit regression model was adopted containing admixture of qualitative and quantitative variables. The maximum likelihood (ML) estimation method was utilized in estimating the Logit model.

Findings from the estimated Logit model show that electricity power fluctuation had negative impact on the profitability of the small businesses in Gwagwalada town while small businesses expenses on alternative electricity power supply had positive impact on the profitability variable of the small businesses. However, both electricity power fluctuation and small businesses' expenses on alternative electricity power supply in Gwagwalada town had insignificant impact on profitability variable of the small businesses.

Furthermore, findings of the study revealed that PHCN has contributed in power supply in Nigeria; however, power shortage and outage is still wide spread in Nigeria. In the review of literature, it was observed that steady supply of power is regarded as essential propelling economic activities aimed at increasing general output in an economy. An increase in output is expected to encourage the income of the factors of production.

CONCLUSION

The use of electric power is taken as a close indicator of industrial activity and a significant index of standard of living. In the developing countries of the world, no activity is more basic to the fuller utilization of their resources than the development of the energy industries. Electricity, rather than the steam engine drives the developing industries of modern Africa. Nigeria, with the largest population in Africa and an energy resource base by African standards, both rich and varied, demonstrates many of the problems and potentialities of electricity production in the developing countries of the tropical world.

Electricity in Nigeria has been fluctuating. This is one of the major problems affecting the Nigerian economy. It has been pointed out that Nigeria has installed a generating capacity of over 8GW but is presently having an output of 2.5GW as at that date. At December 2014, it rose to an average of 3.5 GW. As a result, there is inconsistency in the daily power supply.

Nigeria has been described as belonging to the category of countries that are non-industrial. It's a fact that Nigeria is richly endowed with various energy sources such as crude oil, natural gas, coal, hydropower, solar energy, fissionable materials for nuclear energy. Yet, it is described as an energy poor country because the sector is relatively underdeveloped. The PHCN, a government parastatal, has the sole responsibility for managing the generating plants as well as distribution of power nationally. The total generating capacity is about 3000MW, approximately thrice the current level of national demand. However, the actual power available at any given time is less that 40 percent of the total capacity due to poor maintenance and inadequate infrastructure; hence there is a perennial shortage. This situation is exacerbated by a grossly inefficient, poorly maintained distribution system.

RECOMMENDATIONS

Based on the findings of the study, several recommendations were proposed to address Nigeria's electricity challenges. First, the government should conduct a national demand study to ascertain electricity requirements for short, medium, and long-term needs. To ensure efficient system deployment, an integrated least-cost system expansion plan must be developed. Additionally, initiatives should be pursued to diversify electricity generation and enhance supply security, alongside strategies to generate electricity closer to demand centers to minimize technical losses.

It is essential to complete projects aimed at transforming the radial transmission network into a robust grid with appropriate dispatch and control systems. Moreover, upgrades and reinforcements of the transmission and distribution networks are necessary to support anticipated increases in electricity generation. The development of an appropriate gas policy is critical to encourage gas production and supply for power generation, supported by suitable pricing regimes and incentives to attract investment and ensure efficient operations. Finally, measures must be explored to secure a long-term gas supply for electricity generation, making it a national priority.

Limitations of the Study and Suggestions for Further Studies

This study has raised a lot of vital and important issues that could not be addressed in a single study of this nature. Hence, it may be useful to note some limitations and possible extensions associated with the current study. One of the main features of this study is that it utilized logit modelling approach. Future studies could utilize the probit and tobit models.

Furthermore, studies of this nature can decide to expand on the number of selected explanatory variables used. Some variables could be substituted with others. These suggestions are expected to

provide a more detailed examination of the impact of electric power fluctuation on the profitability of small businesses in Nigeria than has been achieved by the current study.

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