

## IMPACT OF FLUCTUATING POWER SUPPLY ON CORPORATE PERFORMANCE: A STUDY OF MAX ALUMINUM, OWERRI

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### Abstract

*This study on the impact of fluctuating power supply on corporate performance: a study of Max Aluminum, Owerri, takes a descriptive survey approach. Data was sourced from the 29 management staff of Max Aluminum, Owerri, using a five point likert scale questionnaire. The data gathered was analyzed with Wilcoxon Mann Whitney U test which is a non-parametric equivalent of t-test using the 20.0 version of statistical package for social sciences (SPSS). The findings of the study show that fluctuating electricity power supply has a negative impact on corporate performance by vitiating efficiency, competitiveness and acceptable environmental standards. Based on the findings, it was recommended that the federal government should as a matter of urgency review electricity distribution policy in order to accord priority to industrial centers; this will enhance their operation in an eco-friendly manner thereby reducing industrial emissions that pollute the environment and that Government should provide electricity subsidy for small and medium scale enterprises. This will help reduce their production and operational cost thereby enhancing their market competitiveness.*

*Keywords: market competitiveness, organizational performance, operational efficiency*

### Introduction

In Nigeria today, the cost of doing business is rated very high and the investment climate classified as unfriendly despite government's strategic efforts to encourage investors, hence; businesses are closing shop as fast as they are been established. This may not be unconnected with the high operational cost. Social capital which includes basic infrastructures is a strategic constituent of the capital of a business. This implies that the abundance of social capital is a boost to business performance while its absence may endanger corporate performance.

According to Wikipedia, Electric power is the rate at which electrical energy is transferred by an electric circuit. The SI unit of power is the watt, one joule per second. Electric power is usually produced by electric generators, but can also be supplied by sources such as electric batteries. It is generally supplied to businesses and homes by the electric power industry through an electric power grid. Electric power is usually sold by the kilowatt hour (3.6 MJ) which is the product of power in kilowatts multiplied by running time in hours. Electric utilities measure power using an electricity meter, which keeps a running total of the electric energy delivered to a customer. Electric power, like mechanical power, is the rate of doing

Work, measured in watts, and represented by the letter P. The term wattage is used colloquially to mean "electric power in watts." The electric power in watts produced by an electric current I consisting of a charge of Q coulombs every t seconds passing through an electric potential (voltage) difference of V am:

$$P = \text{work done per unit time} = \frac{VQ}{t} = VI$$

Where

Q is electric charge in coulombs

t is time in seconds

I is electric current in amperes

V is electric potential or voltage in volts

Electric power is transformed to other forms of energy when electric charges move through an electric potential (voltage) difference, which occurs in electrical components in electric circuits.

### Statement of the Problems

In Nigeria, one factor that has attracted condemnation across sectors is the state of electricity power supply in the nation. The comatose supply of electricity has forced corporate organizations into self-help by purchasing, installing and maintaining private power generating sets. This has piled pressure on the cost of production, increased the market price of Nigerian made goods and reduces the competitiveness of corporate organizations in Nigeria.

Across the globe, it has become fashionable to talk about "green operation" in industries especially now that the reality of climate change is staring the world at the face. Many nations of the world are supporting their industries to operate in an environmentally friendly manner by dedicating special electricity supply to them. While this promotes the "green operation" idea, it goes beyond that to enhance the financial performance of the industries. But in Nigeria, the case is different as industries despite paying huge electricity bills do not enjoy any dedicated electricity supply yet. It is therefore no longer news that there is fluctuating supply of electricity power supply in Nigeria despite governments' huge investment in the sector, but the extent to which this affects the real sector is yet to gain wide knowledge.

### Objectives of the Study

The general objective of this study is to examine the impact of fluctuating power supply on corporate performance. The specific objectives are as follows;

- i. To examine the impact of fluctuating power supply on organizational market competitiveness.
- ii. To examine the impact of fluctuating power supply on organizational operational efficiency.
- iii. To examine the impacts of fluctuating power supply on organizational environmental standard compliance.

### Research Questions

The following research questions shall serve as a guide to this study:

- i. What are the impacts of fluctuating power supply on organizational market competitiveness?

- ii. What are the impacts of fluctuating power supply on organizational operational efficiency?
- iii. What are the impacts of fluctuating power supply on organizational environmental standard compliance?

### **Hypotheses**

- H<sub>01</sub>: Fluctuating power supply does not impact positively on organizational market competitiveness.
- H<sub>02</sub>: Fluctuating power supply does not impact positively on organizational operational efficiency.
- H<sub>03</sub>: Fluctuating power supply does not impact positively on organizational environmental standard compliance.

### **Review of Related Literature**

Corporate performance: According to Olayemi (2004), an organization is productive if it achieves its goals by transforming inputs into outputs at the lowest cost. An organization is effective when it attains its goals but productivity depends on achieving these goals efficiently. Adeleke, Ogundele and Oyenuga (2008), posit that things which determine corporate performance are; technology, structure and size, communication, the human elements (management and employees), the larger market, competition, source of raw materials and supplies, legal structure, socio-cultural contents, globalization and so on. Corporate performance according to Bibhuti (2010), is defined as the ability of an organization to fulfill its mission through sound management, strong governance and a persistent re-dedication to achieving results. Bibhuti (2010), further stated that effective nonprofits performance are mission-driven, adaptable customer-focused, entrepreneurial, outcome oriented and sustainable.

### **Major Factors Affecting Electricity Generation, Transmission and Distribution in Nigeria**

There are many factors that affect electricity generation in Nigeria, the major ones include but not limited to:

- (i) The Niger Delta crisis which leads to the canalization of oil and gas pipe lines, oil gas exploration and exploitation facilities.
- (ii) The kidnapping of foreign and indigenous professionals that manned oil and gas facilities in Nigeria resulting into abandoning of oil and gas exploration.
- (iii) The inability of Nigerian government in collaboration with oil multinational companies to fully utilize the gas due to gas flaring. The gas is a good source of energy for the generation of electricity.
- (iv) Low level of annual rainfall in Nigeria due to global warming which leads to global climate change that affects water level at hydro generation stations. Reliance on Hydro can be constrained by the volume of water available during the period of draught and during the months of March to June when water level goes down (Sada, 2007).
- (v) Lack of water management in Nigeria is affecting water level at the hydro generation stations.
- (vi) Bribery, Corruption and Mismanagement in the power sector.

- (vii) The absence of research and development in Nigeria which focuses on investigating the different types of electricity generating potentials in Nigeria and how to utilize them. The research and development in the area of electricity generation, transmission and distribution can help in collecting data and offer services to government and private investors in the power sector.
- (viii) Non diversification of existing electricity generating potentials in Nigeria. Nigeria only utilizes oil, gas and dams for electricity generation. There are other alternative potentials existing such as renewable sources of energy (solar, wind, biomass) and nuclear which can supplement the existing hydro, oil and gas generating potentials. According to the Katsina State Government, it has started investing in the electricity generation using wind and Bio-mass sources.
- (ix) There is poor maintenance culture, in which fixed-time maintenance is not carried out regularly. Good maintenance culture leads to availability of electricity utilities in which electricity power is made available to consumers almost all the time (Oroge, 1991). The sector cannot be maintained if operators do not have enough funds to buy the needed spare parts and pay for their running cost. Good maintenance culture is very essential in keeping any physical systems, such as electricity generation, transmission and distribution networks in operational readiness.  
Maintenance of electricity utilities is a combination of actions carried out to retain the utilities in or restore them to normal operational standard. Basically, maintenance can be classified into two categories, namely; planned maintenance and unplanned maintenance. In Nigeria's electricity power sector, unplanned maintenance is normally carried out after systems failure and is normally carried out without any forethought, control and records.
- (x) The electricity consumers in Nigeria are highly indebted to the Power Holding Company of Nigeria (PHCN) due to poor electricity delivery, non-settlement of electricity bills, and corruption by bill collectors. Illegal connections and high maintenance cost of equipment will also lead to low revenue generation by Power Holdings Company of Nigeria.
- (xi) Falling down of electricity transmission and distribution lines by wind as well as canalization of these lines by thieves, construction works fluid, and soil erosion. Due to these factors, the electrical power companies lose about 330KV transmission lines in Nigeria, with and without compensation (Yusuf, Boyi and Muazu, 2007).

Power transmission is the process in which large block of electricity is carried from the generating stations to distribution stations using 330KV EHV transmission lines; 132KV transmission lines and 33KV sub transmission lines either at 50 KHz or 60 KHz transmission frequency. After transmission process, the distribution process follows immediately. At distribution stations, the line voltage is stepped down from 11KV to 0.415KV using three phase secondary distribution transformer or 0.22KV using single phase primary distribution transformer. In Nigeria, the transmission and distribution of electricity are affected by the factors (VI), (ix), and (x) as outlined above. Uwaifo (1994) reveals that in Nigeria, the power distribution efficiency has plummeted to 74 percent while since 1969; the USA power distribution efficiency was 95 percent.

- (xii) The overloading of distribution transformers in Nigeria is seriously affecting the distribution of electricity to consumers.

### **Role of Electricity on Corporate Performance**

There is a symbiotic relationship between electricity and business. Energy supplies have a significant impact on economic activities (Velasquez and Pichler, 2010). This is because it is used for varied purposes ranging from production, storage, powering of office equipment and product display. Consequently, the use of electricity serves as input for production. This makes electricity an essential commodity for all industry types- manufacturing, service and distribution. Various sectors of the economy such as manufacturing and transport use enormous amounts of electricity (Haanes et al., 2011) for operation processes including storage, and production. It is a critical resource needed to make products.

In this respect, electricity as a “transformed unity” serves as a commodity. Consequently, suppliers of electricity have a strong influence on the buying organization’s ability to gain a competitive advantage and provide solutions to their clients. This is because operators of businesses have high dependency on electricity as a standardized input, and without it, they cannot produce to satisfy their customers. This dependency on suppliers therefore explains the value of electricity to business operations along two strands namely: supply risk and reliability of supply.

### **Supply Risk:**

The supply risk trajectory is a critical factor along the perception of electricity as a resource for the operation of SMEs (Halldorsson and Svanberg, 2013). In a report by UNIDO (2009), it was revealed that, in spite of the abundant resources Africa is endowed with, it still struggles with supply challenges in electricity. According to the UNIDO (2009) finding, only 26% of households have electricity making Africa the lowest in electricity penetration in all the continents. UNIDO (2009) reported that, an estimate of 547 million people in Africa lack access to electricity. Many reasons have been put forward by researchers and practitioners as the causes of such a predicament. For instance, Mkhwanazi (2003) and Olumuyiwa and Mnse (2008) have catalogued the following as the causes of poor access to electricity in Africa:

- Performance, resulting in poor quality of supply and service and an inability to meet growing electricity demand.
- Insufficient managerial and technical skills to do the job.
- Inability of the African country’s government to fund expansion or refurbishment, or to attract private sector investment into the power sector.
- Lack of maintenance of the existing facilities due to inadequate finance/technical leading to reliability problems.
- Inappropriate tariffs, often resulting from political interference, with tariffs below marginal costs.
- Poor governance or unstable governments due to regional and ethnic conflicts.
- Inadequate revenue collection mechanisms, and therefore credit unworthy businesses.
- Inadequate rainfall which causes power rationing.

All these have culminated in poor supply of electricity with its attendant effects on the operations and performance of SMEs.

**Reliability:**

Reliability of electricity supply is another trajectory that is closely linked to the supply risk trajectory. Reliability was catalogued as a dimension of service quality in the work of Parasuraman et al., (1988). It was then defined as the degree to which the retail service provides what was promised and when it was promised (Dabholkar et al., 1996). Electricity service providers have since measured system performance using reliability as an index (that is the proportion of uninterrupted customer hours provided per year out of a total number of customer hours provided per year). The deteriorating level of quality of electricity supply has since received a lot of researchers' attention.

In Nigeria, there are problems with the quantum of electricity supplied. The problems have been compounded with fluctuations in the supply of power which tends to affect business operations negatively. The New York Times in 2001 surmised that some businesses especially ICT-related businesses have suffered significant losses resulting from vulnerable electricity supply. Electricity interruption frequencies, the duration of the interruptions and/or load curtailment have been known to cause a lot of difficulties for specific industries particularly those that use electricity as a resource. The electricity interruptions or fluctuations have had varying effects on businesses including but not limited to instantaneous damage to semi-finished goods, associated costs incurred in repairing equipment's and losses accrued from delayed or cancelled orders. Two types of interruptions have been identified. They are planned interruptions and unplanned interruptions.

Planned interruptions have a mitigating effect on business operations because potential damage to semi-finished goods or materials can be minimized through the switch to alternative sources of electrical power such as generators and solar panels. Cost incurred due to delayed or cancelled orders or equipment repairs can also be avoided because production and delivery schedules can be adjusted ahead of time. However, the costs of alternate power sources such as power generators, as well as expenditure on overtime pay to staff and outsourcing service cannot be avoided (Wang, 2002). Unplanned interruptions however, have unmitigated and sometimes unforeseeable effects on business operations. Often, there are damages that tend to affect product quality, semi-finished goods and costs incurred in repairing, and in delays in the delivery of orders. The cancelations in delivery are borne by businesses and that increases the operation and maintenance costs (Lai, Yik and Jones, 2008).

**Empirical Review**

Udoudoh and Umoren (2015), using simple percentages and ranking method conducted an appraisal of public electricity performance and its implications on economic development in Nigeria. In order to get users' opinions on performance of public electricity supply, 450 copies of questionnaire were administered on consumers of electricity in three (3) major cities in the Niger Delta Region of Nigeria. In each city, 150 copies of questionnaire were given out and only a total of 366 copies of questionnaire representing 81% of the administered copies of questionnaire were properly filled and returned within the specified timeframe.

The questionnaire sampled users' opinions on regularity of supply, pattern of distribution, maintenance culture and problems hindering effective performance of the sector

in Nigeria. The research revealed that whereas the pattern of electricity distribution is perfect as indicated by 263 respondents representing 72% of the sampled population, the maintenance culture is very poor. A total of 217 respondents representing 59% of the sampled population noted that PHCN does not maintain its facilities which result in epileptic power supply. The research concluded that the way out is to incorporate experienced private investors in the provision and management of electricity supply through public-private partnership in Nigeria.

Iduu's (2012) research work centers on the power supply and the performance of small and medium scale industries in Nigeria from 1986 – 2010. In carrying out this study, secondary data were collected and empirical analysis was made to achieve these objectives, multiple regressions were used in analyzing the data. In investigating this problem, the researcher introduced 2 hypotheses which suggest that power supply fluctuation has no significant impact in Nigeria; and econometric models were used for evaluation and testing of the hypothesis. The researcher made use of the ordering least square (OLS) and the outcome of the model shows and confirms that power supply changes have a negative impact on Nigerians. And that a unit change in power supply has a positive impact on both the gross domestic product and balance of payment in Nigeria. Based on the findings, certain recommendations were made which include government increasing its efforts in tackling the issue of corruption and fraud.

Doe and Asamoah (2014), analyzed the effect of electric power fluctuations on the profitability and competitiveness of SMEs, using SMEs operating within the Accra business district of Ghana as a case study. This research is a cross-sectional survey and it adopted a mixed method approach. A sample of 70 Ghanaian SMEs was selected using a systematic sampling approach. Inclusion criterion for the selection of the SMEs was their location within the business district of Accra as well as their use of electricity in their main business operation. Data was collected with an interviewer-administered structured questionnaire which focused on the effect of power fluctuation on the operations of SMEs, especially on the profitability and its resulting effect on the firms' competitiveness.

The SPSS statistical package was used to group and analyze the data. The study is a single-factor analysis of the exogenous problems facing the Small and Medium Enterprise sector and it study found that without reliable energy supply, SMEs are unable to produce in increased quantities and quality leading to poor sales hence low levels of profitability. It is established that low profitability negatively affects Return on Assets (ROA) and Return on Investment (ROI) of SMEs. Consequently, if the level of profitability is high, it is expected that ROA and ROI will be high and vice versa

### **Methodology**

This study took a descriptive survey approach and data was sourced from the 29 management staff of max aluminum, owerri using a five point Likert scale questionnaire. The data gathered was analyzed with Wilcoxon Mann Whitney U test which is a non-parametric equivalent of t-test using the 20.0 version of statistical package for social sciences (SPSS). The Wilcoxon Mann Whitney U test is described thus;

$$U_1 = R_1 - \frac{n_1(n_1 + 1)}{2}$$

Where

$R_1$  = Rank of the sample size

$n_1$  = sample size

$U_1$  = Mann Whitney

**Data Analysis**

The SPSS output of the data used in this study is presented in the tables below;

**NPAR TESTS**

/M-W= VAR00001 BY VAR00002 (1 2)

/STATISTICS=DESCRIPTIVES

/MISSING ANALYSIS.

**Mann-Whitney Test for Hypothesis one**

**Table 1. Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
VAR00001	25	5.6000	2.66145	1.00	10.00
VAR00002	25	5.6000	2.92973	1.00	10.00

**Table 2. Ranks**

+	VAR00002	N	Mean Rank	Sum of Ranks
	1.00	1	2.00	2.00
VAR00001	2.00	5	3.80	19.00
	Total	6		

**Table 3. Test Statistics<sup>a</sup>**

	VAR00001
Mann-Whitney U	1.000
Wilcoxon W	2.000
Z	-.933
Asymp. Sig. (2-tailed)	.351
Exact Sig. [2*(1-tailed Sig.)]	.667 <sup>b</sup>

a. Grouping Variable: VAR00002

b. Not corrected for ties.

**Mann-Whitney Test for Hypothesis Two**

**Table 4. Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
VAR00001	25	5.7600	2.50466	1.00	10.00
VAR00002	25	5.6000	2.92973	1.00	10.00

**Table 5. Ranks**

	VAR00002	N	Mean Rank	Sum of Ranks
	1.00	1	3.00	3.00
VAR00001	2.00	5	3.60	18.00
	Total	6		



**Table 6. Test Statistics<sup>a</sup>**

	VAR00001
Mann-Whitney U	2.000
Wilcoxon W	3.000
Z	-.311
Asymp. Sig. (2-tailed)	.756
Exact Sig. [2*(1-tailed Sig.)]	1.000 <sup>b</sup>

a. Grouping Variable: VAR00002

b. Not corrected for ties.

### Mann-Whitney Test for Hypothesis Three

**Table 7. Descriptive Statistics**

	N	Mean	Std. Deviation	Minimum	Maximum
VAR00001	25	5.7200	2.62234	1.00	10.00
VAR00002	25	5.6000	3.12250	1.00	10.00

**Table 8. Ranks**

	VAR00002	N	Mean Rank
VAR00001	1.00	2	6.00
	2.00	4	5.50
	3.00	4	5.25
	Total	10	

**Table 9. Test Statistics<sup>a,b</sup>**

	VAR00001
Chi-Square	.088
Df	2
Asymp. Sig.	.957

a. Kruskal Wallis Test

b. Grouping Variable:  
VAR00002

### Discussion of Results

From the SPSS result obtained as shown in the tables above, hypotheses 1, 2, and 3 shows an output of 0.67, 1.00 and 0.96 which were all above the 0.05 level of significance. Hence, the null hypotheses that fluctuating electricity power supply do not contribute positively to market competitiveness, operational efficiency and environmentally friendly operations were accepted.

### Conclusions

From the findings in this study, the researcher concludes that fluctuating electricity power supply has negative impacts on corporate performance; it also affects operational inefficiency and violation of acceptable operational environmental standards by corporate organizations in Nigeria. Fluctuating power supply leads to high cost of production emanating

from the cost of alternative sources of power; this has exposed Nigerian organizations to competitive pressure from organizations outside Nigeria, for example, China and Japan.

### Recommendations

- Sequel to the results and conclusions as follows, the researcher recommends that;
- i. The federal government should as a matter of urgency review electricity distribution policy in order to accord priority to industrial centers. This will enhance their operation in an eco-friendly manner thereby reducing industrial emissions that pollute the environment
  - ii. Government should provide electricity subsidy for small and medium scales. This will help reduce their production and operational costs, thereby enhancing their market competitiveness.

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