

## Electricity Supply Shortages and Investment Opportunities in the Power Sector: A Study of Transmission Company of Nigeria

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### Abstract

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This study examined the relationship between electricity supply shortages and investment opportunities in Transmission Company of Nigeria of the power sector. The data used in this study were collected from mainly primary source. The main research instrument adopted was explanatory design through survey approach to gather information from the targeted respondents as well as a structured questionnaire that were asked to guide the respondents in order to elicit information on the subject matter. The study had a population of 197 made up of owners, employees of private firms, technical engineers, unions and association and journalists. The sample size of 131 was derived using the taro Yamane formula, out of which (85) were response rate collected and used for analysis. Purposive sampling was used to administer copies of questionnaire and interview on the respondents. The study adopted the use of descriptive statistics to analyze the demographic characteristics of the respondents while inferential statistics of simple linear regression was used to test the hypotheses in line with the objective of the study. The study found out that there is a significant and positive relationship between electricity supply shortages (ESS) and investment opportunities (IO) in the transmission aspect of the power sector. It was recommended that there should be the development short-term roadmap investment strategy by way of partnership that will lead to expansion of transmission lines and network by way of dualization to reduce redundancy and creation of more substations. The study is also of the view that a constructive and efficient implementation strategy developed by the management of transmission company of Nigeria towards attracting investment in modern technology and equipment that can come in form of donations or support from international community. The study concludes that government agencies in the power industry should device new measures in tackling maintenance culture which has been relatively poor and have rendered some assets and facilities obsolete and, in the process, strengthen global best practices and processes so as to gradually eradicate the poor maintenance culture in Nigeria.

**Keywords:** Stormy weather, Equipment failure, Poor maintenance culture, Electricity supply shortages, Investment opportunities

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### **Background to the Study**

Electricity is regarded as one of the fundamental components of contemporary existence. It is a crucial component in the creation of goods and services and in maintaining high standards of living. However, the quality of supply to connected families and businesses is fragile despite the fact that more than 600 million people in Africa need access to electricity (IEA, 2015). Many African nations now often experience electricity disruptions. Dagnard and Andersen (2013). Major businesses like mining, which rely on effective infrastructure to function, are at risk (2013). Lacks in governance, money, and a skilled labor force have been revealed by past energy infrastructure projects in Africa, all of which could be essential components for a successful expansion of the current power system, according to Collier and Venables (2012).

To improve the delivery of power to its citizens, the Federal Government of Nigeria has started a long-term structural reform of the industry since 1999. The main driving force has been the Roadmap for Power Sector Reform, which was introduced in 2010. From a single state-owned utility to an unbundled system with private participation and asset ownership across generation and distribution, the government has transformed the power sector. Therefore, increasing Nigeria's power production is essential to addressing the energy crisis. Construction of new gas-fired power plants and ongoing renovation of existing generation facilities will be beneficial. Building more generation capacity alone, though, is insufficient; it must also be supported downstream by increased transmission capacity and upstream by enhanced gas availability.

First, on a large scale, ongoing power outages distort the business environment and raise the anticipated cost of conducting business. This could either deter prospective business owners from starting their own enterprises or force them to relocate to regions (or nations) with a plausible and reliable supply of electricity. Second, because electricity is a necessary component of production in the intense margin, supply issues have a negative influence on the productivity and profit of businesses. As a result, falling marginal labor productivity brought on by electricity shortages will have a negative impact on labor demand and employment. At the margin, firms employ labor as long as the marginal output of labor is at least equal to wages. The third route involves enterprises' trade competitiveness and exports. Due to fluctuations in the electrical supply, businesses will either have to Use self-generated energy or stop producing. Because of the high cost of generation, relying on self-generated electricity raises manufacturing costs, but stopping production also results in lost output. In either case, a lack of electricity makes it more difficult for businesses to compete on the market with other companies from sophisticated economies that have reliable access to power in terms of pricing and capacity to meet delivery deadlines.

Due to earlier capital investments in the sector failing to provide the intended results that would have improved the supply of electricity and, in turn, stimulated economic development, the Federal Government of Nigeria began the liberalization and privatization of the power sector. As a result, the Nigerian power sector underwent a significant transformation from a vertically integrated, publicly-owned electrical network to one that is primarily privately held, with the division of the various electricity business divisions through

a procedure known as "unbundling." With the reforms, Nigeria's power sector has transitioned from a governmental monopoly to a competitive electricity market.

Five distinct electrical industry segments are available as investment targets: Utility-scale independent power projects to increase generation capacity (a generation plant is considered utility scale if it has a capacity of at least 5 or 10 megawatts (MW), depending on the local context); Projects on the transmission system to increase or expand capacity to move high-voltage electricity from significant load centers to large production centers, as well as interconnections that could enable cross-border power exchange, Projects to improve local networks and create links to new clients in a district, including homes, businesses, and industries, Off-grid schemes to enable local village or individual customer level electricity production and distribution prior to (or concurrently with) the establishment of a centralized electrical grid in the area, investments in technology that support the quality, reliability, and viability of the above segments, such as battery storage, smart meters, and prepayment or mobile payment mechanism.

In addition to generally increasing the system's capacity to fulfill current, latent, and forecast demand, generation and transmission improvements also improve the availability and reliability of energy and decrease downtime. Investments in generation and transmission are crucial to defining a cleaner energy mix, depending on technology, cost structures, and variables like regional trade potential. By incorporating higher proportions of renewable energy and low-emission generation, they achieve this. Effective, well-maintained, least-cost generation and transmission are essential to the financial viability of electricity systems; new projects can ease the utility's financial load by reducing total costs and losses (including by allowing them to retire more expensive generation plants). In a developing nation, increasing generation capacity can have a big impact on the standard of living severe effects on the grid services' reliability and quality. The utility can run more reliably if there is enough generating power. Similar to this, transmission and distribution infrastructure improvements can support grid reliability, which has an impact on energy use, costs, and other areas like productivity and leisure.

The power sector has been impacted by stormy weather, which is a result of outside forces beyond human control and can take the form of thunder, lightning, dark clouds, strong winds, and pelting rain. These conditions are obviously awful and destructive to investments in the power sector in terms of equipment that can fail because systems and equipment are susceptible to failure that can result in complete destruction of equipment and severe power outages. In order to maintain development within the power sector, people must establish a maintenance culture. Non-compliance with international standards can generally have this effect. As a result, the paper explores investment potential in Transmission Company of Nigeria and electrical supply problems in the energy sector.

### **Statement of the Problem**

Despite producing commercial amounts of electricity for more than a century, Nigeria's infrastructure development for electricity is moving at a very slow pace, and the country's

power supply is still woefully insufficient. To address issues related to the previous monopoly of the government in electricity generation, transmission, and distribution, two areas of Nigeria's power sector (generation and distribution) were privatized in 2013. However, privatization just altered the scope of the issues; the nation's electricity supply remains mostly inadequate, expensive, and unreliable.

Ama, B. A. (2020) The challenges of the electricity shortages and investment opportunities may have a resulting effect from the poor budgetary allocation in terms of funding, foreign and currency issues and incompetent management. The consistent fluctuation in electricity supply shortages even with investment from the private and public sector in terms of power development has still remain a very common problem with certain incidence of electricity supply shortages like stormy weather which could be in form of high winds, lightning, snow and wildlife which can damage the power equipment and require investment in critical lines and transmission network; another potential contribution of such electricity supply shortage are the persistent equipment failure as a result of poor manufacturing, damages during shipping, improper installation, extreme currents and voltage and state of mechanical wear which will require investment in modern technology and equipment; unfortunately another issue on electricity supply shortages is maintenance culture which are as a result of non-regular supervision and evaluation, poor training in terms of maintenance capacity development and non-implementation of maintenance policy which may affect project maintenance practices. However, the fundamental major issues for the study will be the decline in investment of critical lines and transmission network, decline in the investment of modern technology and equipment, decline in project maintenance practices and operational processes.

### **Research Question**

The following research questions are addressed by this study in light of the earlier noted issues:

- i) To what extent have electricity supply shortages (stormy weather) influenced investment opportunities in Transmission Company of Nigeria of the power sector?
- ii) To what degree does electricity supply shortages (equipment failure) impact on investment opportunities in Transmission Company of Nigeria of the power sector?
- iii) To what extent have electricity supply shortages (maintenance culture) affected the investment opportunities in Transmission Company of Nigeria of the power sector?

### **Objective of the Study**

Examining the lack of electricity supply and potential investment opportunities in the power sector is the study's main goal. The specific goals are:

- i) To determine the influence of electricity supply shortages (stormy weather) on the investment opportunities in transmission company of Nigeria of the power sector.
- ii) To examine the impact of electricity supply shortages (equipment failure) on the investment opportunities in transmission company of Nigeria of the power sector.
- iii) To access the effect of electricity supply shortages (maintenance culture) investment opportunities in transmission company of Nigeria of the power sector.

### **Statement of Hypotheses**

In the course of this study, the following null hypotheses were formulated:

- H<sub>01</sub>:** Electricity supply shortages (stormy weather) have no significant influence on investment opportunities in Transmission Company of Nigeria in the power sector.
- H<sub>02</sub>:** Electricity supply shortages (equipment failure) does not significantly impact on investment opportunities in Transmission Company of Nigeria in power sector.
- H<sub>03</sub>:** Electricity supply shortages (maintenance culture) have no significant effect on investment opportunities in transmission company of Nigeria in power sector.

### **Significance of the Study**

The study will be benefitting to the management of power companies which will consist of owners, employees, legal expert, power experts, unions and association. The study will be of great importance to the management of Transmission Company of Nigeria towards sustaining investment opportunities so as to reduce the electricity supply shortages in the power sector. It will be of good importance to the body knowledge (researchers and academicians) for further reference and development on the study area.

### **Scope and Limitation of the Study**

The study focused on electricity supply shortages and investment opportunities in the power sector. The study examined the proxies of electricity supply shortages which are stormy weather, equipment failure and poor maintenance culture because they are known to be challenges that confront electricity supply. (NESA). In the course of this study, we focused on a 4-year period precisely from 2015-2019; the period was chosen because some activities happened within this period like the change of government, reported cases of collapse in grids, several changes of director generals at the TCN and security threat. The study will focus on employees and owners of private players in the power sector, technical engineers outside the TCN work, few members of unions and associations and journalists from media house. We were limited due to the short period required to conduct this study and hope to expand more on it after the seminar.

### **Literature Review and Theoretical Framework**

#### **Conceptual Issues**

#### **Electricity Supply Shortages**

As was already said, the main obstacle to Nigeria's economic development is the epileptic power supply to homes and businesses. The power generation component is the backbone of the power system because the amount of electricity generated can be transferred and distributed to households and businesses. This part of the power system had suffered disgracefully from inadequate funding, poor or nonexistent maintenance, and poor infrastructure management, among other things, which had led to a large number of the power generation stations closing down and others producing power far below their installed capacity.

Two dependability indices in the data, one of which measures the frequency of shortages and the other of which measures their duration, are used to describe shortages. A customer's

typical annual number of interruptions is measured by the System Average Interruption Frequency Index (SAIFI). In more detail, SPAIFI is determined by dividing the total yearly number of customer supply interruptions by the total number of consumers served by the distribution firm in any given year. The second metric, the System Average Interruption Duration Index (SAIDI), records the average number of minutes of outages that a client encounter annually. Neither SAIFI nor SAIDI cover load shedding-related disruptions. The value of SAIFI and SAIDI varies significantly between locations, nevertheless, even today.

### **Concept of Weather**

Pressure, wind, humidity, temperature, and precipitation all interact with one another. They affect factors such as the wind's speed and direction, the quantity of sunlight, the amount of cloud cover, and the amount of precipitation. These are referred to as the elements of the climate and the weather. The impact of these factors varies from location to place and throughout time. It might only be available in a small location and for a brief period of time. Depending on the predominant weather element at a place and a time, we frequently refer to this influence as weather when we use words like sunny, hot, warm, cold, fine, etc. Therefore, weather can be defined as the atmosphere of a location during a brief period of time in relation to one or more components. Although the terms weather and climate are sometimes used synonymously, they actually refer to distinct ends of the same continuum. The daily varying atmospheric conditions are referred to as the weather. The average state of the atmosphere and the underlying land or water in a specific area throughout a specific time period is called the climate. Weather is what you receive and climate is what you anticipate. On a variety of scales, daily weather component's function. The micro scale, which includes the surface of a single leaf, is the smallest scale at which heat and moisture transfers take place. The summary statistics of a number of atmospheric and surface variables, including temperature, precipitation, wind, humidity, cloudiness, soil moisture, sea surface temperature, and the concentration and thickness of clouds, are commonly used to characterize climate.

### **Concept of Equipment Failure**

In the industry, equipment failure is a recurring problem that challenges both the manager in charge of ensuring the availability of the equipment and the technician who looks after it. The loss of operation of a single piece of equipment can result in complete downtime and loss of production until the equipment is fixed or replaced, despite the fact that it may seem to be a key worry for the maintenance team. As much as we would prefer that these failures never happen, it is a problem that we will continue to manage, but the success of the management depends on the proper definition of the issue and the accurate determination of the cause. Any situation in which a piece of equipment fails to fulfill its intended function or mission is considered an equipment failure. It might also indicate that the machinery has ceased working, is not operating as it should, or is not performing up to expectations. It will be simple to propose a remedy that can address the problem's fundamental cause once the definition of an equipment failure and what causes it are understood.

### **Concept of Maintenance Culture**

The term "maintenance" refers to all planned and unplanned actions taken to maintain constant access to working machinery in a manufacturing facility. According to Velmurugan and Dhingra (2015), "technical skills, procedures, and methods to properly utilize the assets like factories, power plants, vehicles, equipment, and machines" are needed for proper maintenance. According to some, maintenance is a crucial component of effective production. The significant contribution of maintenance costs to the overall expenditure of the manufacturing plant best illustrates the need of an appropriate maintenance policy. In addition to cost reduction, the highlighted issue is linked to increased quality, decreased component replacement rates, increased profitability and efficiency, as well as an impact on the overall performance of the production process. The primary goals of maintenance actions are to generate revenue while minimizing overall costs. It can be accomplished by getting rid of malfunctions, errors, flaws, wastages, and any undesired occurrences. It can also be accomplished by improving workforce safety and budget management. Additionally, the goal of maintenance activities is to correctly schedule inspections, repairs, and replacements as well as to provide management personnel with information regarding the reasons behind failures and damages. Numerous maintenance plans and procedures have advanced over time, taking the advantages of maintenance policy into mind. The evolution and expansion of these concepts' appeal is impacted by all changes and transformations in the industry.

### **Concept of Investment Opportunities**

Opportunities for Investment Given the enormous need for infrastructure over the ensuing years as well as the quick urbanization of Nigeria's towns and cities, there is a major need for investment at all levels of the value chain, from fuel supply through generation to transmission and distribution. Even though the generation sector has seen a lot of activity, as homes and businesses switch from self-generation to the grid, fresh opportunities are opening up for additional generation facilities. Currently, the majority of money invested in the privatization of the power sector comes from domestic sources. In the case of the DISCOs, the principal JV members were primarily Nigerian firms with international strategic partners.

The following are potential investment opportunities for the private sector due to the deregulation of the industry: constructing new power plants, developing new facilities for the production, purification, and transportation of gas under private ownership or management, Construction of new gas supply facilities, Manufacturing of wires, cables, transformers, and auxiliary equipment, Expansion of current transmission lines in cooperation with TCN, Manufacturing of metering devices, Production and distribution of operations and maintenance services. An asset or object purchased with the intention of generating income or appreciation is referred to as an investment. The term "appreciation" describes a rise in an asset's worth over time. When a person buys a product as an investment, they don't intend to utilize it right away; instead, they plan to use it to make money later on. An investment always entails the expenditure of some resource today—time, money, or effort—in the anticipation of a bigger return than what was first invested.

Investment is the use of money with the intention of earning a profit. Investment, in its broadest sense, refers to the use of money with the intention of increasing it. The acquisition of a financial instrument or other valuable commodity with the hope of receiving favorable future returns is referred to as investing in finance. Every person should invest their hard-earned money because it is an essential activity. Investment is the commitment of money that has been set aside from current expenses in the anticipation of future gains. It is a benefit for holding out for money, therefore. There are numerous investment choices available with various risk-reward tradeoffs. An investor can build a portfolio with the aid of a solid understanding of the ideas and in-depth examination of the available possibilities.

The most extensively used tactic, nevertheless, has been self-generation. When there is a power outage, businesses invest in backup power generation. Reinikka and Svensson (2002), poor and unreliable electric power supply (which forced businesses to invest in backup generators) significantly lowers businesses' investment in other productive activities. Firms invest in back-up facilities to generate their own electricity in-house as a tactic to reduce the expense of an unpredictable or inadequate power supply. As a result, numerous businesses are compelled to keep their backup generation capacity. Self-generated electricity, however, typically costs more than electricity from the grid. This cost disparity restricts self-potential generations as a long-term replacement or remedy for unstable power supplies.

### **Theoretical Framework and Bases**

#### **The Accelerator Theory of Investment (Clark, 1917)**

Assume that the link between the stock of capital and the output is constant and stable. The stock of capital is also instantly adjusted by investment every period, bringing it into alignment with the desired level. The accelerator theory is actually a Keynesian theory because it upholds the fundamental tenet that the real economy is influenced by aggregate demand, with the output in Clark's model serving as a stand-in for aggregate demand. Investment is only influenced by changes in the aggregate demand since the adjustment happens instantly and the capital to output ratio is fixed. To put it another way, while the economy's demand is rising, businesses will invest more in order to maximize their profits because doing so will increase the economy's supply and output. Prices, wages, taxes, and interest rates have no bearing whatsoever on the investment choices made by businesses. The findings, show that there exist a positive and statistically significant relationship between the investment and the production. The constant capital to output ratio and the fact that it downplays the significance of the cost of capital in the firms' decision-making, however, make it the most criticized theory.

#### **The Elite Theory**

A socio-political theory known as the "Elite theory" has its roots primarily in the works of Gaetano Mosca, (1858–1941) Vilfredo Pareto, (1848–1923) Robert Michels, (1876–1936) and Max Weber (1864–1920). The theory's main tenet is that a minority of elites might hold a monopoly on power in society due to the hierarchical organization of social and political institutions in that society, and as a result, they use that power to express their preferences and beliefs. Higley (2010). According to the elite theory, there are two main groups in every



society: the dominated majority and the governing few (the elites). This theory contends that the governed majority is uninterested in and ignorant in public policy, hence it is the minority ruling elites who make judgments regarding public policy in many spheres of society and then persuade the ruled majority to accept those decisions. Mosca's term for political elites normally have "a certain material, intellectual, or even moral superiority" over those that are govern; Pareto mentioned that in a society with truly unrestricted social mobility, elites would comprise of the most talented and deserving individuals; but in actual societies, elites are those most adept at using the two modes of political rule, force and persuasion, and who usually enjoy important advantages such as inherited wealth and family connections; Weber held that political action is always determined by "the principle of small numbers, that means, the superior political maneuverability of small leading groups. The findings of Mosca and Michels, democracies can never be more than competitions between elites who greatly narrow voters' choices and grossly distort their interests. Weber hoped that distinctive "leader democracies" marked by the domination of charismatic leaders over professional parliamentary politicians, party machines, and state bureaucracies might emerge. Pareto was less hopeful: There can, at most, be a "demagogic plutocracy" in which an alliance of fox-like politicians and profit-seeking capitalists' rules through deception, demagoguery, and the bribing of diverse interests.

#### The Neoclassical Theory of Investment. **Jorgenson D. W., & Stephenson J.A, (1963)**

The neoclassical theory of the optimal accumulation of capital serves as the theoretical underpinning of the neoclassical theory of investment. We won't try to summarize the idea because it is lengthy and heavily mathematical. Instead, we'll quickly go through its main findings and how they affect policy. The neoclassical theory states that output and the cost of capital services in relation to the cost of output determine the desirable capital stock. The cost of capital services is influenced by the cost of capital goods, the interest rate, and how corporate income is taxed. As a result, changes in desired capital stock and the cost of capital services compared to the cost of production influence investment. However, the neoclassical approach contends that corporate taxes are significant not because it affects the availability of internal money but rather because of its impact on the cost of capital services. However, regulations intended to change how business revenue is taxed have an impact on the desired capital stock and, consequently, investment. The findings of Jorgenson D. W., and Stephenson J.A., depended critically upon their assumptions that focused on what they now refer to as "maintained hypotheses," tied in part to the Cobb-Douglas production function, which constrains investment behavior to entail identically distributed lagged responses to changes in relative price and in output in accordance with long run elasticities of capital stock demand equal to unity.

#### **System Theory**

Von Bertalanffy (1956) describes a system as a collection of interconnected components. In order to identify universal principles that apply to all systems, von Bertalanffy encourages systems thinking across all academic disciplines. The emphasis on interactions in general systems theory is a basic idea. A single autonomous element's behavior differs from its

behavior when it interacts with other independent components, according to relationships, which lead to this conclusion. The contrast between open, closed, and isolated systems is another fundamental principle. Energy, matter, people, and information are all exchanged with the outside world in open systems. Only energy can be exchanged in closed systems; neither information nor substance can. In an isolated system, there is no elemental exchange. Many strategies were devised, building on general systems theory. Open system theory, viable system model, and viable system approach are a few examples. The relationships between organizations and the environment they are a part of are examined by open system theory (OST). This emphasis reflects how well organizations can change to new environmental conditions, whether or not information processing is required (Boulding, 1956; Katz and Kahn, 1978).

According to this hypothesis, things that can process information about their own particular environment are more equipped to adapt to changes in the surrounding circumstances. There are two adaptive orders that both refer to the informative deviation: I. counteraction - first level (to process data from an organism's environment), associated with the capacity to direct behavior through personal goals (Ashby, 1958); II. amplification - second level, associated with constructivism theory (in contrast to realism), leading to work on self-organization (von Foerster, 1981). When it comes to organizations, Katz and Kahn (1978) use the idea of an open system. The company is viewed as an energetic input-output system, with the energy from the output reactivating the system. Organizations are discussed as socio-technical systems by Emery and Trist (1960), who emphasize the two key parts of the firm as a system: a social component (people) and a technological component (technology and machines). On the other hand, the Viable System Model (VSM) describes a system as an entity that is flexible in order to survive in its changing environment (Beer, 1972). The viable system is a cybernetic abstraction that can be used to describe autonomous groups. The study of how a system's actions lead to changes in the environment that are understood by the system itself in terms of feedback, allowing the system to adapt to new conditions, is known as cybernetics, which is an interdisciplinary study of the structure of regulatory systems.

So, the system has the ability to alter its behavior. In cybernetics, the levels of complexity between the system and the environment are different because the environment possesses complexity levels that the system cannot perceive (Golinelli et al, 2002; Barile, 2005). When used in organizations, the viable system model concentrates on conceptual tools for comprehending the structure of systems in order to redesign them through: (i) change management; (ii) comprehending the organization as a whole; and (iii) assessing the crucial roles of implementation, coordination, control, intelligence, and policy (Beer, 1972; Espejo and Harnden, 1989; Espejo, 1999; Christopher, 2007). Finally, a novel interpretation of unified strategic organizational and management models called sub-systems and supra-systems is proposed by the viable system approach (VSA). While supra-systems concentrate on the links between businesses and other influential systemic elements in their setting, sub-systems analyze interactions among internal business components (Golinelli, 2000; Golinelli, 2005; Barile, 2006; Barile, 2008). Systems functioning on permeable boundaries and self-maintenance processes are considered as being more open and complicated at levels four (cells) or higher (Schneider and Somers, 2006).

This hierarchy is also used to explain how fully systems embody the attributes of agency. There are six stages of the continuum: multivocal systems, reactive systems, goal-driven systems, problem-solving systems, and determined systems (Poole, 2014). Because systems operate in a preset manner in determined systems (level one), agency is not taken into account. In contrast, in multivocal systems (level 6), agents can dynamically form many selves in various contexts that entail problem-solving and monitoring procedures. In other words, if a system has more agencies, it is more likely to be flexible and changeable. In conclusion, systems theory promotes a dynamic vision of social organizations with porous boundaries and stable states achieved through interdependent connections among the components. Despite systems theory's extensive use in organizational research, its environmental determinism perspective has drawn criticism or questions. Opportunities for adaptability may be discouraged or neglected because organizations are viewed as living, growing, and dying biological creatures (Schneider and Somers, 2006). Later theories can overcome this problem by emphasizing the active participation of people in organizations. The system theory was chosen as the theoretical bases to explain the underlying causes of some of the difficulties the Nigerian power sector reform program is currently experiencing.

### **Empirical Review**

Okafor (2008) concluded in his study that despite significant sums of money invested by the Nigerian government in the power sector from 1999 to 2007, the situation remained dire. Less than 3,000 MW were produced in the nation, which has a population of over 140 million, compared to the over 10,000 MW required to alter the economy. Okafor cited a number of reasons why Nigerians lack access to adequate power and claimed that the unfavorable situation had serious negative effects on the expansion and development of the country's industrial sector because the majority of businesses had to spend a significant amount of money running their own private generators. The unhappy scenario, he continued, has significantly hampered the nation's efforts to expand its industrial base.

Ado and Josiah (2015), investigated how the lack of adequate electric power supply affected the operations of small enterprises operating in northeastern Nigeria. Their research demonstrates the seriousness of electrical supply interruptions and the financial burden they place on the region's operating this particular class of enterprises. They recommended that policy emphasis be concentrated on reviving Nigeria's energy industry, which will enhance the country's economy.

Nwankwo and Njogo (2013), evaluate the impact of electricity supply on industrial development as well as the impact of electricity supply on economic development. According to the study, there is a positive correlation between population, industrial production (INDU), Gross fixed capital formation (GFCF), and electricity (ELEC).

George and Oseni (2012), Nigeria's unemployment rates and the availability of electricity are compared by the authors. The impact of electricity power outputs, supply, and consumption in addressing the high unemployment rate in Nigeria was studied using the ordinary least square regression model. Between 1970 and 2005 is the time period covered by their study.

Their research demonstrates that Nigeria's industrial sector received a lower supply of electricity than was provided for household use. According to their research, the industrial sector's insufficient and unreliable power supply is Nigeria's main contributor to the country's high unemployment rate.

Uzochukwu and Nwogwugwu (2012), looked at how much money the Nigerian federal government spent on the electrical sector. The outcome of their research demonstrates that, despite several reforms implemented by previous administrations and an increase in investment in the electrical sector, the reform objectives are not yet fully realized in the electricity output.

### Methodology

The study adopted explanatory design through survey approach to gather information from the targeted respondents. The population of the study was 197 respondents cutting across Business owners and employees of private sector companies, technical engineers, union and association active staff and journalist. Taro Yamane formula was used to determine the sample size (131) for the study. Purposive sampling was applied due to the fact that is extremely time and cost effective and squeeze information out of the number of employees, business owners, union and association, technical engineers, and journalists that made up the sample size. Data were collected from primary source. The information was gathered through interviews and copies of questionnaires. The questionnaire is divided into two sections: section A, which asks questions about respondents' demographics, and section B, which asks questions about responses to the study's research topics and uses a five-point Likert scale with multiple-choice answers. To define the demographic information of respondents, identify energy supply shortfalls, and identify investment opportunities in the power sector, descriptive statistics and simple linear regression analysis were utilized as part of the data analysis methodologies.

## Results and Discussion

### Response Rate

**Table 1:** Response Rate

Respondents	Number of Questionnaires Administered	Number of Questionnaires Retrieved	No Not Retrieved	Valid Percent	Cumulative Percent
Business Owners	18	11	7	13.74	13.74
Employees of private power players	51	33	18	38.93	38.93
Technical Engineers	28	19	9	21.37	21.37
Journalists	12	8	4	9.17	9.17
Union & Association staff	22	14	8	16.79	16.79
<b>Total</b>	<b>131</b>	<b>85</b>	<b>46</b>	<b>100</b>	<b>100</b>

**Source:** Field Survey, (2021)

Table 1, a total of eighty-five (85) questionnaires representing a response rate of 65% were collected out of the one hundred and thirty-one (131) questionnaires that were distributed for the study. The majority of respondents (33) representing 38.93% were employees of private players, while 11 of them representing 13.74% were business owners in the private sphere of power. The analysis also reveals that (19) of these respondents representing 21.37% were union and association members, as were (14) respondents representing 16.79%.

### Demographic Characteristics of Respondents

We therefore include the demographic information of the respondents in table 2 since it is important to note that the respondents' characteristics affect the outcomes. Information on five (5) different respondent characteristics that are pertinent to the study was gathered, as shown in the table, and was then analyzed. To aid in the analysis, data were gathered on the respondents' gender, educational background, employment history, kind of appointment, and designation.

**Table 2:** Respondents Characteristics

		Frequency	Percentage
Union & Association	Union	54	63.53
	Association	31	36.47
	<b>Total</b>	<b>85</b>	<b>100</b>
Educational Qualification	Postgraduate	22	25.88
	Degree	39	45.88
	Diploma	15	17.65
	Others	9	10.59
	<b>Total</b>	<b>85</b>	<b>100</b>
Working Experience	Below 5 years	20	23.53
	Btw 5 to 10 years	38	44.71
	Above 10 years	27	31.76
	<b>Total</b>	<b>85</b>	<b>100</b>
Nature of Appointment	Tenure	26	30.59
	Part time	34	40.00
	Contract	25	29.41
	<b>Total</b>	<b>85</b>	<b>100</b>
Designation	Senior Management	28	32.94
	Middle Level	41	48.24
	Low Level	16	18.82
	<b>Total</b>	<b>85</b>	<b>100</b>

**Source:** Field Survey, (2021)

Table 2 shows that on the respondent's union (54 or 63.53%) responded follow by the association (31 or 36.47%) respectively. This further shows that most of the respondents had a good knowledge of the industry.

It shows that virtually all the respondents have one form of education with the second highest having (22 or 25.88) having postgraduate degree, the majority (39 or 45.88) having bachelor's degrees, (15 or 17.65) possessing Diploma and others (9 or 10.59) respectively. These statistics further shows that most of the respondents had higher education to be engaged competently in the discourse for meaningful contributions to the study.

On the respondents working experience, the table shows that those with below 5 years' experience in the beverage sector amount to (20 or 23.53), those between 5 to 10 years are in the majority with (38 or 44.71) of the total and those above 10 years constitute (27 or 31.76%). This further justifies the earlier conclusion that most of responses were presumed to be emanating from that category of people with the adequate experience in dealings with investment and electricity matters in the power sector.

Furthermore, the table showed that different categories of persons responded; this includes tenure staff (26 or 30.59%) that amounted to as the majority and the part-time constituted (34 or 40.00%) and others (25 or 29.41%). This shows that there was no room for bias in the targeted respondents as questionnaire was spread across all categories.

Finally, the designation of respondents cut across senior, middle management and low-level officials in the beverage industry and the company.

### **Descriptive Statistics on the Components Electricity Supply Shortages and Their Influence on Investment Opportunities**

Table 3 shows a descriptive statistic on the various research questions concerning the components electricity supply shortages (ESS) and their influence on investment opportunities (IO) of the power sector. Each of these was reduced to specific questions as it relates to the research variables.

**Table 3:** Descriptive Statistics on the components electricity supply shortages (ESS) and their influence on investment opportunities (IO) of the power sector.

	N	Min	Max	Mean	Std. Dev
<i>Stormy Weather</i>					
Stormy weather induced collapse of transmission lines	85	1.00	5.00	3.4235	1.02790
Epileptic functioning and total breakdown of the grid	85	1.00	5.00	3.4118	1.09429
<i>Equipment Failures</i>					
Obsolesce of plants and other assets	85	1.00	5.00	3.4353	1.06287
Lack of technical cutting-edge technology	85	1.00	5.00	3.4471	1.02940
<i>Poor Maintenance Culture</i>					
Poorly trained manpower	85	1.00	5.00	3.8588	1.18676
Inadequate funding and poor maintenance culture	85	1.00	5.00	3.3882	1.00112
<i>Investment Opportunities</i>					
Investment in critical lines and transmission network	85	1.00	5.00	3.6706	1.06221
Investment in modern technology and equipment	85	1.00	5.00	3.6706	1.22851
Investment in modern maintenance practices and operational processes	85	1.00	5.00	3.5529	.95750
Investment in asset and project management	85	1.00	5.00	3.6471	1.04319
Valid N (listwise)	85				

**Source:** Generated using SPSS output Version 20.0

From the table, the minimum and maximum value for the level of agreement on each of the question is 1 to 5 respectively and also the Mean and Standard Deviation for each of the questions are on average 3.58 and 1.03, respectively. These results show that on the overall basis, there was agreement on all the research questions and as such, there is a significant relationship between components electricity supply shortages (ESS) and investment opportunities (IO) in the power sector.

### **Test of Hypotheses**

The data gathered for the aforementioned purposes was used in conjunction with multiple ordinary least square (OLS) regression and correlation, two twin inferential statistics. The three (3) predictors (independent variables) of the components electrical supply shortages (ESS)—stormy weather (SW), equipment failure (EF), and poor maintenance culture—were among the variables utilized in the investigation (PMC). The dependent variable, Investment Opportunities (IO), was regressed on by all of these predictors.

### **Multiple Regression Analysis**

Table 4's model summary, the overall multiple correlation and determination coefficients as well as their adjusted forms are 0.593, 0.352, 0.328, and 0.945, respectively. These statistics show that there is a substantial correlation between electricity supply shortages (ESS) and investment opportunities (IO) in the power sector. Actually, according to the corrected R<sup>2</sup>, the influence of electricity supply shortages (ESS) is to blame for 94.5% of variation and investment opportunities (IO) in the power industry.

**Table 4:** Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.593 <sup>a</sup>	.352	.328	

a. Predictors: (Constant), EFL, PMC, STW

b. Dependent Variable: IO

**Source:** Generated using SPSS output Version 20.0

**Table 5:** ANOVA<sup>a</sup>

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	39.253	3	13.084	14.654	.000b
	Residual	72.323	81	.893		
	Total	111.576	84			

a. Dependent Variable: IO

b. Predictors: (Constant), EFL, PMC, STW

Table 5 summarize the ANOVA results of the overall multiple regression model, Given the results of the F-test (111.58) and its probability value (P-value=0.002), it means that the regression equation is of 'good fit' in other words, it is statistically significant at 5% level of significance. This further reinforces our decision to reject the null hypotheses one and accept its alternative one. In other words, the ANOVA result shows that the linear combinations of the four variables if electricity supply shortages are significantly related to the investment opportunities at 5% level of significance.

**Table 6:** Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.172	.512		-.336	.738
	PMC	.333	.105	.297	3.163	.002
	STW	.371	.105	.337	3.547	.001
	EFL	.250	.087	.262	2.872	.005

a. Dependent Variable: IO

**Source:** Generated using SPSS output Version 20.0

Drawing from table 6; hypotheses one to three would be scientifically interpreted via values of the predictors in line with the objectives of the study; we therefore, present the test of hypotheses as follows:



**H<sub>01</sub>:** Stormy Weather has no significant influence on critical lines and transmission network in power sector.

Stormy weather has a positive link with critical lines and transmission (CLT) in the electricity industry, according to the influence of stormy weather's beta coefficient (0.337), which was statistically significant at 5% with a p-value of (0.000). Further, it suggests that, while other variables remain constant, a unit change in Stormy weather (SW) would result in an average change (increase) of 33.7% on critical lines and transmission network (CLT) in the power industry. Due to this, we reject the null hypothesis and support the alternative theory that stormy weather has a substantial impact on important transmission lines in the power industry. This is in line with research findings from Ado and Josiah (2015), whose study demonstrates the severity of energy supply disruptions and the expenditures associated with running this kind of businesses in the region.

**H<sub>02</sub>:** Equipment Failure has no significant effect on Modern Technology and Equipment in the Power Sector

The equipment failure level's beta coefficient (.262), which was statistically significant at 5% with a p-value of .05, reveals a positive association between modern technology and equipment (MTE) and equipment failure (EFL) in the power industry (0.000). Furthermore, it suggests that, assuming other variables remain constant, a unit change in Equipment Failure (EFL) would result in an average change (increase) in Modern Technology and Equipment (MTE) in the power sector of 26.2%. As a result, we reject the null hypothesis and adopt the alternative hypothesis, which states that equipment failure significantly affects modern technology and equipment in the power sector. This is consistent with the findings of George and Oseni (2012), who used an ordinary least square regression model to investigate the role that electricity output, supply, and consumption played in reducing Nigeria's high unemployment rate.

**H<sub>03</sub>:** Poor Maintenance Culture has no significant effect on Project Maintenance Practice and Operational Processes in Power Sector

The maintenance culture's beta coefficient (0.297), which was statistically significant at 5% with a p-value of .05, demonstrates a positive association between the power sector's poor maintenance culture (PMC) and project maintenance practice and operational processes (PMPOP) (0.000). The power sector's project maintenance practices and operational procedures would also change (rise) by an average of 29.7%, keeping other variables unchanged, if the poor maintenance culture (PMC) were to change by one unit. This leads us to reject the null hypothesis and support the alternative hypothesis, which states that the project maintenance practice and operational procedures in the power industry are significantly impacted by bad maintenance culture. This is in line with the findings of Nwankwo and Njiogo (2013), who discovered that the availability of electricity had a favorable impact on both industrial and economic development. According to the study, there is a positive correlation between population, Gross Fixed Capital Formation (GFCF), industrial production (INDU), and electricity (ELEC).

## **Major Findings**

The components of electricity supply shortages and investment opportunities in the power sector are the study's primary objectives. The study found out a significant and positive relationship between components Electricity Supply Shortages (ESS) and Investment Opportunities (IO). Assessing the degree of the impact, the study found out that there is a positive and meaningful relationship between all the three elements of electricity supply shortages and investment opportunities. In the study, we have found the relationship between stormy weather and critical lines and transmission network to exhibit the most significant impact while equipment failure exhibits the least impact. On the extent to which equipment failure influences modern technology in the power sector. Finally, on how poor maintenance culture influenced project maintenance practice and operational processes in the power sector, the analysis revealed that poor maintenance culture has a significant effect on project maintenance practice and operational processes in power sector as more than 80% of those reviewed agree with the assertion.

## **Conclusion**

The study concludes that the activities of stormy weather can cause a serious economic impediment on the critical lines and transmission network which could cause serious doubt on electricity supply, which also cause equipment failure that shows our negative deficiency in investment of modern technology and equipment purchases that has as well affected our maintenance culture in the power sector. It will be important to say that Nigeria should invest in the power sector so that it will lead to improvement in electricity supply, enhance investment opportunities for optimum performance.

## **Recommendations**

Based on the above conclusion, we make the following recommendations:

- i) The Federal Ministry of Power through the transmission company of Nigeria should development a short-term investment strategy and an actualize implementation strategy with the assistance of partnership both from the state and private sector so that they can be a roadmap in the investment of transmission lines and network by way of dualization so as to reduce redundancy and lead to the creation of more substations with less relies on government funding which could cause delay.
- ii) There should be a constructive and efficient planning and collaborative system put in place by the management of Transmission Company of Nigeria towards attracting investment in modern technology and equipment which can come in form of donations or support from international community which are very functional and can efficiently lead to electricity supply sustainability.
- iii) The Federal Government through the ministry of power in conjunction with other power sector agencies should create strong and positive policies and measures in tackling maintenance culture which has been relatively weak and have rendered some assets and facilities obsolete and should be in line with global best practices and processes so as to gradually eradicate the poor maintenance culture in Nigeria.

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