# Power Supply and Industrialization in Enugu State, Nigeria

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*Abstract*

*The study appraised the power supply and industrialization in Enugu State, Nigeria. The specific objectives of the study were to: examine the effect of power supply on the operational costs of industries, determine the effect of power supply on the productivity of industries and examine the effect of power supply on the competitiveness of industries in Enugu State, Nigeria. This study adopted a descriptive survey research design. The study employed secondary and primary sources of data. The population of the study was 2,299. Taro Yamani formula was used to determine the sample size of 341. The collected data was analyzed through the use of mean score. The Chi-square-test analysis technique was applied in testing the hypotheses. The findings revealed that Power supply has a significant negative effect on operational costs of industries in Enugu State, Nigeria (this is where (2cal = 357.230, p = 0.000), that Power supply has a significant negative effect on the productivity of industries in Enugu State, Nigeria (this is where (2cal = 258.945, p = 0.000) and that power supply had a significant negative effect on competitiveness of industries in Enugu State, Nigeria (this is where (2cal = 258.945, p = 0.000),. The study recommended that Government should invest in robust power infrastructure, incentivize renewable energy adoption, while firms should explore energy-efficient technologies, engage in cost-sharing initiatives, and invest in backup systems for uninterrupted production.*

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## 1. Introduction

The relevance of power sector reform in Nigeria cannot be overstated, particularly in the context of fostering industrialization. Nigeria's industrial sector has long been hindered by chronic power shortages and unreliable electricity supply, impeding the growth and competitiveness of industries. Power sector reform is imperative to address this issue and unlock the full potential of

industrialization. According to the World Bank, inadequate and unreliable power supply has been a major constraint on Nigeria's industrial development (World Bank, 2019). The ongoing power sector reform initiatives, such as the privatization of power assets and the introduction of market-driven mechanisms, aim to enhance efficiency, attract private investment, and ensure a reliable power supply. This is crucial for industrialization, as industries heavily depend on consistent and affordable electricity to operate optimally (ECA, 2020). The success of power sector reform is directly linked to the attraction of foreign direct investment (FDI) in the industrial sector. A study by the International Finance Corporation (IFC) highlights the positive correlation between reliable electricity supply and FDI inflows into the manufacturing sector (IFC, 2018). The reform not only improves the ease of doing business but also fosters a conducive environment for the establishment and growth of industries. In all, power sector reform in Nigeria is pivotal for industrialization, as it addresses the longstanding challenge of inadequate and unreliable electricity supply. The successful implementation of these reforms will undoubtedly contribute to the growth and competitiveness of the industrial sector, attracting both domestic and foreign investments.

The current state of power sector supply in Nigeria has profound implications for industrialization, acting as a significant bottleneck to the growth and competitiveness of the industrial sector. The persistent challenges of inadequate and unreliable electricity supply have hindered the optimal functioning of industries, impacting their productivity and global competitiveness. According to the International Energy Agency (IEA), Nigeria faces severe electricity shortages, with many industries experiencing frequent power outages that disrupt operations and hinder production processes (IEA, 2021). These disruptions not only lead to increased operational costs but also discourage potential investors from establishing or expanding industrial facilities in the country. The unreliability of power supply is a major constraint on the overall development of the industrial sector in Nigeria (World Bank, 2019). The current power sector supply situation in Nigeria underscores the urgent need for comprehensive reforms to address infrastructure deficiencies, improve efficiency, and attract private investment. The World Bank emphasizes that sustained efforts to enhance the reliability of electricity supply are crucial for creating an enabling environment for industrialization (World Bank, 2019). In sum, the impact of the current power sector supply on industrialization in Nigeria is profound, adversely affecting the growth and competitiveness of industries. Addressing these challenges through targeted reforms is imperative for unlocking the full potential of the industrial sector and fostering economic development.

The existing literature on the effect of power supply on industrialization in Nigeria reveals a notable gap that necessitates the undertaking of the current study. While various studies acknowledge the adverse impact of inconsistent and insufficient power supply on industrial growth in developing economies, there is a scarcity of comprehensive research specifically focusing on the nuanced dynamics within the Nigerian context. Previous research, such as the work by Agiomor and Imoisili (2018), touches on the challenges faced by the industrial sector in Nigeria due to inadequate power supply but often lacks a detailed exploration of the specific mechanisms through which power shortages hinder industrialization. Additionally, the temporal dynamics and recent developments in Nigeria's power sector, including reforms and policy changes, have not been thoroughly investigated in the existing literature. To address this gap, the current study aims to provide an in-depth analysis of the contemporary relationship between power supply and industrialization in Nigeria. By incorporating recent data and considering the evolving policy landscape, this research seeks to offer a nuanced understanding of the challenges and opportunities within the Nigerian power sector and their direct implications on industrial development.

## 1.2 Statement of the Problem

A reliable and adequate power supply is of paramount importance for industrialization in Nigeria. Industries heavily depend on electricity to power machinery, facilitate production processes, and maintain consistent operations. The absence of a stable power supply has been a longstanding impediment, hindering the growth and competitiveness of the industrial sector. Inadequate electricity availability leads to increased operational costs, reduced productivity, and constraints on expansion and modernization efforts. Furthermore, a robust industrial base is crucial for economzic development, job creation, and poverty alleviation. Therefore, improving power supply is not merely an infrastructural need but a strategic imperative for unlocking the full potential of Nigeria's industrial sector, fostering economic growth, and enhancing the overall well-being of its population.

The persistent problem of power supply poses a formidable challenge to industrialization in Nigeria. The industrial sector relies heavily on consistent and affordable electricity for efficient operations, yet frequent power outages and insufficient supply disrupt production processes, leading to increased operational costs and reduced competitiveness. The unreliability of the power infrastructure discourages both domestic and foreign investments, hindering the establishment and expansion of industries. Additionally, the reliance on alternatively power sources, such as generators, further escalates operational expenses for industries. The cyclical impact of this power supply problem creates a significant barrier to the sustained growth of the industrial sector, stalling economic development and job creation. Addressing this critical issue is essential for unlocking the full potential of Nigeria's industries, fostering economic growth, and enhancing the country's global competitiveness.

Interruptions in electricity disrupt production processes, leading to downtime, increased production costs, and inefficiencies. Industries often resort to using alternative power sources, such as generators, to cope with power shortages. This significantly raises operational costs, making it more expensive for businesses to operate and compete in the market. The lack of a stable power supply acts as a deterrent for potential investors. Existing industries may struggle to expand, while new investments may be hesitant to establish operations in the state, limiting the overall growth of the industrial sector. The industrial sector is a key contributor to job creation. Power shortages can lead to job losses as industries scale down or close operations. This, in turn, contributes to higher unemployment rates and economic strain on the affected population. Industries in Enugu State face challenges in remaining competitive both at the national and international levels. Inconsistent power supply undermines the ability of businesses to meet production demands and adhere to stringent quality standards. This therefore necessitated the government intervention in power supply and industrialization in Enugu State, Nigeria.

## 1.3 Objectives of the Study

The broad objective of the study was to examine the power supply and industrialization in Enugu State, Nigeria. The specific objectives were to:

i. Examine the effect of power supply on the operational costs of industries in Enugu State Nigeria;

ii. Determine the effect of power supply on the productivity of firms in Enugu State Nigeria;
iii. Examine the effect of power supply on the competitiveness of industries in Enugu State Nigeria.

### 1.4 Research Questions

The following research questions were asked.

i. What is the effect of power supply on the operational costs of industries in Enugu State Nigeria?
ii. What effect does power supply has on the productivity of firms in Enugu State Nigeria?
iii. How does power supply affect the competitiveness of industries in Enugu State Nigeria?

### 1.5 Statement of Hypotheses

The following Research Hypotheses guided the Study.

i. Power supply has a significant negative effect on operational costs of industries in Enugu State Nigeria.
ii. Power supply has a significant negative effect on productivity of firms in Enugu State Nigeria
iii. Power supply has a significant negative effect on competitiveness of industries in Enugu State Nigeria

## 2. Review of Related Literature

### 2.1 Conceptual Review

#### 2.1.1 Power Supply

The concept of power supply refers to the provision of electrical energy to meet the demands of various consumers, encompassing residential, commercial, and industrial sectors. Power supply systems involve the generation, transmission, and distribution of electricity, ensuring a reliable and constant flow of energy to end-users. The modern power supply landscape incorporates diverse energy sources, such as fossil fuels, renewables, and nuclear power, reflecting a complex interplay of technological, economic, and environmental considerations (Wood and Wollenberg, 2012). The reliability of power supply is paramount for societal functions and economic activities. Robust power infrastructure, efficient grid management, and advanced technologies contribute to minimizing disruptions and ensuring a stable energy supply. Moreover, the transition towards smart grids and decentralized energy systems enhances the resilience and flexibility of power supply networks (Farhangi, 2010).

Challenges in power supply include the need for sustainable practices, addressing energy poverty, and mitigating environmental impacts. Research and development in energy storage, grid optimization, and renewable technologies are essential for advancing the efficiency and sustainability of power supply systems (International Energy Agency, 2021). In this study, the concept of power supply involves the comprehensive management of electricity generation, transmission, and distribution to meet the diverse needs of society, reflecting a dynamic interplay of technological, economic, and environmental factors.

#### 2.1.2 Industrialization

Industrialization is a multifaceted process characterized by the widespread adoption of mechanized production methods, technological advancements, and the transformation of economies from agrarian to manufacturing-based. It involves the establishment and growth of industries, leading to increased production, economic diversification, and urbanization (Landes, 2003).

The concept of industrialization often encompasses the shift from manual labor and artisanal techniques to large-scale, machine-driven production, fundamentally altering societal structures. Industrialization has historically been a key driver of economic development, fostering innovation, creating employment opportunities, and raising living standards (Mokyr, 1999). Closely linked with globalization, industrialization has enabled the integration of economies into the global market, facilitating the exchange of goods and services on an international scale (Rodrik, 1999). However, it also poses challenges, including environmental degradation, resource depletion, and socio-economic inequalities, necessitating sustainable industrial practices and policies (UNIDO, 2016).

As a dynamic process, industrialization continues to evolve with advancements in technology, automation, and the rise of digital industries. Balancing the benefits and challenges requires strategic planning, effective governance, and consideration of environmental and social impacts to ensure inclusive and sustainable industrial development (UNCTAD, 2018). In this study, industrialization is a transformative process integral to economic growth, technological progress, and societal change, with its implications extending across various domains of human activity.

### 2.1.4 Operational Costs

Operational costs in industries encompass the expenditures incurred during the day-to-day running of business activities. These costs include raw materials, labor, energy, maintenance, and administrative expenses, among others (Horngren et al., 2019). Understanding and managing operational costs are critical for businesses to maintain profitability and competitiveness. Effective cost management involves optimizing production processes, negotiating favorable supplier contracts, and implementing efficient operational practices (Kaplan and Anderson, 2007).

Operational costs are influenced by factors such as technological advancements, market dynamics, and regulatory changes. The application of advanced technologies and data analytics can enhance cost-effectiveness and operational efficiency in industries (Brynjolfsson and McAfee, 2014). Additionally, sustainability initiatives, driven by environmental concerns, are reshaping operational cost structures by encouraging investments in eco-friendly practices (Seuring and Müller, 2008).

### 2.1.5 Productivity

Productivity, a central concept in economics and management, refers to the efficiency with which resources are utilized to produce goods and services. It is a measure of output relative to input, reflecting the ability of an organization or economy to maximize its outputs while minimizing inputs (Mankiw et al., 2015). Productivity improvements often result from technological advancements, process optimization, and effective resource allocation. The productivity of a firm is a measure of its efficiency in transforming inputs, such as labor and capital, into outputs, typically goods or services. It is quantified by the ratio of output to input, reflecting the organization's ability to maximize production with minimal resources. High productivity indicates effective utilization of resources, improved competitiveness, and potential for economic growth. Factors influencing firm productivity include technological innovation, workforce skills, and management practices, all of which contribute to achieving sustainable and efficient production levels.

### 2.1.6 Competitiveness

Competitiveness is a multifaceted concept representing an organization's or a nation's ability to outperform rivals in the market, achieve sustainable economic growth, and enhance living standards (Porter, 1990). It encompasses factors such as efficiency, innovation, and quality that contribute to superior performance in a competitive environment (World Economic Forum, 2018).

Competitiveness is dynamic, influenced by a combination of factors including technological advancements, skilled workforce, and supportive infrastructure (Schwab, 2017). It is vital for firms and countries to continually adapt and invest in these factors to maintain or improve their competitive position in the global economy.

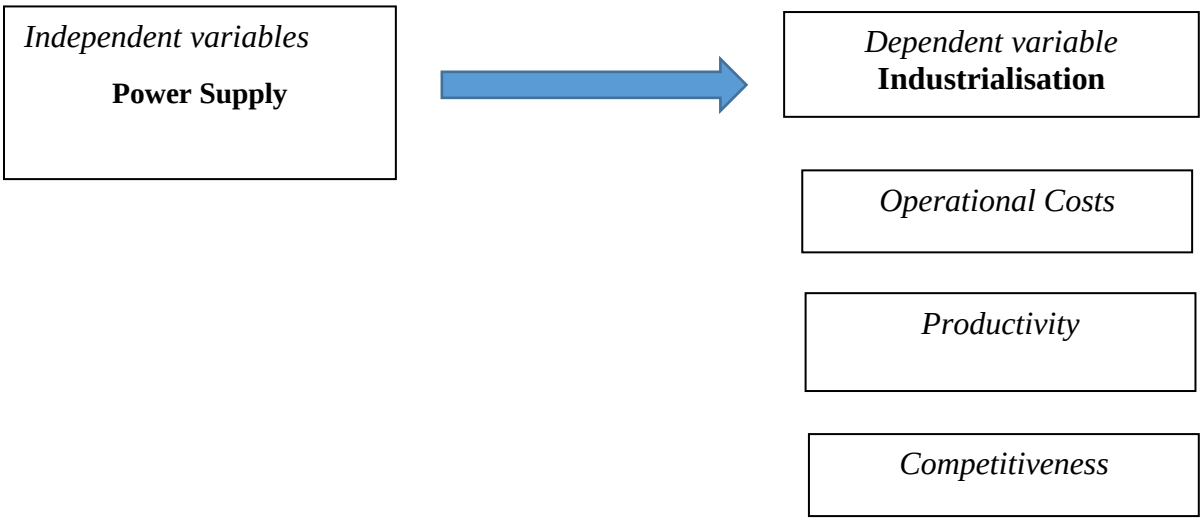


**Figure 1. Conceptual Framework**
**Source: Author's compilation 2024**

## 2.2 Theoretical Framework

This work was anchored on Modernization theory.

Modernization theory, propounded primarily by Walt Rostow in the 1960s, presents a framework for understanding the processes and stages of societal development. Rostow's influential work, "The Stages of Economic Growth: A Non-Communist Manifesto" (1960), outlines the key tenets of modernization theory.

The theory posits that societies evolve through distinct stages of development, moving from traditional agrarian economies to modern industrialized societies. Rostow identified five stages of economic growth: traditional society, preconditions for take-off, take-off, drive to maturity, and the age of high mass consumption. Each stage represents a set of conditions and changes that societies undergo on the path to economic advancement.

The tenets of modernization theory emphasize the importance of technological innovation, industrialization, and the adoption of Western-style institutions for economic development. It assumes that as societies progress through these stages, they will experience improvements in social, political, and economic aspects. However, critics argue that modernization theory oversimplifies the complexities of development, neglecting cultural, historical, and structural factors that influence a society's trajectory.

While Rostow's modernization theory has been influential, it has also faced significant scrutiny, prompting the exploration of alternative perspectives that consider the diverse pathways and challenges associated with development. The theory is applicable to the study in that the reliability of power supply is paramount for societal functions and economic activities. Robust power infrastructure, efficient grid management, and advanced technologies contribute to minimizing disruptions and ensuring a stable energy supply.

## 2.3 Empirical Review

### 2.3.1 Power Supply and Production Costs

Alo and Adeyemo (2021) conducted a study on distorted electricity supply and the profitability of Small and Medium Scale Enterprises: A Survey of selected inhabitants in Southwest Nigerian States. The correlation coefficient and simple regression analysis techniques were used to analyze the responses from the respondents. Findings from the study showed that effective power supply (EPS) exhibited a significant positive impact on the profitability of business enterprises and the cost of maintaining mechanical generators (KHZ) as an alternative source of power has a negative effect on the profitability of the enterprises. The study concluded that power supply has a significant influence on the profitability of SMEs in Nigeria.

Christian and Imoh (2021). Looked into the effect of electricity supply on the performance of Small and Medium-Scale Enterprises in Nigeria: A case study of Calabar South and Calabar Municipality of Cross River State. The survey research design was adopted. The results of the study revealed that there is a significant effect of electricity supply on the performance of small and medium-scale enterprises in Calabar South and Calabar Municipality. The results further revealed that insufficient electricity supply significantly affect the performance of small and medium-scale enterprises in Calabar South and Calabar Municipality. The study concludes that there are enormous difficulties being experienced by businesses in Cross River State and other parts of Nigeria due to inadequate and unreliable electric power supply. Thus an inadequate and unreliable supply of electricity imposes costs and therefore constrained firms' operational performance as firms suffer high overhead cost due to the deficient electricity supply from the national grid.

Akinyemi et al (2021) focused on impact of Electricity Supply on the Performance of Small and Medium-Scale Enterprises (SMEs) in Nigeria: A Case Study. The data was analyzed using Statistical Package for Social Science (SPSS), variance analysis (ANOVA) and Correlations and Ordinary Least Squares (OLS) techniques. A total of 120 questionnaires were distributed, of which 90 were compiled and analyzed. The findings showed that there is significant impact of electricity supply on the performance of SMEs in Ado-Odo Ota Area, in Ogun State. Also, alternative power sources have significant impact on performance of SME in Ado-Odo Ota Area, in Ogun State. Therefore, by and large, from the findings of this study.

Afukonyo (2023) investigated the impact of inadequate power supply on small and medium scale Enterprises: A Case study of Takum Local Government Area of Taraba State. The study also used 30 structured questionnaires to collect primary data directly from the selected SMEs. The study identified that epileptic power supply has a negative impact on SMEs making them to spend about 20% - 30% on backup energy. The study also revealed that epileptic power supply does not affect the operational performance of SMEs and that the supply of power to SMEs is not sufficient.

### 2.3.2 Power Supply and Productivity

The effect of electricity service efficiency on the performance of manufacturing SMEs in Nigeria was checked by Abdulrahim, Issa and Ismaila (2017). 201 survey questionnaires were used by participants of the output association MAN, SPSS, as well as basic regression analysis, was performed. The result shows that more than 50 per cent of the difference in the financial and non-financial output of manufacturing SMEs in Nigeria appears to account for consistency. To remove bias linked to time, it was proposed that future studies should collect panel data/longitudinal data.

Mohammed and Abdullahi (2021) analysed the effect of erratic power supply on the productivity and profitability of small and medium enterprises in A.B.U community market in Samaru Zaria.

The research is a cross-sectional survey. A structured questionnaire was used to collect the data for the study. M.R.M. in the form of O.L.S. was employed. SPSS statistical package version 16 was used to analyze the data. The finding reveals that 90.91% of the enterprises studied indicated that erratic power supply was the major constraint to their productivity and profitability, with an average of 180 hours of power outage per month lasting 6 hours per day, causing the enterprises an average of N24, 000:00 monthly.

Ahmad, et al (2023) conducted a study to analyze the impact of electricity supply on the productivity of small scale industries in Kano metropolis. The model was specified using Ordinary Least Squares (OLS) Econometric technique. The results show that education, size of business, duration of electricity supplied by Kano Electricity Distribution Company (KEDCO) and frequency of electricity received by industries has significant and positive relationships with the turnover of the small scale industries. In contrast, it demonstrates an insignificant and negative relationship with the nature of the business. The cost of alternative source of electricity, amount of electricity supplied by KEDCO and the structure of power supply in the area of operation has positive but insignificant effect on the weekly average turnover of the small scale industries. The study concluded that as a component of infrastructure, electricity influences small scale industries outputs in multiple and complex processes.

### 2.3.3 Power Supply and Competitiveness

Ahmed & Mallo (2015) focused on Impact of deficient Electricity Supply on the operations of Small Scale Businesses in North East Nigeria. From the population of small scale businesses, a sample was selected through the use of stratified random sampling to ensure the effective representation of the population of small scale businesses in north east Nigeria. Results from data analysis indicates the severity of electricity supply outages and the costs imposed by power supply outages on the operation of this class of businesses in the region.

Nyanzu and Adarkwah (2016) explored the effect of power supply on the performance of Small and Medium Size Enterprises: A comparative analysis between SMEs in Tema and the Northern part of Ghana. The study employs both chi-square and t-test to do pattern analysis. In addition, ordinary regression analysis (OLS) was employed to regress firm performance variable on electricity supply variable and other covariates. The results show that, the presence of power outages, thus, the number of times power outages experienced and hours of power outages negatively affected firms performance (profitability). In addition, it was further realized that power outages (power interruptions) severely affects SMEs located in the Northern part of Ghana than SMEs located elsewhere.

Olaoye and Talabi (2018) focused on the Effect of Electricity Tariff and Self-Generated Power Supply on Business Performance in Nigeria. The data collected were analyzed through the Ordinary Least Square (OLS) estimation model. From the findings, it was discovered that both high electricity tariff and self- generated electricity cost affect firms' performance, indicating that they have significant impact on business performance. Also the result reveals that there is significant difference between electricity tariff and self- generated electricity on business performance, since a rise in the electricity outage will trigger rises in generator usage.

## METHODOLOGY

### 3.1 Research Design

The study employed descriptive research design which according to Chukwuemeka (2019) is broadly viewed as steps a researcher intends to take in carrying out his research project, dissertation or thesis. To generate data for this study both survey and documentary methods of data collection (Mixed method) were used. The survey design was used in getting firsthand information from

primary data elicited from the target population. To this end, the primary data for the study was obtained through Questionnaires, which was designed to achieve the study objectives and test the hypothesis.

Based on the instrumentation and validity of data, the number of respondents stood at 2,299. Consequently, the sample used for the data collection and analysis was drawn using Taro Yamani (1968) statistical formula, of which is a total of 341 representing the sample size of the population under investigation.

**Table 3.1: Population distribution**

| S/N | Firm | Population | Percentage |
|---|---|---|---|
| 1 | Innoson group | 1,343 | 57 |
| 2 | Juhel Nig. Ltd | 431 | 18 |
| 3 | Aqua Rapha Investment Nigeria | 313 | 16 |
| 4 | Dalex Paints | 212 | 9 |
| | Total | 2,299 | 100 |

**Source: Author's compilation from Online websites of the firms, 2023.**

### 3.5 Sample Size Determination

Taro Yamane statistical sampling formula were used to obtain a sample size from a finite population of employees and management. The formula is stated under.

$$n = \frac{N}{1+N(e)^2}$$

Where n = Sample size, N = Population size, e = Error margin allowed, 1 = Constant

The researcher chose five percent (0.05) as error margin allowed. The translation of the formula is shown below. The translation of the formula is shown below.

$$n = \frac{2,299}{1+2,299\ (0.05)^2}$$

$$n = \frac{2,299}{1+5.7475}$$

$$\frac{2,299}{6.7475}$$

n = 340.718 = 341 by approximation.

### 3.9 Methods of Data Analyses

Data collected for the study was presented with descriptive statistic using tables, frequencies and percentages, mean, standard deviations. The collected data from the survey questionnaire was transformed into useful information through the use of tables and Mean Score while Chi-square Analysis was used to test the Hypotheses.

Chi-square test tool with formular as:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where O = observed frequency, E = Expected frequency

**Assumptions:** Level of significance = 0.05
**Decision Rule:**

1. Reject Ho if the P-Value cal < 0.05 at 5% level of significance.
2. Otherwise accept the null hypothesis (Ho).

## DATA PRESENTATION AND ANALYSIS

### 4.1 Data Presentation and Analysis

The data gathered from the field were presented under this section. Mean score were employed in presenting and analyzing the data and Chi-square was used to test the hypotheses. Three Hundred and Sixty-Nine copies of questionnaire were distributed and Three Hundred and Sixty were returned

**Research Question 1:** What is the effect of power supply on the operational costs of industries in Enugu State Nigeria?

**Table 4.1:** Effect of power supply on the operational costs of industries in Enugu State Nigeria

| s/n | Response | SA | A | U | D | SD | Total | Mean | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Frequent power outages and unreliable power supply can force industries in Enugu State to resort to alternative sources, such as generators, leading to increased fuel costs and maintenance expense | 100 | 100 | 20 | 80 | 40 | 340 | 3.3 | Accepted |
| 2 | Fluctuations in power supply leads to repairing or replacing machinery incurs additional costs, impacting operational budgets | 120 | 120 | 10 | 50 | 40 | 340 | 3.6 | Accepted |
| 3 | Industries incurs upfront costs and ongoing maintenance expenses | 100 | 110 | 10 | 70 | 50 | 340 | 3.3 | Accepted |
| 4 | Industries often face higher energy costs when relying on self-generated power | 130 | 130 | 10 | 60 | 10 | 340 | 3.8 | Accepted |
| 5 | Power supply issues can disrupt the supply chain, leading to delays in receiving raw materials or delivering finished goods | 140 | 90 | 20 | 50 | 40 | 340 | 3.8 | Accepted |
| | **Grand Mean** | | | | | | | **3.56** | |

**Source: Field Survey 2024.**

Table 4.1 above shows the mean distribution of opinions of the respondents on the effect of power supply on the operational costs of industries in Enugu State Nigeria. Items (1,2,3,4,5), the mean score of 3.3, 3.6, 3.3, 3.8 & 3.8 respectively and Grand Means of 3.56 showed that the respondents agreed that inadequate power supply increases the operational costs of industries in Enugu State Nigeria.

**Research Question 2:** What effect does power supply has on the productivity of firms in Enugu State Nigeria?

**Table 4.2:** Effect of power supply on the productivity of firms in Enugu State Nigeria

| s/n | | SA | A | U | D | SD | Total | Mean | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Poor power supply results in decreased overall productivity as workers are unable to perform their tasks efficiently | 110 | 101 | 11 | 60 | 58 | 340 | 3.4 | Accepted |
| 2 | Unreliable power supply may force firms to operate for shorter durations, limiting the time available for production | 120 | 101 | 9 | 70 | 40 | 340 | 3.4 | Accepted |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | Insufficient power supply result in suboptimal production rates and an increase in waste, impacting overall productivity. | 100 | 110 | 15 | 65 | 70 | 340 | 3.5 | Accepted |
| 4 | Inconsistent power supply may lead to variations in production processes, impacting product quality | 90 | 100 | 10 | 80 | 60 | 340 | 3.1 | Accepted |
| 5 | Power supply uncertainties make it challenging for firms to meet production targets, resulting in missed deadlines and potentially damaging relationships with clients or customers | 100 | 90 | 10 | 70 | 70 | 340 | 3.2 | Accepted |
| | **Grand Mean** | | | | | | | **3.32** | |

**Source: Field Survey, 2024.**

Table 4.2 indicates the mean distribution of opinions of the respondents on the effect of power supply on the productivity of firms in Enugu State Nigeria. The grand mean of 3.32, means that respondents are agreed that poor power supply limits the productivity of firms in Enugu State Nigeria

**Research Question Three:** How does power supply affect the competitiveness of industries in Enugu State Nigeria?

**Table 4.3:** Effect of power supply on the competitiveness of industries in Enugu State Nigeria

| s/n | Response | SA | A | D | DA | SD | FREQ | Mean | Decision |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Unreliable power supply leads to disruptions in production processes, and increased operational costs, negatively impacting their competitiveness in terms of cost-effectiveness and timely delivery. | 120 | 121 | 19 | 50 | 30 | 340 | 3.8 | Accepted |
| 2 | Elevated operational expenses diminish cost competitiveness, making products or services less attractive to consumers | 120 | 129 | 20 | 61 | 20 | 340 | 3.9 | Accepted |
| 3 | Fluctuating power supply lead to inefficiencies in machinery and equipment diminishing competitiveness | 130 | 120 | 10 | 50 | 30 | 340 | 3.7 | Accepted |
| 4 | Inconsistent power supply compromise product quality, Industries with compromised quality struggle to compete on quality standards, impacting overall competitiveness. | 120 | 100 | 10 | 65 | 25 | 340 | 3.5 | Accepted |
| 5 | Power interruptions may lead to missed production targets and delayed deliveries, resulting in lost market opportunities | 120 | 120 | 20 | 50 | 30 | 340 | 3.8 | Accepted |
| | **Grand Mean** | | | | | | | **3.75** | |

**Source: Field Survey, 2024.**

Table 4.3 above shows the mean distribution of opinions of the respondents on the effect of power supply on the competitiveness of industries in Enugu State Nigeria. Their mean responses were positive. The grand mean of 3.75 revealed that the respondents strongly agreed that epileptic power supply hinders competitiveness of industries in Enugu State Nigeria

## 4.3 Test of Hypotheses

Data generated from the study were used to test the hypotheses using the Chi-square test tool with formular as:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where O = observed frequency, E = Expected frequency

**Assumptions:** Level of significance = 0.05

**Decision Rule:**

3. Reject Ho if the P-Value cal < 0.05 at 5% level of significance.
4. Otherwise accept the null hypothesis (Ho).

**Test of hypotheses one**

**Statement of hypothesis one**

Ho: Power supply has a significant negative effect on operational costs of industries in Enugu State Nigeria.

**Table 4.2: Chi-Square Tests**

| | Value | Df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 357.230[a] | 9 | .000 |
| Likelihood Ratio | 322.324 | 9 | .000 |
| Linear-by-Linear Association | 99.385 | 1 | .000 |
| N of Valid Cases | 601 | | |

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 4.48.

Degree of freedom; D.F = 9; $\chi^2$cal = 357.230, p = 0.000

**Decision:** From the Chi-square analysis in Table 4.4, based on the $\chi^2$cal value of 357.230 and P-value of 0.00, in table 4.3, This result, therefore suggests that we should accept our alternate hypothesis one ($H_1$) which states that Power supply has a significant positive effect on operational costs of industries in Enugu State Nigeria.

**Test of hypotheses Two**

**Statement of hypothesis Two**

Ho: Power supply has a significant negative effect on the productivity of firms in Enugu State Nigeria

**Table 4.5: Chi-Square Tests**

| | Value | Df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 259.945[a] | 9 | .000 |
| Likelihood Ratio | 259.874 | 9 | .000 |
| Linear-by-Linear Association | 101.184 | 1 | .000 |
| N of Valid Cases | 601 | | |

a. 1 cells (6.3%) have expected count less than 5. The minimum expected count is 4.17.

Degree of freedom; D.F = 9; $\chi^2$cal = 258.945, p = 0.00

**Decision:** From the Chi-square analysis in Table 4.4, based on the $\chi^2$cal value of 258.945 and P-value of 0.00, in table 4.5 revealed that we should accept our alternate hypothesis two ($H_i$) which states the Power supply has a significant positive effect on productivity of firms in Enugu State Nigeria

**Test of hypotheses Three**

**Statement of hypothesis Three**

Ho: Power supply has a significant negative effect on competitiveness of industries in Enugu State Nigeria

**Table 4.6: Chi-Square Tests**

| | Value | Df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 181.629[a] | 9 | .000 |
| Likelihood Ratio | 202.605 | 9 | .000 |
| Linear-by-Linear Association | 102.577 | 1 | .000 |
| N of Valid Cases | 601 | | |

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 3.67.

Degree of freedom; D.F = 9; $\chi^2$cal = 258.945, p = 0.000

**Decision:** From the Chi-square analysis in Table 4.4, based on the $\chi^2$cal value of 258.945 and P-value of 0.00, in table 4.6 revealed that that we should accept our alternate hypothesis one ($H_o$) which states that Power supply has a significant positive effect on competitiveness of industries in Enugu State Nigeria.

## 4.4 Discussion of Findings

### 4.4.1 Power Supply and Operational Costs

The result of hypothesis one revealed that power supply has a significant negative effect on operational costs in Enugu State, Nigeria. This is evident from the fact that D.F = 9; $\chi^2$cal = 357.230, p = 0.000. The data in Table 4.1 is an indication that the respondents accepted that frequent power outages and unreliable power supply can force industries in Enugu State to resort to alternative sources, such as generators, leading to increased fuel costs and maintenance expense, the finding posits that fluctuations in power supply leads to repairing or replacing machinery incurs additional costs, impacting operational budgets, we can infer from here that Industries incurs upfront costs and ongoing maintenance expenses.

### 4.4.2 Power Supply and Productivity

The result of hypothesis two indicated that power supply has a significant negative effect on the productivity of firms in Enugu State Nigeria. Evidence from the Chi-square test showed a D.F = 16; $\chi^2$cal = 258.945, p = 0.00. The view of the respondents was all positive going by the data in table 4.2. The respondents affirmed that frequent power outages lead to downtime in production processes, disrupting the workflow and causing delays. This results in decreased overall productivity as workers are unable to perform their tasks efficiently. We equally affirmed that Unreliable power supply may force firms to operate for shorter durations, limiting the time available for production. This reduction in operational hours directly impacts the quantity of goods or services that can be produced within a given timeframe. We can see from the findings that Fluctuating power, especially voltage fluctuations, can lead to inefficiencies in machinery and equipment performance. This can result in suboptimal production rates and an increase in waste, impacting overall productivity.

### 4.4.3 Power Supply and Competiveness

Equally, the result of hypothesis three indicated that power supply has a significant negative effect on the competitiveness of industries in Enugu State Nigeria. This is where: D.F = 16; $\chi^2$cal = 258.945, p = 0.11. Data in table 4.3 showed that the respondents affirmed that Unreliable power

supply leads to disruptions in production processes, reducing efficiency. Industries may experience downtime, delays, and increased operational costs, negatively impacting their competitiveness in terms of cost-effectiveness and timely delivery, based on the finding we can assert that dependency on alternative power sources, such as generators, results in higher fuel and maintenance costs. elevated operational expenses diminish cost competitiveness, making products or services less attractive to consumers, one major talking point from the finding was that fluctuating power supply lead to inefficiencies in machinery and equipment, increasing production costs per unit. Higher production costs affect pricing strategies, potentially making products less competitive in the market.

**Summary of Findings, Conclusions and Recommendations**

**5.1 Summary of Findings**

The following are the findings from the study.

i. Power supply has a significant negative effect on the operational costs of industries in Enugu State Nigeria.
ii. Power supply has a significant negative effect on the productivity of firms in Enugu State Nigeria.
iii. Power supply has a significant negative effect on the competitiveness of industries in Enugu State Nigeria.

**5.3 Recommendations**

The study recommended as follows:

i. Government should invest in robust power infrastructure, incentivize renewable energy adoption while firms should explore energy-efficient technologies, engage in cost-sharing initiatives, and invest in backup systems for uninterrupted production.
ii. To improve productivity, government should Implement policies to stabilize power supply, encourage industries to adopt modern technologies while firms should develop contingency plans, invest in employee training, and leverage technology for streamlined operations during power interruptions.
iii. To guarantee competitiveness firms should **d**iversify power sources, engage in collaborative efforts, and prioritize operational resilience for enhanced competitiveness. Addressing power supply issues through strategic investments and policy initiatives is crucial for fostering a conducive environment for industries.

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