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RESEARCH ARTICLE

Impact of Irregular Power Supply on the Performance of Engineering Firms in Nigeria: A Case Study of Enugu State

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ABSTRACT

This study presents the impact of irregular power supply on the performance of Engineering firms in Nigeria using Enugu State as a case study. The research work assesses the impacts of irregular power supply on the performance of engineering firms in selected firms in respect of the profit, market share and return on assets of engineering firms in Enugu State. Descriptive survey design was used in this study. A total population of 29 was used for the study while the census method used as the sample size determination technique. The instrument for data collection was questionnaire. With the help of measurement of central tendency and measurement of dispersion anchored on Microsoft Office Excel, the collected data was duly analyzed while the formulated hypotheses were tested using T-test. From the result and analysis of data collected, it was shown that the average score of the response of workers in the studied engineering firms in Enugu state on the level to which irregular power supply affects the firms' profit, market share and return on assets were 3.42, 3.26 and 3.28 respectively. This implies that the workers agreed that irregular power supply affects to a great extent, the performance of the engineering firms studied in Enugu state, Nigeria. Also, with a calculated T-value of 6.19, 4.65 and 5.32 (for the three research question respectively) confirmed that the average score response of the workers of the studied engineering firms are significantly above the minimum accepted benchmark of 2.5. Based on the results and analysis carried out, it was concluded that irregular power supply affects to a great extent the performance of studied engineering firms in Enugu state, Nigeria especially as it relates to profit, return on asset and market share of the studied engineering firms in Enugu state, Nigeria. It is recommended that all critical stake holders should endeavor to fund the power sector effectively to ensure regular supply of electric power to the Nigerian populace. This will help engineering firms to produce at reduced cost thereby increasing their profit, market share and return on assets for overall improved performance and economic growth of the firms and the country at large.

***Keywords**: Irregular Power Supply; Engineering Firms; Performance*

Introduction

The power sector comprises three dependent subsectors: the generation, the transmission and the distribution. It is worthy of note that these subsectors are so linked that a deficient in one of them poses harm to the others. In Nigeria, it is evident that the power sector suffers from poor generation, inadequate transmission facilities and overburdened distribution network. This situation has resulted into unholy load shedding, poor power quality, under-voltage, epileptic power supply and incessant voltage collapse. To counter this ugly trend, Nigerians have resorted to off-grid generation of power using generator sets of different sizes (Ahmed and Mallo, 2015).

Enugu state is one of the five south-eastern states that is supplied by the Enugu electricity distribution company EEDC. However, the EEDC receives almost the least amount of power on the national grid. Currently, the EEDC distributes only 9% of the total power on the national grid which is significantly too inadequate to meet the power needs of the people of south east who are majorly business owner and entrepreneurs (Remteng *et al.,* 2021). Considering the poor state of power nationwide, Enugu has been one of the worst hit states with frequent grid collapse contributing greatly to irregular power supply. At least 6 partial grid collapses that has thrown many states in the dark was experienced in 2022 alone. This is highly undesirable for a system that wants massive development of the manufacturing and engineering sector.

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Power supply whether to large corporations or SMEs is a very critical factor for ensuring performance. Access to a reliable power supply is widely considered as vital to the operations of most small and medium-scale businesses. Surveys suggest that, in most developing countries, firms consider access to electricity as one of the biggest constraints to their business. (Christian and Imoh, 2021).

It is undisputable that inadequate power supply poses a big threat to survival of businesses especially the manufacturing sector that wholly depend on power for their production. The state of power infrastructure in Enugu state has further exacerbated the problem of poor power supply. Individuals who wish to connect to the distribution network are over tasked with too many responsibilities such as provision of transformer, poles, cables and other accessories. An unreliable electricity supply – electricity insecurity – can affect several aspects of business operations. The most significant impact on productivity results from forced and unexpected halts in manufacturing processes. Such processes include the running of assembly lines, using machine tools, or producing textiles. Communications, delivery times, lighting and refrigeration are also affected by electricity insecurity, with consequences for the routine operation of businesses and their ability to ensure delivery times (Nwankwo and Njogo 2013). The news agency of Nigeria once reported that Persistent power outage paralyzed economic activities in Nsukka, Enugu state, and its environs for three days, and that checks by NAN revealed that residents then, depended on generating sets to power their facilities to remain in business (NAN 2022).

Small and Medium scale Enterprises in Enugu has continued to complain about the high cost of doing business in the state resulting from the cost of fuel for running standby generators for long hour almost on daily basis. They complained that the frequent long power outages reduced sales, profit and their overall performance thereby limiting the growth and expansion of their businesses.

Many scholars have studied the challenges of small and medium scales enterprises in Nigeria; however, their studies were focused more on variables that are overtly related to the development of SME such as government policies, government intervention, etc. (Alhassan, 2017), While these variables were studied independently, there is a relationship between other variables like the price of energy (electric power) and an SME's capacity to produce optimally, its sales volume and labour cost. For SMEs in particular and for national economic development in general, The activities of electricity operators are critical and they need to be examined because public interest can be jeopardized in terms of pricing or quality of power supplied unless a completely competitive market is realized (Chau, 2009).

Nigeria has an abundant supply of energy sources. It is endowed with thermal, hydro, solar, and oil resources, and yet it is described as an energy-poor country because the sector is relatively under-developed. The very poor quality of power supply in recent years has been a major constraint on the performance of most industries in the economy. This has impacted negatively on the performance of Engineering firms and indeed other businesses especially in terms of profit, market share, return on assets, etc. Upon this background and in an effort to provide analyzed data and useful recommendations; this study will evaluate the effects of inconsistent power supply on the performance of engineering firms in Enugu state, Nigeria.

Materials and Methods

Study Area

Survey carried out in this research was on three engineering firms located in Enugu State. The firms include: Hiconnet Engineering and Communications, Enugu Road, Nsukka (internet/network providers), Hot Iron Fabrications, Emene, Enugu (Metal works and fabrication services) and Achotech computer assemblage and repairs, Ogui, Enugu (Computer assemblage, software and Hardware repairs). Enugu lies approximately between latitude 6^{o} 21' N and 6^{o} 30'N and between longitude 7^{o} 26' E and 7^{o} 37'E. The total area coverage is approximately 72.8 square kilometres. Enugu state is the capital of the eastern region with a population of about 3.2 million. It has 17 local government areas and 3 senatorial districts. Enugu State is one of the states in the eastern part of Nigeria located at the foot of the Udi Plateau. The state shares borders with Abia State and Imo State to the south, Ebonyi State to the east, Benue State to the northeast, Kogi State to the northwest and Anambra State to the west. Enugu State is located on the North western fringe of south eastern Nigeria between latitudes 6°30N and 7°ON and longitudes 6°35E and 7°300E.Enugu has good soil-land and climatic conditions all year round, sitting at about 223 metres (732 ft) above sea level, and the soil is well drained during its rainy seasons (NGSAE, 2015). The state has a large number of up-coming Engineering firms and Small and Medium Scale Enterprises.

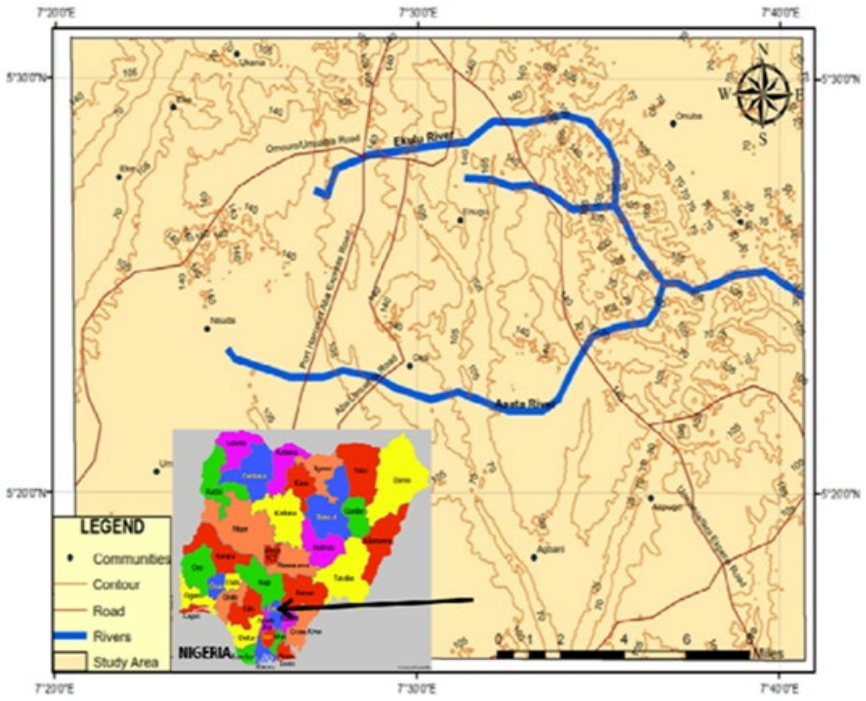

Figure 1: Map of Enugu State (Source: NGSA, 2015)

Methods

Sources of Data Collection

The source of data for this study is structured questionnaire which was designed solely for this study. The questionnaire was administered to relevant individuals from the case study organizations and their responses noted and collated.

Population of the Study

The importance of capturing the right population while conducting a study cannot be over emphasized. Thus, the population of this study is the workers in the three case study Engineering firms including: 13 workers from Hiconnet Engineering and Communications, 9 workers from Hot Iron Fabrications and 7 workers from Achotech computer assemblage and repairs. This gives a total population of 29 workers (respondents)

Determination of Sample Size

The sample size for a study in which the total population under consideration is less than two hundred (200) shall consist of the entire population to ensure a fair and unbiased outcome (Israel, 2003). This method of sampling the entire population, otherwise known as census method is most appropriate for this study in view of the fact the entire population is less than two hundred (200).

Validation of the Instrument

The questionnaire being the instrument of data collection was subjected to content validity analysis by administering it to four independent experts who analysed the contents in relation to the research aim and objectives. The experts offered useful suggestions which were generously adopted while making the final copy of the questionnaire.

Reliability of the Instrument

The reliability of the instrument was evaluated through pilot test done with the help of Cronbach Alpha reliability estimate. To achieve this, five (5) copies of the drafted questionnaires were administered to sister organizations in

Ebonyi state and their responses were analysed accordingly. The analysis showed that the reliability coefficient (α) was 0.96; hence acceptable.

Method of Data Analysis

The data obtained was analyzed with the aid of inferential statistics executed using Microsoft Office Excel. The responses from the respondents were collated and keyed into the software and the results were consequently obtained. Meanwhile, the responses were graded using a four-level scale shown below;

Very High Level (VHL) 4
High Level (HL) 3
Low Level (LL) 2
Very Low Level (VLL) 1

With this result, any item that has mean value of 2.50 or higher was accepted while those below the baseline of 2.50 were rejected.

The formulated alternative hypothesis was tested using T-test. T-test is suitable for this analysis considering that the sample size is less than 30. This alternative hypothesis will be accepted if the calculated T-value is greater than the table value. On the other hand if the calculated T-value is smaller than the table value, the alternative hypothesis will be rejected.

The formula for computing T-test is as follows;

$$T = \frac{\bar{X}-\mu}{s/\sqrt{n}} \qquad (1)$$

Where
$\bar{X}$= the mean of the sample
s = the sample standard deviations.
n = the sample size
μ = the mean of the numeric weight assigned to the four levels of response (VGE, GE, LE and VLE). This mean is the minimum benchmark for acceptance and as such will serve as the comparison mean

Data Presentation and Analysis
Data Presentation
Table 1: Responses of workers of case study engineering firms on research question one

S/N	Ranking	Responses on research Question One		
		Profit	Market share	Return on Asset
1	VGE	21	13	19
2	GE	5	10	5
3	LE	2	6	4
4	VLE	1	0	1
TOTAL		29	29	29

Note: VGE means Very Great Extent, GE means Great Extent, LE means Less Extent and VLE means Very Less Extent.

Table 1 shows the result response obtained from workers on research question of to what level does irregular power supply affects the profit of engineering firms in Enugu State, Nigeria.

Table 2: Average mark of workers' responses in the engineering firms, under study on the level to which irregular power supply affects the profit of engineering firms in Enugu State, Nigeria

S/N	Description	Respondents' Scores		
	To what level does irregular power supply affects the profit of engineering firms in Enugu State, Nigeria.	**(X)**	**SD**	**GRADE**
1	Income	3.58	0.77	GE
2	Sales	3.24	0.78	GE

3	Cost of labour	3.45	0.86	GE
	GRAND MEAN/SD SCORE	3.42	0.80	GE

Table 2 shows that the average score of the response of workers' in the studied engineering firms is 3.42. This means that the workers agree that irregular power supply affects to a great extent, the profit of the organizations studied in Enugu state Nigeria. This is true considering that irregular power supply increases cost of production, reduces income and sales of goods and services thereby reducing profit of the firms and consequently the performance of the firm.

Table 3: Responses of workers of case study engineering firms on research question two

S/N	Ranking	Responses on research Question Two		
		Income	**Expenses**	**Losses**
1	VGE	18	17	11
2	GE	4	7	10
3	LE	5	5	7
4	VLE	2	0	1
TOTAL		29	29	29

Table 3 shows the result response obtained from workers on research question of to what level does irregular power supply affects the market share of engineering firms in Enugu State, Nigeria

Table 4: Average mark of workers' responses in the engineering firms under study on the level to which irregular power supply affects market share of engineering firms in Enugu State, Nigeria

S/N	Description	Respondents' Scores		
	To what level does irregular power supply affects the market share of engineering firms in Enugu State, Nigeria	**(X)**	**SD**	**GRADE**
1	Customer relationship	3.31	1	GE
2	Product quality	3.41	0.77	GE
3	Price reduction	3.07	0.88	LE
	GRAND MEAN/SD SCORE	3.26	0.88	GE

Table 4 shows the mean score of the response of workers' in the studied Engineering firms is 3.26. This shows that the workers agree that irregular power supply affects to a great extent the market share of engineering firms in Enugu state, Nigeria. This result is expected considering irregular power supply can affect the firm's effectiveness and quality of product and services. This could negatively affect the relationship of the firm with her customers and could lead to reduced customer base and product quality. Also increased production cost can increase prices of goods and services. This can also impact negatively on customer relationship. The implication of the above impacts is an overall reduction in performance due to the firm's poor market share.

Table 5: Responses of workers of case study Engineering firms on the return on Asset of Engineering Firms

S/N	Ranking	Responses on research Question Three		
		Inflow of Staff	**Out flow of Staff**	**Work Force**
1	VGE	19	13	12
2	GE	8	10	8
3	LE	2	6	7
4	VLE	0	0	2
TOTAL		29	29	29

Table 5 shows the result response obtained from workers on research question of to what level does irregular power supply affects the return on Asset of Engineering firms in Enugu State, Nigeria?

Table 6: Average Mark of Workers' Responses on How Irregular Power Supply Affects Return on Asset of Engineering Firms in Enugu State, Nigeria

S/N	Description	Respondents' Scores		
	To what level does irregular power supply affects the return on asset of Engineering firms in Enugu State, Nigeria.	**(X)**	**SD**	**GRADE**
1	Income from Assets	3.58	0.62	LE
2	Cost of equipment maintenance	3.24	0.78	GE
3	Efficiency of Assets	3.03	0.98	GE
	GRAND MEAN/SD SCORE	3.28	0.79	GE

Result analysis shown in table 6 imply that the mean score of the response of managers and supervisors' in the studied manufacturing organizations is 3.28. This means that the respondents agree that irregular power supply affects to a great extent, the return on assets of studied Engineering firms in Enugu state, Nigeria. When equipment used in Engineering firms get damaged by incessant power outage, firms spent huge sum of moneys in fixing the equipment. Apart from the cost of repairs, firms lose huge revenue due to time lost during repairs. This repaired equipment may not function optimally as before thereby reducing their efficiencies. The overall impact of these issues raised is poor performance due to reduced return on assets.

Test of Hypotheses

Null hypotheses are formulated to determine whether there a significant difference between the comparison mean (2.5) and the sample mean for the research question being analysed. These null hypotheses will be accepted if the calculated T-value is smaller than the table value. On the other hand, if the calculated T-value is bigger than the table value, the null hypothesis will be rejected.

Table 7: T-test Analysis of the Mean score of workers responses in the Engineering firms under study on the level to which irregular power supply affects the profit of studied manufacturing organizations in Enugu state, Nigeria.

	N0	X Sample	X Comparison	SD	T-Calculated	T-Critical	Level of Significance	Decision
Sample Data	29	3.42	2.5	0.80	6.19	0.9842	0.05	H_{01} Rejected

H_{01}: There is no significant difference between minimum acceptable mean (2.5) and the mean score of workers' responses in the Engineering firms under study on the level to which irregular power supply affects the profit of studied organizations.

Table 7 shows that the calculated T-value (6.19) is greater than the table value (0.9842). As a result, the first null hypothesis is rejected. This implies that the average score response of the workers of the studied Engineering firms (3.42) is significantly above the minimum accepted benchmark of 2.5. It can confidently be said that workers of the studied engineering firms in Enugu state agree that irregular power supply affects to a great extent (GE) the profit of engineering firms Enugu State, Nigeria.

Table 8: T-test Analysis of the Mean score of workers' responses in the Engineering firms under study on the level to which irregular power supply affects the market share of studied Engineering firms in Enugu state, Nigeria.

	N0	X Sample	X Comparison	SD	T-Calculated	T-Critical	Level of Significance	Decision
Sample Data	29	3.26	2.5	0.88	4.65	0.9842	0.05	H_{02}Rejected

H_{02}: There is no significant difference between minimum acceptable mean (2.5) and the mean score of workers' responses in the Engineering firms under study on the level to which irregular power supply affects market share of studied organizations.

Table 8 it can be seen that the calculated T-value (4.65) is greater than the table value (0.9842). As a result, the first null hypothesis is rejected. This implies that the average score response of the workers of the studied Engineering

firms (3.26) is significantly above the minimum accepted benchmark of 2.5. It can confidently be said that workers of the studied Engineering firms in Enugu state agree that irregular power supply affects to a great extent (GE) the market share of Engineering firms Enugu State, Nigeria.

Table 9: T-test Analysis of the Mean score of workers' responses in the Engineering firms under study on the level to which irregular power supply affects the return on asstes of studied Engineering firms in Enugu state, Nigeria.

	N0	X Sample	X Comparison	SD	T-Calculated	T-Critical	Level of Significance	Decision
Sample Data	29	3.28	2.5	0.69	5.32	0.9842	0.05	H_{02}Rejected

H_{03}. There is no significant difference between minimum acceptable mean (2.5) and the mean score of workers' responses in the engineering firms under study on the level to which irregular power supply affects return on assets of studied organizations.

Table 9 shows that the calculated T-value (5.32) is greater than the table value (0.9842). As a result, the first null hypothesis is rejected. This implies that the average score response of the workers of the studied Engineering firms (3.28) is significantly above the minimum accepted benchmark of 2.5. It can confidently be said that workers of the studied Engineering firms in Enugu state agree that irregular power supply affects to a great extent (GE) the profit of engineering firms Enugu State, Nigeria.

Conclusion

On the basis of findings, the study established the average score of the response of workers in the studied engineering firms in Enugu state on the level to which irregular power supply affects the firms' profit is 3.42. This implies that the workers agree that irregular power supply affects to a great extent, the profit of the engineering firms studied in Enugu state, Nigeria. Also, with a calculated T-value of 6.19 (which is greater than the table value of 0.9842), confirmed that the average score response of the workers of the studied engineering firms (3.42) is significantly above the minimum accepted benchmark of 2.5. The average score of the response of workers in the studied engineering firms in Enugu state on the level to which irregular power supply affects the firms' market share is 3.26. This implies that the workers agree that irregular power supply affects to a great extent, the market share of the engineering firms studied in Enugu state, Nigeria. Also, with a calculated T-value of 4.65 (which is greater than the table value of 0.9842), confirmed that the average score response of the workers of the studied engineering firms (3.26) is significantly above the minimum accepted benchmark of 2.5. The average score of the response of workers in the studied engineering firms in Enugu state on the level to which irregular power supply affects the firms' return on assets is 3.28. This implies that the workers agree that irregular power supply affects to a great extent, the return on assets of the engineering firms studied in Enugu state, Nigeria. Also, with a calculated T-value of 5.32 (which is greater than the table value of 0.9842), confirmed that the average score response of the workers of the studied engineering firms (3.28) is significantly above the minimum accepted benchmark of 2.5.

It can be concluded that irregular power supply affects to a great extent the performance of studied engineering firms in Enugu state, Nigeria especially as it relates to profit, return on asset and market share of the studied engineering firms in Enugu state, Nigeria.

Recommendations

All critical stake holders should endeavour to fund the power sector effectively to ensure regular supply of electric power to the Nigerian populace. This will help engineering firms to produce at reduced cost thereby increasing their profit and performance for the economic growth of the firms and the country at large.

Effort should be made to minimize corruption in the power sector. This will ensure that funds are judiciously utilized for increasing generation and transmission capacity for improved power supply to users. This will help engineering firms produce quality products and services as well as operate effectively for increased market share and performance.

Experienced technocrats in the power sector should be assembled to formulate the best policies that will drive the power sector from fossil-based sources to renewable energy-based sources of electricity. This will reduce the challenges of incessant gas supply that impacts negatively on the availability of electric power in Nigeria. This will mitigate the problem of irregular power supply thereby helping engineering firms to increase their return on assets for the overall improved performance of the firms.

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