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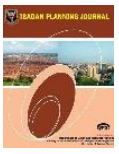

Effects of Incessant Electric Power Outages on Physical Development in Akure, Nigeria

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Abstract

Electricity is a necessity in modern life, on which human work, healthcare, leisure, economy, and livelihood depend. Hence, incessant electric power outages can lead to relative chaos, financial setbacks, and loss of life. This paper examines the effect of incessant electric power outages on the physical development and livelihood of residents in Akure, Nigeria, with a view to improving the reliability and accessibility of electricity supply in the region. The study annexed both primary and secondary sources of data gathering. The primary data were retrieved directly from residents within the metropolis of Akure while the secondary data were retrieved from related organizations in charge of power generation and distribution to the study area such as National Bureau of Statistics (NBS), Energy Commission of Nigeria (ECN), Benin Electricity Distribution Company of Nigeria (BEDC), and the Nigerian Electricity Regulatory Commission (NERC) among others. The study area was categorized into core, periphery, and suburban areas. Systematic Random sampling was used to administer the questionnaire to sampled residents in the selected communities across the three zones. The data obtained were analyzed using SPSS, and the results of the findings revealed that incessant power supply has significant effects on the construction and completion of amenities within the area. It was also affirmed that frequent electric power outages in the area negatively impacted the operation of local businesses and industries, thereby affecting the overall economic growth. This has discouraged new investments, development projects, as well as the quality of life and standard of living of residents in the study area. The study concluded to affirm that these impacts created a challenging environment for physical development, which has possibly trapped the area in a low-development equilibrium. Therefore, infrastructure modernization, capacity enhancement, and implementation of a robust maintenance programme were recommended as strategies towards the improvement of power supply within the metropolis.

Keywords
Incessant power outage, IBEDC, Power accessibility, Residents' livelihood

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1. Introduction

Electricity is an important enabler of economic growth and supports most productive industrial activities (Mutumba, Odongo, Nathan & Bagire, 2021). Energy is fundamental to human life (Adams, 2010); a basic requirement of modern societies and an essential input for socio-economic development (Goldemberg, Johansson, Reddy & Williams, 2020). According to the International Energy Agency (IEA, 2011), modern energy services are crucial to human well-being and the country's economic development. The United Nations Development Programme (UNDP, 2010) describes access to affordable modern energy services as fundamental to human activities, national development, economic growth, and an essential component of poverty reduction. Countries fall into the vicious circle of poverty, social instability, and underdevelopment when there is no adequate access to modern energy services (IEA, 2014).

Energy is crucial to reducing poverty, and unhindered access to basic energy services is central to poverty reduction. The development committee of the Organization for Economic Co-operation and Development (OECD) countries has proposed reducing the proportion of people living in extreme poverty by half by 2015.

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Twenty percent (20%) of people lacked access to modern electricity across the globe, while an additional one billion people have unstable, intermittent and unreliable access to erratic electricity supplies (UN, 2015).

Lack of electricity and heavy reliance on traditional biomass are hallmarks of poverty in developing countries (IEA, 2012). The provision of social services and infrastructure facilitates the basic functions of a society, which are necessary to provide essential services and ultimately reduce poverty (Bazillian, 2015).

Power outage is a disruption in the supply of electricity resulting in loss of power to homes, businesses, and other facilities (Carrerea, Lynch, Newman & Dobson, 2011). Outages can lead to acute food insecurity when refrigerators lack power, fear related to personal safety, and economic losses in commercial and industrial sectors. Power outages represent acute health hazards for certain vulnerable groups. Those using electricity-dependent durable medical equipment (DME), such as oxygen concentrators, infusion pumps, and mobility devices, rely on electricity to maintain their health. Others vulnerable to power outages include under-resourced communities and historically marginalized groups. Pathways include disrupted hourly employment, older and less-insulated housing stock resulting in dangerous indoor temperatures, lack of access to cooling facilities, and a higher burden of underlying chronic diseases sensitive to extreme temperatures (Do *et al,* 2023). Globally, access to reliable and uninterrupted electricity is essential for sustaining economic development, enhancing living standards, and fostering societal progress (Parada, Pirlea, & Wadhwa, 2023).

Electricity outage in Nigeria is attributed to various factors, including insufficient generation capacity. Nigeria's electricity generation capacity falls short of demand, leading to frequent outages. The challenges of inadequate generation capacity and its impact on electricity supply reliability in Nigeria is horrific. More so, poor infrastructure also accounts for electricity outages in Nigeria. The need for infrastructure upgrades to improve power supply reliability in Nigeria is long overdue. The economic implications of electricity outage on Nigeria's economy are enormous and mostly felt among the peasants and the poor who cannot afford alternative energy.

Therefore, this paper tends to examine the effects of incessant electric power outages on physical development in Akure, Nigeria, with a view to improving the reliability and accessibility of electricity supply in the region.

2. Literature Underpinning the Study

Persistent electric outages pose significant challenges with extensive repercussions for individuals, businesses, and the broader economy. This essay explores the diverse impacts of these frequent power disruptions, using scholarly research and authoritative sources to provide a thorough understanding of the wide-ranging consequences of this pervasive issue. One of the most immediate and visible effects of frequent power outages is the negative impact on industrial productivity. Power interruptions disrupt manufacturing processes, causing downtime, increased operational expenses, and delays in production schedules. According to Adeoti (2020), industries that rely on a steady power supply experience substantial financial losses when faced with frequent outages, which hinders economic productivity on both micro and macro levels. The economic consequences of persistent outages extend beyond immediate productivity losses, as unreliable power supplies discourage both domestic and foreign investment, thereby impeding economic growth. Olotuah (2022) highlights the connection between policy inconsistencies, governance challenges, and declining investor confidence in Nigeria's energy sector. The resulting lack of investment hampers infrastructure development and perpetuates the ongoing cycle of inadequate electricity supply.

In response to frequent power outages, businesses often turn to alternative power sources like generators, which significantly increase operational costs. The reliance on self-generated power raises expenses, diminishing the overall competitiveness of businesses in the global market. This financial burden makes it especially difficult for Small and Medium-sized Enterprises (SMEs) to thrive (IJE, 2021). Persistent outages directly translate into revenue losses for businesses. SMEs, in particular, are disproportionately affected due to their limited financial resilience. The World Bank (2021) notes the strong correlation between frequent power interruptions and employment challenges, as SMEs - key contributors to employment-face the risk of downsizing or closure. This negative impact

on employment exacerbates broader economic challenges, contributing to higher unemployment rates. The technology sector, crucial for economic diversification and innovation, also faces significant obstacles due to unreliable electricity. Start-ups and tech companies need a stable power supply to operate efficiently and develop innovative solutions. The lack of reliable electricity hinders research and development, stifling technological progress. This, in turn, limits Nigeria's ability to compete globally in emerging technological fields and hampers the growth of a knowledge-based economy (Iwayemi, 2020).

Persistent electric outages also have significant social implications, affecting daily life for many individuals. Access to essential services such as healthcare, education, and communication is compromised. Vulnerable populations are disproportionately affected, as unreliable electricity exacerbates existing inequalities and reduces the overall quality of life (International Journal of Energy, 2018). Addressing the complex effects of persistent electric outages requires a comprehensive approach. Policymakers must prioritize policy stability to foster an environment that encourages investment and infrastructure development. Investing in renewable energy sources, modernizing the grid, and adopting new technologies are critical to strengthening the resilience of the power infrastructure. The impact of persistent electric outages spans various aspects of society, including industrial productivity, economic growth, competitiveness, employment, technological innovation, and overall quality of life. Reducing these consequences requires coordinated efforts from policymakers, industry stakeholders, and the international community. Implementing robust policies, investing in infrastructure, and promoting sustainable energy practices are essential steps toward ensuring a reliable and resilient power supply that supports economic development and societal well-being (Iwayemi, 2020).

3. Research Methodology

3.1 Research Location

Akure is a city in southwestern Nigeria. It is the capital and largest city of Ondo State. The city had a population of 403,000 as of the 2006 population census, with a projected population of 663,810 in the year 2025. The study area lies within Latitudes $7^0$09' and $7^0$19'N and Longitudes $5^0$07' and $5^0$17'E (Northing 790820 – 809277 mN and Easting 733726 – 752139 mE, UTM Minna Zone 31 (Federal Republic of Nigeria, National Population Commission, 2006).

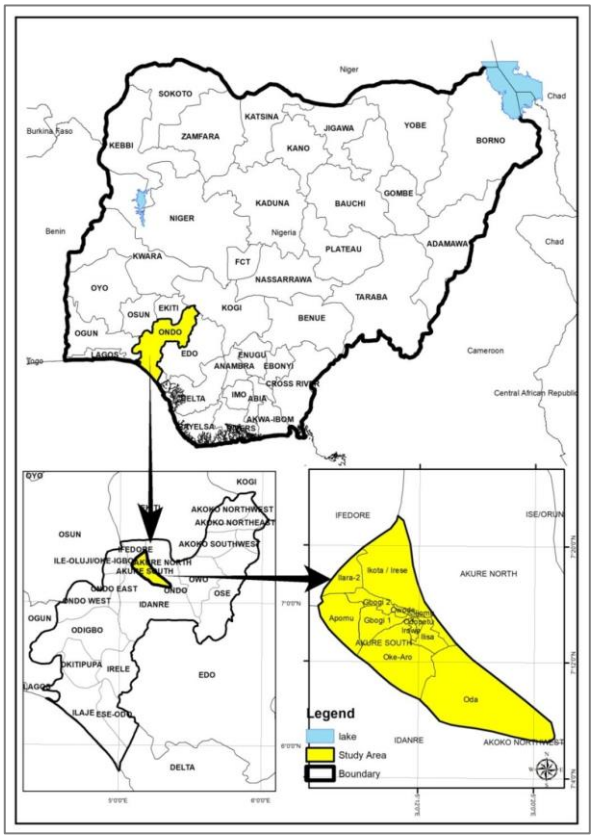

Figure 1: 1A: Map of Nigeria Showing Ondo State; **1B:** Map of Ondo State Showing Akure South; and **1C:** Map of Akure South Showing the Various Wards.

Source: Researchers' Google Earth image & Digitized Work, 2024

It is about 700 km (430 mi) southwest of Abuja and 311 km (193 mi) north of Lagos State. Residential districts are of varying density; some areas, such as Arakale, Ayedun, Ijoka, and Oja-Oba, consist of over 201 inhabitants per hectare (81/acre), while areas such as Ijapo Estate, Alagbaka Estate, Avenue, and Idofin have between 60 and 100 inhabitants per hectare (24 and 40/acre). Akure is situated within Ondo State in the Southwestern region of Nigeria, and it serves as a medium-sized urban centre. In 1939, it became the provincial headquarters of Ondo province, and it was designated as the capital city of Ondo State and a local government headquarters in 1976 (Afe, 2012). These dual political roles of Akure have contributed to the influx of people into the city. The growth of the city, along with the presence of administrative facilities it performs, employment opportunities, convenient

transportation, water access, healthcare facilities, educational institutions, and marketplaces, has attracted young individuals from neighbouring towns and settlements who seek employment prospects and other benefits, resulting in a rise in the city's population (Afe, 2014). Over time, the city's morphology has evolved, leading to its current status and the accompanying land use challenges, which are common among medium-sized urban centres in Nigeria. Akure is located at an elevation of 346.17 meters (1135.73 feet) above sea level. It has a Tropical wet and dry or savanna climate (Classification: Aw). The district's yearly temperature is 29.93ºC (85.87ºF), and it is 0.47% higher than Nigeria's average. Akure typically receives about 192.64 millimetres (7.58 inches) of precipitation and has 280.38 rainy days (76.82% of the time) annually (Adedayo, 2014).

3.2 Research Database

This study employed a descriptive survey design. Survey design helped the researcher elicit responses from the residents of Akure metropolis concerning their spatial pattern of incessant power outage in the communities. The study utilized both primary and secondary data. The primary data for the study were obtained from a door-to-door household field survey, using personal interviews and a survey instrument (questionnaire) to obtain relevant information from sampled respondents in the study area, while the secondary source of data was obtained using existing data generated by government institutions, as part of organizational record-keeping. The data were extracted from more varied data files.

This study made use of the multistage sampling techniques. The study on the first stage made use of stratified sampling to divide the population into specific sub-groups. The study area (Akure) was categorized into core, periphery, and transition zones. Systematic Random sampling was then used to administer the questionnaire to sampled residents in the selected areas.

The targeted population for the study is 16,653 houses with billed customers of the BEDC Electricity Plc. These are regarded as official registered customers with the organization. With the targeted population of 16653, a sample size of 204 at 1.5% was taken for questionnaire administration. This choice aligns with the sample size employed by Davis & Jones (2017) in their study titled: Spatial and Temporal Analysis of Power Outages in Urban Areas. In this research, they utilized a sample size of 1.5% to effectively capture and analyse power outage patterns within urban settings, to balance between statistical reliability and practical feasibility. This percentage allowed them to obtain a representative snapshot of the population while managing the data collection and analysis processes efficiently. Their findings demonstrated that this sample size was sufficient for identifying significant spatial and temporal patterns in power outages. Similarly, findings in this study have proved that the sample size is large enough to offer meaningful insights on data management and analysis to provide a good understanding of power outage patterns in Akure.

4. Results and Discussion of Findings

4.1 Demographic Data Presentation

Table 1 contained the demographic data representation of respondents. The table contains six demographic items, which include: Sex of Respondents- Male: 119 (58.3%), Female: 85 (41.7%). The distribution of male and female respondents indicates a higher representation of males (58.3%) compared to females (41.7%). This might reflect the demographic structure of the population under study or could suggest a gender-based interest or availability to participate in the survey. The second demographic item is the occupation: The table indicated that Civil Servants made up 39 respondents (19.1%), Traders were 58 respondents (28.4%), Students were 17 respondents (8.4%), Artisans were 22 respondents (10.8%), Self-employed: 68 respondents (33.3%). The foregoing implies that the highest proportion of respondents were self-employed (33.3%), followed by traders (28.4%). Civil servants and artisans make up 19.1% and 10.8% of the sample, respectively, while students represented the smallest group (8.4%). The diverse occupational backgrounds provided a broad perspective on how different sectors are affected by power outages, enriching the overall analysis and conclusions of the study. This distribution provided insights into the economic activities predominant in the area.

The third item on the table was the religion of the respondents. The table indicated that Christianity had 153 respondents (75%) while Islam had 51 respondents (25%), making a total of 204 respondents (100%). This implied that a significant majority of the respondents identified were

Christians (75%), with a smaller proportion identified as Muslims (25%). This religious composition reflected the dominant religious affiliations within the study area.

The fourth item on the table represented the use of the building. The table indicated that Residential were 101 respondents (49.5%), Commercial 30 respondents (14.7%), Mixed use 73 respondents (35.7%), making a total of 204 respondents (100%). This implied that the majority of respondents used their buildings for residential purposes (49.5%). A relatively high respondents used them for mixed purposes (35.7%), while a smaller percentage used them for commercial purposes (14.7%). This indicated a predominantly residential area and mixed areas, with some commercial activity in some areas.

The demographic data in Table 1 provided a comprehensive overview of the characteristics of the respondents. Key insights include: a higher participation rate of males compared to females, a diverse range of occupations with a significant number of self-employed individuals, predominantly Christian religious affiliation, and the majority use of buildings for residential purposes.

Table 1: Demographic Characteristics of Respondents

Variables		Frequency	%
Sex	Male	119	58.3
	Female	85	41.7
	Total	204	100
Occupation	Civil Servant	39	19.1
	Trader	58	28.4
	Student	17	8.4
	Artisan	22	10.8
	Self-employed	68	33.3
	Total	204	100
Religion	Christianity	153	75
	Islam	51	25
	Total	204	100
Use of the Building	Residential	101	49.5
	Commercial	30	14.7
	Mixed	73	35.7
	Total	204	100

Source: Field Survey, 2024

Figure 2 reveals the educational level of respondents. The figure indicated that respondents with MSc holders were 17 (8.3%), HND/BSc were 116 respondents (56.9%), SSCE were 53 respondents (26%), OND were 16 respondents (7.8%), while PhD were 2 respondents (1%), making a total of 204 respondents (100%). The implication of the foregoing is that the majority of respondents have a higher education degree (HND/BSc - 56.9%), indicating a relatively high level of educational attainment among the participants. A significant portion has completed secondary education (SSCE - 26%), while postgraduate degrees (MSc. and PhD) were less common (9.3% combined).

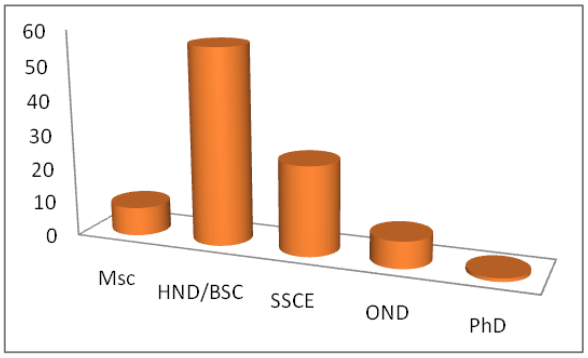

Figure 2: Educational Level of Respondents
Source: Field Survey, 2024

Figure 3 represents the income Level of respondents. The figure indicated that ₦30,000 has 41 respondents (20.1%), ₦30,000-₦50,000 have 65 respondents (31.9%), ₦51,000-₦100,000 have 77 respondents (37.7%), while ₦101,000 and above have 21 respondents (10.3%), making a total of 204 respondents (100%). The foregoing implied that most respondents have an income between ₦51,000 and ₦100,000 (37.7%), followed by those earning between ₦30,000 and ₦50,000 (31.9%). The lowest income bracket (₦30,000) constituted 20.1%, while the highest income bracket (₦101,000 and above) was the smallest group at 10.3%. This spread provided an understanding of the economic status of the respondents.

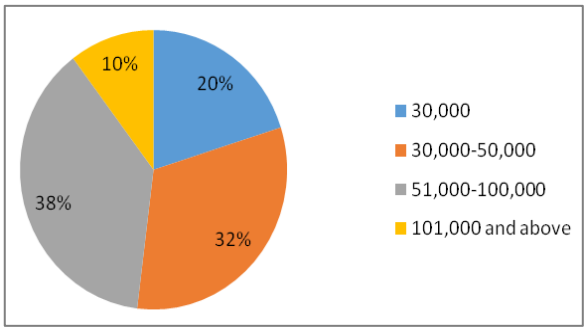

Figure 3: Income Level of Respondents
Source: Field Survey, 2024

4.2 Effects of Incessant Electric Power Outages on Physical Developments in the Study Area

Table 2 represents the effects of incessant electric power outages on physical developments in the study area. The grand mean of 3.92 (out of 5) indicated that, on average, respondents tend to agree

with the statements about the negative impacts of power outages on physical developments in the area. This suggested a significant perceived effect of power outages on various aspects of development and quality of life. The items on the table indicated that there is a moderate to strong agreement that power outages were hindering the development of amenities. The relatively low standard deviation suggested consistency in responses as depicted by the mean score of 3.56 and the Standard deviation of 0.4. Also, the table implied that there is strong agreement that power outages were negatively affecting local businesses and economic growth. This has the second-highest mean, indicating it was a major concern. More so, the respondents agreed that unreliable electricity deterred new investments. Also, there was a strong agreement that power outages were impacting quality of life. The very low standard deviation suggests high consistency in responses. The last item on the table indicated moderate responses to strong agreement about the damage to appliances and increased costs. This tied with Statement 1 for the lowest mean, but it was still well above the midpoint of the scale. The foregoing implied that the standard deviations were relatively low (ranging from 0.2 to 0.5), suggesting that there was a consensus among respondents about these issues. The high agreement with statements about economic impacts (statements 2 and 3) revealed that power outages were perceived as a significant barrier to economic development in the area. The strong agreement with statements 1 and 3 indicated that power outages were seen as a major obstacle to physical infrastructure development and new investments in the area. The high mean for statement 4 (3.90) underscored the perceived impact on residents' quality of life, suggesting that the effects of power outages extend beyond just economic concerns. While still showing agreement, the relatively lower mean for statement 5 (3.56) suggested that while personal financial impacts were significant, they were perceived as slightly less severe than the broader economic and developmental impacts. The data in Table 2 painted a clear picture of the multifaceted negative impacts of incessant power outages in the study area. Respondents strongly agreed that these outages were hindering economic growth, discouraging investment, affecting quality of life, and impeding physical development. The consistency in responses across all statements reinforced the reliability of these perceptions. As noted by Scott et al. (2024), unreliable electricity supply can have far-reaching consequences on economic development, education, healthcare, and overall quality of life. The magnitude of the electricity outage problem revealed in this study suggests that residents were facing significant obstacles to their daily activities and long-term development prospects.

As Kessides (2023) notes, chronic power shortages can impede economic growth, reducing the resources available for infrastructure investment and maintenance. This, in turn, leads to further deterioration of the power system and more frequent outages. These impacts were likely to have long-term implications for economic development in the study area. As argued by Andersen & Dalgaard (2023), persistent power outages can significantly hamper economic growth by reducing the productivity of both labour and capital. As argued by Adewuyi & Emmanuel (2018), the availability of public amenities is crucial for community development and quality of life. The delay or incompletion of such projects due to power outages can slow down overall physical development in the area and negatively impact residents' access to essential services. Escribano et al. (2010) found that poor electricity infrastructure significantly hampers firm productivity and growth across several African countries. The strong agreement with this statement in the study area suggests that local businesses were experiencing substantial operational challenges due to power outages, which in turn are affecting overall economic growth. As argued by Adenikinju (2020), reliable electricity supply is a key factor in investment decisions, particularly for industries that rely heavily on power. The very strong agreement with this statement suggests that the study area may be missing out on potential investments and development projects due to its unreliable power supply. The implications of this investment deterrence for physical development were significant. New investments often bring about physical changes through the construction of facilities, expansion of infrastructure, and development of supporting amenities. If such investments were being discouraged due to power issues, it could significantly slow the pace of physical development in the area. As argued by Khandker et al. (2014), improvements in quality of life and living standards often drive demand for better housing, infrastructure, and amenities. If

power outages were negatively impacting living standards, it could affect residents' capacity and willingness to invest in physical improvements to their homes and communities. Moreover, as noted by Scott et al. (2014), access to reliable electricity is itself a key component of improved living standards in developing countries. The strong agreement with this statement suggests that the lack of reliable power is a significant obstacle to improving overall living conditions in the study area. As noted by Oseni & Pollitt (2020), frequent power outages and associated voltage fluctuations can cause significant damage to electrical equipment. In the context of physical development, this can have several implications: Businesses may be hesitant to invest in advanced equipment that could enhance productivity and drive expansion. Households may be reluctant to purchase modern appliances that could improve living standards. The need for frequent repairs or replacements may divert resources that could otherwise be invested in physical improvements.

The conclusion is drawn from the combination of high severity ratings (SC), moderate agreement (A), and the consistency of responses around the mean with low variability (Standard Deviation).

Table 2: Effect of incessant electric power outage on physical developments in Akure

S/N	Variables Investigated		SA	A	N	D	SD	Total	M	STD	Rank
1	Incessant power outages have significantly hindered the construction and completion of amenities in the area.		78	48	17	34	27	204	3.56	0.4	4th
		%	38.23	23.5	8.33	16.67	13.24	100			
2	Frequent electric outages negatively impact the operation of local businesses and industries, affecting the overall economic growth in the study area		118	28	13	15	30	204	3.92	0.5	2nd
		%	57.8	13.7	6.37	7.4	14.7	100			
3	The lack of a reliable electricity supply has discouraged new investments and development projects in the area.		128	24	14	18	20	204	3.99	0.3	1st
		%	62.7	11.7	6.9	8.8	9.8	100			
4	Frequent power outages have affected the quality of life and living standards of residents in the area.		98	38	21	44	3	204	3.90	0.2	3rd
		%	48	18.6	10.2	21.6	1.5	100			
5	Incessant power outages have caused damage to electrical appliances and equipment, leading to increased repair and replacement costs for residents and businesses.		78	48	17	34	27	204	3.56	0.4	4th
		%	38.2	23.5	8.3	16.7	13.2	100			

NB: SA= Strongly Agreed; A= Agreed; N=Neutral; D= Disagreed; SD= Strongly Disagreed; M= Mean; STD = Standard Deviation. **Grand Mean** = 3.92

Source: Field Survey (2024)

5. Conclusion and Recommendations

Conclusively, the unreliable electricity supply is found to be hindering economic growth, discouraging investment, affecting quality of life, and directly impeding physical development projects. Construction and completion of amenities are delayed, local businesses struggle to operate efficiently, and potential investors are deterred by the unreliable power situation. These impacts create a challenging environment for physical development, potentially trapping the area in a low-development equilibrium.

The interconnected nature of these findings highlights the critical role that a reliable electricity supply plays in enabling both economic and physical development. The challenges of power supply outage revealed in this study are not unique to the area but reflect broader patterns observed in many developing regions. However, understanding the specific manifestations and impacts of these power outages in the study area is crucial for developing targeted and effective interventions.

Ensuring a proper and constant power supply within the area requires a comprehensive and sustained effort. Improvements in infrastructure, both in terms of capacity and modernization, are clearly needed. However, hardware upgrades alone are unlikely to be sufficient. Enhancing maintenance practices, improving communication between providers and consumers, and addressing systemic inefficiencies in the power sector will be equally important. Moreover, given the significant economic burden that residents are already bearing due to unreliable supply, there may be opportunities to leverage community resources and willingness-to-pay for improved services. Innovative financing mechanisms, decentralized power solutions, and public-private partnerships could all play a role in accelerating improvements.

No doubt, this study has illuminated the profound and far-reaching impacts of incessant electricity outages in the study area. The findings underscore the urgent need for improvements in electricity supply reliability, not just as a matter of convenience, but as a fundamental prerequisite for economic development and improved quality of life. While the challenges are significant, understanding their nature and impacts is a crucial first step towards developing effective solutions. With concerted effort and strategic interventions, there is potential to break the cycle of unreliable supply and unlock the area's development potential. Hence, the following recommendations were made to address the menace of power outages on physical development in Akure:

1. Infrastructure modernization and capacity enhancement toward improving the existing infrastructure and enhancing capacity towards improving power generation within the study area;
2. Implementation of robust maintenance programs that will promote and enhance the power supply within the region.
3. Improve communication and customer services; and
4. The government should implement supportive policies and a regulatory framework to attract investment.

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