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The effect of electricity reliability on the sustainability of SMEs in Fako Division of Cameroon

Felix Tapang[1*], Irene Mbarika[2]
The ICT University Cameroon, Cameroon[1&2]
felix.tapang@ictuniversity.edu.cm

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Abstract

Purpose: To investigate the effects of the reliability of electricity supply on the sustainability of SMEs in Cameroon.

Research Methodology: This study investigates the effects of the reliability of electricity supply on the sustainability of SMEs in Cameroon. The study used a quantitative approach with the philosophical underpinnings of objectivist ontology and positivist epistemology. Primary data were obtained through closed-ended questionnaires that were responded to by 54 purposively sampled participants in the Fako division. The data were analyzed by Structural Equation Modeling (SEM) using SPSS 23 and SPSS Amos 24 software.

Results: The study revealed that sporadic electricity supply interruptions, chronic electricity supply interruptions, and momentary electricity supply interruptions have no significant positive impact on the sustainability of SMEs in the Fako Division of the Southwest Region of Cameroon.

Limitations: This study had a limitation in methodology, as it used a quantitative approach only. A better understanding of this study's phenomenon can be achieved by adopting a mixed research method, where the qualitative aspect will provide a deeper understanding of the effects of other variables that affect SME sustainability.

Contribution: Based on the results of this study, business managers will come to the understanding that the sustainability of their businesses is not dependent on the reliability of the electricity supply. This means that other variables responsible for the sustainability of businesses can be studied qualitatively.

Keywords: *Electricity, interruptions, sustainability, small and medium size enterprises, electricity interruptions*

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1. Introduction

Electricity is an essential commodity that has become indispensable in everyday life and human life and has been made easier today with its discovery because functions such as lighting, heating, cooling of homes, and the operation of various electrical appliances are possible (Mahmud o‘g‘li & Khudoymurodovich, 2022). A reliable supply of electricity is of great importance to SMEs, especially because they are the major players that promote growth in most economies (Hussain, Karimu, Salia, & Owen, 2022). In recent decades, the world has witnessed a significant boom in technology, which is dependent on availability and access to electricity (Milin, Mungiu Pupazan, Rehman, Chirtoc, & Ecobici, 2022). Therefore, economic development and social progress in a community or nation are difficult to achieve without a reliable supply of electricity (Nyemb & Novikova, 2019). The necessity of electricity supply applies both for industrial and local purposes, which in these modern times, is obtained by simply turning on a switch through which electricity flows from the electrical network to power the appliances of the consumers. The electricity network is composed of medium- and low-voltage cables mounted mainly on poles, as well as distribution transformers and other network materials.

The rapid growth in population, which is associated with an increase in the demand for energy in the 21st century, has resulted in considerable impacts of electricity interruption on consumers (Goudarzi, Ghayoor, Waseem, Fahad, & Traore, 2022). These interruptions require efforts from electricity utility companies to make electrical networks more responsive to consumer needs. The impact on SMEs is of serious concern, especially as they make up the majority of businesses worldwide (Mendes, Ferreira, Kannan, Ferreira, & Correia, 2022; Messabia, Beauvoir, & Kooli, 2021, 2022). According to Mukete et al. (2021)represents approximately 60% of the population and Gross Domestic Product (GDP). In Africa, it is estimated that SMEs makeup approximately 80% of firms that employ over 70% of the local population and contribute to an estimated 45% of the total GDP (Mukete et al., 2021). According to the Foretia Foundation (2020), in the case of Cameroon, SMEs are estimated to contribute approximately 36% of the GDP and constitute over 90% of businesses that employ more than 60% of the population. Therefore, SMEs play crucial roles in enhancing economic growth, such that the factors retarding their sustainability, such as electricity interruptions, need to be addressed.

The constant electricity supply interruptions in Cameroon are causing serious problems for businesses, which are at the center of development (Falama et al., 2021). Therefore, this study investigates the impact of electricity supply interruptions on SMEs in the Fako Division of the Southwest Region of Cameroon in view of developing strategies that the Electricity Utility Company of Cameroon (ENEO) could help reduce the frequency and duration of electricity supply interruptions.

There is a serious problem with the reliability of the electricity supply in Cameroon, coupled with recurring interruptions ranging from durations of one hour to three days (Ngounou, Gonin, Gachet, & Crettenand, 2015). The main indicators that measure the reliability of electricity supply are SAIFI and SAIDI. SAIFI refers to the system average interruption frequency index, whereas SAIDI refers to the System Average Interruption Duration Index. According to the electricity utility company in Cameroon ENEO (2022), the evolution of the average SAIFI in the Fako Division over the last five years was 0.195 in 2018, 0.254 in 2019, 0.426 in 2020, 0.153 in 2021, and 0.012 in 2022. The SAIFI indices range from 0 to 1. Good SAIFI indices were close to zero, whereas poor values were close to one. In addition, according to ENEO (2022), the evolution of the average SAIDI in the Fako Division over the last five years was 0.265 in 2018, 0.303 in 2019, 0.551 in 2020, 0.257 in 2021, and 0.061 in 2022. Good SAIDI indices are close to 0, whereas the higher the SAIDI indices, the poorer they are. These poor interruption indices reflect frequent and long electricity supply interruptions that affect SMEs' operations. Some SMEs have virtually closed down in the Fako Division because they have no capacity to sustain regular electricity interruptions, whereas others barely exist and do not make optimal profits. When the profit of SMEs is substantially affected, they can neither grow on a long-term basis nor pay taxes to the government required for development and hence, cannot contribute optimally to the development of the nation.

The purpose of this study is to investigate the impact of electricity supply interruptions on the sustainability of SMEs and to create awareness of Cameroon's electricity supply utility company. This awareness will help us appreciate the negative financial implications sustained each time there is an interruption in the electricity supply. Based on the negative financial implications, the electricity utility company of Cameroon will see the need to invest in their electricity networks based on the recommendations that this study will make to ensure that the electricity networks are improved with the goal of eliminating the occurrence of interruptions or limiting them to the possible minimum.

The main question this study seeks to answer is: What is the effect of electricity supply reliability on the sustainability of SMEs in the Fako Division of Cameroon? This question will be answered by addressing the following research questions (RQ):

1. **RQ 1**: What is the effect of *sporadic electricity supply interruptions* on the sustainability of SMEs in the Fako Division of Cameroon?

2. **RQ 2**: What is the effect of *chronic interruptions in electricity supply* on the sustainability of SMEs in Cameroon's Fako?
3. **RQ 3**: What is the effect of *momentary electricity supply interruptions* on the sustainability of SMEs in Fako Division Cameroon?

The relevant theories regarding interruptions of electricity supply and reliable electricity supply considered in this study include resilience theory (Francis & Bekera, 2014), control theory (John, Bruce, & Allen, 1990) and lifetime theory (Li, Vaahedi, & Choudhury, 2006).

1.1. The resilience theory

According to Haimes (2009), resilience is defined as the ability of a system to overcome serious interruptions and recover within an acceptable period at low composite costs and risks. According to Francis and Bekera (2014), resilience theory is based on information linked to the construct of interruptions to which a system might be exposed, such as the probability of incidents on the system that can be estimated so that resources can be combined to restore the system.

Resilience theory revolves around the aspects of resistance, flexibility, and recovery of an entity, with the emphasis that certain preventive measures should be undertaken to mitigate any eventual breaks in the system (Francis & Bekera, 2014). Therefore, resilience theory involves a set of capacities that include absorptive capacity, which absorbs system perturbations, adaptive capacity, which adapts to system disturbances, and recovery capacity, which plays the role of recovering from perturbations (Vugrin, Warren, & Ehlen, 2011).

1.2. The control theory

Control theory is centered on feeding back a system with control signals, whereby signals are compared with specific reference signals, and their differences are exploited to make adjustments (John et al., 1990).

To ensure system stability, the most important issue regarding control theory is that it generates solutions to mitigate or correct the root cause of disruptions in systems (Cheruto & Munene, 2019). This is due to the fact that in every normal functioning system, there is an input and output signal that must be related in a particular way when there are no abnormalities and adjusted when abnormalities occur (Glad & Ljung, 2014).

1.3. The lifetime theory

According to Li et al. (2006), the lifetime theory of power system equipment accounts for the interruption of the electricity supply. Lifetime theory is centered on the fact that network components have technical and economic dimensions associated with physical, technical, and economic lifetimes (Li et al., 2006). According to Li et al. (2006), the physical lifetime is the period in which the equipment is in a good state of operation, and the technical lifetime refers to the period of time the equipment is technically operational, even if it does not look physically in order, while the economic lifetime refers to the period in which the equipment is economically valuable.

The three theories can be summarized with the help of the theoretical gap matrix presented in Table 1.

Table 1. Theoretical Gap Matrix

Variables	**Resilience theory** (Francis & Bekera, 2014)	**Control theory** (John et al., 1990)	**Lifetime theory** (Li et al., 2006)
System flexibility	√	√	x
Recovery capacity	√	√	x
Absorptive capacity	√	x	x

Adaptive capacity	√	x	x
Anticipate consequence	√	x	√
Minimize consequence	√	x	√
Withstand consequence	√	x	x
Feedback	x	√	x
Corrective	x	√	x
Technical	√	√	√
Economic	√	√	√

Source: Adapted from Francis and Bekera (2014), John et al. (1990) & Li et al. (2006)

From the theoretical gap matrix above, the resilience theory is more applicable to this study because of its ability to withstand disruptions.

2. Literature Review

Reliable electricity supply is a major challenge in many countries, especially in Africa, where it is associated with power quality problems such as voltage sags, harmonics, and interruptions (Adeoye, 2021). Electricity supply interruptions can be planned or unplanned, and they reflect the quality of the distribution of electricity networks (Tzvetkova, 2021). Many reasons account for electricity supply interruptions, including overloaded networks. These loads could originate from residences, industries, agriculture, and government entities (El-Bassiouny, El-Shimy, & Hammouda, 2017). Furthermore, the occurrence of serious voltage drops in an electricity network due to an increase in reactive power accounts for the lack of electricity supply to customers (Hanger, 2003).

The structure of an electricity network plays a vital role in determining its reliability. According to Onaolapo, Carpanen, Dorrell, and Ojo (2022), the reliability of electricity networks depends on the structure of the network, which, to a great extent, is affected when weather conditions are harsh, thus causing interruptions. Kefale, Getie, and Eshetie (2021) opined that interruptions in electricity supply are mostly caused by the overloading of networks and the contact of trees with electricity cables.

There are several implications and impacts of electricity interruptions. Many electricity supplying companies pay little attention to improving their supply services, which worsen when weather conditions are poor (Nduhuura, Garschagen, & Zerga, 2021). As a result, when adverse weather conditions increase, electricity supply interruptions also increase in both chronic and sporadic ways. An increase in interruptions has diverse effects on different consumer groups. Besides its negative impacts on business organizations, even medical equipment fails in their operations, thus compromising treatment or patient survival (Bean, Snow, Glencross, Viller, & Horrocks, 2020).

Electricity supply interruptions have always caused serious damage to consumers, and are usually followed by serious socioeconomic disadvantages. In the case of the empirical study by Nduhuura et al. (2021) in Ghana, the interruption of the supply of electricity greatly impacted households in the area of safety and food supply. Furthermore, according to Otcenasova, Bolf, Altus, and Regula (2019), interruptions occur because of imbalances in the network that generate losses. In the case of Cameroon, small and medium-size enterprises easily face enormous challenges in their operations due to electricity supply interruptions to the extent of difficulties in staying in business (Ef Ii, 2021). By implication, electricity companies and customers suffer financially when the root causes of interruptions are not addressed.

According to Oseni and Pollitt (2015), financial losses resulting from unmitigated interruptions of electricity supply in Sub-Saharan Africa were estimated at US$2.01–23.92 per kWh for firms that mitigated interruptions with alternative ways of generation and from US$1.54-32.46 per kWh for those without alternative ways of generation. In the case of Cameroon, according to Diboma and Tatietse (2013), electricity supply interruption costs are quite high, ranging from €3.62/kWh to €5.42/kWh for a one-hour interruption and from 1.96/kWh to €2.46/kWh for a four-hour interruption, which significantly affects Cameroonian businesses negatively. In Lebanon, the losses on the economy of the country resulting from electricity supply interruption over the period from 2009 to 2014 were estimated at 23.23 billion USD, which began to decline with the installation of two supplementary power plants in 2013 as alternative measures to boost the electricity supply (Bouri & El Assad, 2016). Furthermore, the analysis of Linares and Rey (2013) showed that the cost for the Spanish economy of one kWh of electricity that is unsupplied during interruptions was above €4/Kwh. These figures reflect the negative financial impact of electricity supply interruptions in different countries.

There are some possibilities for preventing interruptions in the electricity supply. When countries improve their income levels, it becomes important to improve energy policies, especially to balance electricity supply intensity, because failure to do so triggers electricity network saturation, which leads to network breakdown and interruptions (Deichmann, Reuter, Vollmer, & Zhang, 2019). According to Minnaar, Visser, and Crafford (2017), to reduce power outages, electricity supply companies need to make investments to upgrade their networks. This means that electricity utility companies must derive strategies to quickly identify faults that must be treated without much delay (Eikeland et al., 2022). In addition, according to Moura et al. (2017), preventive maintenance demands keen attention to obtaining reliable electricity networks that will serve customers satisfactorily. According to Izadi and Safdarian (2018), preventive maintenance can be achieved in numerous ways, one of which is remote-controlled switches (RCSs). Other methods include the use of artificial neural networks (ANN) owing to their compact structure and the possibility of predicting outages caused by harsh weather, which can enable utility companies to intervene in time (Onaolapo et al., 2022).

To cope with electricity shortages and interruptions, alternative sources of generation, such as renewable energy, can play a vital role in filling this gap while simultaneously reducing harmful emissions (Lehmann et al., 2019; Zhao, Tang, & Wang, 2013). As stated by Kefale et al. (2021), solar photovoltaic systems can also help resolve the problem of interruptions by connecting their supply to electricity grids. Gupta, Bruce-Konuah, and Howard (2019) opined that the energy from solar photovoltaic systems can be boosted with batteries at night when there is no sunshine through the discharge of stored electricity. According to Kunaifi and Reinders (2018), boosting the electricity supply can be further improved by using backup generators, for which most households will be willing to pay extra for their monthly electricity bills to improve the reliability of their electricity supply.

In addition to conventional ways of preventing electricity supply interruptions, restoration techniques through smart electricity networks can be developed to mitigate the effects of interruptions (Moraes, Vilas Boas, Lambert-Torres, Andrade, & Costa, 2022). Furthermore, Numbere, Idoniboyeobu, and Braide (2022) opined that the analysis of power flow to ensure that available power matches consumer energy needs was relevant to reducing interruptions in electricity supply. According to Numbere et al. (2022), a relief transformer improvement approach can be introduced to networks with existing overloaded transformers to free the transformers from eventual damage that will result in interruptions. This solution could solve the similar situation raised by Mireku, Dauda, and Danladi (2022) in Ghana, where electricity generation hardly meets the demands of consumers, thus resulting in dissatisfaction and relationship strain between the electricity utility company and customers.

The hypotheses derived from the empirical literature review are as follows.
H1: Sporadic electricity supply interruptions have a significant effect on the sustainability of SMEs in the Fako Division of Cameroon.
H2: Chronic electricity supply interruptions have a significant effect on the sustainability of SMEs in the Fako Division of Cameroon.
H3: Interruptions in the momentary electricity supply have a significant effect on the sustainability of SMEs in the Fako Division of Cameroon.

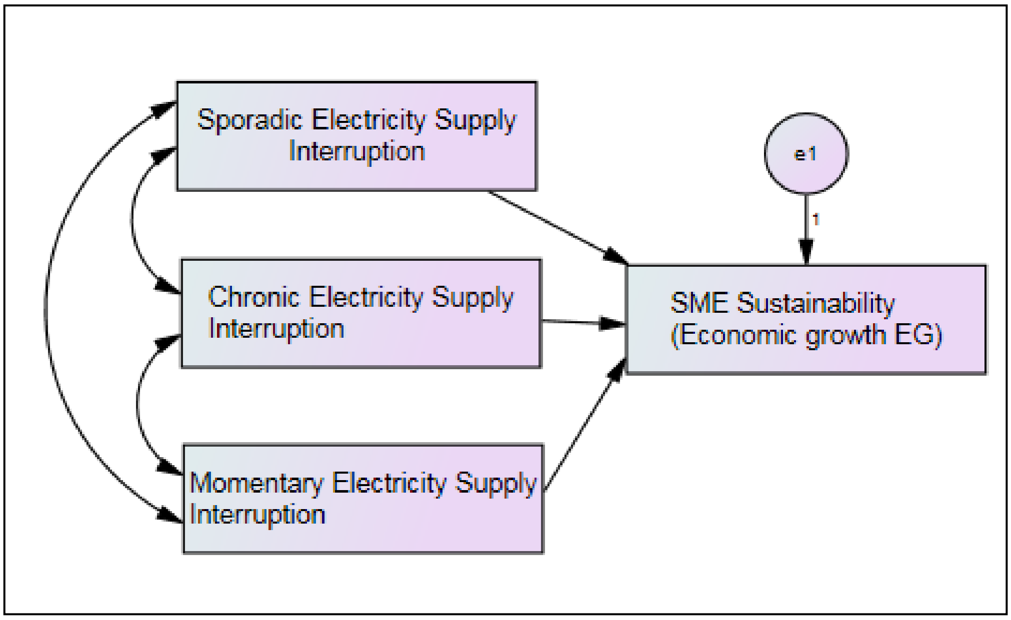


Figure 1. Conceptual framework of the study
Source: SPSS Amos 24

The variables represented in the framework were isolated as variable gaps from those found in the literature review to explain the effects of electricity supply interruptions on customers.

2.1. Definitions of new terminology

1. **Sporadic Electricity Supply Interruption:** Sporadic electricity supply interruptions occur suddenly, especially during weather storms. These interruptions usually have long durations, associated with huge economic impacts (Yan, Dokic, & Kezunovic, 2016).
2. **Chronic Electricity Supply Interruption**: Chronic electricity supply interruptions are interruptions caused by poor electricity networks that are dilapidated and poorly planned. Such networks constitute low-standard materials and network components such as transformers, cables, protective devices that are not upgraded, and rotten wooden poles. (Küfeoğlu, 2015). Electricity consumers connected to such networks have no guarantee of regular flow of electricity supply because interruptions are too frequent on a regular basis.
3. **Momentary electricity supply interruptions**: These are electricity supply interruptions with short durations, where interrupters in power stations trip when faults are diagnosed automatically (Ortmeyer, Reeves, Hou, & McGrath, 2010).
4. **Economic growth**: Economic growth is the increase in the value of a company, which creates more profit for businesses measured in terms of an increase in real income (Roser, 2021).

3. Research Methodology

The phenomenon in this research is objectively ascertained, and the source of acceptable knowledge is positivist epistemology (Martí & Fernández, 2013). The research approach is deductive, while axiology is value-free (Gonzalez, 2013). A descriptive design was used, and a survey strategy was adopted to answer the research questions to achieve the research objectives. A purposive and stratified sampling technique was used to recruit 54 managers and owners of SMEs in the Fako division.

A survey questionnaire was used in this study. The questionnaire was composed of four sections: a section with the research title, a section with a description of the researcher, a section to capture the demographic characteristics of respondents and a section with questions that contained twenty questions. The questionnaire was distributed for data collection between February and March 2023. The inclusion criteria of participants for data collection were managers and proprietors of SMEs in the towns of the Fako division in the southwest region of Cameroon. Managers and proprietors out of this area of

Cameroon were excluded. Closed-ended statements were used in the questionnaire used for the study with five (5) Likert scale measurements ranging from Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD) (Boone Jr & Boone, 2012). The Cronbach alpha test was used in the research to ensure the internal consistency of the construct indicators through the value $\alpha > 0.7$ (Cronbach, 1951). Exploratory and confirmatory factor analyses were used to clean the data and reduce redundancy (Hurley et al., 1997). The construct validity test was carried out to ensure that the Average Variance Extracted AVE > 0.5. Missing data were identified and replaced by the mean of the data distribution. This study tested the assumptions of the parametric analysis. Outliers for the linearity assumption were identified using boxplots, the multivariate normality assumption was tested through Q-Q plots, the multicollinearity assumption was checked using variance inflation Factor VIF and Tolerance–T, and finally, the homoscedasticity assumption was tested using scatter plots. SPSS and SPSS AMOS were used to quantitatively analyze the data using statistical inferences and modeling.

4. Results and discussion

4.1. Demographic of participants

Demographic characteristics of the participants are presented in Table 2.

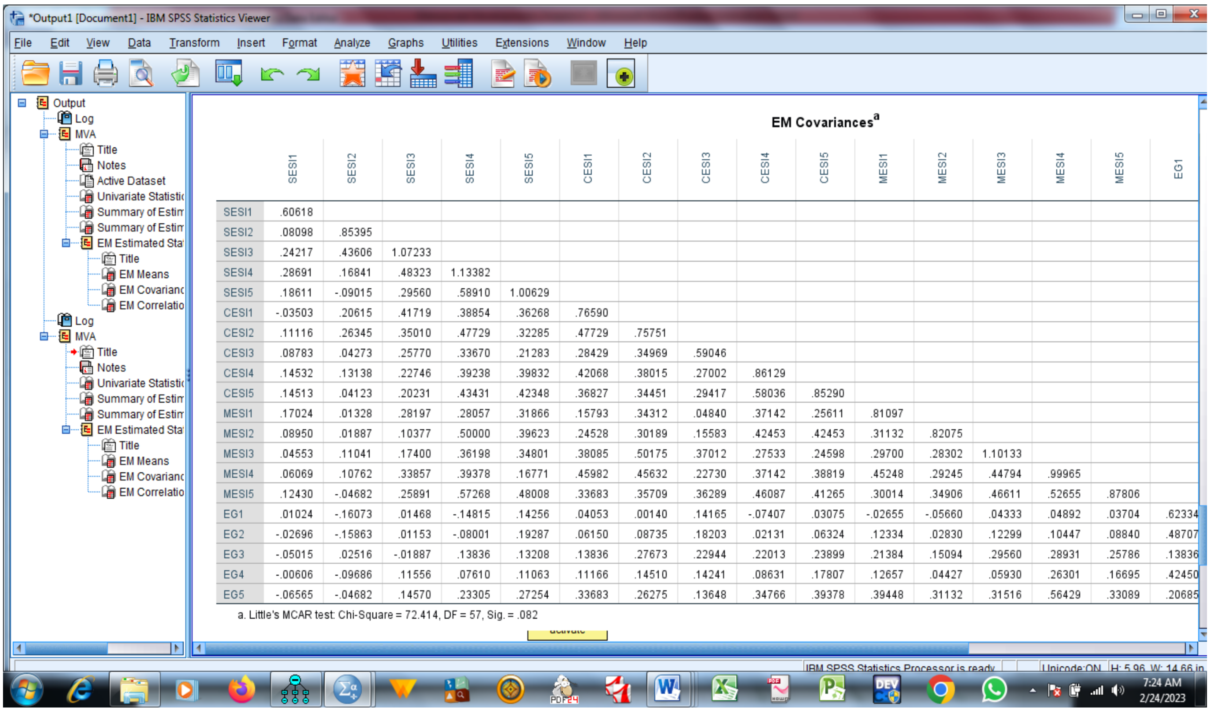
Table 2. Demographic characteristics of the sample

Variable	Count	Percent	Cumulative percent
Gender			
Male	33	61%	61%
Female	21	39%	100%
Marital status			
Married	37	69%	69%
Single	16	30%	98%
Divorced	1	2%	100%
Widowed	0	0%	100%
Age bracket			
Below 25 yrs.	6	11%	11%
26 - 35 yrs.	18	33%	44%
36 - 45 yrs.	6	11%	56%
Above 45 yrs.	24	44%	100%

4.2. Data cleaning analysis and results

4.2.1. Missing data management

Using SPSS, Missing data analysis was performed using MCAR Little's test**,** and the results are shown in Figure 2.


EM Covariances[a]

	SESI1	SESI2	SESI3	SESI4	SESI5	CESI1	CESI2	CESI3	CESI4	CESI5	MESI1	MESI2	MESI3	MESI4	MESI5	EG1
SESI1	.60618															
SESI2	.08098	.85395														
SESI3	.24217	.43606	1.07233													
SESI4	.28691	.16841	.48323	1.13382												
SESI5	.18611	-.09015	.29560	.58910	1.00629											
CESI1	-.03503	.20615	.41719	.38854	.36268	.76590										
CESI2	.11116	.26345	.35010	.47729	.32285	.47729	.75751									
CESI3	.08783	.04273	.25770	.33670	.21283	.28429	.34969	.59046								
CESI4	.14532	.13138	.22746	.39238	.39832	.42068	.38015	.27002	.86129							
CESI5	.14513	.04123	.20231	.43431	.42348	.36827	.34451	.29417	.58036	.85290						
MESI1	.17024	.01328	.28197	.28057	.31866	.15793	.34312	.04840	.37142	.25611	.81097					
MESI2	.08950	.01887	.10377	.50000	.39623	.24528	.30189	.15583	.42453	.42453	.31132	.82075				
MESI3	.04553	.11041	.17400	.36198	.34801	.38085	.50175	.37012	.27533	.24598	.29700	.28302	1.10133			
MESI4	.06069	.10762	.33857	.39378	.16771	.45982	.45632	.22730	.37142	.38819	.45248	.29245	.44794	.99965		
MESI5	.12430	-.04682	.25891	.57268	.48008	.33683	.35709	.36289	.46087	.41265	.30014	.34906	.46611	.52655	.87806	
EG1	.01024	-.16073	.01468	-.14815	.14256	.04053	.00140	.14165	-.07407	.03075	-.02655	-.05660	.04333	.04892	.03704	.62334
EG2	-.02696	-.15863	.01153	-.08001	.19287	.06150	.08735	.18203	.02131	.06324	.12334	.02830	.12299	.10447	.08840	.48707
EG3	-.05015	.02516	-.01887	.13836	.13208	.13836	.27673	.22944	.22013	.23899	.21384	.15094	.29560	.28931	.25786	.13836
EG4	-.00606	-.09686	.11556	.07610	.11063	.11166	.14510	.14241	.08631	.17807	.12657	.04427	.05930	.26301	.16695	.42450
EG5	-.06565	-.04682	.14570	.23305	.27254	.33683	.26275	.13648	.34766	.39378	.39448	.31132	.31516	.56429	.33089	.20685

a. Little's MCAR test: Chi-Square = 72.414, DF = 57, Sig. = .082

Figure 2. MCAR Little's test results
Source: SPSS

Based on Little's MCAR test, with Chi-Square = 72.414, Degree of Freedom DF= 57, the P-value = 0.82, which is greater than 0.05, indicates that all missing data in the dataset were missing completely at random (MCAR). This is because according to the law, the P-value must be greater than 0.05 for data to be missing completely at random.

From the data analysis, the missing values were the values of the variable SESI1 of the 19th respondent and the variable CESI3 of the 7th respondent. These missing values were replaced by their respective means of 1.6 and 1.9 in the dataset.

4.3. Dimension analysis and results

4.3.1. Exploratory Factor Analysis for the Independent Latent Constructs

The independent latent constructs in the model consist of sporadic Electricity Supply Interruption (SESI), chronic (CESI) and momentary electricity supply interruptions (MESI). Exploratory Factor Analysis (EFA) was performed to clean the data through dimension reduction. Table 3 presents the results for the independent variables with a large amount of noise requiring cleaning.

Table 3. EFA with noise for the independent Variables

Pattern Matrix[a]			
	Component		
	1	2	3
SESI1	-0.526	0.654	
SESI2			0.833
SESI3			0.758
SESI4		0.635	
SESI5		0.787	

CESI1	0.766		
CESI2	0.663		
CESI3	0.523		
CESI4		0.512	
CESI5		0.598	
MESI1		0.513	
MESI2		0.68	
MESI3	0.635		
MESI4	0.699		
MESI5		0.52	
Extraction Method: Principal Component Analysis.			
Rotation Method: Promax with Kaiser Normalization.			
a. Rotation converged in 10 iterations.			

Source: SPSS

After cleaning the data by removing factor loadings of the same variables in different matrix components referred to as cross-loadings, Table 4 shows the data without noise with all the retained indicators of each independent variable, where the factor loadings of similar variables are loaded in the same component of the matrix. Additionally, according to the law, the retained factors must be greater than 0.5, which is satisfied by the factors in the table.

Table 4. Results of EFA without noise for the independent Variables

Pattern Matrix[a]			
	Component		
	1	2	3
SESI2			0.955
SESI3			0.727
CESI1		0.636	
CESI2		0.538	
CESI3		1.021	
MESI1	1.014		
MESI2	0.661		
MESI4	0.657		
Extraction Method: Principal Component Analysis.			
Rotation Method: Promax with Kaiser Normalization.			

a. Rotation converged in 5 iterations.

Source: SPSS

In addition, the KMO and Bartlett's tests for the independent variable were performed, and the results are shown in Table 5.

Table 5. Results of KMO and Bartlett's test for independent variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.664
Bartlett's Test of Sphericity	Approx. Chi-Square	133.874
	df	28
	Sig.	0

Source: SPSS

As seen in Table 5, in the KMO test, the sample adequacy assumption is met because the value is 0.664, which lies between 0.5 and 1. In addition, for Bartlett's Test of Specificity, the P-value is 0, which is less than 0.5, which fulfills the test.

Table 6. Retained and Rejected Indicators of the Independent Construct

LATENT CONSTRUCT	**RETAINED INDICATORS**	**REJECTED INDICATORS**
SESI: Sporadic Electricity Supply Interruptions	**SESI2**: Heavy rains are associated with thunderstorms always **SESI3**: During heavy rains, electricity supply is always interrupted	**SESI1**: There are seasons of heavy rains every year that affect electricity supply **SESI4**: When the electricity supply is interrupted during heavy rains, it usually takes too long for ENEO to reinstate the supply **SESI5**: Sometimes when the electricity supply is interrupted during heavy rains, ENEO takes more than one day to be reinstated
CESI: Chronic Electricity Supply Interruption	**CESI1**: It is observed that most wooden poles in the electricity network of ENEO are rotten **CESI2**: It is observed that the wooden poles in the electricity network of ENEO fall too often **CESI3**: It is observed that ENEO transformers get bad too often	**CESI4**: It is observed that ENEO cables burn too often **CESI5**: It is observed that circuit breakers mounted on poles burn too often

MESI: Momentary Electricity Supply Interruption	**MESI1**: There are seasons with strong winds that affect electricity supply **MESI2**: It is observed that there are many trees with branches around electricity high-tension lines of ENEO **MESI4**: It is observed that during strong winds, the electricity supply goes off always	**MESI3:** It is observed that some ENEO high-tension lines pass through bushes **MESI5**: It is observed that when the electricity supply goes off during strong winds, it takes longer for the supply to be reinstated by ENEO

4.3.2. Exploratory Factor Analysis for the Dependent Latent Construct

The dependent latent construct in the model is economic growth (EG). An EFA was also performed to clean the data through dimension reduction. Table 7 shows the results for the presence of noise of the two indicators loaded in Component Two of the pattern matrix. These two indicators were removed from subsequent analysis.

Table 7. Results of EFA with noise for the dependent variables

Pattern Matrix[a]		
	Component	
	1	2
EG1	1.05	
EG2	0.865	
EG3		0.892
EG4	0.738	
EG5		0.848
Extraction Method: Principal Component Analysis.		
Rotation Method: Promax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

Source: SPSS

In addition, the KMO and Bartlett's tests for the dependent variable were performed, and the results are shown in Table 8.

Table 8. Results of KMO and Bartlett's test for dependent variable

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.741

Bartlett's Test of Sphericity	Approx. Chi-Square	96.963
	df	3
	Sig.	0

Source: SPSS

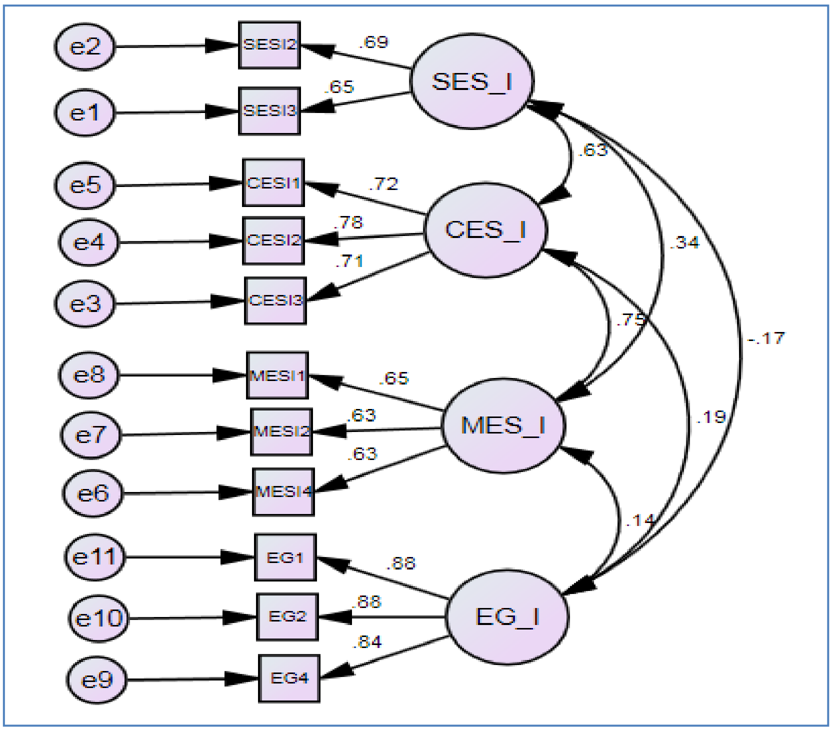
As seen in the KMO test results in Table 8, the sample adequacy assumption was met because the value was 0.741, which lies between 0.5 and 1. In addition, for Bartlett's Test of Specificity, the p-value is 0, which is less than 0.5, and thus fulfills the test.

Table 9. Retained and rejected indicators for the dependent construct

VARIABLES	RETAINED INDICATORS	REJECTED INDICATORS
EG: Economic growth	**EG1**: Electricity interruption impacts business negatively **EG2**: Due to the impact of electricity interruptions, business does not go on smoothly **EG4**: Due to the impact of electricity interruptions, some business products always get bad	**EG3**: Due to the impact of electricity interruptions, business profit is low **EG5:** Due to the impact of electricity interruptions on business, it's difficult to recruit more workers

4.3.3. Confirmatory Factor Analysis

A Confirmatory Factor Analysis (CFA) model was completed using SPSS AMOS to confirm the factor loadings of the EFA. All observed regression paths in the model as shown below are statistically significant.



CHI SQUARE=63.701 , DF=45, P_VALUE= 0.035, GFI= 0.713, IFI=0.917, TLI=0.894, CFI=0.913 RMSEA=0.089

Figure 3. Confirmatory Factor Analysis
Source: SPSS AMOS

The CFA results indicate that all the retained factors of the EFA were also loaded acceptably in the CFA analysis, as shown in Table 10.

Table 10. Factor loadings in EFA and CFA

Constructs	**Indicators**	**EFA Factor loadings** ***(Source: SPSS)***	**CFA Factor loadings** ***(Source: AMOS)***
Sporadic Electricity Supply Interruption (SESI)	SESI2	0.955	0.69
	SESI3	0.727	0.65
Chronic Electricity Supply Interruption (CESI)	CESI1	0.636	0.72
	CESI2	0.538	0.78
	CESI3	1.021	0.71
Momentary Electricity Supply Interruption (MESI)	MESI1	1.014	0.65
	MESI2	0.661	0.63
	MESI4	0.657	0.63
Economic growth (EG)	EG1	0.827	0.88
	EG2	0.982	0.88
	EG4	0.976	0.84

4.3.4. Validity and reliability analyses and results

All the retained indicators and constructs were tested for Construct Validity (CV) and reliability. The acceptable threshold for validity is when the Average Variance Explained (AVE > 0.5), and the acceptable threshold for reliability is when Cronbach's α (α) is >0.6. Table 11 presents the results.

Table 11. Validity and reliability of constructs (Source; SPSS)

Constructs	**Indicators**	**Factor loadings (EFA)**	**Factor loadings squared**	**Validity**	**Reliability**
Sporadic Electricity Supply Interruption (SESI)	SESI2	0.955	0.9	AVE = 0.7 > 0.5	α – Cronbach = 0.62 > 0.6
	SESI3	0.727	0.5		
Chronic Electricity Supply Interruption (CESI)	CESI1	0.636	0.4	AVE = 1.7 > 0.5	α – Cronbach = 0.77 > 0.6
	CESI2	0.538	0.3		
	CESI3	1.021	1.0		

Momentary Electricity Supply Interruption (MESI)	MESI1	1.014	1.0	AVE = 1.9 > 0.5	α – Cronbach = 0.67 > 0.6
	MESI2	0.661	0.4		
	MESI4	0.657	0.4		
Economic growth (EG)	EG1	0.827	0.7	AVE = 0.9 > 0.5	α – Cronbach = 0.89 > 0.6
	EG2	0.982	1.0		
	EG4	0.976	1.0		

Source: SPSS

As seen in the table, the criteria for both the validity and reliability of the constructs of the study on the basis of the retained indicators were satisfied.

4.4. Regression analysis

4.4.1. Parametric assumptions analyses and results

Before conducting a regression analysis to test the hypotheses developed for the study, tests of all parametric assumptions were carried out to ensure reliable results of the regression analysis. The test for linearity was performed using the box plot method to identify outliers. Figure 4 shows that there were outliers in the variables (SESI and EG). This means that the linearity test was not satisfactory and had to be treated by replacing them with their respective means.

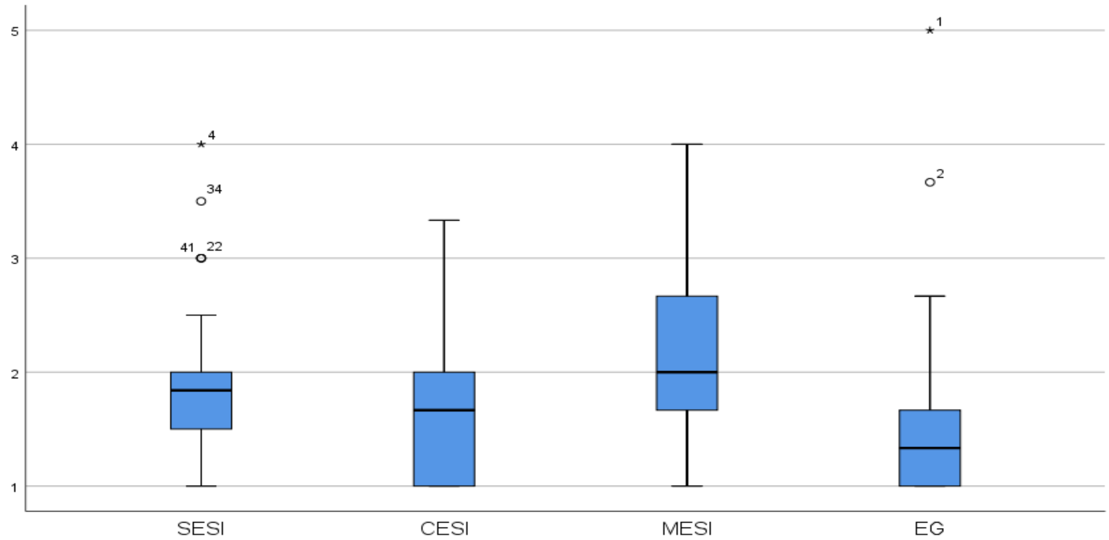


Figure 4. Outliers Identified through Boxplots

From the results of the descriptive statistics, the mean SESI was 1.85 and the mean EG was 1.46. Therefore, all the outliers in Figure 4 were replaced with their respective means, and the result of another test for outliers is indicated by the box plot in Figure 5, which shows that there are no more outliers.

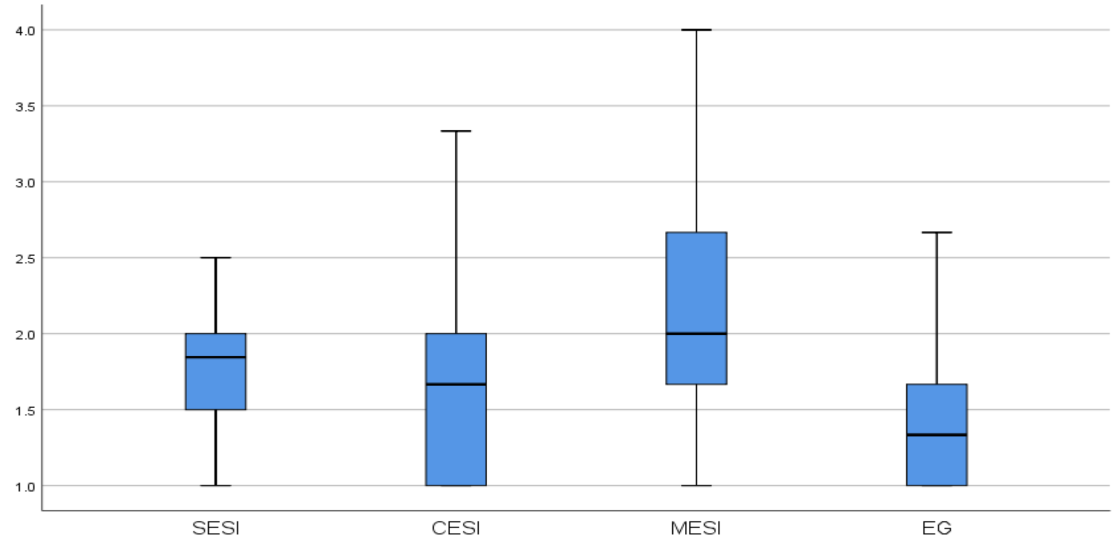


Figure 5. Outliers Treatment through Boxplots

The multivariate normality assumption was verified using QQ Plots, as shown below. For all variables, the test showed a normal diagonal line with no strong deviation from the points. This indicates that the residuals were normally distributed; hence, the multivariate normality test was satisfied.

The multivariate normality test results using QQ Plots for the three independent variables are shown below:

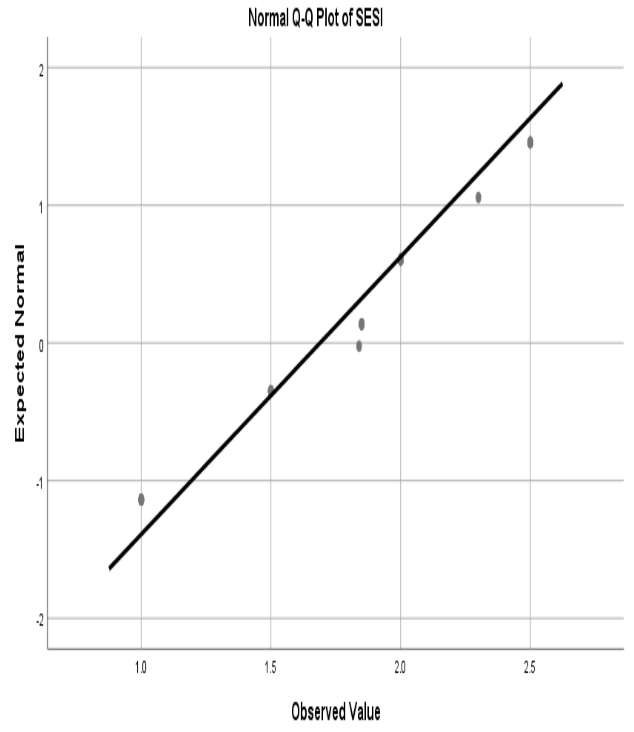


Figure 6. Q-Q plot for variable SESI (Source: SPSS)

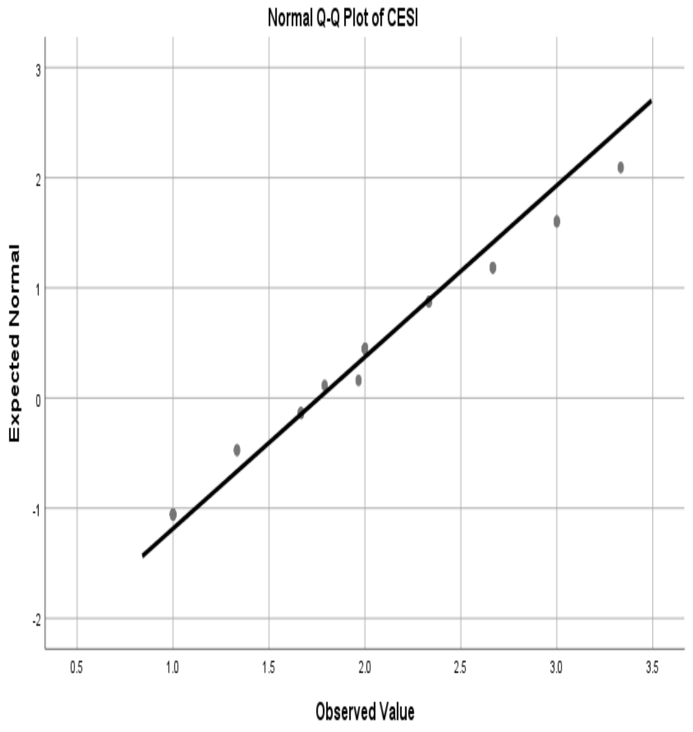


Figure 7. Q-Q plot for variable CESI (Source: SPSS)

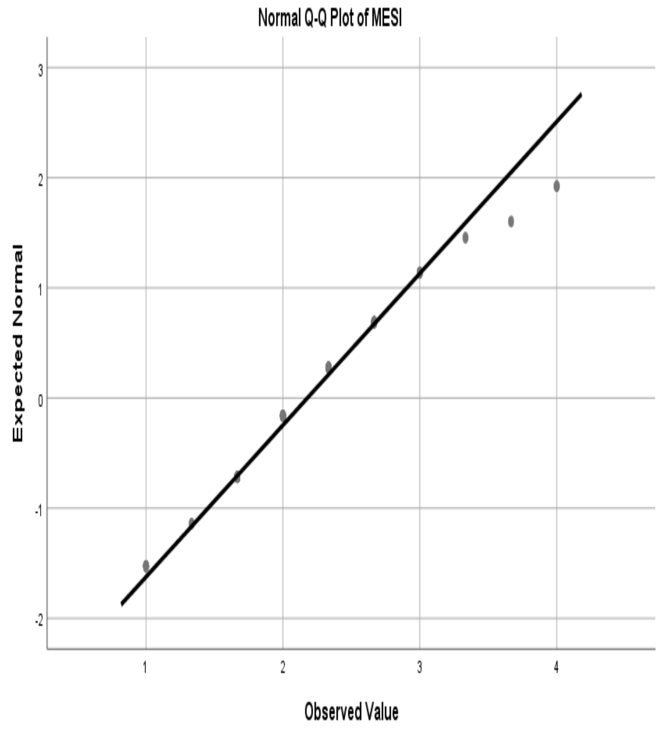


Figure 8. Q-Q plot for variable MESI (Source: SPSS)

The multivariate normality test results through QQ Plots for the dependent variables are shown below:

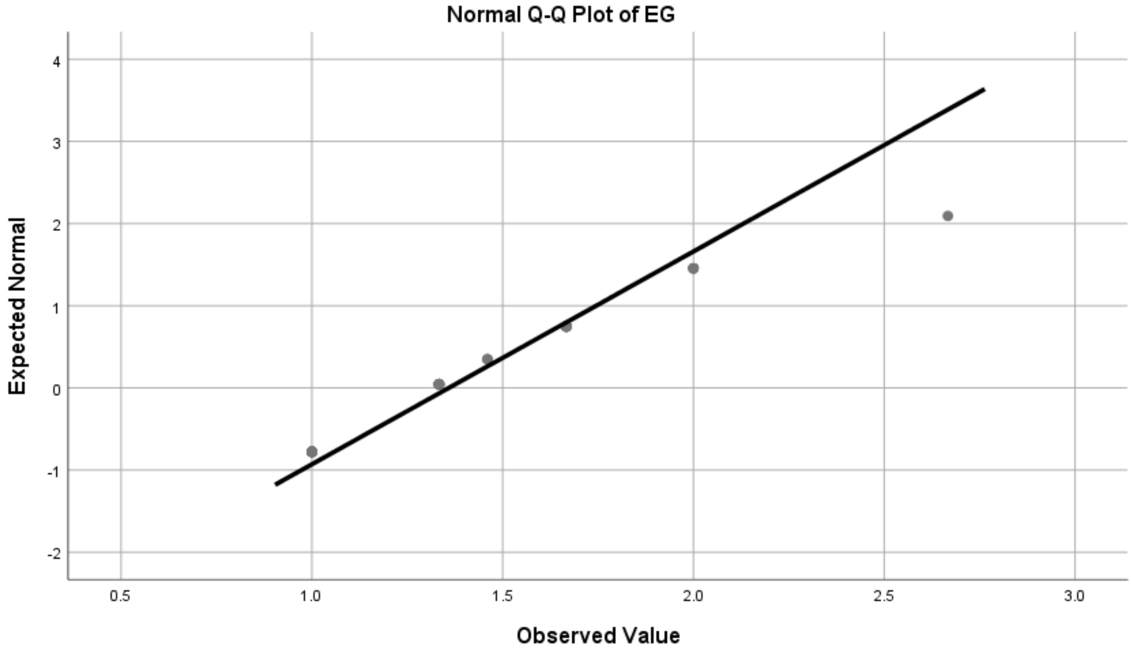


Figure 9. Q-Q plot for variable EG (Source: SPSS)

The assumption of multicollinearity was checked using both the tolerance test [T > 0.1] and the Variance Inflation Factor [VIF < 10]. The results were acceptable, as shown in the table below.

Table 12. Test of Multicollinearity

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.696	0.213		3.263	0.002		
	SESI	0.131	0.107	0.169	1.226	0.226	0.846	1.182
	CESI	0.164	0.092	0.273	1.779	0.081	0.683	1.463
	MESI	0.07	0.076	0.131	0.918	0.363	0.786	1.272
a. Dependent Variable: EG								

LAW for no Multicollinearity: VIF<10 or Tolerance > 0.1
Source: SPSS

As shown in Table 12, the Variance Inflator Factor (VIF) values were less than 10 for all variables. In addition, the tolerances for all variables were greater than 0.1. This implies that there is no multicollinearity among the variables because, according to the law, VIF<10 or Tolerance > 0.1 for all variables.

The assumption for homoscedasticity was tested, as shown in Figure 10, which shows that the variance of the error term is similar across the independent variables based on the distances between the points to the straight line. In addition, the shape of the scatter plot was tube-like, thus fulfilling the criteria for homoscedasticity.

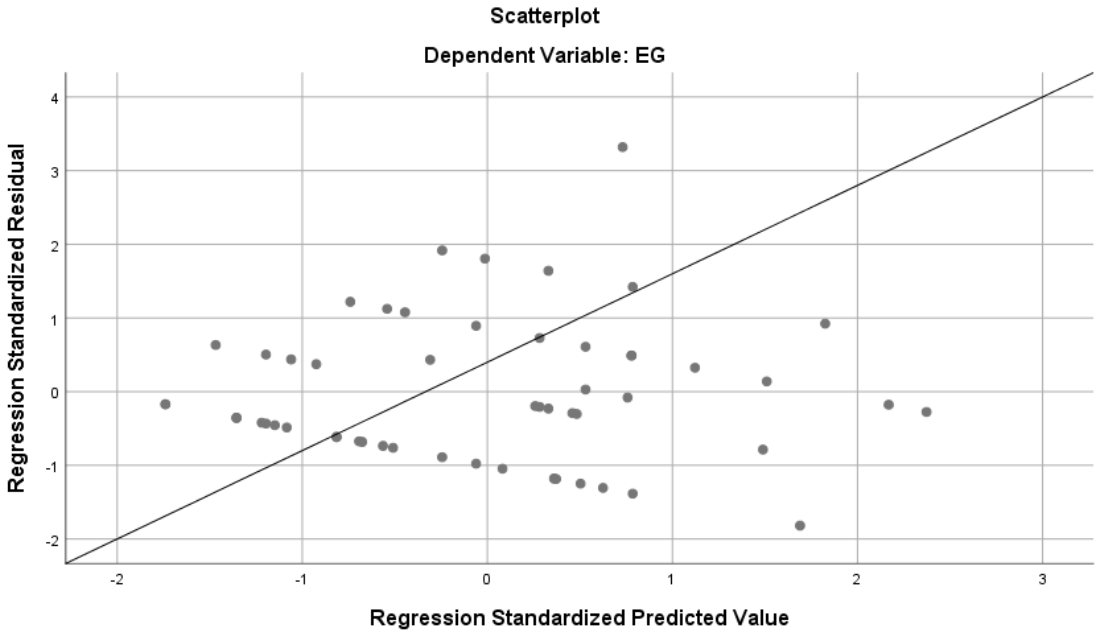
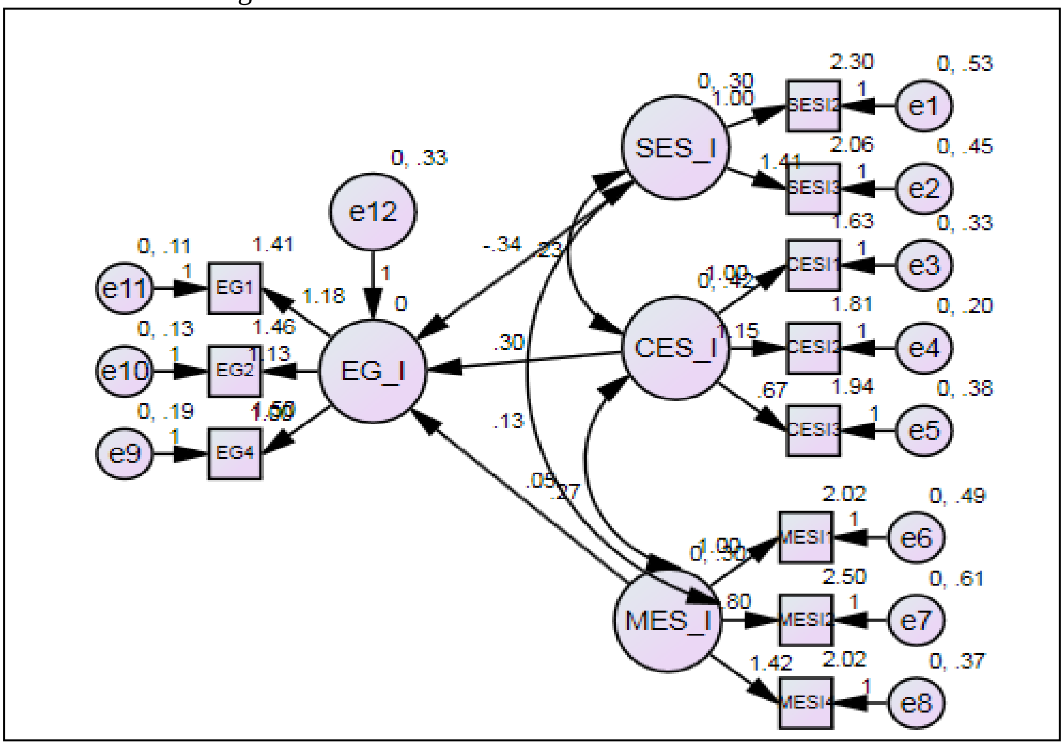


Figure 10. Test for homoscedasticity (Source: SPSS)

4.5. Test of hypotheses using Structural Equation Model (SEM)

The hypotheses for the study were tested using a Structural Equation Model (SEM). The hypotheses for the three predictors of sustainability through economic growth were tested using SEM, and the results are shown in the diagram below.



CHI SQUARE=51.325 , DF=38, P_VALUE= 0.073, GFI= 0.811, IFI=0.943, TLI=0.911, CFI=0.938, RMSEA=0.081

Figure 11. Structural Equation Model (Source: SPSS AMOS)

The regression weights of the analysis using the Structural Equation Model (SEM) are shown in Table 13.

Table 13. Regression weights

			Estimate	S.E.	C.R.	P	Label
EG_I	<---	SES_I	-0.345	0.324	-1.063	0.288	
EG_I	<---	MES_I	0.051	0.388	0.133	0.894	
EG_I	<---	CES_I	0.295	0.413	0.714	0.475	

Source: SPSS AMOS

With the specifications for goodness of fit in Figure 11, the test of the hypothesis from the Structural Equation Model is tabulated in Table 14.

Table 14. Hypothesis tests and decision

Hypothesis		P-Value at 95% Confidence Interval (CI)	Decision /Conclusion
Hypothesis 1	There is a significant impact of sporadic electricity supply interruptions on the sustainability of SMEs in the Fako Division of the South West Region of Cameroon	P-Value = 0.288 > 0.05 (Statistically insignificant)	Decline to reject the null hypothesis and conclude that there is no significant statistical evidence to suggest that Sporadic electricity supply interruptions have a significant positive effect on the sustainability of SMEs.
Hypothesis 2	There is a significant impact of momentary electricity supply interruptions on the sustainability of SMEs in the Fako Division of the South West Region of Cameroon	P-Value = 0.894 > 0.05 (Statistically insignificant)	Decline to reject the null hypothesis and conclude that there is no significant statistical evidence to suggest that Momentary electricity supply interruptions have a significant positive effect on the sustainability of SMEs.
Hypothesis 3	There is a significant impact of chronic electricity supply interruptions on the sustainability of SMEs in the Fako Division of the South West Region of Cameroon	P-Value = 0.475 > 0.05 (Statistically insignificant)	Decline to reject the null hypothesis and conclude that there is no significant statistical evidence to suggest that Chronic electricity supply interruptions have a significant positive effect on the sustainability of SMEs.

4.6. Discussion

Consistent with the objectives of this study to investigate the impacts of electricity supply interruptions on the sustainability of SMEs in the Fako Division of Cameroon., three findings emerged:

First, the study established no significant statistical evidence to suggest that there is an effect of sporadic electricity supply interruptions on the sustainability of SMEs through economic growth in the Fako Division of the Southwest Region of Cameroon. This is in contrast to the empirical findings of Nduhuura et al. (2021), where adverse weather events led to sudden sporadic interruptions in electricity supply. Furthermore, according to Bean et al. (2020), sudden electricity interruptions from weather storms are associated with equipment damage that affects different groups of customers differently. However, the implication of the findings of this study is that sudden interruptions in electricity supply caused mainly by weather storms have no significant impact on the sustainability of SMEs in the Fako division based on their economic growth. This finding is in line with the low occurrence of weather storms in the Fako division of Cameroon, where the rainy season in particular is mainly in the months of August and is very mild in the month before (July) and one month after (September).

Second, the study established no significant statistical evidence to suggest that there is an effect of chronic interruptions in electricity supply on the sustainability of SMEs through economic growth in Cameroon's Fako. According to Adeoye (2021), this finding contrasts with previous studies, especially in Africa, where most electricity networks are associated with dilapidated network components that lead to breakdowns and frequent interruptions. Furthermore, Tzvetkova (2021) found that interruptions of electricity in most African countries are unplanned because of low-quality network materials that fail often and unexpectedly. However, the implication of this study is that sudden interruptions in electricity supply, which are usually caused by dilapidated electricity distribution networks, have no significant impact on the sustainability of SMEs in the Fako division in terms of their economic growth. This finding is inconsistent with the reality of the field in the Fako Division. This is because the electricity network in the Fako division is dilapidated to a great extent; in particular, the low-voltage network is composed of rotten wooden poles that fall often, regular burning of overloaded distribution cables, and a medium-voltage network is composed of many overloaded distribution transformers that breakdown often. These occurrences are frequent in the Fako division, leading to chronic interruptions in the electricity supply.

Third, the study established no significant statistical evidence to suggest that momentary electricity supply interruptions affect the sustainability of SMEs through economic growth in the Fako Division of the Southwest Region of Cameroon. This is in line with the findings of Onaolapo et al. (2022), where momentary interruptions are minimized owing to networks that are void of physical contact of medium-voltage cables with tree branches and vegetation. Kefale et al. (2021) added that momentary interruptions, mostly caused by the overloading and contact of trees on electricity cables, are easily handled by network operators. The implication of this study is that low-duration interruptions of electricity supply caused mainly by winds have no significant impact on the expansion of SMEs in the Fako division in terms of their economic growth. Winds tend to blow tree branches to the extent that they come in contact with naked medium-voltage electricity cables that create short circuits and eventual resultant interruptions. This finding is in line with the low occurrence of strong winds in the Fako division of Cameroon and the fact that trees close to the naked medium-voltage networks are being trimmed regularly by the electricity utility company in the Fako division.

The findings suggest that other factors affect the sustainability through economic growth in the Fako Division of Cameroon. Therefore, other studies should attempt a qualitative approach to investigate the factors that impact the sustainability of SMEs.

5. Conclusion

5.1. Conclusion

This study examined the effect of electricity supply reliability on the sustainability of SMEs required for Cameroon's development: a case study in the Fako Division, Southwest Region. By focusing on sporadic, chronic, and momentary electricity supply interruptions, this study found no significant statistical evidence to suggest their impact on the sustainability of SMEs through economic growth. However, as underscored in the discussion section, the second finding related to the impact of chronic electricity supply was inconsistent with the realities in the field in the Fako division. In conclusion, this study recommends further research to investigate the underlying factors that impact sustainability.

This study had a limitation in methodology, as it used only a quantitative approach. As a recommendation, a better understanding of this study's phenomenon can be achieved by adopting a mixed research method, where the qualitative aspect will provide a deeper understanding of the effects of other variables that affect SME sustainability.

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