Unbundling Socio-Political Dynamics Underpinning The Nigerian Energy Crisis: Casestudy Of South – South And South Eastern Nigeria

[1]Okereke Reuben A, [2]Ukanwa Emannuel O, and [3]Agu Lilian

1 & 2: Department of Quantity Surveying, Imo State University, Owerri, Nigeria
3: Department of Architecture, Imo State University, Owerri, Nigeria
Corresponding Author's Email: rapghica2013@gmail.com

***Abstract*— Energy is important to economic growth, progress, development, and security of any nation. Nigeria is experiencing energy poverty as a result of her detrimental low income, high-energy costs, low energy-efficiency and developmental indices; hence this paper explored the socio-political dynamics underpinning Nigeria's energy crisis, using a multistage sampling approach across nine power distribution companies in the country. A total of 900 participants (270 distributors and 630 consumers) in South South and South Eastern Nigeria were surveyed using structured questionnaires, and data were analyzed with SPSS and Jamovi, employing descriptive statistics, factor analysis, and structural equation modeling (SEM). The findings highlight key challenges in Nigeria's energy sector, such as unreliable electricity supply, with 66% of respondents indicating frequent availability but 45.8% rating its quality as unreliable. Notably, 94.6% of respondents believe energy poverty negatively impacts employment opportunities, while 68.9% report disruptions to their businesses, and 69.1% attribute rising inflation to energy poverty. Governance issues are a significant concern, with 81.3% rating government management as ineffective and 91.9% identifying corruption as a major factor. Structural Equation Model (SEM) outcomes show political patronage to be the largest contributor to the crisis (β = 0.99), followed by infrastructural decay (β = 0.65) and regulatory challenges (β = 0.58). However, consistent government policies (β = 0.96), involvement of international investors due to friendly policies (β = 0.46), creation of awareness campaigns on energy consumption ($\beta = 0.42$), regulatory support for growth of distributors($\beta = 0.38$), adequate implementation of energy distribution infrastructure ($\beta = 0.37$), government support for expansion ($\beta = 0.30$) and, timely and efficient regulatory changes ($\beta = 0.27$), respectively, were uncovered to be significant factors for mitigating the socio-political problems of the Nigerian energy sector. The findings suggest an urgent need for comprehensive policy reforms to tackle challenges in Nigeria's energy sector.**

Keywords*— *Energy Crisis, Socio-Political Dynamics, Poverty, Sustainable Energy

1. Introduction

Energy is a vital sub-system of sustainable development goals (SDGs) and the major driver of social, environmental and economic problems bedeviling SDGS across developing countries. Energy is a critical precursor to achieving SDGS (Islar*et al.,* 2017). The survival of human in the society depends significantly on the level of energy supply and uses (Okereke *et al*., 2020a). The quantity of energy consumed per capita also determined the growth and the sustainability of modern economies as well as the measure of a country modernization index (Okereke *et al*., 2020a). Uninterrupted supply of energy is one of the critical concerns for all the nations in today's world.

In Nigeria, the energy dynamics has three major mixes (hydropower, fossil-gas and thermal) contributing 12,500MW generation capacity (GET.invest, 2020). The available energy to final consumers is in the range of 3,500 to 5,000MW (Ebhota and Tabakov, 2018). The shortfall between the inadequate generation capacity and the quota available for consumption constitute an 'energy crises. The Nigeria energy crisis therefore arises from losses attributed to non-availability of generated capacity (installed capacity) and high incidences of technical and non-technical issues in the supply value chain. However, energy poverty subsists when undesirable indices relating to low income, high-energy costs, and low energy-efficiency are very seminal (Sokolowski *et al*., 2020). The current estimate of energy losses in Nigeria is 16% (4,895GWh) out of the estimated 30,000GWh needed to achieve sufficiency (GET.invest, 2020).

Contemporary debates on energy crisis focus on security, mitigation of climate change and poverty eradication (Islar*et al*., 2017). However, recent researches have embedded very strongly political nomenclature in the interface of low energy-efficiency across the globe (Burke and Stephens, 2018). The understanding suggests that sustainable energy transition is a politically motivated process (Burke and Stephens, 2018). The dimension of political undertone to energy crisis are beginning to engage the attention of social scientist in Nigeria. Adewuyi*et al.* (2020) observed that the socio-political disposition to the sustainable energy debate must address issues affecting policy framework, efficient legislation and regulated competitive market. The socio-political philosophy is projected, therefore, to twist further, the already complicated energy sector problems. In the last few years, development of electricity process facilities that utilize non-sustainable sources such as coal is prohibited by the international politics using the electricity de-carbonization and climate change mitigation treaties (Adewuyi*et al*., 2020). The instrument is to the developing nation, a ploy to short-change their progress wheel to energy-efficiency. The developed nation, despite their significant progress with the use of sustainable energy, has the bulk of their energy stock processed from related non-sustainable sources. The world powers such as the US only recently pulled out of the Paris accord due to its socio-economic and political implications (Rapier, 2018). A strong willful disposition is imperative to set in motion, sustainable energy development (Adewuyi*et al*., 2020). A clue from the Indian model revealed that strong socio-political dynamics are imperative to ensure public and private sector synergy in community energy systems (Katre and Tozzi, 2019). Amidst this growing awareness on the role of socio-political dynamics in the global energy crisis, limited studies explore the dimensions of associated problems in a full-scale despite charitable acknowledgement across studies in Nigeria.

Low energy-efficiency adds to the gloom of poverty ravaging the developing nations, and improvement in energy supply could advance both the standard of living and economic growth of Nigeria (Okereke e*t al.,* 2020b). The efforts to advance poverty index therefore requires universal access to energy services, which are not only affordable and reliable but also clean and sustainable. Nigeria and many sub-Saharan African nations face energy poverty occasioned by multiple mutually exclusives drivers: socio-political, structural and financial problems. Attempt to unravel these problems focused on structural and financial dimensions (Okereke *et al.,* 2020b). Yet, the sub-Saharan African nations are challenged to reduce poverty level by at least 50% before 2025. This objective is contingent on growing the gross domestic product (GDP) at the rate of 7% per annum (Okereke *et al*., 2020b). However, poor access to energy resources are therefore some of the factors impeding the economic growth of sub-Saharan African nations and their ability to maximise their potentials. Developing these economies, therefore, depend on the capacity to develop strategies to mitigate performance inhibitors in the energy sector.

As a further angle to the problem, in aberrant to the traditional assumptions underpinning existing studies relating to the energy sector problems in Nigeria, emerging thinking favours the imperative of tackling technical, economic and financial dynamics contributing to the problem(Ajaelu and Okereke., 2020; Okereke *et al*., 2020a). However, studies have explored the solutions to the ubiquitous technical, economics and financial challenges inhibiting energy-efficiency in Nigeria (Ebhota and Tabakov, 2018; Adewuyi*et al.,* 2020; Okereke *et al*., 2020a). Even though the converging consensus tend to direct stakeholders' attention to the need to advance sustainable energy resources, the scope of renewable energy development is likewise very low (Ajaelu and Okereke, 2020; Okereke *et al.,* 2020a). Despite these implications, the use of renewable energy is negligible, estimated as 0.7 percent of total energy consumed among league of developing markets (Shaaban and Petinrin, 2014), and 1.83 percent of Nigeria's 3500 MW most consistent electricity output in recent times (Ebhota and Tabakov, 2018). The imperfect state of the energy market and available renewable energy solutions, low efficiency of power generation and distribution, high cost of renewable technologies and increased tariff amidst poor services remain pertinent challenges to be resolved. The misconception about the performance of sustainable energy resources among the populace and policymakers in Nigeria remains seminal.

However, the spectrum of investigations from legislative oversight functions, the dwindling economic fortunes, low access to power supply, low per capita income, extreme poverty and low energy level per capita portrays the problem as the failure of socio-political dynamics. It remains a major concern why the energy per capita formation in Nigeria is one of the least in the world despite multi-billion dollars investment in the power sector (Mainstream Energy Solutions Limited, MESL, Abuja, 2019). The spectrum of power sector reforms since 1999 reviewed in 2013 and subsequently unbundled to privatized fifteen (15) public sector generating and distribution companies in 2015 could not abate the energy crisis in Nigeria. This study therefore argues that the failure of the Nigeria power sector is beyond policy reforms, technical concerns and increase investment portfolios. Thus it remains a mirage why Nigeria's energy level per capita is one of the least in the world despite multi-billion dollars investment and efforts to address technical constraints in research. Whilst the problems overarches, developing pertinent solution to tackle the problem is ongoing across sectors: governments, the international lending agencies, non-governmental organizations, academia and the various stakeholders. Despite inherent challenges, there are enough reasons to agree that variables of sustainable energy system will attain very high level of penetration in developing countries (Arndt *et al.,* 2019). It is therefore incumbent to develop a toolkits framework for resolving socio-political dynamics affecting the energy sector performance in Nigeria. This paper therefore seeks to develop a framework to effectively tackle the inhibitors posing against a sustainable energy efficiency in Nigeria and thus the study will focus on the following objectives:

1. To evaluate the dimensions of energy poverty in the national economy of Nigeria,
2. To assess the dynamics of socio-political problems influencing energy sector efficiency in Nigeria,
3. To explore the drivers of socio-political problems associated with energy sector crisis in Nigeria, and
4. To develop and validate a framework for tackling the socio-political problems in the Nigerian energy enigma.

2. Literature Review

Sustainable Energy Potentials of Nigeria

The potentials of sustainable energy and the development of related technologies in Nigeria is compelling (Emodi and Ebele, 2016; Ebhota and Tabakov, 2018). Sustainable energy sources abound including hydropower, solar, biomass, geothermal, hydrogen-based energy and ocean energy (Sambo, 2009). However, the majority of these sources are less developed to solve inherent problems of the sector. Sustainable energy refers to energy resources that are replenished at the same rate as they are used. Sambo (2009) designate two characteristics to renewable energy resources (1) they are available unlimitedly and (2) they are replenished more quickly than their consumption rates. The development of sustainable energy is negligible in Nigeria. Statistics shows sustainable energy accounts for an insignificant 0.7% of the total energy consumed in developing countries (Shaaban and Petinrin, 2014), and 1.83% percent of Nigeria's 3500 MW most consistent electricity output in recent times (Ebhota and Tabakov, 2018; Nguetcha, 2022). Therefore, the prevalent disposition towards sustainable energy portrays sustainable energy as luxury benefited by the high-income earners in the society. Despite advances in the dissemination of awareness relating sustainable energy development, most developing countries lack clear public sector policy to promote the adoption of related technologies (Nguetcha, 2022). The competition and incentives resulting from the niche created by vast renewable energy market in Africa seems inadequate to improve the adoption of related technologies in the emerging markets. High initial and capital costs of sustainable energy systems continue to hinder vibrant decision-making to adopt these technologies, in favour of fossil-based electricity and fuel-based generators (Oluwole et al., 2021).

On the contrary, fossil-based electricity drives energy supply in the country. Statistics shows out of the approximated 12,500MW installed capacity from 15 plants in Nigeria; only 12.5% is hydropower (12.5%) and the balance is thermal power with gas dominating (GET.invest, 2020). Despite the insignificant 12.5% to the National grid, the understanding of renewable energy in Nigeria focuses on solar as well as wind (Ajaelu and Okereke., 2020). However, the factual position reveals hydropower sustained Nigeria's household energy consumption until recently (Solangi*et al.*, 2011) but the misconceptions about sustainable energy sources inhibit their development and uptake. Despite inherent challenges, there are enough reasons to agree that variable sustainable energy system will attain very high level of penetration in developing countries (Arndt *et al.,* 2019).

Energy Poverty in Nigeria

The usage of the phrase energy poverty among investment analysts in Nigeria depicts two critical shortfall positions (1) inadequate supply to meet estimated demand and (2) inability to achieve total installed capacity. However, the broader understanding of problem depicts high cost of energy, low per capita and low efficiency (Bernard *et al.*, 2016). Sokolowski *et al.* (2020) headlined low income, high-energy costs, and low energy-efficiency as indicators of energy poverty. The energy-efficiency level of Nigeria is one of the least in the world, while the energy per capital formation is negligible (150kWh). The current estimate of the Nigerian energy-efficiency level is likewise on the steady decline (Benard*et al*., 2016). Only about 60 to 75% of the populace have partial access to electricity (Edoma and Nwaubani, 2014) and this proportion relish 4-6 hours power supply daily (Oji *et al*., 2012). The number of blackout per day is also alarming, while the contribution to CO_2 emission is over 0.7 tons per capita (Ebhota and Tabakov, 2018). Ajaelu and Okereke (2020) citing a Newspaper publication reported the cost escalation in utility bills payment from $30 to $185 per month in Nigeria. The average per capita income of 92.4% of the populace was less than $2 per day, while 70.8% lived below $1 daily benchmark. Economic intelligence are of the view that tackling energy poverty is key to solving global poverty pandemic (Central Bank of Nigeria, 2019). Overall, energy poverty is capped using the low energy access compared to huge energy potential, huge energy demand-supply gap (30,000MW vs 3,500MW), high domestic energy prices, low installed capacity utilization, power energy infrastructure and weak state of economic and social conditions of the citizenry (Okereke *et al.*, 2020b). The Nigerian energy crisis can be summarised using four paradoxes.

Paradox 1: Abundant energy but little power ironically

Sub-Saharan Africa is endowed with both renewable and exhaustible energy resources (Okereke et al, 2020a). At present, for instance, the region can only exploits 8% of its gross hydropower potential of 3.3 million gigawatt-hours (GWh) annually. The countries on the Gulf of Guinea hold 4.9% of the world's proven oil reserves (some 60 billion barrels) and 7.8% of proven natural gas reserves (some 14 trillion cubic feet). When this reserve is converted to electricity, the natural gas currently flared during oil production could itself meet a substantial share of Africa's power needs (Jimoh and Raji, 2023). Moreover, in most Sub-Saharan African countries, energy markets are too small to take advantage of efficiencies from large-scale electricity production. With today's technology, full economies of scale in thermal power generation begin at about 400 MW; national power systems meet this threshold in only 14 countries in SSA. In another 14, power systems have only 100 MW of capacity. With relatively little cross-border trade, many SSA countries use technically inefficient forms of generation (Nguetcha, 2022). In Western Africa, about a third of installed capacity is diesel-based generators. These countries have few domestic energy resources of their own, even though there are sufficient hydro and gas resources in neighboring countries to support much lower-cost forms of generation (Nguetcha, 2022). The consequences of this technically inefficient pattern of power generation become evident when average operating costs of different types of power systems are compared. The average for predominantly diesel-based power systems is as much as \$0.20/kWh more expensive than the cost of hydro-based systems.

Paradox 2: High prices but even higher costs

The variation in electricity charges across Sub-Saharan African countries is huge. It spans some of the cheapest power in the world. Nevertheless, looking across countries, the average charges today look high by international standards and are a result of recent increases reflecting higher oil prices and tightening supply conditions worldwide (Nguetcha, 2022) The overall average revenue has risen from \$0.07/kWh in 2001 to \$0.13/kWh since 2005. In countries reliant on diesel-based power generation systems, average revenues have risen from \$0.08 to \$0.17/kWh. Yet the average revenue in Sub-Saharan African countries still fall short of covering the average operating costs of \$0.27/kWh. This occurs despite the rise in average revenue in hydro-based countries, from \$0.02 to \$0.07/kWh (Jimoh and Raji, 2023). Despite such comparatively high average revenues, the vast majority of Sub-Saharan African countries are doing little more than covering average operating costs. The correlation between average revenue and average operating cost is as high as 90%, indicating that operating cost recovery is usually the driving principle behind power pricing. Nevertheless, once average operating costs exceed \$0.20/kWh, there is a tendency to price below the 45 degree line (Jimoh and Raji, 2023). The implication is that past capital costs of power-sector development have historically been almost entirely subsidized by the state.

Paradox 3: Widespread but ineffective reform

Although they are somewhat behind the reform programs in other regions of the world, Sub-Saharan African countries also embarked upon the path power-sector reform orthodoxy. This included reform legislation and sector restructuring to pave the way for competition in generation and private sector participation across the electricity supply chain. As of 2006, more than 80 percent of Sub-Saharan African countries had enacted a power-sector reform law, 75% had experienced private participation in power, about 66% had corporatized their state-owned utilities, more than half had established a regulator, and over a third had independent power producers (Nguetcha, 2022). Yet a few countries have adopted the full range of reform measures.

The lack of results has forced a rethinking of whether certain reform principles and programs apply in SSA (Okereke *et al.*, 2020b). One reform that has not been widely adopted in Sub-Saharan African is unbundling of generation, transmission, and distribution functions to create competition in generation and supply. Even though the status has now changed in Nigeria, Besant-Jones (2006) in his global review concluded that restructuring the power sector to advance competition only made sense in countries large enough to support several generators above minimum efficient scale. The power systems in most Sub-Saharan African countries are so small that this prescription is largely irrelevant for them. Nevertheless, even in the largest countries, where unbundling could work, there has not been much progress.

Paradox 4: High expenditure but inadequate finance

Sub-Saharan African countries on average spend 2.7% of their GDP on power; and a significant number spend more than 4%. Typically, more than 90% of this spending is channeled through the national state-owned utility; while less than 10 percent appears on the central government budget. Operating costs absorb 75% of total spending. As a result, public investment in the sector is very low, on average only 0.7 percent of GDP (Okereke *et al.*, 2020b).

Towards a Comprehensive Solution to Energy Crisis in Nigeria

There are abundant sources of power, significant levels of government funding, and notable efforts at reform. Yet, electricity access rates are very low compared to other developing regions, prices are high, and the power supply insufficient and unreliable. The policy choices that best address these paradoxes are not clear-cut. The traditional model that predominates in the SSA power sector – vertically integrated, state-owned monopolist utilities – has yielded disappointing results (Nguetcha, 2022). Yet reform to increase efficiency and boost competition through private participation has in many cases failed to deliver the expected results. For example, unbundling is limited, failures of transactions and projects frequent, and there has been minimal additional investment. The lesson that emerges is that success in tackling the challenge is not a simple function of the model adopted. The power sector in Africa needs to move to a "mixed economy," characterized by a range of structures, regulation, and technologies adapted to each country's context. Successful interventions will tackle several problems simultaneously to put the sector on a positive trajectory of improved sector and utility management, financial viability, new investment, and better customer service. This means recognizing that the power sector has quasi-monopolistic characteristics – particularly in grid-based distribution and to a lesser extent in transmission (Nguetcha, 2022). Furthermore, incumbent utilities will continue to be the largest players in the sector for the near future. However, interventions also need to be innovative and ambitious, recognizing that meeting customer needs means multiple providers, financial viability, and new forms of external financial assistance. Where certain preconditions are in place – including appropriate regulatory frameworks for public-private partnerships, reformed tariff frameworks and sufficient security of investment for investors-sector reforms can do much to facilitate the entry of strategic private partners. Consequently, the starting point is sustained and concerted action on three strategic priorities: (i) regional scaling-up of generation capacity, (ii) improving the effectiveness and governance of utilities, and (iii) expanding access through sector-wide engagement.

The three priorities are interdependent and must be tackled together. Efforts to boost generation and regional power trade will stumble if the utilities, which will continue to be central actors in the sector, remain inefficient and insolvent (Nguetcha, 2022). Expanding electricity distribution systems without taking measures to tackle the shortages in generation and to improve transmission capacity would clearly be futile. In addition, focusing exclusively on utility reform would be fruitless unless a start is made on substantial, long-gestation investments in both generation and access to improve quality of service and render the utilities viable. In short, these strategic priorities must progress together. At the same time, the period required to yield results from these actions is such that they need to be complemented by important short-term measures (Nguetcha, 2022). These include demand-side management, for example, the introduction of energy-efficient bulbs and loss-reduction programs such as enhanced bill collection and initiatives to tackle electricity theft.

Conceptual Framework

The contexts of socio-political dynamics underlining energy poverty in Nigeria is conceptualized using five components. The components are energy poverty, development of energy poverty index, assessment of energy poverty level, drivers of energy poverty (socio-political dynamics), concepts of socio-political dynamics, and sustainability frameworks towards energy-efficiency in Nigeria. The study, therefore postulates as follows (1) that the dimensions of energy poverty is confused with the lack of sustainable livelihood and low energy-efficiency resulting from household comprehensive income level, and (2) socio-political dynamics are imperative drivers of low energy-efficiency and low uptake of sustainable energy regime in Nigeria. The third postulation is that Nigerian needs pertinent knowledge of feasible sustainable energy system, enabling policies to decimate socio-political drivers towards comprehensive energy efficiency. Therefore, the energy poverty level of Nigeria is uncertain and revolves around two dynamics, income status and the sustainable livelihood dynamics. The inherent confusion between the two sources of pertinent dimensions of energy poverty mandate the needs to determine statuesque. Achieving this goal requires the development of local energy poverty index to establish the factual sources of the Nigerian energy poverty and to determine the energy poverty benchmark. The low energy-efficiency arises from socio-political dynamics that require enabling policies and feasible sustainable energy technologies to improve current energy-efficiency level. Whether there is energy poverty, is contingent on the assessment and subsequent measurement based local parameters. The framework as visualized in Figure 1.

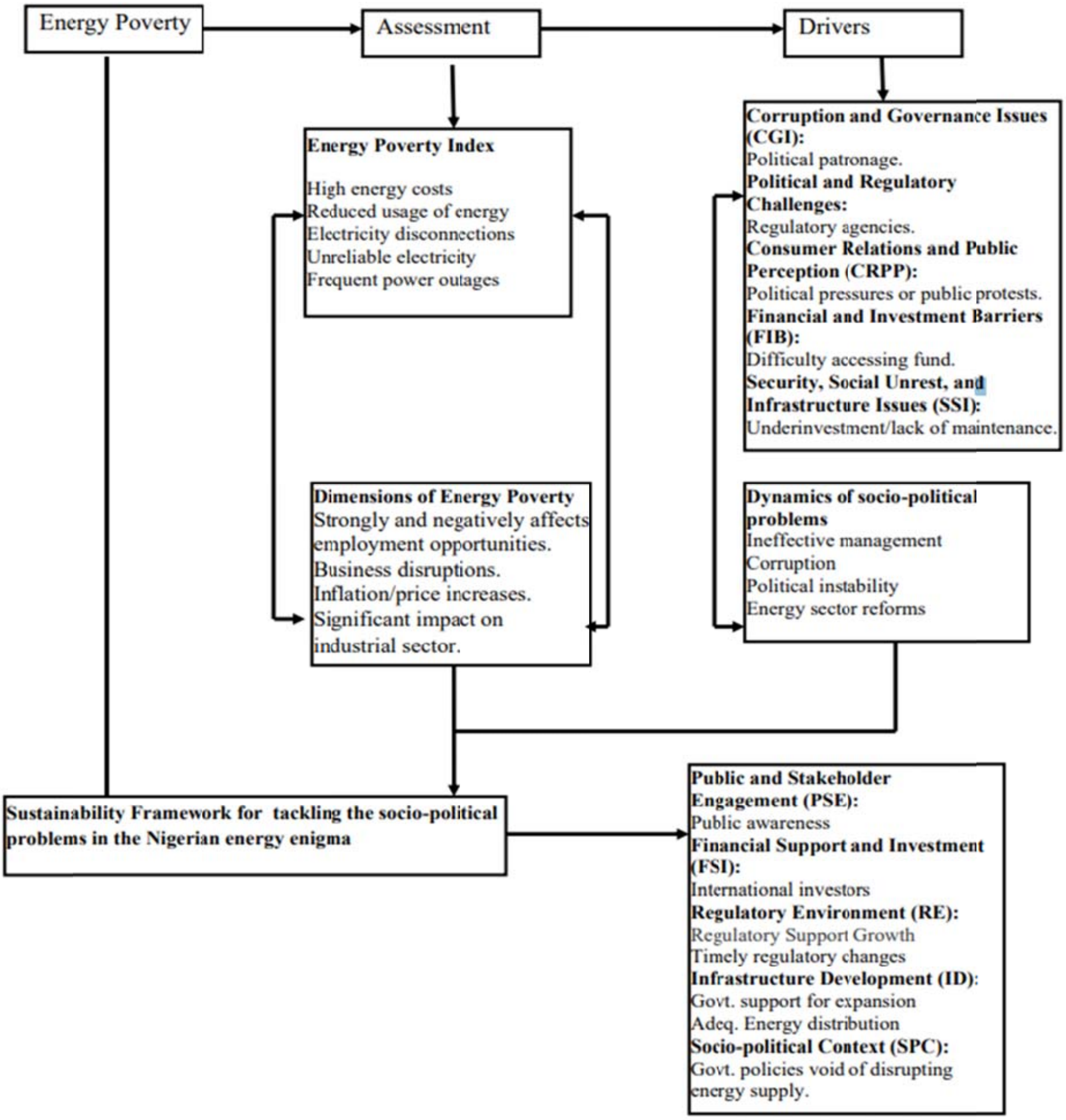

Figure 1: Conceptual framework for unbundling the socio-political dynamics underpinning the Nigerian energy poverty (Authors Construct).

3. Research Methodology

The study adopted a multistage sampling, in which a state was randomly selected from the states under the same distribution company. This was repeated for the nine power distribution companies in Nigeria. It was further tailored to a selection of 30 Distributors and 80 Consumers in a state by stratified proportionate random sampling technique, making a population of 270 Distributors and 630 Consumers in Nigeria. A well structured questionnaire was designed and administered for data collection, for which analysis was carried out with the aid of SPSS (ver.23) and Jamovi for descriptive statistics, Factor Analysis, and the Structural Equation Modeling (SEM), in the quest to obtain answers to the objectives of the study.

4. Results

Table 1: Questionnaire Distribution

Instrument	Group	Freq	Perc.(%)
Retrieved	Distributors	212	78.52
	Consumers	541	85.87

Table 1 indicated that strong involvement was shown by the distributor and customer questionnaire retrieval rates, which were 78.52% and 85.87%, respectively. A marginally higher response rate from consumers suggested that they were more accessible or motivated. All things considered, the high retrieval rates guarantee solid and reliable data by lowering non-response bias and improving the study's findings' dependability.

Table 2: Demographic characteristics of Consumers

Variable	Category	Freq.	Perc. (%)
Gender	**Male**	323	59.7
	Female	218	40.3
AgeGroup	<18yrs	21	3.9
	18-30yrs	132	24.4
	31-45yrs	259	47.9
	46-60yrs	129	23.8
Residence	Urban	278	51.4
	Rural	263	48.6
Service Provider	AEDC	27	5.0
	BEDC	72	13.3
	EKEDC	73	13.5
	EEDC	77	14.2
	IBEDC	74	13.7
	JEDC	50	9.2
	KEDC	72	13.3
	KEDCO	67	12.4
	PHEDC	29	5.4
Type of Consumer	Residential	416	76.9
	Commercial	93	17.2
	Industrial	32	5.9
Educational Level	No Formal Education	14	2.6
	Primary	14	2.6
	Secondary	173	32.0
	Tertiary	263	48.6
	Post Graduate	77	14.2

Table 2 reveals significant demographic insights. Males (59.7%) dominate, with females at 40.3%. The majority are aged 31–45 years (47.9%), while only 3.9% are under 18. Urban residents (51.4%) slightly outnumber rural ones (48.6%). AEDC has the lowest service provider representation (5.0%), while EEDC leads (14.2%). Residential consumers form the majority (76.9%), with commercial (17.2%) and industrial (5.9%) trailing. Educationally, tertiary-level respondents dominate (48.6%), followed by secondary (32%), postgraduates (14.2%), and minimal representation for primary and no formal education (2.6% each). This distribution highlights the diverse backgrounds of participants, ensuring comprehensive perspectives for the study.

Table 3: Demographic characteristics of Distributors

Variable	Category	Freq.	Perc. (%)
Role	Senior Management	36	17.0
	Operational/Technical Staff	41	19.3
	Customer Service Rep	110	51.9
	Reg/Policy Analyst	9	4.2
	Others	16	7.5
Experience	<1yr	16	7.5
	1-3yrs	34	16.0
	3-5yrs	90	42.5
	>5yrs	72	34.0

Table 3 reveals the respondents' roles and levels of experience. Senior Management (17.0%), Operational/Technical Staff (19.3%), and Customer Service Representatives (51.9%) make up the majority of responders; Regulators/Policy Analysts (4.2%) and Others (7.5%) are less common. In terms of experience, 34.0% have more than five years, while the majority (42.5%) have three to five years. 7.5% have less than a year, and 16.0% have one to three years. Because mid-level positions and professionals with moderate to extensive experience make up the majority of the workforce, this distribution ensures that the company has a diversified range of perspectives from different levels of competence.

Table 4: Evaluation of the Dimensions of Energy Poverty in Nigeria's National Economy

Item	Category	Freq.	Perc. (%)
In your opinion, how does energy poverty affect employment opportunities in Nigeria?	Strongly negatively	512	94.6
	Moderately negatively	20	3.7
	No effect	9	1.7
How has the lack of reliable energy affected the businesses in your area?	Greatly disrupted operations	373	68.9
	Slightly disrupted operations	145	26.8
	No disruption	23	4.3
Do you think energy poverty contributes to inflation or price increases in Nigeria?	Undecided	23	4.3
	Agree	144	26.6
	Strongly agree	374	69.1
How would you rate the influence of energy poverty on Nigeria's industrial sector?	Very significant impact	392	72.5
	Moderate impact	149	27.5

From Table 4, it is apparent that there is a severe impact of energy poverty in Nigeria, as vast majority (94.6%) believe it strongly and negatively affects employment opportunities, while 3.7% see moderate effects and 1.7% no effect. Regarding business operations, 68.9% report significant disruption due to unreliable energy, 26.8% report slight disruption, and 4.3% observe none. On inflation, 69.1% strongly agree and 26.6% agree that energy poverty contributes to rising prices, while 4.3% are undecided. The industrial sector is also deeply affected, with 72.5% citing very significant impacts and 27.5% noting moderate effects. These findings highlight energy poverty as a critical economic challenge, and connotes with the assertion by Okereke et al. (2020) that low energy access hampers economic growth.

Table 5: Assess the Dynamics of Socio-Political Problems Influencing Energy Sector Efficiency

Item	Category	Freq.	Perc. (%)
How would you rate the role of government in managing energy resources in Nigeria?	Very ineffective	440	81.3
	Ineffective	101	18.7
Do you believe corruption in the energy sector has contributed to Nigeria's energy crisis?	Agree	44	8.1
	strongly agree	497	91.9
How would you rate the impact of political instability on the energy sector in Nigeria?	Low	10	1.8
	Moderate	117	21.6
	Very significant	414	76.5
To what extent do ethnic and regional tensions influence energy distribution in Nigeria?	Not at all	326	60.3
	Slightly	103	19.0
	Moderately	80	14.8
	Very significantly	32	5.9
How effective are energy sector reforms in improving energy access and efficiency in Nigeria?	Very Ineffective	178	32.9
	Effective	201	37.2
	Very effective	162	29.9

Table 5 highlights perceptions of governance and systemic issues in Nigeria's energy sector. A vast majority (81.3%) rate government management of energy resources as very ineffective, while 18.7% see it as ineffective. Corruption is viewed as a major factor, with 91.9% strongly agreeing it contributes to the energy crisis. Political instability also plays a significant role, with 76.5% attributing a very significant impact to it. Ethnic and regional tensions in energy distribution are less pronounced, as 60.3% see no influence, while 19.0% note slight effects. Energy sector reforms are moderately effective, with 37.2% finding them effective, but 32.9% view them as very ineffective. These findings emphasize the need for systemic change and also affirms with Sokolowski et al. (2020), who described energy sector governance failures as a key issue in managing the energy sector.

Table 6: Bartlett's Test for Drivers of Socio-Political Problems Associated with the Energy Sector Crisis in Nigeria.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.551
Bartlett's Test of Sphericity	Approx. Chi-Square	7212.312
	Df	171
	Sig.	.000

Examination of Table 6 shows Bartlett's Test of Sphericity yielded value of 7212.31 and associated degree of significance 0.00 (<0.05), which depicts the adequacy of the model (Tobias & Carlson,1969).

Table 7: Total Variance Explained for Drivers of Socio-Political Problems Associated with the Energy Sector Crisis in Nigeria.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulativ e %	Total
1	5.982	31.482	31.482	5.982	31.482	31.482	5.095
2	3.764	19.813	51.295	3.764	19.813	51.295	3.529
3	3.482	18.329	69.624	3.482	18.329	69.624	3.513
4	2.160	11.370	80.995	2.160	11.370	80.995	2.729
5	1.099	5.787	86.781	1.099	5.787	86.781	4.380
6	.699	3.680	90.461				
7	.498	2.623	93.084				
8	.374	1.970	95.055				
9	.326	1.716	96.771				
10	.181	.954	97.725				
11	.159	.835	98.560				
12	.119	.629	99.189				
13	.054	.283	99.472				
14	.049	.258	99.730				
15	.025	.132	99.862				
16	.016	.084	99.946				
17	.007	.038	99.984				
18	.002	.011	99.995				
19	.001	.005	100.000				
Extraction Method: Principal Component Analysis.							
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.							

In determining how many factors to extract to represent the data, only five factors are retained for rotation by the conventional eigenvalues ≥ 1 rule (Govindasamy,e al, 2024), as shown in Table 7. These factors account for 31.5%, 19.8%, 18.3%, 11.4%, and 5.8% of the total variance, respectively. This implies that 86.8% of the total variance is accounted for by these five factors. It could therefore be deduced that a five-factor model should be sufficient to represent drivers of socio-political problems associated with the energy sector crisis, as further supported by the scree plot in Figure 2.

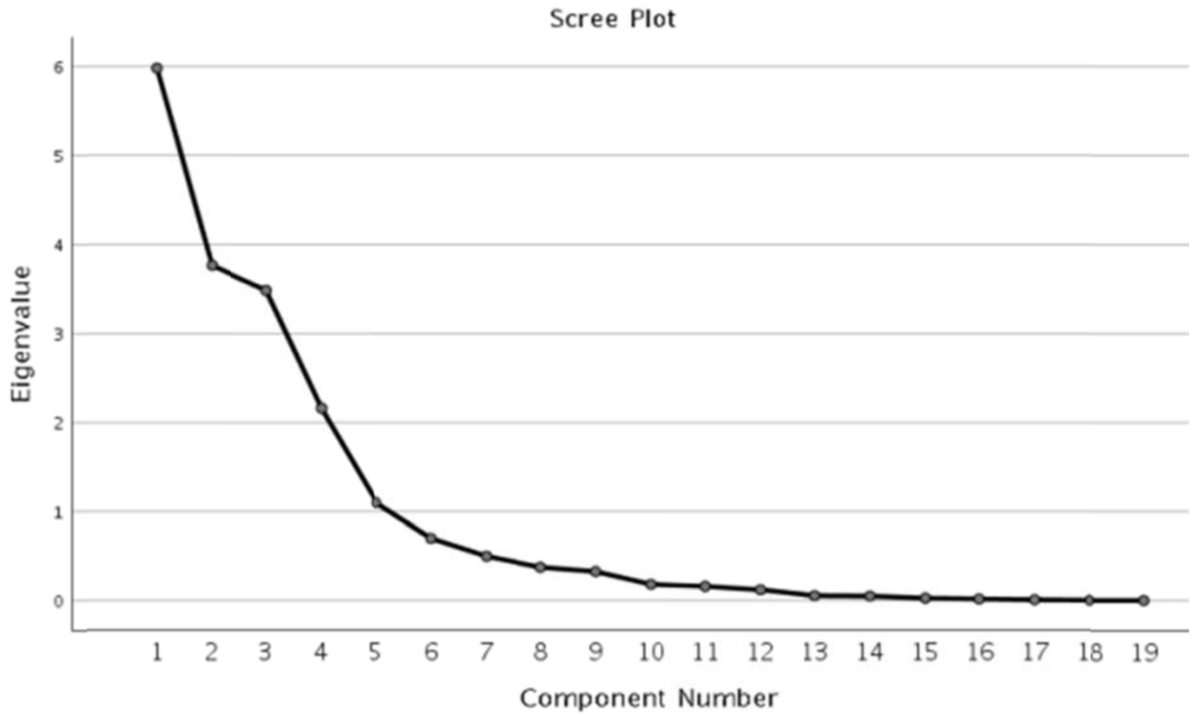

Figure 2: Scree plot of drivers of socio-political problems associated with the energy sector crisis.

Table 8: Pattern Matrix[a]

Item	Code	Component				
		1	2	3	4	5
Political patronage (the allocation of energy sector contracts based on political connections rather than merit)	CGI3	.958				
Regulatory agencies (Nigerian Electricity Regulatory Commission – NERC	PRC3		.919			
Political pressures or public protests (e.g., against high tariffs or poor service)	CRPP2			.973		
Challenges in accessing funding due to the political and economic environment	FIB2				.988	
Underinvestment or lack of maintenance	SSI4					.823
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.						
	a. Rotation converged in 7 iterations.					

Table 8 depicts that corruption and governance (CG13) is a significant hindrance to service delivery in the energy sector, following the tendency of politicians to allocate contracts based on political connections with slight considerations for competency. Political and regulatory challenges (PRC) from agencies like NERC, also contribute largely to the crisis experienced in the energy sector. In the same vein, political pressures (CRPP2), difficulty in accessing funding (FIB2), poor investment and maintenance mindset (SSI4), respectively induce the crises in the Nigerian energy sector.

Table 9: Model tests

Label			χ^2	Df	p
User Model			1.51	5	0.912
Baseline Model			265.15	10	<.001
		95% Confidence Intervals			
SRMR	RMSEA	Lower	Upper	RMSEA p	
0.013	0.000	0.000	0.037	0.969	

Table 10: User Model Fit Indices

	Model
Comparative Fit Index (CFI)	0.986
Tucker-Lewis Index (TLI)	0.979
Bentler-Bonett Non-normed Fit Index (NNFI)	0.979
Relative Noncentrality Index (RNI)	0.986
Bentler-Bonett Normed Fit Index (NFI)	0.931
Bollen's Relative Fit Index (RFI)	0.898
Bollen's Incremental Fit Index (IFI)	0.986
Parsimony Normed Fit Index (PNFI)	0.632

Table 11: Measurement model

Latent	Observed	Estimate	SE	β	p
EnergySecCrisis	PolPatronage (CGI3)	1.000	0.0000	0.9968	
	ReguAgancies (PRC3)	0.619	0.0757	0.5889	<.001
	PolPressure (CRPP2)	0.434	0.0633	0.4862	<.001
	AccessFund (FIB2)	0.158	0.1309	0.0834	0.226
	InfrDecay (SSI4)	0.717	0.0800	0.6509	<.001

From Tables 9 and 10, absolute model fit was satisfied since $\boldsymbol{RMSEA}(0.00) < 0.08$. Test for incremental fit was also satisfied (CFI, TLI, NNFI, RNI, NFI > 0.90) (Table). The model also satisfied parsimony as $\chi^2/df(0.30) < 5.0$ (min. discrepancy). The model is therefore deemed fit and adequate for the data (Ho, 2013).

Table 11 shows the standardized regression weights indicating a significant contributions of the five-factor model to energy sector crisis, as suggested by the factor analysis. Result depicts political patronage ($\boldsymbol{\beta} = 0.99$) as the most critical driver, followed by infrastructural decay due to lack of maintenance ($\boldsymbol{\beta} = 0.65$), regulatory agencies like NERC ($\boldsymbol{\beta} = 058$), and political pressures ($\boldsymbol{\beta} = 0.48$), with exception to access to funding which had negligible contribution to the energy sector crisis, which is further expressed in figure 3.

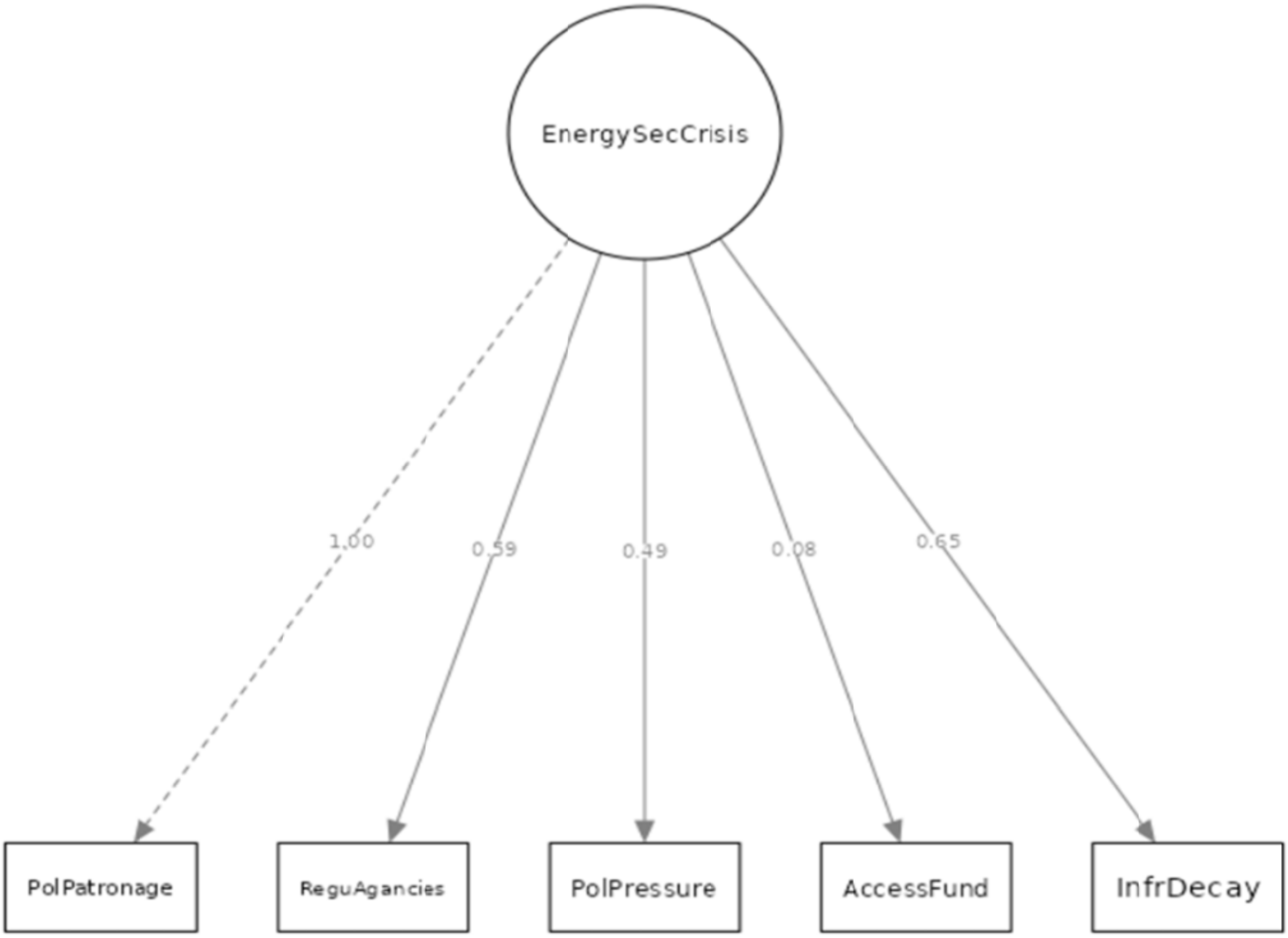

Figure 3: Path diagram of drivers of socio-political energy sector crisis in Nigeria.

Table 12: Bartlett's Test for Framework for Tackling Socio-Political Problems in the Nigerian Energy Sector.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.466
Bartlett's Test of Sphericity	Approx. Chi-Square	5149.992
	Df	171
	Sig.	.000

Inspection of the above table indicates that Bartlett's Test of Sphericity yielded value of 5149.99 and associated degree of significance 0.00 (<0.05), which depicts the adequacy of the model.

Table 13: Total Variance Explained for Framework for Tackling Socio-Political Problems in the Nigerian Energy Sector.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.267	38.615	38.615	9.267	38.615	38.615	6.939
2	3.727	15.529	54.143	3.727	15.529	54.143	3.964
3	2.481	10.336	64.480	2.481	10.336	64.480	4.059
4	2.212	9.215	73.694	2.212	9.215	73.694	3.662
5	1.422	5.925	79.619	1.422	5.925	79.619	3.865
6	1.222	5.094	84.712	1.222	5.094	84.712	2.221
7	1.007	4.196	88.909	1.007	4.196	88.909	4.654
8	.713	2.970	91.879				
9	.531	2.212	94.090				
10	.411	1.711	95.801				
11	.252	1.049	96.850				
12	.218	.910	97.760				
13	.199	.831	98.591				
14	.159	.664	99.255				
15	.079	.331	99.585				
16	.041	.171	99.756				
17	.032	.132	99.888				
18	.015	.064	99.951				
19	.012	.049	100.000				
20	2.244E-15	9.350E-15	100.000				
21	1.240E-15	5.168E-15	100.000				
22	-9.201E-17	-3.834E-16	100.000				
23	-1.448E-15	-6.032E-15	100.000				
24	-3.271E-15	-1.363E-14	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

From the Table 13, only seven factors are retained for rotation by the conventional eigenvalues ≥ 1 threshold. These factors account for 38.62 %, 15.52%, 10.34%, 9.22%, 5.93%, 5.09%, and 4.20% of the total variance, respectively. This implies that 88.91% of the total variance is accounted for by these seven factors. A seven-factor model is therefore recommended as sufficient for designing a framework for tackling socio-political problems in the Nigerian energy sector, as further supported by the scree plot in figure 4.

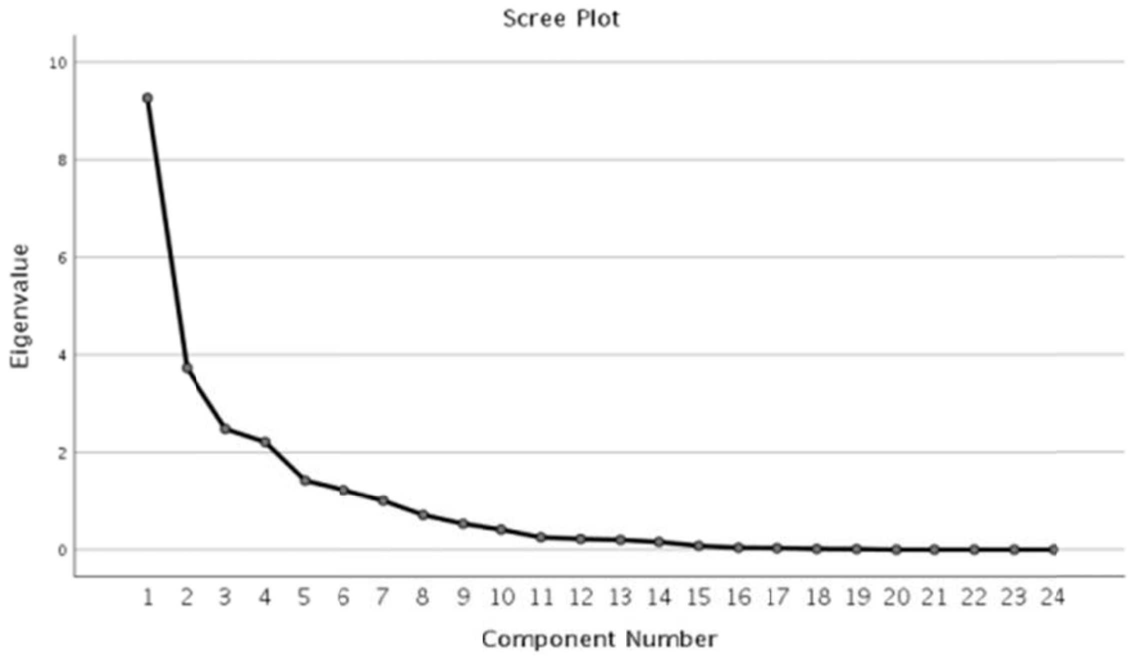

Figure 4: scree plot of framework for tackling socio-political problems in the Nigerian energy sector.

Table 14: Pattern Matrix[a]

Item	Code	Component						
		1	2	3	4	5	6	7
Public awareness campaigns by the government influence energy consumption patterns.	PSE1	.943						
International investors involvement in Nigeria's energy sector due to friendly policies	FSI3		.901					
The energy sector's regulatory framework supports the growth of distributors.	RE4			.913				
Government support is necessary for expanding energy distribution infrastructure.	ID1				.988			
Consistent Government policies void of causing disruptions in energy supply.	SPC2					.785		
Adequate implementation energy distribution infrastructure to meet growing demand.	ID2						.924	
Regulatory changes are implemented in a timely and efficient manner.	RE2							.949
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.								
a. Rotation converged in 13 iterations.								

Table 14 shows that public and stakeholder engagement (PSE1) has potentials to thwart the problems emanating from socio-political sphere towards the energy sector by creation of awareness campaigns on energy consumption patterns. Financial support and investment was also noted as a significant factor in dealing with the socio-political problems by the involvement of international investors (FSI3) into the Nigerian energy sector. Regulatory support for growth of distributors (RE4) and, timely and efficient regulatory changes (RE2), respectively, were considered factors to tackling the escalating socio-political problems in the energy sector. Similarly, government support for expansion (ID1) and adequate implementation of energy distribution infrastructure (ID2) were also deemed effective in curtailing the horrendous effect of the crisis in energy sector. Lastly, consistent government policies void of disrupting energy supply (SPC2) was considered effective in achieving a well functioning energy sector.

Table 15 : Model tests

Label		χ^2	Df	p
User Model		19.6	10	0.034
Baseline Model		229.9	21	<.001
Fit indices		95% Confidence Intervals		
SRMR	RMSEA	Lower	Upper	RMSEA p
0.047	0.067	0.018	0.111	0.229

Table 16: User Model Fit Indices

	Model
Comparative Fit Index (CFI)	0.954
Tucker-Lewis Index (TLI)	0.904
Bentler-Bonett Non-normed Fit Index (NNFI)	0.904
Relative Noncentrality Index (RNI)	0.954
Bentler-Bonett Normed Fit Index (NFI)	0.915
Bollen's Relative Fit Index (RFI)	0.821
Bollen's Incremental Fit Index (IFI)	0.956
Parsimony Normed Fit Index (PNFI)	0.436

From Tables 15 and 16, absolute model fit was satisfied as $p - val(0.034) < 0.05$, which is further supported by $RMSEA(0.067)$, following the rule of $\mathbf{0.08}$ threshold. Test for incremental fit was also satisfied (CFI, TLI, NNFI, RNI, NFI > 0.90). The model also satisfied parsimony as χ^2 /df (1.96) < 5.0 (min. discrepancy). The model is therefore deemed fit and adequate for the data.

Table 17: Measurement model

Latent	Observed	Estimate	SE	β	p
Framework	Public Awareness (PSE1)(PA)	1.000	0.000	0.424	
	International Investors (FSI3) (II)	0.907	0.324	0.462	0.005
	Regulatory Support Growth (RE4) (RS)	0.886	0.293	0.376	0.002
	Govt. Support for Expansion(ID1) (GS)	0.774	0.273	0.309	0.005
	Govt. Policies (SPC2) (GP)	2.344	0.537	0.965	<.001
	Adeq. Imp. Energy Dist. (ID2) (AI)	0.849	0.281	0.373	0.003
	Reg. Timely Effective (RE2) (RT)	0.732	0.271	0.270	0.007

Table 17 shows the standardized regression weights indicating a significant contributions of the seven-factor model to tackling the socio-political problems in the energy sector. Result depicts consistent government policies void of disrupting energy supply (SPC2) to be most effective in achieving a well functioning energy sector ($\beta = 0.96$), followed by financial support and investment was also noted as a significant factor in dealing with the socio-political problems by the involvement of international investors (FSI3)($\beta = 0.46$), creation of awareness campaigns on energy consumption pattern (PSE1) ($\beta = 0.42$), regulatory support for growth of distributors (RE4) ($\beta = 0.38$), adequate implementation of energy distribution infrastructure (ID2) ($\beta = 0.37$), government support for expansion (ID1)($\beta = 0.30$), timely and efficient regulatory changes (RE2)($\beta = 0.27$), as further portrayed in figure 5.

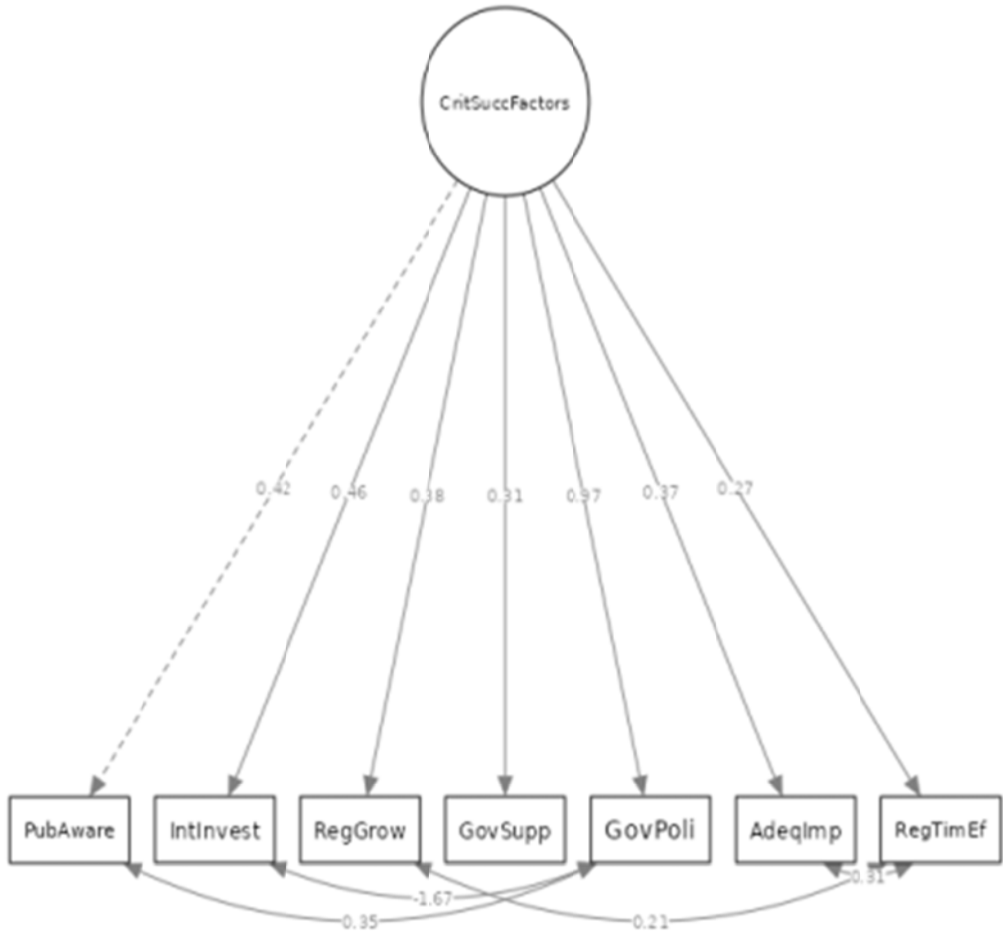

Figure 5: path diagram showing contributions of the seven-factor model to tackling the socio-political problems in energy sector.

From table 17 and figure 5, the framework for tackling socio-political problems in the energy sector is inferred to be a seven factor model is explicitly expressed as:

$$CSF = 0.424PA + 0.462II + 0.376RS + 0.309RS + 0.965GP + 0.373AI + 0.270RT \qquad (1)$$

The developed framework (Eqn. 1)provides a statistical foundation for addressing socio-political challenges in the energy sector by highlighting key factors that significantly influence success. With a robust R^2 value of 89.91%, the model demonstrates that the variables collectively explain nearly 90% of the variation in the socio-political problems of the energy sector.

Government policies (β=0.965) emerge as the most influential variable, underscoring the importance of stable and supportive regulatory environments in fostering energy sector development. international investors (β=00.462) and public awareness (β=0.424) also play pivotal roles, emphasizing the need for foreign investments and public engagement in achieving sustainable energy solutions. Regulatory support for growth (β=0.376) and adequate implementation of energy distribution (β=0.373) highlight the operational challenges that require targeted interventions. The model further identifies government support for expansion (β=0.309) and regulatory timely effectiveness (β=0.270) as supporting factors, crucial for addressing bureaucratic inefficiencies. collectively, the framework guides policymakers to prioritize legislative stability, stakeholder involvement, and infrastructure development, ensuring a holistic approach to solving socio-political energy issues.

5. Discussion

The study results point out important challenges and perceptions of the Nigeria's energy sector. In terms of demography, most respondents were male (59.7%), aged between 31 and 45 years (47.9%) and had tertiary education with (48.6%). Most of the employees have senior management, operation and customer service backgrounds with a working experience of mostly 3-5years. Energy problems seem to be more serious with 66.0% indicating frequent availability of electricity as a majority, 30.7% only have access occasionally whereas 3.3% have no access to electricity at all. Given that, the majority of them, that is 45.8%, regard the quality of electricity as unreliable, and the majority, that is, 61.6%, have experience of outages. This conforms to the finding of Okereke et al. (2020) who have benchmarked that energy poverty affects energy access inadequacy in Nigeria, 60-75% of the population do not have access to useful energy. How energy poverty affects the economy seems to be quite frankly fundamental; for 94.6% of Ugandans it limits chances for employment, as many as 68.9% said their activities are affected in one way or the other, while 69.1% said it's the cause of inflation.

Furthermore, Dhali et al (2023) and Shinwari et al (2024) express similar sentiments whereby they posit how hampering energy poverty is on economic growth. With governance issues remaining one of the most signgcant factor as effectiveness of government management of energy resources has been rated very low 81.3 percent very ineffective while 91.9 percent reported corruption as an impediment. It adds a speedy crisis for which Sokolowski et al (2020) and Hanson-Agumbah (2022) are trying to come up with solutions, severe and augments political instability (76.5%), ineffective reform of energy sector (32.9%). The structural equation model informs that political patronage (β=0.99) and infrastructural decay (β=0.65) are the most prominent enduring factors of the crisis. In respect of these unsolved problems, this paper maintain that the most sustainable government policies (β=0.96), budgetary allocations for infrastructure (β=0.46) are extremely required, as further supported by Ajaelu and Okereke (2020).

6. Conclusion and Recommendation

This paper therefore concludes that the Nigerian energy sector is struggling with issues of access, quality, cost and governance and these problems are deeply intertwined. The results further indicate that energy poverty adversely affects the ability to find work, interferes with business activities and increases the cost of living. The global energy crisis is worsened by such factors as the mismanagement of energy resources, corruption and unrest. It is appropriate that this problem is accompanied by a coherent government policy, financial resources and investment in the development of infrastructure facilities.This paper recommends that the need for consistent, transparent, and effective government policies to ensure reliable energy supply. Strengthening institutions like NERC and addressing corruption will foster a better-managed energy sector.

Significant investment in energy infrastructure, including power generation, transmission, and distribution systems, is essential to reduce power outages and enhance access to reliable electricity.Diversifying energy sources, particularly through renewable energy options, could alleviate dependence on fossil fuels, reduce CO2 emissions, and improve sustainability.

Raising awareness about energy consumption patterns and promoting energy-efficient practices can reduce energy costs and encourage sustainable energy usage.Encouraging international investors to support the energy sector through funding and expertise can help address Nigeria's energy gap and foster long-term sector stability (Shinwari et al., 2024).

7. Acknoledgement

The research work for this paper was carried out under the sponsorship of

Tertiary Education Fund of Nigeria (TETFUND).

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