COMPARATIVE ANALYSIS OF THE DECENTRALIZATION IN THE ELECTRICITY SUPPLY INDUSTRY

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1.0. INTRODUCTION

The decentralization of the electricity supply industry, with a focus on Nigeria. We'll use comparative analysis to better understand how decentralization functions in three other countries: the United States, the United Kingdom, and India to represent the Asia.

Electricity is often described as the lifeblood of modern economies. It powers homes, fuels industries, and enables social and economic development. Yet, in many parts of the world, including Nigeria, access to reliable and affordable electricity remains a persistent challenge. Traditionally, electricity systems have been centralized, characterized by large-scale power plants feeding electricity through vast transmission and distribution networks to consumers. While this model has worked in many advanced economies, it has proven inadequate in addressing the unique challenges of rapidly growing populations, rural energy poverty, and system inefficiencies in countries like Nigeria.

In recent years, we have witnessed a global shift towards decentralization in the electricity supply industry. This shift involves a reconfiguration of how electricity is generated, managed, and distributed favouring localized, smaller-scale, and often renewable energy systems. This transformation is driven by several factors: technological innovation, the cost of renewable energy, the need to increase uninterrupted access to energy, and growing concerns over climate change and sustainability.

Nigeria presents a particularly interesting case. Despite having substantial natural energy resources, the country continues to grapple with chronic electricity shortages, an unreliable national grid, and high levels of energy exclusion specially in rural areas.

That's why decentralization, the redistribution of power and decision-making from central authorities to regional or local actors has become a key reform strategy.

To **address these persistent issues, decentralization has emerged as a key reform strategy**.

Globally, countries such as the United States, United Kingdom, and India e.t.c have adopted various forms of decentralization to improve efficiency, promote competition, and expand access to electricity. These Nations offer valuable insights into different models of decentralization ranging from federal structures with strong state involvement to liberalized markets and hybrid governance systems.

2.0. Understanding Decentralization in Electricity Supply

To effectively analyse decentralization in any power sector, it is essential to first understand what decentralization means in the context of electricity supply, its different dimensions, and why it matters.

1. **What is Decentralization?**

Decentralization in the electricity sector refers to the transfer of authority, decision-making, and operational responsibilities from central government agencies to state governments, private operators, communities, and other non-state actors.

Instead of relying solely on large, centralized power plants and long-distance transmission lines, a decentralized system includes numerous smaller-scale power sources such as solar mini-grids, rooftop solar panels, wind turbines, biomass systems, and embedded generation that supply power closer to the point of use.

Decentralization refers to the process of transferring authority, responsibility, and decision-making power from a centralized entity usually the Federal government or a monopolistic utility to lower levels such as:

- Subnational governments (states, regions, or municipalities),
- Local communities,
- Private sector entities,
- Independent power producers (IPPs), or

- Consumers themselves.

This concept is applied across many sectors, but in electricity supply, it specifically focuses on who controls, regulates, owns, and operates the different components of the electricity value chain.

2. 1. The Electricity Value Chain

The electricity supply industry typically comprises three major segments:

1. **Generation**: Production of electricity from various sources (e.g., gas, hydro, solar).

ii. **Transmission**: High-voltage bulk transfer of electricity across regions.

iii. **Distribution:** Low-voltage delivery of electricity to final consumers.

2.2 **Key Characteristics of Decentralized Electricity Systems**

i**. Local Generation**: Power is produced near where it is consumed, reducing dependence on the national grid..

ii**. Diverse Ownership**: Can be owned and managed by communities, private companies, cooperatives, or even

iii. **Flexible Infrastructure**: Often modular and scalable, allowing for gradual expansion based on demand.

iv. **Resilience**: Less vulnerable to large-scale grid failures or blackouts, especially in remote or disaster-prone areas.

v. **Renewable Energy Integration**: Often based on solar, wind, hydro, and other sustainable sources.

vi. **multiple players** :In a centralized system, a single government entity often controls all three segments. In contrast, decentralized systems involve multiple players and layers of governance.

2.2. **Types of Decentralization**

Decentralization in the electricity sector can take various forms:

a**. Political Decentralization**

Shifting legislative and regulatory authority to sub-national governments. Enables states or provinces to create and implement their own electricity policies and laws.

b. **Administrative Decentralization**

Allows local authorities or independent agencies to manage planning, procurement, and implementation of electricity projects. Encourages context-specific solutions.

c. **Economic or Market Decentralization**

Involves privatization and the introduction of competition. Encourages investment by allowing private companies to generate, distribute, or sell electricity.

d. **Technological Decentralization**

The use of distributed energy resources (DERS) such as:

- Mini-grids
- Solar home systems
- Rooftop solar panels
- Battery storage

Promotes off-grid or grid-independent solutions, especially in rural or underserved areas.

2.3. **Why is Decentralization Important in Electricity Supply?**

a. **Expanding Access**: Centralized grids are often slow to reach remote or rural areas. Decentralized solutions like mini-grids can bring power to communities that might otherwise wait decades for national grid extension.

b. **Improving Efficiency**: Local authorities or private companies may operate more efficiently than centralized bureaucracies. Reduces transmission losses and service delays.

c. **Encouraging Innovation:** Competitive and decentralized markets can accelerate the adoption of new technologies, especially renewable energy.

d. **Enhancing Resilience**: Decentralized systems are less vulnerable to large-scale blackouts and can operate independently during national grid failures.

e. **Attracting Investment:** Decentralization allows for diverse investment opportunities across generation, distribution, and renewable energy systems.

3.0. NIGERIA'S ELECTRICITY SECTOR: AN OVERVIEW

3.1. Historical Background

The development of Nigeria's electricity sector dates back to 1896 when electricity was first introduced in Lagos. Over time, generation and distribution expanded, but under highly centralized

control Historically, Nigeria's electricity sector was highly dominated by government-run agency, the National Electric Power Authority (NEPA) Despite its mandate, NEPA was plagued by inefficiency, chronic underinvestment, corruption, poor maintenance, and growing demand that far exceeded supply. The result was frequent blackouts, low access to electricity, and reliance on expensive alternatives such as diesel generators.

NEPA was dissolved and replaced by the Power Holding Company of Nigeria (PHCN). This structure concentrated control of generation, transmission, and distribution under federal authority, leading to inefficiencies, poor service delivery, and limited access to electricity especially in rural areas.

NESI's power generation and distribution subsectors in 2013 underwent privatization. However, as the challenges persisted, the need for legislative action triumphed. Thus, on March 17, 2023, the Constitution Alteration Act was enacted. The Act amended the concurrent list to grant state governments the authority to handle electricity generation, transmission, and distribution within their states, particularly in areas covered by the national grid. This marked a move towards decentralization in the NESI. It is important to note that the Federal Government of Nigeria has always been responsible for the policy formulation of NESI.

To facilitate the decentralization process, the Electricity Act of 2023, enacted on June 9, 2023, replaced the Electric Power Sector Reform Act of 2005 and aimed to establish a framework for the post-privatization competitive phase in the power sector. Sections 2(2) and 63(1) of the Act grant states authority to legislate, establish local electricity markets, issue licenses, create regulatory bodies, and perform regulatory functions within their jurisdictions. Furthermore, sections 230(2) to 230(9) delineate procedural steps for transferring regulatory responsibilities from the Nigerian Electricity Regulatory Commission (NERC) to a state electricity regulatory authority (state regulator) after the enactment of a law establishing a state's electricity market.

Several reforms have been introduced over the last two decades aimed at liberalizing, privatizing, and decentralizing the sector.

Key Milestones in Decentralization

i. Electric Power Sector Reform Act (EPSRA), 2005

- Unbundled PHCN into 18 successor companies: 6 GenCos, 11 DisCos, and 1 TCN.
- Established the Nigerian Electricity Regulatory Commission (NERC) as the sector's regulator and responsible for licensing, tariff setting, consumer protection, and market regulation.
- Allowed for private sector participation and independent power producers.

ii. Privatization of GenCos and Discos (2013)

- Private investors took over power generation and distribution.
- The federal government retained control of transmission via the Transmission Company of Nigeria (TCN).

iii. Emergence of Off-Grid Solutions

- Growth of mini-grids and solar home systems, especially in underserved rural areas.
- Promoted by the Rural Electrification Agency (REA) and supported by international partners (World Bank, USAID, AfDB).

iv. 2023 Constitutional Amendment

- A landmark shift: Electricity was removed from the Exclusive Legislative List, empowering states to legislate, generate, transmit, and distribute electricity within their territories.
- This marked the beginning of true political and regulatory decentralization in the sector.

3.2. **Structure of NESI**

NESI is broadly segmented into four major components:

A. **Generation**

- Handled by Generation Companies (GenCos) post-privatization.
- Includes large-scale hydro and thermal power plants.

- Nigeria has an installed capacity of over 13,000 MW, but actual generation is often under 5,000 MW due to operational challenges.

B. **Transmission**

- Managed by the Transmission Company of Nigeria (TCN), still government-owned.
- Acts as a single buyer and transporter of bulk electricity from GenCos to DisCos.
- Faces limitations in grid coverage and system reliability.

C. Distribution

- Managed by 11 Distribution Companies (DisCos) operating under regional franchises.
- Responsible for the delivery of electricity to end-users and revenue collection.
- Privatized in 2013, but still faces challenges with metering, billing, and service quality.

D. **Regulation and Coordination**

The Nigerian Electricity Regulatory Commission (NERC) is the primary regulator.

Other key players include:

- Bureau of Public Enterprises (BPE) - Oversaw privatization
- Nigerian Bulk Electricity Trading Company (NBET) power purchase agreements. Facilitates
- Rural Electrification Agency (REA) - Promotes off-grid and rural power access.

COMPARATIVE ANALYSIS WITH OTHER COUNTRIES

Feature	Nigeria	USA	UK	India
Governance structure	Federal,emerging	Federal,decentralized	Centralized regulator	Federal-satate hybrid
Role of private sector	emerging	Mixed(IOUS, munis,co-ops)	Dominant,private-led	Mixed, growing role
Regulatory Body	NERC, evolving state roles	FERC+ state PUCS	ofgem	CERC SERCS
Electrification Strategy	grid Grid + mini/off-grid	State-level+ DERS	National planning+ competition	Central + state programs
Major Challenges	Poor infrastructure, coordination	Fragmentation, aging grid	Price volatility, reliance on imports	DISCOM debt, political risk

➤ The **UNITED STATE** offers an example of **mature federal decentralization**.

Key Features

- Electricity governance is decentralized across federal and state levels.
- Federal Energy Regulatory Commission (FERC) regulates interstate electricity markets and transmission.
- State public utility commissions (PUCs) regulate in-state utilities.
- A mix of investor-owned utilities (IOUs), municipal utilities, and cooperatives serve different regions.

- **Decentralization Benefits for the US**:
- Encourages innovation and competition.
- State-level policies (e.g., Renewable Portfolio Standards) enable tailored energy transitions.
- Growth of distributed energy resources (DERs) such as rooftop solar, microgrids, and energy storage.

Lessons for Nigeria:

- Empower state-level electricity regulation and innovation.
- Encourage participation by cooperatives and municipal utilities.
- Develop competitive regional electricity markets.
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- ➤ UNITED KINGDOM

The UK is a case of centralized regulation with decentralized market operation.

Key Features

- Full privatization and liberalization of the electricity market since the 1990s.
- Ofgem (Office of gas & electricity markets) serves as a strong and independent regulatory authority.
- National Grid handles transmission and system balancing.
- Multiple private firms compete in generation and supply markets.

Achievements

- High levels of customer choice and service quality.
- Rapid transition to renewables, especially wind and solar.
- Competitive retail market with transparent pricing.

Lesson for Nigeria:

- Strengthen independent regulatory oversight.
- Ensure investor confidence through transparent rules.

- Promote retail competition and customer engagement.

➤ INDIA

India presents a hybrid model where both the central and state governments play active roles.

Structure

- **Electricity Act 2003** restructured the power sector to allow for competition, open access, and private participation.
- **Central Electricity Regulatory Commission (CERC**) and **State Electricity Regulatory Commissions (SERCs)** operate concurrently.
- Generation and transmission are shared across levels; distribution is mostly state-run (through DISCOMS).

Decentralization in Practice

- States have the autonomy to implement local energy policies.
- Large-scale rural electrification drives: Saubhagya Scheme, PM-KUSUM, etc.
- Growing investment in decentralized renewable energy (DRE) solutions.

Lesson for Nigeria:

- Blend centralized policy direction with state-level implementation.
- Scale decentralized renewable energy solutions.
- Improve financial viability of state utilities.

It is important to note that all three countries listed above with their success story on decentralisation are not without their own challenges.

4.0. ADVANTAGES OF DECENTRALIZATION IN THE ELECTRICITY SUPPLY INDUSTRY

1. **Improved Energy Access**

Decentralization allows for localized power generation (e.g., mini-grids, solar home systems), which helps reach remote and underserved areas not connected to the national grid.

Reduces dependency on centralized infrastructure that is often slow and expensive to extend.

2. **Enhanced Reliability and Resilience**

Local generation and distribution systems are less vulnerable to national grid failures, reducing blackouts and downtime.

Supports resilient systems that can operate independently (e.g., during natural disasters, grid failures, or conflict situations).

3. **Faster Deployment and Innovation**

Smaller, modular systems (like solar microgrids) can be deployed quickly compared to large centralized power plants.

Encourages technological innovation and adoption of renewable energy sources. Promotes experimentation with new business models (e.g., pay-as-you-go, prosumer participation).

4. **Encourages Private Sector Participation**

Decentralization lowers entry barriers for private investors, local entrepreneurs, and energy startups. Promotes competition and potentially improves service quality and efficiency.

5. **Local Economic Development**

Provides power to local businesses, agriculture, and cottage industries, stimulating economic activities.

Creates job opportunities in installation, maintenance, and energy services at the community level.

6**. Environmental Sustainability**

Facilitates the integration of clean energy technologies like solar, wind, biomass, and small hydro.

Reduces greenhouse gas emissions and air pollution compared to diesel generators and fossil fuel-based centralized systems.

7. **Greater Community Participation and Ownership**

Local communities can own and manage their energy systems, enhancing transparency and accountability.

Builds a sense of ownership and responsibility, leading to better maintenance and long-term sustainability.

8. **Flexibility in Policy and Regulation**

Allows states or local governments to develop context-specific policies, tariffs, and business models.

Encourages devolution of regulatory powers for more responsive and adaptive energy governance.

9. **Reduced Transmission and Distribution Losses**

Localized generation minimizes long-distance power transmission, reducing technical losses and improving efficiency.

10. **Energy Security and Independence**

Less dependence on national infrastructure and fossil fuel imports.Enhances energy autonomy for states, businesses, and communities.

5.0. IMPACTS OF DECENTRALIZATION IN NIGERIA

1. **Increased Access to Electricity**

- Off-grid and mini-grid projects have significantly expanded access to electricity in rural and peri-urban areas where the national grid is absent or unreliable.
- Programs like the Nigeria Electrification Project (NEP), supported by the Rural Electrification Agency (REA), have connected thousands of households, schools, and health centres using solar systems and microgrids.

2**. Economic Empowerment and Job Creation**

- Small-scale energy solutions have enabled local businesses and cottage Industries to grow, especially in areas previously underserved by the grid.
- Decentralized energy projects have created employment opportunities in solar installation, maintenance, metering, and customer service.

3**. Improved Service Reliability**

- Decentralized supply models such as embedded generation in Lagos or captive power plants in Ogun and Edo states have provided more stable electricity for government services and industrial zones.
- Users of mini-grids and solar home systems experience less downtime compared to those connected to the national grid.

4. **Reduction in Generator Dependence**

- Many homes, small businesses, and institutions have shifted from diesel or petrol generators to cleaner, decentralized energy solutions, reducing both costs and pollution.
- This shift contributes to lower carbon emissions and better public health outcomes.

5**. Empowerment of State and Local Governments**

- Following the Electricity Act 2023, states now have legal authority to generate, transmit, and distribute electricity within their boundaries.
- States like Lagos, Kaduna, and Edo have begun crafting their own electricity markets and policies, boosting local control and innovation.

6**. Stimulus for Renewable Energy Adoption**

- Decentralization has accelerated the uptake of renewable energy, particularly solar PV, due to its scalability and suitability for off-grid applications.
- Nigeria is becoming a growing market for green energy companies and investors.

7. Increased Private Sector Participation

- More private firms, start-ups, and investors are entering the decentralized energy space, especially in mini-grids, solar home systems, and independent power producers (IPPs).
- Public-private partnerships are driving innovation and efficiency.

8. **Improvement in Social Services**

- Electrification of schools, health centres, and water facilities has improved education, healthcare delivery, and quality of life in many rural areas.
- Reliable power enables vaccine storage, nighttime deliveries, digital learning, and more.

6.1. CHALLENGES OF DECENTRALIZATION IN NIGERIA'S ELECTRICITY SUPPLY INDUSTRY

Despite multiple reforms and increased attention from both government and international partners, Nigeria's electricity sector continues to face numerous systemic and structural challenges. These challenges hinder the success of decentralization efforts and affect overall sector performance.

1. **Regulatory and Legal Uncertainty**

- Overlapping mandates between federal and state authorities create confusion.
- Some states lack clear regulatory frameworks or capacity to implement decentralization effectively.
- Electricity Act 2023 is still in early stages of implementation, with gaps in interpretation and enforcement.

2. **Inadequate Infrastructure**

- Poor condition of existing infrastructure (e.g., weak distribution networks, limited substations) limits the integration of decentralized systems. Much of Nigeria's electricity infrastructure is outdated and poorly maintained, leading to frequent breakdowns and technical losses.
- Many mini-grids and embedded systems are isolated, lacking interconnection with broader networks for redundancy or scalability.

- Low Grid Coverage: The national grid does not extend to many rural and peri-urban areas, limiting access to electricity for millions of Nigerians.
- Even when power is generated, the Transmission Company of Nigeria (TCN) often lacks the capacity to wheel it across long distances due to limited and fragile infrastructure.

3. **Financing and Investment Barriers**
    - High upfront capital costs deter investment in mini-grids and off-grid solutions.
    - Limited access to affordable, long-term financing for developers and consumers.
    - Perceived risk of policy inconsistency and low return on investment discourages private participation.

4**. Metering and Revenue Collection Issues**
    - A significant portion of customers are still unmetered and billed on estimated usage, which leads to consumer distrust, bill rejection and non-payment andrevenue loss for DisCos.
    - Government initiatives like the National Mass Metering Programme (NMMP) are ongoing, but implementation has been slow.

5. **Technical Capacity Constraints**
    - Shortage of skilled professionals for designing, building, and maintaining decentralized energy systems, Japa syndrome contributes to this dilemma.
    - Local operators often lack the technical know-how to ensure system reliability and safety.

6. **Consumer Affordability and Willingness to Pay**
    - Many consumers with the current economy situation, especially in rural areas, cannot afford the full cost-reflective tariffs needed to sustain decentralized systems.
    - Historical reliance on subsidies and irregular billing practices reduces willingness to pay for better-quality service.

7. **Grid Integration and Coordination Issues**
    - Lack of standards and frameworks for integrating mini-grids and embedded generation into the national grid.

- DisCos sometimes resist decentralized solutions due to fear of losing market share or revenue.

8. **Generation vs. Actual Supply Gap**

- Although Nigeria has an installed generation capacity of over 13,000 MW, less than 5,000 MW is typically available for use due to:

i. Gas supply shortages

ii. Equipment failures

iii.Grid constraints

- This creates a paradox because generation capacity exists but cannot be fully utilized, making investments in generation less attractive.

9. **Data Gaps and Planning Limitations**

- Inadequate data on energy demand, usage patterns, and available resources at the local level impedes effective planning.
- Without reliable data, it's difficult to identify viable sites for mini-grids or determine optimal energy mixes.

10**. Policy Inconsistency and Bureaucracy**

- Frequent changes in government policies and leadership disrupt continuity in energy planning and decentralization initiatives.
- Lengthy approval processes for licenses, permits, and tariffs slow down project execution.

11**. Public Awareness and Engagement**

- Limited awareness of the benefits of decentralized energy systems among consumers and local leaders.
- Lack of community participation can lead to poor adoption and sustainability of projects.

12**. Equity and Regional Disparities**

- Wealthier and more organized states (e.g., Lagos, Edo) are advancing faster, leaving less developed states behind.
- Some states are more proactive and better resourced than others, leading to regional disparities in the pace and scale of decentralization.

- Risk of widening the urban-rural electricity gap if decentralization is not equitably supported nationwide.

13**.Security and Vandalism**

- Electricity infrastructure is often the target of theft and vandalism, especially in unstable regions.
- This further disrupts service delivery and increases maintenance costs for utilities.

6.0. **RECOMMENDATION**

Here are some key recommendations for achieving effective decentralization in Nigeria's electricity sector:

1. **Strengthen Regulatory Framework**

- Empower state governments: Enforce the provisions of the 2023 Electricity Act, which allows states to regulate electricity markets within their borders.
- Independent regulation: Establish state-level regulatory commissions with clear mandates and autonomy.
- Transparent licensing: Streamline processes for licensing mini-grids and Independent Power Producers (IPPs).

2. **Promote Mini-Grids and Off-Grid Solutions**

- Support rural electrification: Expand the Rural Electrification Agency (REA) programs, especially for remote and underserved communities.
- Incentivize investment: Offer tax breaks, subsidies, and risk guarantees to private developers of mini-grids and solar home systems.
- Community ownership models: Encourage cooperatives and community-driven energy projects to foster local participation and accountability.

3. **Encourage Private Sector Participation**

- Ease of doing business: Reduce red tape for project approvals, importation of renewable energy equipment, and land acquisition.

- Public-private partnerships (PPPs): Facilitate partnerships for infrastructure financing, especially in generation and distribution.
- Power Purchase Agreements (PPAs): Develop bankable and standardized PPAs to attract investment.

4. **Grid Modernization and Interoperability**
   - Upgrade transmission and distribution infrastructure: Focus on regional interconnectivity and smart grid technologies to handle decentralized inputs.
   - Enable net metering: Allow consumers to sell excess electricity back to the grid to promote distributed generation.
   - Consumer-Centric Reforms: Promote prepaid metering, net metering, and energy education.

5. **Capacity Building and Local Content Development**
   - Technical training: Develop vocational programs to train local engineers and technicians in renewable and decentralized energy systems.
   - Promote local manufacturing: Support local production of solar panels, inverters, and batteries to reduce reliance on imports.

6. **Leverage Digital Technology**
   - Smart metering and billing systems: Improve transparency and reduce losses.
   - Mobile platforms: Use mobile money and apps to facilitate payments and system monitoring, especially in rural areas.

7. **Stakeholder Engagement and Public Awareness**
   - Educate communities: Promote awareness of off-grid and renewable energy options.
   - Consult stakeholders: Involve local communities, traditional leaders, and civil society in planning and decision-making.

7.0. CONCLUSION

Decentralization is not a one-size-fits-all solution, but a strategic approach to improving access, reliability, and sustainability in the electricity sector.
By learning from global experiences especially the US's federal model, the UK's market reforms, and India's hybrid system, Nigeria can chart a more inclusive and resilient energy future.

Understanding decentralization in electricity supply is essential for countries like Nigeria, which face persistent power sector challenges. It is not just about transferring authority; it is about creating an ecosystem that enables innovation, improves service delivery, and enhances energy access. When designed and implemented properly, decentralization can serve as a catalyst for a more inclusive, reliable, and sustainable electricity system.

Decentralization presents an opportunity, but it is not a silver bullet. If implemented without addressing they core challenges that comes with it, decentralization could merely redistribute dysfunction rather than solve it.

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