

# EFFECT OF REGULATORY FRAMEWORKS, TECHNICAL CAPABILITIES AND FINANCIAL MANAGEMENT PRACTICES ON EFFICIENCY OF TRANSMISSION COMPANY OF NIGERIA

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## ABSTRACT

This study investigated the efficiency of the Transmission Company of Nigeria (TCN) by analysing the effects of regulatory frameworks, technical capabilities, and financial management practises. The study probed the complex interconnections between these elements and their collective impact on efficiency of TCN. The study utilized a quantitative methodology, questionnaire was administered on employees of TCN to elicit primary data. The data obtained was subjected to analysis utilising Partial Least Squares Structural Equation Modelling (PLS-SEM) through the utilisation of SmartPLS3. The results indicate that efficiency of TCN is positively and significantly affected by regulatory frameworks, technical capabilities and financial management practises. These findings provide insights into the complex dynamics within TCN's operations and add to comprehensive comprehension of the factors that influence its efficiency. The findings of this study have significant implications for policymakers, regulators, and stakeholders who are interested in improving the operational efficiency of public enterprises in the power sector.

**Keyword:** Efficiency, financial management practices, regulatory, framework, technical capability

## INTRODUCTION

Public enterprises are entities established and owned by the government and intended to provide basic services, foster economic progress, and contribute to the general development of a nation (Peng & Tao, 2022). These entities frequently assume pivotal position in various industries, including energy, transportation and telecommunications (Bas & Paunov, 2021). In the Nigerian context, the establishment of public companies has been undertaken to tackle issues pertaining to service delivery, infrastructural development, and economic progress.

The energy sector in Nigeria, specifically power generation, transmission, and distribution, has had significant participation from public firms. The Transmission Company of Nigeria (TCN) is a prominent entity within this industry, tasked with the crucial role of facilitating the transmission of electrical power throughout the entirety of the national grid (Salami et al., 2022). According to Ayamolowo et al. (2019), the job of TCN is of utmost importance in guaranteeing dependable provision of electricity to residential dwellings and commercial enterprises. This is vital for facilitating economic endeavours and enhancing the overall standard of living of Nigerians.

The evaluation of performance in public companies is heavily focused on the concept of efficiency. Efficient operations enable these institutions to successfully implement their mandates, optimise the utilisation of resources, and make constructive contributions towards the achievement of the country's development objectives (Tu et al., 2019). When evaluating the efficiency of TCN, it is necessary to analyse multiple facets of its functioning, such as the dependability of the transmission network, the extent to which its capacity is utilised, the magnitude of technical losses, the management of financial resources, and compliance with regulatory norms.

The efficiency of TCN carries substantial consequences for the power sector in Nigeria as well as the wider economy (Ayamolowo et al. 2019). An efficient TCN has the potential to mitigate transmission losses, enhance grid stability, and enable seamless integration of renewable energy sources into the energy portfolio. Further, an efficient TCN has the potential to attract private investments in the electricity sector, thereby fostering economic growth and bolstering the country's competitiveness (Salami et al., 2022).

It is important to acknowledge that efficiency of public enterprises can be impacted by various factors, including governance structures, regulatory frameworks, technical capabilities, financial management practises, and extent of autonomy. Furthermore, it is important to acknowledge that the overall efficiency of TCN in Nigeria might be influenced by the wider socio-political and economic context, highlighting the necessity of conducting a thorough evaluation that takes into account both internal and external elements.

Considering the importance of public companies such as TCN to Nigeria's developmental trajectory, it is essential to do a comprehensive evaluation of their efficiency. The present evaluation will not alone yield observations regarding existing condition of TCN's activities, but will also propose strategies for enhancing its efficacy and overcoming any obstacles that may hinder its performance. It will also provide insights for policymakers, regulators, investors, and other stakeholders who have vested interest in the efficient operation of public companies and the sustainable progress of Nigeria as a collective entity.

Public firms, such as the TCN, assume a crucial role in fostering the socio-economic progress of a nation. The successful operation of TCN is crucial in ensuring the stability and reliability of the power transmission network, which subsequently has an impact on economic growth, industrial development, and the overall quality of life for the Nigerian population (Odunlami Adegunwa et al., 2019). Nevertheless, despite its considerable importance, the efficiency of TCN is confronted with numerous obstacles, mostly arising from the complex interaction between legislative frameworks, technical capabilities, and financial management practises (Adebayo et al., 2020).

Although the significance of these aspects is recognised, there is a noticeable dearth of scholarly research examining the collective influence of these parameters on efficiency of TCN. Previous research has analysed these variables in isolation, with separate investigations into regulatory concerns, technical limitations, and financial obstacles. Consequently, the complex interconnections and possible collaborative effects among these variables have not been well investigated, resulting in a significant gap in knowledge that impede a comprehension of the efficiency dynamics of TCNs.

The operational autonomy of TCNs can be hindered by lack of well-defined regulatory framework. The presence of diverse regulations and variations in their enforcement might result in suboptimal allocation of resources and impede its ability to engage in long-term planning (Obeng & Idris, 2020). Also, the efficiency of TCN may be significantly influenced by its technical capabilities. The intricate characteristics of energy transmission necessitate the utilisation of advanced technologies, proficient human resources, and properly maintained infrastructure (Ayamolowo et al. 2019). Insufficient technical capabilities can lead to transmission losses, grid instability, and decrease in the reliability of the system (Ebohon & Mabawonku, 2019).

Although previous studies have acknowledged the existence of technical obstacles, there is scarcity of research that specifically measures their impact on the overall efficiency of TCN. Moreover, the implementation of sound financial management practises may significantly influence TCN's capacity to allocate funds towards infrastructure investments, adopt contemporary technology, and carry out regular maintenance activities. Inefficient allocation of funds and inadequate financial management practises might result in operational bottlenecks, and impede overall efficiency of the organisation (Nkanga & Udoka, 2017). However, there is a scarcity of research that examines the direct connections between financial management practises and efficiency of TCN.

This study addressed the overall issue of the limited comprehension about the cumulative influence of legislative frameworks, technological capabilities, and financial management practises on the efficiency of TCN. The study examined the interrelationships between legislative frameworks, technological capabilities, and financial management practises and measured their respective impact on efficiency of TCN. The outcome of the study offer insights that can inform policy interventions, regulatory adaptations, and managerial approaches to improve TCN's efficiency. The following hypotheses were formulated to guide the study:

Ho<sub>1</sub>: Regulatory frameworks has no significant effect on efficiency of TCN in Lagos state, Nigeria.

Ho<sub>2</sub>: Technical capabilities has no significant effect on efficiency of TCN in Lagos state, Nigeria.

Ho<sub>3</sub>: Financial management practices has no significant effect on efficiency of TCN in Lagos state, Nigeria.

## LITERATURE REVIEW

### Concept of Efficiency

Efficiency is a fundamental notion in the fields of economics and management, representing the strategic allocation of resources to achieve predetermined goals (Ozkeser, 2019). This concept carries significant importance within the realm of public enterprises, going beyond mere productivity to embrace efficient allocation of resources, operational processes, and performance in attaining desired goals (Singh et al., 2020). Amrutha and Geetha (2020) affirm that efficiency is multifaceted, encompassing various dimensions such as technical efficiency, allocative efficiency, and operational efficiency, which work together synergistically to enhance overall effectiveness of an entity (Úbeda-García et al., 2021).

Technical efficiency refers to ability of an organisation to maximise its output with a specific set of inputs (Ahmed et al., 2021). It highlights an entity's capacity to efficiently utilise resources, including labour, capital, and technology, while minimising any form of wastage (Roundy & Burke-Smalley, 2022). In the realm of public enterprises, such as the TCN, the imperative of optimising resource utilisation is paramount in upholding the dependability and equilibrium of the electric power transmission network, consequently augmenting the calibre of power provision.

Allocative efficiency refers to the process of allocating resources among different activities in order to attain the most favourable outcomes (Adesina, 2019). The mandate ensures optimal allocation of resources, aiming to maximise community welfare by directing resources into endeavours that are both productive and worthwhile (Gnocato et al., 2020). Thus, allocative efficiency for TCN includes strategic allocation of resources towards initiatives that improve the dependability of the electricity transmission system, hence stimulating economic growth.

Operational efficiency refers to the capacity of an organisation to carry out its routine activities with minimal instances of inefficiency, delays, and interruptions (Carnevale & Hatak, 2020). This statement underscores the need to enhance overall productivity by implementing streamlined processes, eliminating redundancies, and optimizing workflows (Doz, 2020). Hence, in the context of TCN, operational efficiency refers to the implementation of measures aimed at reducing transmission losses, ensuring timely maintenance, and swiftly resolving technical issues in order to ensure continuous and uninterrupted power supply.

### Regulatory Frameworks

Regulatory frameworks influence the functioning, conduct and efficiency of public companies (Li et al., 2019), especially in crucial areas like the electricity industry. TCN is a key participant in Nigeria's electricity transmission industry, and its operations are influenced by a range of regulatory structures. These factors impact the company's efficiency, operational decision-making, and overall contribution to the power sector. This extensive investigation examines the intricacies of regulatory frameworks in relation to TCN's operations, emphasising their influence on the company's efficiency and the wider power sector environment.

**Technical Capabilities**

Operational efficiency of an organisation heavily rely on its technical capabilities (Santa et al., 2019). Thus, technical capabilities of TCN refer to the comprehensive set of knowledge, skills, infrastructure, and technologies necessary to assure consistent transmission of energy throughout the national grid. This extensive investigation examines the intricacies of TCN's technological capabilities, emphasising their impact on the company's operational efficiency and their wider ramifications for the electricity sector in Nigeria.

The technical capabilities of TCN are evident in its physical infrastructure, comprising substations, transmission lines, transformers and control systems (Ayamolowo et al. 2019). The efficacy of power transmission is contingent upon the calibre and resilience of the associated infrastructure. The implementation of well-maintained and modernised equipment has the potential to mitigate transmission losses, decrease periods of inactivity, and improve overall stability of the grid. On the other hand, the presence of old infrastructure and inadequate maintenance practises might result in technical limitations and inefficiencies in the transmission of power (Ebohon & Mabawonku, 2019).

**Financial Management Practices**

The implementation of effective financial management practises is crucial to the long-term viability and success of any organisation (Boisjoly et al., 2020). Financial management involves several activities including budgeting, resource allocation, cost control, and investment decisions (Agyabeng-Mensah et al., 2020). These activities are crucial to the ability of TCN to maintain and improve the efficiency of its operations. Hence, effective financial management practises involve the optimal allocation of resources and implementation of budgetary measures (Nizam et al., 2019). Thus, efficiency of TCN is significantly influenced by its capacity to effectively distribute funds among different operational areas, maintenance, and infrastructure development. According to Abbas and Sağsan (2019), an effective budgeting process that is clear and well-structured plays a crucial role in directing resources to areas of highest priority, hence reducing inefficiencies and improving overall operational efficiency.

**Theoretical Framework**

This study is rooted in systems theory, which originated in the domain of systems thinking and management (Sony & Naik, 2020), and which offers a theoretical framework that is highly applicable in comprehending intricate organisations such as TCN. According to Hartmann and Lussier (2020), systems theory posits that organisations can be conceptualised as dynamic systems comprising interconnected components that engage in interactions to accomplish certain objectives. The theory emphasize the notion that an organisation is not only a collection of its constituent elements, but is also moulded by the interplay and dynamics that occur among these elements (Dong et al., 2021).

Within the scope of this research, TCN can be perceived as a complex system comprising interrelated components, namely legislative frameworks, technical capabilities, and financial management practises. The interplay between these variables results in reciprocal influences, giving rise to an intricate network of interconnected relationships. The systems theory provides a framework for understanding how modifications or adaptations in one component can affect the entire system, and influence its overall efficiency (Kipper et al., 2021).

Changes in legislative frameworks can impact decision-making autonomy and resource allocation of TCN, subsequently influencing its technical capability and financial management practises. In a similar vein, advancements in technical skills have the potential to enhance efficiency of electricity transmission, thereby exert favourable impact on financial management of the firm through reduction of losses and maintenance expenses. On the other hand, financial limitations may impede ability of TCN to allocate resources towards acquisition of contemporary technology and infrastructure, so potentially compromising its technical capacities and overall operational efficacy.

By utilising the systems theory, this study offer a comprehensive viewpoint on how interrelated components inside TCN operate and impact its efficiency. This theoretical framework allows for the examination of the complex interconnections, reciprocal influences, and possible collaborative effects

of regulatory structures, technological capacities, and financial management practices. Additionally, it aids the comprehension of the systemic ramifications of policy modifications, investments, and operational choices, so contributing to a thorough evaluation of TCN's efficiency dynamics.

### METHODOLOGY

This study was a cross-sectional. Kothari and Garg (2014) observed the comparatively longer time period necessary for carrying out longitudinal surveys, as opposed to the relatively shorter timeframe required for cross-sectional surveys. Researchers often opt for cross-sectional surveys because they offer advantages in terms of time and cost efficiency, in contrast to longitudinal surveys (Sekaran & Bougie, 2010).

The study focuses on TCN, hence, it is case study. Employees of TCN served as test units. The precise number of employees of TCN could not be determined, hence, 70 employees from the business unit of the company were sampled using purposive sampling technique. Purposive sampling is a widely used technique in quantitative research, where sample elements are purposefully identified and selected based on their potential to provide substantial amount of information. This approach optimise the use of limited resources in a more effective manner (Dong et al., 2021). The distribution of questionnaires was limited to employees holding high-ranking positions within the organisation, as they were deemed to possess the necessary knowledge relevant to the study.

Questionnaire was utilized to collect primary data. To acquire the necessary data from participants, researchers utilised duplicated iterations of questionnaire. The questionnaire utilised for measuring variables in the study were adapted from items employed by earlier researchers. The assessment of the questionnaire's reliability was conducted via Composite reliability. The evaluation of internal consistency was performed by employing Composite reliability coefficient. The study utilised SmartPls2 software to perform partial least square structural equation modelling (PLS-SEM) on the gathered dataset. Structural equation modelling (SEM) is a statistical methodology that has exhibited exceptional efficacy in managing limited sample sizes and intricate models (Urbach & Ahlemann, 2010).

### DATA PRESENTATION AND ANALYSIS

**Table 1: Construct Reliability and Validity**

Construct	Items	Loadings	AVE	CR
Regulatory Frameworks	RF1	0.77	0.54	0.82
	RF2	0.76		
	RF3	0.79		
	RF4	0.81		
	RF5	0.76		
Technical Capabilities	TC1	0.72	0.56	0.84
	TC2	0.75		
	TC3	0.78		
	TC4	0.84		
	TC5	0.77		
Financial Management Practices	FMP1	0.75	0.52	0.81
	FMP2	0.79		
	FMP3	0.74		
	FMP4	0.78		
	FMP5	0.77		
Efficiency of the TCN	ETCN1	0.75	0.54	0.83
	ETCN2	0.73		
	ETCN3	0.76		
	ETCN4	0.71		
	ETCN5	0.78		

NOTE: No items were deleted from the data set, as they all met the minimum requirements. AVE stands for Average Variance Extracted while CR represents Composite Reliability.

Hair et al. (2014) recommends that loadings should not be lower than the threshold of 0.4. Based on the results shown in Table 4.5, it can be noted that all the items exhibited loadings that exceed the established threshold of 0.5. This suggests that all the components loaded reliably into their corresponding construct. In a comparable manner, Table 1 shows that all constructs have a composite reliability coefficient surpassing the threshold of 0.7, thus satisfying the minimum requirement for composite reliability as outlined by Tabachnick and Fidell (2013). Furthermore, all constructs in the study met the minimum threshold for average variance extracted (AVE), which has been established as 0.5 (Tabachnick & Fidell, 2013). Therefore, we can deduce that the data exhibits convergent validity. The assessment of discriminant validity was subsequently conducted for the data reported in Table 2.

**Table 2: Discriminant Validity using Fornell-larcker criterion**

	1	2	3	6
1. Regulatory Frameworks	<b>0.73</b>			
2. Technical Capabilities	0.57	<b>0.75</b>		
3. Financial Management Practices	0.52	0.12	<b>0.72</b>	
4. Efficiency of the TCN	0.59	0.14	0.11	<b>0.73</b>

Note: The bold diagonal numbers represents the square root of the AVE of each latent construct

Table 2 displays the outcome of discriminant validity. In order to ascertain the discriminant validity of the variables, it is imperative that the square root of the AVE of each variable surpasses its correlations with any other construct (Fornell & Larcker, 1981). In order to establish the discriminant validity of each reflective construct in the study, it is imperative that the square root of the average AVE surpasses its correlation with other latent variables (Garson, 2016). The figures highlighted in bold within the analysis are the square root of the AVE for each latent variable. The data indicates that these numerical values exhibit higher magnitudes compared to the correlations observed between each construct and any other latent variable. This finding provides evidence that the variables examined in this research exhibit discriminant validity.

### Bootstrapping Analysis

It is important to carry out bootstrapping analysis to determine effect of exogenous variable on endogenous variable in a study. Bootstrapping was done by using 5000 subsamples on 58 cases, thus, testing the hypotheses of the study. Table 3 presents the result of the test of hypotheses.

**Table 3: Direct Path Coefficient**

Hypotheses	Beta Value	Standard Error	T Stat	P Value	Decision
H <sub>01</sub> : RF->ETCN	0.34	0.06	5.65***	0.00	Rejected
H <sub>02</sub> : TC->ETCN	0.31	0.07	4.40***	0.00	Rejected
H <sub>03</sub> : FMP->ETCN	0.42	0.05	8.39***	0.00	Rejected

\*\*\* p< 0.01; \*\*p< 0.05; \*p <0.1

The statistical analysis conducted on the data provided in Table 3 reveals a substantial correlation between regulatory frameworks and efficiency of TCN. The coefficient of 0.34 and p-value of less than 0.01 support this position. Hence, the null hypothesis Ho<sub>1</sub>, which suggests that the regulatory frameworks have no substantial impact on efficiency of TCN in Lagos state, Nigeria, was rejected.

Similarly, a significant positive association was discerned between technical capabilities and efficiency of TCN ( $\beta=0.31$ ,  $p<0.01$ ). Consequently, null hypothesis Ho<sub>2</sub>, which states that there is no significant impact of technological capabilities on efficiency of TCN in Lagos state, Nigeria, was rejected. Further, the study's results demonstrate a statistically significant positive correlation between financial management practises and the efficiency of TCN ( $\beta=0.42$ ,  $p<0.01$ ). Hence, Ho<sub>3</sub>, which asserts that there is no substantial impact of financial management practises on efficiency of TCN in Lagos state, Nigeria, was likewise rejected.

**Table 4: R Square**

Construct	R Square
Efficiency of the TCN	51

Adjusted R square for efficiency of TCN is 51%. This is accounted for by the interplay of regulatory frameworks, technical capabilities, and financial management practices. Thus, increase in positive regulatory frameworks, technical capabilities, and financial management practices of TCN, will lead to 51% increase in the efficiency of TCN in Lagos state, Nigeria.

### **DISCUSSION OF FINDINGS**

The present study's empirical analysis offer significant insight into the contribution of regulatory frameworks, technological capabilities, financial management practises to efficiency of TCN. The study's findings emphasise the crucial significance of regulatory frameworks to efficiency of TCN. Research has demonstrated that regulatory rules that are clear, consistent, and effective have favourable influence on operational decisions and allocation of resources.

Our findings align with prior research that emphasise the importance of well-established regulatory frameworks in creating stable atmosphere for public firms to strategize, implement, and foster innovation (Núñez-Ríos et al., 2021). The correlation between regulatory frameworks and the efficiency of the TCN suggests that the presence of well-defined rules and norms can foster an environment that promotes strategic decision-making and enhances operational performance.

The study's recognition of technical capabilities as a factor influencing efficiency of TCN is consistent with the intrinsic characteristics of the power transmission industry. Ensuring reliable electricity transmission for transmission network operators (TCN) necessitates the presence of a resilient technical infrastructure, use of contemporary technology, and efficient grid management practises. The existence of positive association between technical capabilities and efficiency supports the idea that investments in technology, infrastructure, and trained employees play a role in minimising transmission losses, improving grid stability, and reducing downtime (Shahzad et al., 2023). This highlights the significance of consistently investing in technical proficiency and innovation to attain maximum operational efficiency within the TCN.

Financial management practises play significant roles in determining efficiency of TCN, aligning with the broader concept of financial sustainability in public companies. The allocation of budget, utilisation of resources, and collection of income are crucial to TCN's ability to meet operational expenses, make investments in infrastructure, and sustain financial stability. The study of Obeng and Idris (2020) supports the notion that there is a direct correlation between financial management practises and efficiency. This finding aligns with other studies that have underscored the need to implement effective financial planning and responsible allocation of resources in public sector organisations.

The convergence of these results indicates a multifaceted interaction between regulatory frameworks, technical capabilities, and financial management practises in influencing efficiency of TCN. An environment characterised by regulatory measures that support autonomy, foster technical improvements, and encourage prudent financial management generates a synergistic impact, hence augmenting the ability of TCN to provide dependable power transmission services.

The findings of this study have broader implications that extend beyond the specific context of the TCN. They provide useful insights that may be applied to inform decision-making processes of policymakers, regulators, and other public entities operating within the Nigerian electricity industry. Through a deep understanding of these interconnections, stakeholders can customise methods that maximise their operational efficiency and support the overarching objective of establishing a dependable and sustainable public service delivery system in Nigeria.

### **CONCLUSION AND RECOMMENDATIONS**

This research highlights the interconnectedness of regulatory frameworks, technical skills, and financial management practises in influencing operational efficiency of TCN. The empirical investigation underscores the notable and statistically significant impact of these factors on efficiency TCN. The ability of TCN to provide reliable power transmission services within Nigeria's power sector is

influenced by several factors, including the presence of well-defined and consistent regulations, a strong technical infrastructure, and efficient financial planning.

The study's findings give rise to many recommendations aimed at improving the efficiency of TCN and making more impactful contribution to the electricity sector. It is imperative for policymakers to preserve meticulously designed regulatory frameworks that grant decision-making autonomy to third-country nationals (TCN) while also guaranteeing transparency. To maintain optimal grid management and responsiveness, it is recommended that TCN allocate resources towards the modernization of technical capabilities, the adoption of technological advancements, and the cultivation of qualified staff.

The implementation of sound financial management practises, which include transparent allocation of budgets and wise utilisation of resources, is crucial for ensuring financial sustainability and operational efficiency of TCN. The collaborative implementation of planning initiatives, capacity building, monitoring and evaluation systems, and stakeholder participation can improve TCN's efficiency and its crucial position in Nigeria's power supply system.

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