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Management of electric cooperatives in Central Luzon, Philippines: An analysis of challenges and intervention measures

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Abstract

Aim: This study aimed to describe and evaluate the management practices of electric cooperatives in Central Luzon, Philippines, identify key challenges affecting their operations, and propose intervention measures to enhance organizational performance and service delivery.

Methodology: A descriptive–evaluative mixed-methods research design was employed using a non-experimental, cross-sectional approach. Quantitative and qualitative data were collected from board members, general managers, department heads, supervisors, staff, and member-consumers of selected electric cooperatives during the 2025 operational period. Management performance was assessed based on compliance with National Electrification Administration (NEA) and Energy Regulatory Commission (ERC) standards covering governance, financial management, distribution system operations, power supply procurement, and consumer services. Data were analyzed using descriptive statistics, supported by interviews, document review, and direct observation.

Key Findings: The findings revealed consistently high levels of compliance across major management indicators, with grand mean ratings ranging from 4.53 to 4.83, particularly in governance, financial management, system reliability, power supply procurement, and consumer protection. Despite these strengths, electric cooperatives face persistent challenges, including limited proactive compliance monitoring, weak market intelligence and analytical capacity, outdated maintenance practices, and insufficient digital infrastructure. While human resource development initiatives are generally implemented, gaps remain in leadership sustainability, specialization in emerging technical fields, and integrated technology adoption.

Conclusion: Electric cooperatives in Central Luzon demonstrate institutional maturity in governance and regulatory compliance but remain constrained in adapting to evolving energy policies, technological advancements, and market dynamics. Strengthening digital systems, enhancing market intelligence, investing in leadership and human capital development, and expanding technical capacity—particularly in renewable energy integration and energy data analytics—are essential to achieving long-term sustainability, transparency, and improved public service outcomes.

Keywords: *electric cooperatives; management practices; regulatory compliance; digital infrastructure; market intelligence; Central Luzon*

INTRODUCTION

Electric cooperatives have historically played a crucial role in expanding access to electricity in underserved and rural communities worldwide. Unlike investor-owned utilities, electric cooperatives are member-owned, non-profit organizations established to deliver reliable and affordable electricity while simultaneously supporting local economic and social development. Many of these cooperatives were formed in the mid-twentieth century to address the limitations of private-sector investment in rural electrification. In the United States, the Rural Electrification Administration (REA) enabled local communities to develop and manage their own electric systems, contributing significantly to rural economic growth and social inclusion (National Rural Electric Cooperative Association, 2020). Similar cooperative-based electrification models continue to play a vital role in Asia and Latin America, particularly in regions where geographic isolation and low commercial viability hinder private utility expansion.

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In recent years, global developments in the energy sector have reshaped the operating environment of electric cooperatives. The increasing adoption of renewable energy technologies, the deployment of smart-grid systems, and the strengthening of regulatory oversight have required cooperatives to modernize governance structures, technical operations, and management practices. Several countries, including Japan, India, and South Korea, have explored distributed generation, net-metering mechanisms, and the use of geographic information systems (GIS) to improve asset management and distribution efficiency (Kale & Pohekar, 2014). Despite these innovations, electric cooperatives worldwide continue to face persistent challenges related to governance effectiveness, financial sustainability, aging infrastructure, limited technical expertise, and inadequate analytical capacity. These challenges underscore the need for systematic evaluation of cooperative management practices to ensure resilience and long-term viability.

In the Philippine context, electric cooperatives were institutionalized through Presidential Decree No. 269, which established the National Electrification Administration (NEA) in the 1970s. Since then, electric cooperatives have served as the primary mechanism for rural electrification, contributing to electricity access for nearly 90 percent of Filipino households (Department of Energy [DOE], 2022). Their role has been especially critical in geographically isolated and disadvantaged areas (GIDAs), where private distribution utilities have limited operational presence. The enactment of the Electric Power Industry Reform Act (EPIRA) of 2001 further transformed the sector by unbundling the electricity industry and strengthening regulatory oversight through the Energy Regulatory Commission (ERC), thereby increasing compliance and reporting requirements for electric cooperatives.

Despite significant progress in electrification, Philippine electric cooperatives continue to experience governance and management challenges. Reports of financial mismanagement, weak accountability mechanisms, and regulatory non-compliance have raised concerns regarding service quality and institutional credibility. In some cases, allegations of unauthorized financial transactions and governance irregularities resulted in regulatory intervention and leadership sanctions, highlighting persistent accountability issues within certain cooperatives (Energy Regulatory Commission, 2023). These developments suggest that formal compliance with regulatory requirements does not necessarily translate into effective management and that continuous evaluation of cooperative performance remains essential.

Central Luzon, often referred to as the "Rice Bowl of the Philippines," is a region characterized by high agricultural productivity alongside rapid industrial and commercial growth. Reliable and affordable electricity supply is critical to sustaining both traditional agricultural activities and emerging industrial zones across the provinces of Aurora, Bataan, Nueva Ecija, Pampanga, Tarlac, and Zambales. Electric cooperatives operating in the region—such as AURELCO, TARELCO I and II, PELCO I, II, and III, PRESCO, PENELCO, ZAMECO I and II, NEECO I and II, and SAJELCO—play a central role in regional development, public service delivery, and economic stability.

Although several studies have examined specific aspects of electric cooperative operations, such as governance structures, financial performance, or technical efficiency, existing research remains fragmented. Many studies focus on individual cooperatives, single functional areas, or narrowly defined technical outcomes. There is limited empirical research that provides a comprehensive, region-wide evaluation of electric cooperative management across governance, operational, financial, technological, and social dimensions, particularly from a Public Administration perspective. This gap underscores the need for a systematic, descriptive–evaluative assessment that integrates regulatory compliance, management practices, and organizational challenges within a regional context.

This study addressed these gaps by evaluating the management of electric cooperatives in Central Luzon using multiple performance indicators and mixed data sources. By integrating quantitative and qualitative evidence from various stakeholder groups, the study contributed to academic discourse on cooperative governance and public utility management while offering practical insights for policymakers, regulators, and cooperative leaders. The findings were intended to support evidence-based policy formulation, strengthen institutional accountability, and enhance sustainable energy service delivery in the Philippine context.

Review of Related Literature and Studies

Governance, Compliance, and Regulatory Relations

Effective governance and regulatory compliance have been widely recognized as fundamental to the sustainability of electric cooperatives. International literature emphasizes that cooperative governance relies on accountability, transparency, and adherence to both cooperative principles and state regulations (Baldwin et al., 2019). In developing countries, weak governance structures have often hindered cooperatives from fulfilling their mandate of providing affordable and reliable electricity, resulting in inefficiencies and mismanagement

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(Bhattacharyya, 2018). Regulatory compliance also serves as a mechanism for building stakeholder trust, as member-consumers are more likely to perceive cooperatives as credible and legitimate when governance systems are transparent and accountable.

In the Philippines, electric cooperatives operate under the regulatory framework established by the Electric Power Industry Reform Act (EPIRA) of 2001 (Republic Act No. 9136). EPIRA unbundled the electricity sector and placed electric cooperatives under stricter oversight by the Energy Regulatory Commission (ERC), particularly in tariff setting, reporting, and consumer protection. While these regulations aim to promote transparency and efficiency, they also impose administrative and technical burdens on cooperatives with limited institutional capacity. Additionally, some cooperatives continue to experience political influence at the board level, which weakens democratic decision-making and leads to resource misallocation (Mendoza, 2021).

To address these challenges, scholars and policy institutions have recommended the adoption of corporate governance mechanisms adapted to the cooperative context, including board competency frameworks, independent audits, and transparent procurement systems (OECD, 2017). In the Philippine setting, strengthening capacity development for cooperative leaders, enforcing transparency measures, and enhancing NEA's supervisory role have been identified as key strategies for improving governance and compliance (NEA, 2021). These studies highlight the importance of systematic evaluation to ensure that governance reforms translate into improved organizational performance.

Theoretical Framework

This study was anchored on principles derived from Good Governance Theory and Public Value Theory. Good Governance Theory emphasizes accountability, transparency, participation, efficiency, and responsiveness as essential elements of effective organizational management, particularly in public and quasi-public institutions such as electric cooperatives. These principles provide a normative foundation for evaluating governance structures, regulatory compliance, and decision-making processes within cooperatives.

Public Value Theory further informed the study by framing electric cooperatives as institutions that generate value not only through efficient service delivery but also through social equity, community development, and public trust. From this perspective, cooperative performance is assessed not solely based on financial or technical outcomes but also on its contribution to societal goals, regulatory accountability, and citizen welfare. These theoretical perspectives guided the evaluation of management practices and reinforced the relevance of the study to the discipline of Public Administration.

Conceptual Framework

The conceptual framework of the study was guided by the research objectives and focused on four major components: (1) the description and evaluation of management practices, (2) the identification of management challenges, (3) the formulation of intervention measures, and (4) the implications of the findings for Public Administration.

Management practices were evaluated across eleven key indicators: governance, compliance, and regulatory relations; market participation and power supply procurement; distribution system operations, reliability, and power quality; consumer protection and service standards; financial management, tariff setting, and cost recovery; electrification and access; renewable energy, net-metering, and energy efficiency; corporate social responsibility and community engagement; risk management, safety, and resilience; data governance, transparency, and ethics; and human resources and capacity development. These indicators served as the analytical basis for assessing organizational strengths and weaknesses.

The framework assumed that management practices influence both the challenges encountered by electric cooperatives and the effectiveness of intervention measures adopted to address these challenges. The findings were further linked to implications for Public Administration, emphasizing policy formulation, regulatory oversight, and institutional accountability. Through this framework, the study systematically examined the interrelationship between cooperative management, organizational challenges, strategic interventions, and public value creation, thereby guiding the overall conduct and analysis of the research.

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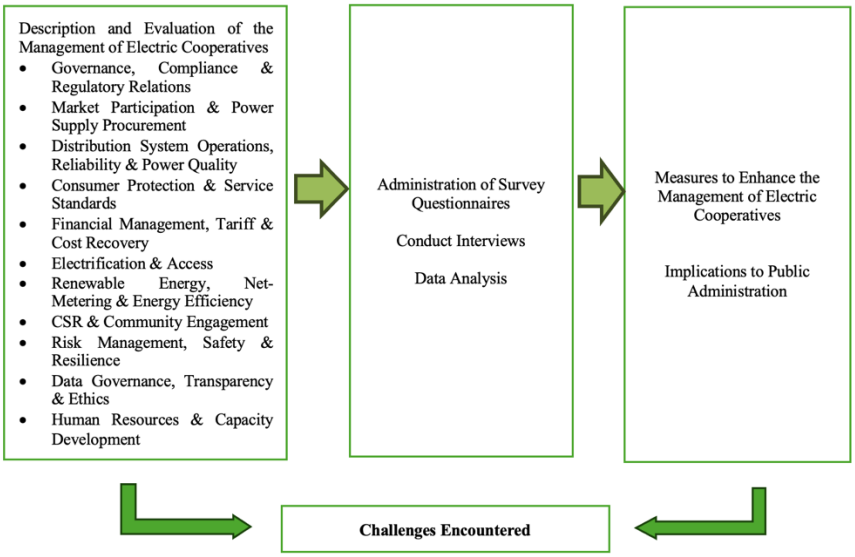

Figure 1. Paradigm of the Study

Statement of the Problem

Electric cooperatives play a critical role in ensuring equitable and reliable electricity access, particularly in rural and semi-urban areas of the Philippines. Despite their importance, many electric cooperatives continue to experience persistent challenges related to governance, regulatory compliance, operational efficiency, financial sustainability, technological readiness, and human resource development. Although national regulatory frameworks and performance standards have been established by agencies such as the National Electrification Administration and the Energy Regulatory Commission, variations in management effectiveness among electric cooperatives remain evident.

In Central Luzon, the growing demand for reliable electricity—driven by agricultural productivity, industrial expansion, and population growth—places increasing pressure on electric cooperatives to strengthen management practices and service delivery. However, existing empirical studies remain limited in providing a comprehensive, region-wide evaluation of electric cooperative management that integrates governance, operational performance, identified challenges, and intervention measures. This gap highlights the need for a systematic assessment to support effective public administration, informed policy formulation, and sustainable energy service delivery in the region.

Research Objectives

General Objective

To evaluate the management of electric cooperatives in Central Luzon, Philippines, with emphasis on governance, operational performance, and service delivery indicators.

Specific Objectives

Specifically, the study aimed to:

1. Describe and evaluate the management practices of electric cooperatives in terms of governance, compliance, and regulatory relations;
2. Assess market participation and power supply procurement practices;
3. Evaluate distribution system operations, reliability, and power quality;
4. Examine consumer protection and service standards;
5. Analyze financial management, tariff setting, and cost recovery mechanisms;
6. Assess electrification initiatives and access to electricity services;
7. Evaluate renewable energy, net-metering, and energy efficiency practices;

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8. Examine corporate social responsibility and community engagement initiatives;
9. Assess risk management, safety, and resilience measures;
10. Evaluate data governance, transparency, and ethical practices;
11. Assess human resources and capacity development initiatives;
12. Identify challenges affecting the management of electric cooperatives;
13. Propose measures to enhance the management of electric cooperatives; and
14. Determine the implications of the findings for Public Administration.

Research Questions

1. How is the management of electric cooperatives in Central Luzon described and evaluated in terms of:
   1.1 governance, compliance, and regulatory relations;
   1.2 market participation and power supply procurement;
   1.3 distribution system operations, reliability, and power quality;
   1.4 consumer protection and service standards;
   1.5 financial management, tariff setting, and cost recovery;
   1.6 electrification and access;
   1.7 renewable energy, net-metering, and energy efficiency;
   1.8 corporate social responsibility and community engagement;
   1.9 risk management, safety, and resilience;
   1.10 data governance, transparency, and ethics; and
   1.11 human resources and capacity development?
2. What challenges affect the management of electric cooperatives in Central Luzon?
3. What measures can be proposed to enhance the management of electric cooperatives?
4. What are the implications of the findings for Public Administration?

METHODS

Research Design

The study employed a descriptive–evaluative mixed-methods research design using a non-experimental, cross-sectional approach. This design was appropriate because the study aimed to systematically describe and evaluate existing management practices of electric cooperatives without manipulating variables or introducing interventions. The quantitative component provided numerical assessments of management performance and compliance across key indicators, while the qualitative component offered in-depth insights into contextual challenges and intervention measures. The integration of both approaches allowed for data triangulation and enhanced the validity and comprehensiveness of the findings.

Population and Sampling

The study population consisted of key stakeholders involved in the management and operations of electric cooperatives in Central Luzon, Philippines. A total of 217 respondents participated in the quantitative component of the study. These respondents included members of the board of directors, general managers, department heads, supervisors, staff, and selected member-consumers from electric cooperatives operating in the provinces of Aurora, Bataan, Nueva Ecija, Pampanga, Tarlac, and Zambales.

A purposive sampling technique was employed to ensure that respondents possessed direct knowledge and experience relevant to cooperative management and service delivery. For the qualitative component, key informants—including human resource officers, finance officers, regulatory liaison officers, and selected member-consumers—were purposively selected based on their roles and involvement in governance, compliance, and operational decision-making.

Instruments

Quantitative Instrument

The primary quantitative instrument was a researcher-developed structured questionnaire designed to evaluate the management of electric cooperatives in Central Luzon. The questionnaire was anchored on the Electric Power Industry Reform Act (EPIRA) of 2001, the Philippine Electricity Market Corporation (PEMC) rules, National

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Electrification Administration (NEA) guidelines, and other relevant regulatory frameworks governing electric cooperatives. It covered eleven management indicators: governance and regulatory relations; market participation and power supply procurement; distribution system operations; consumer protection; financial management; electrification and access; renewable energy and energy efficiency; corporate social responsibility; risk management and safety; data governance and ethics; and human resources and capacity development.

The instrument underwent content validation by three experts in public administration, energy regulation, and cooperative management. A pilot test was conducted among respondents outside the study area, and Cronbach's Alpha was computed to establish internal consistency reliability. Based on the results, the questionnaire was refined and finalized prior to administration.

Qualitative Instruments

Semi-structured interview guides and focus group discussion (FGD) guides were developed to elicit qualitative data on management challenges, compliance issues, and intervention measures. These guides were aligned with the study objectives and validated by the same group of experts to ensure clarity and relevance.

Data Collection

Data collection was conducted from October to November 2025 across selected electric cooperatives in Central Luzon.

For the quantitative component, structured questionnaires were distributed either through face-to-face administration or electronic means, depending on respondent availability. Prior coordination with cooperative management facilitated access and scheduling.

For the qualitative component, key informant interviews and focus group discussions were conducted with purposively selected participants. Official cooperative documents and records were also reviewed to verify operational and compliance-related information. Direct observation of cooperative operations supplemented survey and interview data.

Data Analysis

Quantitative data were analyzed using descriptive and inferential statistical techniques. Frequency counts and percentages described respondent profiles, while weighted means and rankings assessed management performance and challenges. Inferential tools, including the t-test and Analysis of Variance (ANOVA), were used to determine significant differences among respondent groups when applicable.

Qualitative data from interviews, FGDs, document reviews, and observations were analyzed through thematic analysis. Responses were transcribed, coded, and grouped into recurring themes related to governance challenges, operational constraints, and intervention strategies. The qualitative findings were used to explain, validate, and enrich quantitative results.

Integration of quantitative and qualitative data occurred at the interpretation stage, where converging and diverging findings were compared to strengthen conclusions and recommendations.

Ethical Considerations

Ethical standards were strictly observed throughout the study. All participants were informed of the study's purpose, procedures, and voluntary nature. Confidentiality and anonymity were ensured, and respondents were informed of their right to withdraw at any time without consequences. All data were securely handled in compliance with the Data Privacy Act of 2012 (Republic Act No. 10173). Cultural sensitivity, objectivity, and transparency were maintained, and the findings were reported responsibly to avoid harm to individuals or institutions.

RESULTS and DISCUSSION

This section presents, analyzes, and discusses the findings derived from the survey questionnaires, interviews, document review, and observations conducted among electric cooperatives in Central Luzon. Results are presented in relation to the research questions and are immediately followed by interpretative discussions supported by relevant literature.

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Overall Evaluation of the Management of Electric Cooperatives

The overall grand mean of 4.64, interpreted as "Always Complied," indicated that electric cooperatives in Central Luzon consistently demonstrated high levels of compliance across governance, operational, financial, and social responsibility indicators. This finding suggested that the cooperatives generally adhered to established regulatory standards and management requirements.

Overall Evaluation of the Management of Electric Cooperatives

Statement	Grand Mean	Adjectival Description	
Governance, Compliance & Regulatory Relations	4.83	Always Complied	
Market Participation & Power Supply Procurement	4.53	Always Complied	
Distribution System Operations, Reliability & Power Quality	4.56	Always Complied	
Consumer Protection & Service Standards	4.63	Always Complied	
Financial Management, Tariff & Cost Recovery	4.86	Always Complied	
Electrification & Access	4.64	Always Complied	
Renewable Energy, Net-Metering & Energy Efficiency	4.54	Always Complied	
CSR & Community Engagement	4.68	Always Complied	
Risk Management, Safety & Resilience	4.66	Always Complied	
Data Governance, Transparency & Ethics	4.83	Always Complied	
Human Resources & Capacity Development	4.33	Often Complied	
Overall Grand Mean	**4.64**	**Always Complied**	

This high level of compliance reflected sound management practices and a strong commitment to accountability and stakeholder engagement. The result was consistent with the principles of good governance emphasized by the Energy Regulatory Commission (ERC, 2022) and the National Electrification Administration (NEA, 2023), which underscored transparency, efficiency, and accountability as essential to sustainable electric distribution operations.

Financial Management, Governance, and Data Transparency

Among the assessed indicators, Financial Management, Tariff and Cost Recovery obtained the highest mean score (M = 4.86, Always Complied). This result indicated that the cooperatives maintained effective financial controls, prudent tariff application, and reliable cost recovery mechanisms. The finding supported the study of Gonzales and Garcia (2021), who reported that effective financial governance among Philippine electric cooperatives contributed to improved liquidity and enhanced consumer trust. In addition, compliance with transparent tariff-setting processes aligned with the Department of Energy (DOE, 2022) mandate for equitable and performance-based rate structures.

Similarly, Governance, Compliance and Regulatory Relations and Data Governance, Transparency and Ethics both recorded high mean scores (M = 4.83). These results reflected strong adherence to ethical standards, regulatory requirements, and transparency mechanisms. This finding was consistent with Uy and Santos (2020), who emphasized that robust governance frameworks enhanced the credibility and legitimacy of electric cooperatives. Comparable results were reported by Aguilar and Cruz (2022), who found that organizations with transparent reporting systems and strong regulatory compliance achieved higher stakeholder satisfaction and regulatory ratings.

Risk Management, CSR, and Electrification Access

High compliance was also observed in Risk Management, Safety and Resilience (M = 4.66) and Corporate Social Responsibility (CSR) and Community Engagement (M = 4.68). These findings indicated that cooperatives actively implemented safety measures and community-oriented programs. Internationally, similar outcomes were observed by Moyo and Maganga (2020) in African rural electrification programs, where CSR-based community engagement enhanced long-term cooperative viability.

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The Electrification and Access indicator also registered a high mean (M = 4.64), reflecting the cooperatives' sustained commitment to rural development and universal energy access. This finding aligned with the objectives of the Total Electrification Program (DOE, 2021) and was supported by Batalla and Ramos (2020), who reported that cooperative-led electrification initiatives significantly reduced energy poverty and stimulated local economic activity in the Philippines.

Operational Performance and Market Participation

Operational indicators such as Distribution System Operations, Reliability and Power Quality (M = 4.56) and Renewable Energy, Net-Metering and Energy Efficiency (M = 4.54) were likewise rated as Always Complied. These results indicated effective technical performance and growing engagement with sustainable energy practices. The findings supported Delos Reyes and Lim (2022), who noted that adherence to NEA reliability standards and renewable energy adoption improved service continuity and reduced system losses. Consistent with this, the International Energy Agency (IEA, 2021) reported that utilities investing in grid modernization and net-metering achieved improved operational efficiency and greater consumer participation in clean energy initiatives.

The Market Participation and Power Supply Procurement indicator obtained a mean of 4.53, also interpreted as Always Complied. This result suggested effective participation in the Wholesale Electricity Spot Market (WESM) and compliance with procurement guidelines. Santos and Pascual (2021) emphasized that transparent and competitive procurement practices enhanced energy affordability and organizational stability, reinforcing the importance of sound market engagement.

Consumer Protection and Human Resource Development

The Consumer Protection and Service Standards indicator recorded a mean of 4.63, indicating strong compliance with customer service requirements and the ERC Consumer Charter (2022). This finding was consistent with Yap et al. (2023), who found that transparent billing systems and effective complaint-handling mechanisms significantly improved consumer trust and satisfaction.

In contrast, Human Resources and Capacity Development was the only indicator rated "Often Complied" (M = 4.33). While HR policies were generally implemented, the result indicated limitations in continuous training, performance evaluation, and long-term employee development. This finding aligned with Luz and Herrera (2020), who reported that many Philippine cooperatives faced constraints in sustaining systematic HR development due to funding limitations and staff turnover. Similarly, Cruz and Hernandez (2022) emphasized that sustained investment in human capital was critical to enhancing organizational performance and service quality.

Overall, the relatively lower score in human resource development suggested the need for a more strategic HR framework aligned with emerging technical and leadership competencies. This observation was consistent with Kaplan and Norton's (1996) Balanced Scorecard Framework, which emphasized that long-term financial and operational outcomes depended on strong learning and growth systems.

Challenges Encountered by Electric Cooperatives

Despite high compliance ratings, qualitative findings revealed that electric cooperatives faced persistent challenges related to regulatory burden, financial rigidity, limited workforce capacity, and uneven technological adoption. These challenges highlighted the gap between regulatory expectations and organizational capabilities. From a Public Administration perspective, such constraints underscored the importance of institutional adaptability, transparency, and collaborative governance in public service delivery.

The findings suggested that while electric cooperatives demonstrated institutional maturity, their effectiveness remained influenced by external regulatory pressures and internal capacity limitations. Addressing these challenges through administrative simplification, human capital investment, infrastructure modernization, and strengthened stakeholder coordination may enhance operational resilience and public trust.

Intervention Measures and Implications for Public Administration

Based on the integrated findings, the study identified intervention measures focused on governance strengthening, financial sustainability, infrastructure modernization, workforce development, and consumer engagement. These measures reflected a shift toward adaptive, transparent, and performance-driven management models aligned with the principles of modern public administration. As noted by Garcia and Domingo (2023), cooperatives that effectively integrated regulatory compliance with innovation and social responsibility were more likely to achieve sustainable performance.

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The findings further demonstrated that electric cooperatives served as important governance actors beyond traditional government institutions. Their management practices illustrated how public value could be generated through accountable, participatory, and evidence-based management, reinforcing the relevance of Public Administration theory in community-based and regulated service organizations.

Summary of Findings

Overall, electric cooperatives in Central Luzon consistently demonstrated high compliance across governance, financial, operational, and service delivery domains, reflecting alignment with NEA, ERC, and EPIRA standards. Strengths were evident in governance discipline, procurement transparency, system reliability, and consumer responsiveness. However, challenges persisted in areas such as workforce development, digital integration, analytical capacity, and long-term risk management.

These findings indicated that while electric cooperatives had achieved institutional maturity, continued efforts toward modernization, digital transformation, and adaptive governance remained essential to sustaining competitiveness and resilience in a rapidly evolving energy sector.

Conclusions

Electric cooperatives in Central Luzon exhibited strong compliance, governance, and operational performance, reflecting institutional maturity and commitment to service standards. Nevertheless, several areas emerged where further enhancement may support long-term resilience, efficiency, and sustainability.

Governance and compliance mechanisms were consistently implemented; however, findings suggest that adaptive and learning-oriented governance approaches may further strengthen responsiveness to evolving regulatory environments. Procurement practices were generally transparent, although limited analytical and risk assessment capacity appeared to constrain strategic decision-making. Operational reliability remained high, yet gaps in modernization and continued reliance on manual maintenance systems indicated opportunities for improved efficiency.

Consumer protection mechanisms were in place, but variations in complaint resolution processes and digital engagement may influence consumer trust. Financial management systems were generally sound, though greater integration of digital financial tools may enhance oversight and planning. Leadership and human resource development initiatives were evident; however, succession planning and alignment of training with emerging technical competencies may further strengthen organizational capacity.

Corporate social responsibility initiatives aligned with cooperative mandates, but the absence of systematic impact assessment frameworks limited the ability to evaluate long-term outcomes. Risk management and technological adoption remained largely reactive, indicating that forward-looking approaches to digitalization, renewable energy integration, cybersecurity, and data governance may enhance institutional resilience.

Recommendations

Based on the findings of the study, several strategies may be considered to further strengthen the management, operational efficiency, and long-term sustainability of electric cooperatives in Central Luzon.

Electric cooperatives may consider adopting digital compliance monitoring systems to transform regulatory adherence from a periodic activity into a continuous and adaptive management process. Such systems may enhance transparency, reduce administrative burden, and support timely reporting to regulatory agencies.

To improve market participation and power supply procurement, cooperatives may strengthen market intelligence and analytical capacity by establishing dedicated units or functions focused on data analysis, demand forecasting, and risk assessment. Enhanced analytical capability may support more informed procurement decisions and reduce exposure to market volatility.

Upgrading digital and technical infrastructure—such as Geographic Information Systems (GIS) and Supervisory Control and Data Acquisition (SCADA) systems—may support predictive maintenance, reduce system outages, and improve overall distribution efficiency. Incremental modernization may allow cooperatives to optimize asset management while maintaining operational reliability.

In the area of consumer protection and engagement, cooperatives may enhance service delivery through integrated digital platforms that facilitate transparent billing, efficient complaint resolution, and two-way communication with member-consumers. Expanded use of online portals, mobile applications, and customer feedback mechanisms may improve responsiveness and consumer trust.

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Financial management practices may be further strengthened through the adoption of integrated and automated accounting, budgeting, and reporting systems. Digital financial tools may improve accuracy, enhance internal controls, and support evidence-based financial planning in compliance with regulatory standards.

Leadership development initiatives may prioritize succession planning and strategic leadership training to ensure continuity and organizational adaptability. Capacity-building programs may be aligned with emerging competencies in energy analytics, renewable energy integration, cybersecurity, and data governance to prepare the workforce for evolving sectoral demands.

Corporate social responsibility and community engagement initiatives may benefit from the development of systematic impact assessment frameworks. Linking CSR programs to measurable outcomes and relevant Sustainable Development Goals (SDGs) may allow cooperatives to evaluate long-term social impact and enhance accountability to member-communities.

Risk management frameworks may be strengthened by incorporating predictive and scenario-based planning approaches that address climate-related risks, operational disruptions, financial vulnerabilities, and technological threats. Establishing contingency plans and maintaining appropriate financial reserves may enhance institutional resilience during emergencies and periods of uncertainty.

Overall, continuous investment in digital transformation, human capital development, and adaptive governance may enable electric cooperatives to remain responsive, transparent, and sustainable in a rapidly evolving energy environment, thereby supporting inclusive and equitable energy access in Central Luzon.

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