



Effect of Project Planning Practices on Performance of Rural Electricity Distribution Project in Nyamagabe District, Rwanda

Vincent Mbonigaba & Sam Bazimya

University of Kigali

Email: akaline103@gmail.com

Abstract: *This paper investigates the effect of planning practices on the performance of rural electricity distribution projects in Nyamagabe District, Rwanda. Guided by the Project Scope Management Theory, the study adopted a descriptive-correlational research design, employing both quantitative and qualitative approaches to explore how clearly defined scope contributes to project performance. Stratified random sampling was used to select a sample of 183 respondents from a target population of 338 staff members under the Energy Development Corporation Limited (EDCL), representing various departments involved in planning, implementation, and monitoring of electrification projects. Data were collected through structured questionnaires and semi-structured interviews, and analyzed using SPSS Version 21. Findings revealed a strong and statistically significant positive correlation between project scope and project performance ($r = 0.718$, $p < 0.001$). Regression analysis further confirmed project scope as a significant predictor of project performance, with an R^2 value of 0.660 and a standardized beta coefficient of 0.342 ($p = 0.011$). Qualitative insights supported these results, highlighting the importance of scope clarity in setting expectations, managing timelines, and minimizing delays. However, the findings also suggest that scope alone does not guarantee effective stakeholder coordination, indicating a need for enhanced communication and collaboration mechanisms. The study concludes that well-defined and effectively managed project scope is essential for improving the performance of rural electrification projects. It recommends that project managers should continue to monitor and adapt the project scope throughout the project lifecycle, ensuring that any changes are well documented, communicated, and integrated into the overall project plan.*

Keywords: *Project planning, Project performance, Rural electricity distribution project, Nyamagabe District*

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1. Introduction

In today's rapidly evolving global economy, effective project management has become an indispensable part of organizational success (Pantos, 2024). Businesses face increasing pressures from economic challenges,

technological advancements, regulatory changes, and heightened competition. To navigate these challenges, organizations must adopt robust project management practices to deliver projects on time, within budget, and to the required quality. The energy sector, especially electricity distribution, has experienced substantial growth

due to rising demand, technological innovations, and the global shift towards sustainability (Thierry, 2022). The transition from conventional to renewable energy, modernization of electricity grids, and rural energy access efforts have placed pressure on companies to execute large-scale projects efficiently, making project management vital for success in this sector.

In developed countries, project management practices in the energy sector, particularly in electricity distribution, have evolved to incorporate advanced methodologies such as PMBOK, PRINCE2, and Agile to ensure effective execution (Turner & Muller, 2020). For instance, the United States and Germany use Project Management Information Systems (PMIS) and sophisticated risk management techniques, leading to successful projects like smart grids and renewable energy initiatives (Gareis, 2020). Countries such as Denmark and the UK have modernized aging infrastructure and incorporated energy storage solutions into their electricity distribution systems. With well-funded projects, clear regulations, and strong stakeholder engagement, these countries achieve high performance in energy projects, as project management practices mitigate risks and ensure compliance with environmental standards (Hassan, 2021).

In Sub-Saharan Africa, energy projects face unique challenges, and project management practices are often less mature than in developed countries. Countries like Nigeria and the Democratic Republic of Congo deal with limited resources, poor infrastructure complicating effective project management (Akinwale, 2016). Despite this, there is a growing recognition of the need for stronger project management to improve success rates in energy projects. In Ghana, project managers are adopting modern practices to address cost overruns and delays (Goddard et al., 2018). However, countries like Kenya face significant challenges, such as delays in power sector projects due to financing issues, poor scope management, and lack of skilled professionals. Despite these issues, there are efforts to improve local capacity and apply international best practices to achieve successful electricity distribution and rural electrification projects.

East Africa, particularly Kenya and Tanzania, has made notable progress in energy infrastructure, with increased investments in electricity distribution and renewable energy. However, project management practices face hurdles such as resource constraints and skill gaps (Kuriakose et al., 2021). While Kenya has seen improvements, countries like Tanzania still struggle with project delays due to inadequate scope management and risk planning (Muller, 2022). In Uganda, rural electrification projects face issues like poor coordination and insufficient skilled project managers (Kuriakose et al., 2020). Despite these challenges, East African countries are increasingly adopting international best practices and

technological advancements. Regional power pools, like the East African Power Pool (EAPP), and efforts to integrate renewable energy are driving better project management practices to meet the growing energy demand sustainably (Mahmud, 2023).

In Rwanda, the energy sector has experienced significant growth, particularly in rural electrification. The government has made efforts to improve project management practices, focusing on expanding electricity access in rural areas (Niyongabo et al., 2020). Despite strategic planning and clear project scopes, challenges such as limited resources, technical expertise, and financing persist (Chirwa, 2022). Although Rwanda has adopted internationally recognized project management frameworks, local project managers often face difficulties due to inconsistent project execution and capacity issues. For instance, delays in the Rural Electrification Strategy have occurred due to funding gaps and logistical issues (Ntaganda et al., 2020). Nonetheless, Rwanda has leveraged international partnerships, foreign aid, and technology-driven solutions to drive energy projects forward. The government's commitment to achieving universal electricity access by 2024 highlights the importance of effective project management in sustainable energy development (Chirwa, 2022; Niyongabo et al., 2020).

1.1. Problem statement

Effective project planning practices are crucial for the success of electricity distribution projects, particularly in developing countries where infrastructure development is vital for economic growth and poverty reduction (Golbachev, 2020). Proper project management ensures timely completion, cost efficiency, and adherence to quality standards. However, many electricity distribution projects face challenges such as delays, budget overruns, and inefficiencies, often due to poor planning, lack of technical expertise, and inadequate project oversight (International Energy Agency, 2023). In resource-constrained regions, gaps in project management capacity can lead to suboptimal outcomes, preventing the realization of electricity access goals. Without well-established project management frameworks, the risk of failure escalates, hindering progress toward universal electricity access (Maria, 2022).

In Rwanda, the energy sector has seen notable growth, particularly in electricity distribution and rural electrification, with the government setting ambitious goals under the Rural Electrification Strategy (Rwanda Energy Group, 2023). However, challenges remain, including limited technical expertise, insufficient project management capacity, and funding constraints. These issues have resulted in delays, budget overruns, and inefficiencies in project execution (World Bank, 2022).

The need for a more focused approach to project management is clear, especially in the context of large-scale electricity distribution projects, where effective management of resources, timelines, and risks is crucial. Without a strong framework to manage these complexities, the country's progress toward universal electricity access continues to be undermined.

Existing literature highlights the importance of project management practices in the success of energy projects. Developed countries like the United States and Germany utilize established frameworks such as PMBOK, PRINCE2, and Agile, which improve project performance and resource management (Turner & Muller, 2020). In contrast, many Sub-Saharan African countries, including Rwanda, face challenges such as inadequate infrastructure, limited skilled professionals, and inconsistent application of project management practices, which hinder project performance (Akinwale, 2016). Studies in Rwanda, including those by Niyongabo et al. (2020), Murekezi et al. (2018), and Chirwa (2018), emphasize the need for stronger local project management practices to address challenges like funding gaps, delays, and limited capacity. While improvements in project scope management, risk assessment, and stakeholder engagement are recognized as essential, these studies do not provide a focused examination of how these practices specifically impact rural electricity distribution projects in Rwanda (Uwase et al., 2020; Terimbera et al., 2018).

While existing research underscores the importance of project management frameworks, a significant gap remains in understanding how specific project management practices such as project scope management, team competence, and risk planning directly affect the performance of rural electricity distribution projects in Rwanda. Current studies primarily focus on general project management challenges and do not delve into the nuances of how these practices can be applied to improve the performance of rural electrification projects. Moreover, although international best practices are often referenced, there is a lack of research on how these frameworks can be tailored to Rwanda's unique context. This gap points to the need for more in-depth studies that explore the application of these practices in Rwanda's energy sector. This study aims to fill this gap by specifically examining how project scope management influence the performance of rural electricity distribution projects in Rwanda.

This study sought to achieve the following Research Question:

To analyze the effect of project scope on the performance of rural electricity distribution projects in Nyamagabe District, Rwanda.

2. Literature Review

Project management has become an increasingly dynamic and multifaceted discipline, influenced by technological innovation, globalization, and evolving stakeholder expectations. This literature review explores the current trends, tools, and theoretical foundations shaping modern project management practices. By examining the latest research and insights, this section highlights how project planning, scope management, and performance evaluation have adapted to meet the demands of contemporary project environments. The review draws on a range of academic sources and industry reports to provide a comprehensive understanding of the methodologies and strategies that contribute to successful project outcomes.

The subsections that follow delve into three core components: project planning practices, project scope, and project performance. These areas are examined not only in terms of traditional frameworks but also in light of recent innovations such as agile methodologies, digital transformation, and sustainability-driven planning. Together, they present a holistic view of how project management continues to evolve to address the complexities of today's organizational and operational challenges.

2.1 Project Planning Practices

Project planning practices have evolved significantly in recent years, driven by the increasing complexity of global markets, technological advancements, and the demand for greater agility (Rasty, 2020). A prominent trend in contemporary project planning is the integration of agile methodologies alongside traditional project management approaches. As highlighted by Serrador and Pinto (2020), agile methods, particularly in software development and IT projects, have introduced more flexibility, faster delivery, and enhanced customer satisfaction. However, traditional approaches such as the Waterfall model still dominate industries like construction and engineering, where clear timelines and deliverables are essential. A hybrid approach, blending the flexibility of agile with the structure of traditional methodologies, has become a key strategy for success across various sectors (Liu et al., 2021).

Another key development in project planning practices is the growing emphasis on sustainability and social responsibility. Increasingly, stakeholders expect projects to meet environmental, social, and governance (ESG) criteria. Dangelico and Vocalelli (2022) suggest that incorporating sustainability into project planning requires a shift in how project managers approach decision-making, risk assessment, and resource allocation. Project managers must now balance traditional project objectives—such as cost, schedule, and quality—with the broader goal of

reducing environmental impact and promoting social equity. This approach aligns with global sustainability frameworks like the United Nations Sustainable Development Goals (SDGs), pushing organizations to adapt their project planning practices to incorporate sustainability as a core principle (Agarwal & Gupta, 2023).

The digital transformation of project planning practices has also been profound, largely due to the rise of advanced technology. Cloud-based project management tools, AI-driven predictive analytics, and collaborative platforms like Microsoft Teams and Slack have enhanced communication and streamlined workflows, especially in geographically dispersed teams. Turner and Keegan (2024) emphasize that these tools enable real-time tracking of project progress, improved risk management, and better stakeholder communication. Additionally, the use of data analytics has optimized resource allocation, identified potential bottlenecks, and improved decision-making. However, these technological advancements also present challenges, particularly regarding cybersecurity, data privacy, and the need for project managers to continuously upskill in order to navigate an increasingly digital project planning landscape (Shah & Kumar, 2023).

2.2 Project Scope

Project scope is a critical aspect of project success, ensuring that all necessary work is included while preventing scope creep—an expansion of the project's objectives that was not initially planned. According to Pinto et al. (2022), defining the scope clearly at the beginning of the project is essential for aligning stakeholder expectations and project deliverables. Tools like the Work Breakdown Structure (WBS) and scope validation processes are frequently used to break the project into manageable sections, ensuring that teams can focus on specific tasks while avoiding unnecessary expansions. Scope management also involves handling changes in scope through structured change control processes. The importance of managing scope effectively is particularly evident in complex projects with diverse stakeholders, where unclear boundaries can lead to significant cost overruns and delays (Ko & Shin, 2021). Therefore, a disciplined approach to scope management is necessary to ensure that the project remains focused and within budget and schedule constraints.

The rise of digital technologies has further transformed project scope management. With advancements in cloud-based project management platforms and collaboration tools, project managers can now track scope changes and project progress in real-time, making it easier to detect discrepancies early and make adjustments as needed. These digital tools allow for enhanced communication among

teams, ensuring that all members are aligned on the scope and any adjustments. Additionally, technology offers a more integrated approach to scope management by enabling automated tracking and reporting. This minimizes human error and ensures that any scope creep is detected promptly, giving project managers more control over the project's trajectory. Serrador and Pinto (2020) note that real-time updates and agile methodologies have also become essential, especially in industries like software development, where scope requirements are constantly evolving. This digital approach to scope management enables greater flexibility while still maintaining strong oversight over project objectives.

2.3 Project Performance

Project performance refers to the degree to which a project meets its predefined objectives, including scope, time, cost, and quality. A well-performing project is one that delivers the expected outcomes within the allocated resources and timeframe while satisfying stakeholder requirements. According to Müller and Jugdev (2021), performance measurement in projects is critical to ensure alignment with strategic goals and identify areas for improvement. Key Performance Indicators (KPIs), such as schedule variance, cost performance index (CPI), and customer satisfaction scores, are commonly used metrics. These indicators help project managers monitor progress, evaluate efficiency, and make informed decisions to steer the project in the right direction. A strong emphasis on performance tracking throughout the project lifecycle supports continuous improvement and enhances the likelihood of project success.

The integration of technology has significantly influenced how project performance is measured and managed. Digital tools, such as project dashboards and analytics software, now enable real-time tracking and performance visualization, facilitating proactive management. AI and machine learning algorithms can predict potential delays or budget overruns before they occur, giving teams a chance to address issues early. As noted by Shah and Kumar (2023), such predictive capabilities have revolutionized project performance management by reducing uncertainty and increasing responsiveness. These advancements have also allowed for more dynamic risk management, with project teams able to adapt to changes quickly. Furthermore, digital collaboration platforms improve communication across distributed teams, enhance coordination and reducing misunderstandings that could impact performance negatively.

However, achieving high project performance also depends on human factors such as leadership, team dynamics, and stakeholder engagement. A skilled project manager who can motivate the team, manage conflicts, and foster a culture of accountability plays a crucial role in driving

performance. Turner and Keegan (2024) emphasize the importance of soft skills in project management, noting that even with the best tools, poor communication and weak leadership can derail a project. Moreover, involving stakeholders throughout the project and managing their expectations contributes to smoother execution and higher satisfaction levels. Thus, a balanced approach that combines technological tools with effective leadership and stakeholder management is essential for sustaining high project performance across diverse and complex projects.

2.4 Theoretical Review

This section presents the theoretical foundation that guides the study, with a focus on concepts central to project scope definition, control, and performance. A clear understanding of theoretical models in project management helps in framing the research problem and interpreting findings in a structured way. Among the various project management theories, the Project Scope Management Theory is selected due to its strong relevance to understanding how project boundaries are set and maintained, particularly in development projects such as rural electrification. The following subsection outlines the origins, core principles, limitations, and practical application of this theory in the context of rural electricity distribution in Nyamagabe District, Rwanda.

2.4.1 Project Scope Management Theory

The Project Scope Management Theory is rooted in the Project Management Institute's (PMI) Project Management Body of Knowledge (PMBOK) Guide, which has been evolving since its first publication in 1987 (Cool, 2020). Although the theory does not have a singular founder, it is widely attributed to the collective work of the PMI and various project management scholars who contributed to developing structured project management processes. Over the years, the theory has been refined, with major updates included in the 5th edition (2013) and the latest 7th edition (2021) of the PMBOK Guide. Project scope management has become a core concept in modern project management, emphasizing the need for well-defined boundaries in order to achieve project goals within the constraints of time, cost, and quality.

Project Scope Management Theory focuses on the processes involved in clearly defining and effectively controlling what is and is not included in a project (Peter, 2021). It emphasizes that consistent and accurate scope definition is critical to project success. The theory outlines several key processes: scope planning, scope definition, the development of a Work Breakdown Structure (WBS), scope verification, and scope control. These processes enable project managers to ensure that all necessary tasks are identified and completed, while unnecessary activities

are excluded. A central concept in the theory is the prevention of scope creep—the uncontrolled expansion of project objectives without appropriate approval—which can lead to delays, increased costs, and misalignment with project goals. Managing scope effectively is therefore essential for delivering successful project outcomes within the approved timeline and budget (Raphael & Ann, 2020).

Despite its widespread use, the theory is not without limitations. One major concern is its relatively rigid focus on scope control, which may not be well-suited to dynamic environments where project requirements evolve (Opion, 2020). In complex or large-scale projects, changes may arise due to shifting stakeholder priorities, new regulations, or unexpected challenges. In such cases, a strictly linear approach to scope management may hinder adaptability and responsiveness. Furthermore, the theory assumes that a clear scope can always be defined at the start of the project, which is not always realistic, particularly in uncertain or rural contexts where full project requirements may emerge gradually. Another limitation is that the theory does not fully address the role of stakeholder engagement in scope development, despite its importance in ensuring that the project scope aligns with community needs and expectations.

Project Scope Management Theory is particularly relevant to the study of rural electricity distribution projects in Nyamagabe District, Rwanda. These types of projects frequently encounter challenges such as limited resources, evolving community needs, and political or regulatory shifts, all of which can affect the project scope. Applying this theory helps the study analyze how a well-defined and controlled scope can influence the success of rural electrification efforts. Clearly outlining the scope from the beginning and managing changes effectively can help ensure that projects stay on schedule, within budget, and aligned with their objectives of providing electricity access to underserved communities. Additionally, the theory's focus on stakeholder inclusion, although somewhat understated, is critical in understanding how active engagement with local populations, government entities, and other stakeholders supports realistic and sustainable scope definition for successful project delivery.

2.5 Empirical Literature

This section reviews existing empirical studies on the factors influencing project performance, with a specific focus on project scope. The review aims to highlight the significant role each factor plays in determining the success of projects, particularly in the context of rural electricity distribution initiatives.

2.5.1 Effect of project scope on Project Performance

In developed countries, project scope management has been closely linked to project success, particularly in the construction sector. Morris and Pinto (2019) conducted a study on large-scale construction projects in the United States and found that projects with clearly defined scope had 15% fewer cost overruns and were 12% more likely to be completed on time compared to projects with unclear scope. Their study used a regression coefficient of 0.72, indicating a strong positive relationship between clear scope definition and project performance. The research highlighted that scope creep—the gradual expansion of project requirements—was a significant issue, accounting for 18% of delays and 22% of cost overruns. However, the study did not sufficiently explore the influence of external factors, such as changes in market conditions, regulatory shifts, or unforeseen environmental challenges, which could lead to scope changes and affect project performance, especially in urban construction projects.

In the UK, Hernandez et al. (2020) examined the impact of project scope clarity on public infrastructure projects, finding that projects with a clear scope experienced 19% less delay and were 16% more cost-efficient than those with vague or frequently changing scopes. Their study used a regression coefficient of 0.68, confirming that clear scope planning significantly influenced project outcomes. However, the study did not address how stakeholder changes and political influence might alter the project scope mid-execution, especially in public sector projects where these factors can be particularly volatile. A gap in this research lies in the dynamic nature of scope management in projects with multiple and shifting stakeholders.

In Africa, a similar study by Mujahid et al. (2021) explored the relationship between project scope and performance in public infrastructure projects across sub-Saharan Africa. The study indicated that well-defined scope resulted in a 20% reduction in project delays and a 15% decrease in cost overruns. The authors used a coefficient of determination ($R^2 = 0.72$) to demonstrate that project scope explained a significant portion of the variance in project performance. Projects with scope issues had 28% more chance of failing to meet performance targets. However, the study highlighted a gap in understanding the effects of scope changes due to external factors like fluctuating commodity prices, which is particularly pronounced in the African context and can alter the project's scope unexpectedly.

In East Africa, Kibera and Kyalo (2022) examined rural electrification projects in Uganda and found that clearly defined scope improved project performance by 25% in

terms of completion time and 18% in terms of budget adherence. They also used a regression analysis with a coefficient of 0.58, indicating a moderate positive relationship between scope clarity and project success. However, the study identified that changes in local regulations and community resistance to certain aspects of the scope could significantly delay the projects. The gap in this research lies in the insufficient exploration of community-based scope management, where local participation in defining the project scope could lead to better ownership and sustainability of the projects, particularly in rural settings where local contexts can drastically affect project success.

In Rwanda, Niyonzima et al. (2023) investigated the role of project scope in rural electrification projects in Nyamagabe District. They found that projects with well-structured scope were 30% more likely to be completed on time and within budget, with a significant negative correlation (coefficient = -0.71) between scope changes and project performance. The study revealed that scope creep affected 35% of rural electrification projects, leading to delays and cost overruns. While the study was insightful, a notable gap in the research was the lack of analysis on cultural factors influencing scope definition and whether local stakeholders' expectations and involvement in defining scope could reduce scope changes, thereby enhancing project performance in rural settings.

3. Methodology

This study followed a carefully structured research design combining descriptive and correlational approaches to examine the influence of project planning practices—specifically project scope, team competence, and risk planning on the performance of rural electricity distribution projects in Nyamagabe District, Rwanda. The descriptive design enabled the researcher to explore the current status of these variables without manipulating them, while the correlational design assessed the relationships and degree of influence among them. Together, these approaches provided a comprehensive framework for understanding the dynamics of planning and project outcomes.

The target population consisted of 338 individuals involved in various aspects of rural electricity distribution under the Energy Development Corporation Limited (EDCL). These included staff from departments such as planning and Monitoring and Evaluation, energy distribution and access, project management, finance, and support. This population represented a diverse range of stakeholders who play critical roles in the planning and implementation of rural electrification projects, ensuring that the study captured multiple perspectives across technical, administrative, and support functions.

A sample of 183 individuals was selected using Yamane's formula at a 95% confidence level with a 5% margin of error. To ensure fair representation across all departments, stratified random sampling was employed. This technique divided the population into subgroups based on roles or departments and selected participants proportionally from each group. The approach guaranteed inclusivity, enhancing the reliability and generalizability of the findings by reflecting the composition of the larger population.

The study used multiple data collection methods to ensure depth and accuracy. Questionnaires served as the primary tool for quantitative data, targeting a broad range of staff across different departments. Semi-structured interviews were conducted with heads of units, providing qualitative insights into challenges, experiences, and project planning effectiveness. Additionally, document reviews helped validate primary data and offered background information on project implementation processes. These sources collectively enriched the data set, allowing for triangulation and more robust conclusions.

To ensure the instruments were effective, a pilot study was conducted with 15 participants from a similar public institution. The aim was to test clarity, reliability, and validity of the questionnaire. Feedback from the pilot led to necessary revisions, ensuring the final instrument accurately measured key constructs such as project scope, team competence, and risk planning. The study also ensured content and construct validity, incorporating input from various staff levels to confirm the questionnaire's relevance and clarity.

Reliability was assessed using Cronbach's alpha, with values above 0.7 considered acceptable. This statistical measure tested the internal consistency of the questionnaire items, confirming that they reliably measured the intended concepts. High reliability ensured that the results were consistent and dependable, reinforcing the study's credibility. If any item fell below the acceptable threshold, adjustments were made to improve the instrument's coherence and accuracy.

Data analysis combined both quantitative and qualitative techniques. Quantitative data were analyzed using descriptive statistics, correlation, and regression analysis to measure the strength and direction of relationships between planning practices and project performance. The regression model identified which factors most significantly predicted project outcomes. Meanwhile, qualitative data were thematically analyzed to uncover deeper insights from interviews, offering context and explanation for quantitative trends. The research adhered to strict ethical standards, ensuring confidentiality, informed consent,

cultural sensitivity, and honest reporting throughout the study.

Ethical considerations were prioritized in this study to ensure integrity, respect, and responsibility toward participants. Informed consent was obtained, ensuring participants understood the study's purpose, procedures, and their right to withdraw. Confidentiality and anonymity were maintained by removing personal identifiers and securely storing data. Participants were treated with dignity, with sensitivity to cultural and social contexts, and the researcher ensured no harm or discomfort. Integrity was upheld by reporting findings honestly, disclosing conflicts of interest, and properly acknowledging sources, ensuring the study adhered to the highest ethical standards.

4. Results and Discussion

This section presents the analysis and interpretation of the findings of the study in relation to the research question.

4.1 Response Rate

The study targeted 338 staff members from the EDCL Projects, selecting 183 respondents, including key leadership and staff from various departments such as Energy Distribution, Project Management, and Finance. A total of 180 questionnaires were distributed, with 146 returned, resulting in a response rate of 81.1%. This high response rate, along with the 3 direct interviews conducted, brought the total number of participants to 149, ensuring strong engagement and enhancing the reliability of the study's findings. The response rate suggests that the topic was relevant and of interest to the respondents, making the data collection process robust and reflective of the staff's perspectives.

4.2 Descriptive Statistics of Project Scope

This section presents an analysis of the research question and delves into the perceptions of respondents based on the survey questions. Descriptive statistics were employed to summarize and present the data in a clear and meaningful way. A Likert scale, ranging from 1 to 5, was utilized to gauge respondents' attitudes, with 5 indicating "Strongly Agree," 4 for "Agree," 3 for "Neutral," 2 for "Disagree," and 1 for "Strongly Disagree." This approach enabled the researchers to effectively interpret and categorize respondents' views on the study's key topics. The results of the descriptive analysis are provided in Table 1 below.

Table 1: Level of agreement of project scope and project performance

Statements	N	Mean	Std. Deviation
The project scope is clearly defined at the beginning of rural electrification projects.	146	3.93	.835
Changes to the project scope are effectively managed during the course of rural electrification projects.	146	4.30	.898
The defined project scope helps in delivering rural electrification projects on time.	146	4.42	.786
A well-structured project scope leads to better coordination among project stakeholders.	146	1.65	1.086
The project scope contributes significantly to the successful completion of rural electrification projects.	146	4.43	.787
Valid N (listwise)	146		

Source : Primary Data, 2025-**Key :** M=Mean ; SD=Standard Deviation

Table 1. presents the opinions of respondents regarding the relationship between project scope and the performance of the Electricity Access Rollout Program (EARP) in Nyamagabe District, Rwanda. The analysis addresses the first research objective, which seeks to analyze the effect of project scope on the performance of rural electricity distribution projects.

The responses indicate that the majority of participants perceive the project scope as a critical factor in the success of rural electrification projects. Respondents generally agreed that the project scope is clearly defined at the start of these projects, with a mean score of 3.93. This suggests that, in the early stages, the scope of the project is typically well outlined, and there is broad consensus regarding the clarity of the scope. The relatively low standard deviation of 0.835 supports this, indicating minimal disagreement among participants. The clarity in defining the scope at the outset of a project is essential for ensuring that all stakeholders understand the goals and deliverables, which can ultimately lead to smoother project execution.

Regarding the management of changes to the project scope during implementation, the mean score of 4.30 reflects a strong agreement that changes to the scope are effectively managed throughout the project. With a standard deviation of 0.898, there is a moderate level of agreement, suggesting that most respondents believe that any changes to the scope are handled in a manner that minimizes disruptions. Effective scope management is crucial for maintaining project timelines and avoiding unnecessary delays, particularly in rural electrification projects where unforeseen challenges can arise.

The statement "The defined project scope helps in delivering rural electrification projects on time" received the highest mean score of 4.42, showing that respondents strongly agree that a well-defined project scope contributes to the timely completion of these projects. The standard deviation of 0.786 indicates that the responses were quite

consistent, reflecting the general consensus that a well-structured scope is vital for keeping projects on track and ensuring timely delivery. This finding underscores the importance of setting clear boundaries and objectives for a project to avoid scope creep and delays. However, an interesting anomaly arises with the statement, "A well-structured project scope leads to better coordination among project stakeholders," which has a much lower mean score of 1.65. This could indicate that respondents did not view the project scope as significantly contributing to improved coordination between stakeholders. The high standard deviation of 1.086 further suggests considerable disagreement among participants regarding the effectiveness of the project scope in enhancing stakeholder coordination. This divergence in views may indicate that other factors, such as communication strategies or stakeholder engagement, play a more prominent role in coordination than the project scope itself.

Finally, the statement, "The project scope contributes significantly to the successful completion of rural electrification projects," received a mean score of 4.43, indicating strong agreement among respondents that the project scope plays a key role in the overall success of the project. With a standard deviation of 0.787, this response shows that while there is strong agreement on the importance of the project scope, some variation in responses still exists, suggesting that other factors may also contribute to project success.

From the findings, the results indicate that a well-defined project scope is widely recognized as an essential component for the successful and timely completion of rural electrification projects in Nyamagabe District. A clear project scope ensures that all stakeholders are aligned on project objectives and deliverables, and its effective management, especially in terms of scope changes, helps prevent delays. However, the lower agreement on the role of project scope in stakeholder coordination suggests that factors beyond the scope definition, such as

communication, collaboration mechanisms, and stakeholder involvement, may play a more significant role in ensuring effective coordination during project execution. These insights suggest that, while project scope is vital for the success of rural electrification projects, future project planning should also focus on enhancing coordination mechanisms and stakeholder engagement to maximize the impact of the scope definition.

The qualitative data from the interviews revealed that many respondents emphasized the critical role of a clearly defined project scope in ensuring the success of rural electrification projects. Several key stakeholders, including Heads of Units and project managers, agreed that having a well-articulated scope at the beginning of a project sets clear expectations, reduces confusion, and enhances coordination among team members. One interviewee mentioned, "A well-defined scope is the backbone of project planning; it ensures that all parties are aligned, which directly impacts our ability to meet deadlines and achieve our goals." This view was echoed by others, who noted that when the scope is clearly communicated, it significantly contributes to maintaining project timelines and minimizing delays caused by misunderstandings or scope creep.

However, some respondents also noted that while a clear scope is vital, it is not sufficient on its own for ensuring project success. Several interviewees pointed out the importance of effective communication and strong relationships among stakeholders for smooth coordination and problem-solving during project implementation. One

respondent from the Rwanda Universal Energy Access Program explained, "Coordination is not just about a defined scope it's about having regular communication and trust between all stakeholders." This indicates that, while a clear scope is necessary for guiding the project, fostering a collaborative environment and addressing challenges in real-time are equally important for achieving successful project outcomes.

These findings agree with previous studies that emphasize the importance of a clearly defined project scope in project success. For instance, research by Smith et al. (2018) highlights that a well-defined scope not only provides a roadmap for project execution but also ensures that all team members are aligned with the project objectives, reducing the risk of miscommunication and delays. Similarly, the insights from the interviews align with the work of Johnson and Carter (2017), who argue that effective communication and stakeholder engagement are crucial for the success of large-scale infrastructure projects. This suggests that while a defined project scope is essential, the ability to manage interpersonal relationships and communication channels remains key to navigating the complexities of rural electrification projects. Therefore, future projects should focus on both clear scope definition and enhancing collaborative efforts among stakeholders.

4.3 Correlation Analysis

The findings of the correlations between the independent variables and the dependent variables are summarized and presented in Table 2

Table 2: Correlation between independent variable and dependent variable

		Project scope	Project Performance
Project Scope	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	146	
Project Performance	Pearson Correlation	.718**	1
	Sig. (2-tailed)	.000	
	N	146	146

Source: Primary data, 2025

The correlation analysis in Table 2 shows a strong positive relationship between project scope and project performance, with a Pearson correlation coefficient of 0.718. This value indicates a significant and moderate to strong positive correlation, suggesting that as the project scope increases, project performance tends to improve as well. The p-value of 0.000 (which is less than 0.05) indicates that this correlation is statistically significant. With 146 participants in the analysis, the data strongly supports the idea that project scope plays an important role

in influencing project performance, highlighting its relevance in project management strategies.

These findings are in agreement with previous studies that emphasize the importance of clearly defined project scope in enhancing project performance. Research by Pinto and Slevin (2023) suggests that a well-defined project scope provides clear objectives, minimizes misunderstandings, and ensures that all team members are aligned, ultimately

contributing to better performance outcomes. Similarly, Chamber (2023) found that an increase in the scope of a project, when managed effectively, can lead to improvements in the overall quality, efficiency, and success of project deliverables. Therefore, this study reinforces the notion that proper management of project scope is crucial for optimizing project performance

4.4 Regression Analysis

A multiple regression analysis was performed in this section to identify the predictor and its contribution towards the criterion. It aims to determine the prediction of a single dependent variable from a group of independent variables. The multiple regression analysis was performed with all the assumptions complied with. Table 3 shows the model summary of the results.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.813 ^a	.660	.653	.25132

a. Predictors: (Constant), Project Scope

The model summary from the multiple regression analysis indicates a strong relationship between the independent variable (Project Scope) and the dependent variable (Project Performance). The correlation coefficient (R) is 0.813, suggesting a high degree of association between the variables. The R-squared value of 0.660 means that approximately 66% of the variance in project performance can be explained by the project scope. The adjusted R-

square value of 0.653 indicates that when adjusting for the number of predictors in the model, 65.3% of the variance in project performance is still accounted for by project scope. The standard error of the estimate is 0.25132, which gives an indication of the average distance that the observed values fall from the regression line. This suggests that the model is relatively accurate in predicting project performance based on project scope.

Table 4. ANOVA results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.425	3	5.808	91.956	.000 ^b
	Residual	8.969	142	.063		
	Total	26.394	145			

a. Dependent Variable: Project Scope
b. Predictors: (Constant), Project Performance

The ANOVA results in Table 4 provide important insights into the overall significance of the regression model. The regression sum of squares is 17.425, and with 3 degrees of freedom for the predictors, the mean square for the regression is 5.808. The F-value of 91.956 is highly significant, with a p-value of 0.000, indicating that the model as a whole significantly explains the variation in the dependent variable (Project Scope). The residual sum of squares is 8.969, with 142 degrees of freedom, resulting in

a residual mean square of 0.063. The total sum of squares is 26.394, representing the total variation in the dependent variable. Since the p-value is less than the standard significance level of 0.05, it can be concluded that the independent variable (Project Performance) significantly predicts the dependent variable (Project Scope), and the model is highly effective in explaining the variance in project scope.

Table 5. Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.460	.276		-1.665	.098
	Project Scope	.343	.134	.342	2.559	.011

a. Dependent Variable: Project Performance

The regression coefficients in Table 5 provide important information about the relationship between the independent variable (Project Scope) and the dependent variable (Project Performance). The unstandardized coefficient for Project Scope is 0.343, which indicates that for each unit an increase in Project Scope, Project Performance is expected to increase by 0.343 units. The standardized coefficient (Beta) for Project Scope is 0.342, showing a moderate positive effect of Project Scope on Project Performance. The t-value for Project Scope is 2.559, and the associated p-value is 0.011, which is less than the standard significance level of 0.05, indicating that Project Scope is a statistically significant predictor of Project Performance. The constant term (intercept) is -0.460 with a t-value of -1.665 and a p-value of 0.098, which is not statistically significant at the 0.05 level. This suggests that while Project Scope positively influences Project Performance, the constant value does not significantly affect the outcome when Project Scope is zero. Overall, the results suggest that Project Scope plays an important role in predicting Project Performance.

These findings are supported by previous studies, such as those by Lee (2018), who found that the scope of a project has a significant positive impact on its overall performance. Additionally, research by Johnson and Sarkozy (2020) confirmed that clear and well-defined project scope contributes to better project outcomes by enhancing focus and alignment among team members. The positive relationship between Project Scope and Project Performance is further corroborated by similar findings in the work of Roberts and Thompson (2024), who demonstrated that project scope clarity leads to improved performance by reducing ambiguities and ensuring that objectives are well understood and achievable. These studies emphasize the importance of managing project scope effectively to enhance the success of project performance.

5. Conclusion and Recommendations

5.1 Conclusion

In conclusion, this study highlights the critical role of a clearly defined project scope in ensuring the success of rural electrification projects in Nyamagabe District, Rwanda. The findings demonstrate that a well-defined project scope significantly influences project performance by improving coordination, preventing scope creep, and contributing to the timely and successful completion of projects. The analysis further emphasizes the importance of effective management of changes to the project scope throughout the project's lifecycle. Although communication and stakeholder engagement are also

crucial for project success, the study underscores that a strong and clear project scope serves as the foundation for effective project execution. Overall, the research reinforces the importance of strategic planning and scope management in rural electrification projects, providing valuable insights for future project development and implementation.

5.2 Recommendations

Based on the findings of the study, the following three recommendations should be made to improve the success of rural electrification projects in Nyamagabe District, Rwanda:

1. While a clear project scope is essential, the study highlights that improved coordination among stakeholders is crucial for project success. Future projects should prioritize regular communication and foster strong relationships between all stakeholders, ensuring that everyone is aligned on the project's objectives and progress. This can be achieved through more frequent meetings, transparent information sharing, and collaborative problem-solving strategies.
2. The study found that changes to the project scope are effectively managed, which positively impacts project performance. It is recommended that project managers should continue to monitor and adapt the project scope throughout the project lifecycle, ensuring that any changes are well documented, communicated, and integrated into the overall project plan. This will help minimize disruptions and ensure the project remains on track, meeting deadlines and objectives.
3. To ensure that the benefits of a well-defined project scope are maximized, it is essential to invest in training for project managers on best practices for scope definition and management. This training should include techniques for clearly outlining project objectives, handling scope changes, and managing stakeholder expectations, all of which contribute to successful project execution and performance.

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