

**INFLUENCE OF PUBLIC PRIVATE PARTNERSHIP DRIVERS ON
PERFORMANCE OF RENEWABLE ENERGY PROJECTS IN KENYA**

PHILIPH K.A CHAMDANY

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DECLARATION AND RECOMMENDATION

This thesis is my original work and has not been presented for examination in any other university.

Signed:

Date:

Philiph K.A Chamdany

BUS-3-3140-3/2023

This thesis has been submitted for examination with my approval as university supervisors.

Signature:

Date:

Mr. Moses Kithinji

KeMU Business School,

Kenya Methodist University

Signature:

Date:

Dr. Dorothy Kirimi (PhD)

KeMU Business School,

Kenya Methodist University

DEDICATION

I dedicate this thesis to my family, whose unwavering support, encouragement, and belief in my academic journey have been a constant source of motivation. Your patience and sacrifices have made this achievement possible. To my mentors and colleagues, who have inspired me to pursue excellence in research, I extend my deepest gratitude. This work is also dedicated to all professionals in the renewable energy sector striving for sustainable solutions to global energy challenges.

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ABBREVIATIONS AND ACRONYMS

AIPP	Association of Independent Power Producers
CAPM	Capital Asset Pricing Model
CSR	Corporate Social Responsibility
EBK	Engineers Board of Kenya
EPRA	Energy and Petroleum Regulatory Authority
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GLM	Generalized Linear Model
GLS	Generalized Least Squares
IPP	Independent Power Producer
KEREA	Kenya Renewable Energy Association
KPLC	Kenya Power and Lighting Company
MPT	Modern Portfolio Theory
PCA	Principal Component Analysis
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
RBV	Resource-Based View Theory
RE	Renewable Energy
REREC	Rural Electrification and Renewable Energy Corporation
VIF	Variance Inflation Factor
WLS	Weighted Least Squares

ABSTRACT

The growing global emphasis on clean energy transition has intensified the implementation of renewable energy projects, particularly through Public-Private Partnerships. However, the performance of such projects in Kenya has remained inconsistent, prompting the need to assess the influence of key PPP drivers financial structuring, stakeholder management, resource management and risk management on the performance of renewable energy projects in Kenya. The study was guided by theories such as the Pecking Order Theory, Stakeholder Theory, Resource-Based View Theory and Prospect Theory, which provided a multidimensional lens for examining how institutional and managerial practices shape project outcomes. The study adopted an explanatory research design. Primary data were collected using structured questionnaires, while secondary data were obtained from relevant project reports and regulatory agencies. The target population was 380. Sample size was 195. The stratified random sampling technique was the most appropriate approach for this study. The findings revealed that all four variables: financial structuring, stakeholder management, resource management, and risk management had a positive and statistically significant influence on project performance. The study concludes that the successful implementation of renewable energy projects through PPPs in Kenya requires strategic attention to financing models, inclusive stakeholder engagement, efficient resource allocation, and robust risk management frameworks. The study recommends strengthening PPP-driven renewable energy projects through short-term actions like expanding innovative financing options, enhancing stakeholder engagement, building technical capacity and adopting risk and climate resilience frameworks. Long-term priorities include creating a centralized financing hub, institutionalizing participatory governance, modernizing grids with storage solutions, and reinforcing regulatory frameworks with clear risk-sharing and policy consistency. The study also identifies gaps for future research, particularly the need to explore the roles of technological innovation, regulatory governance and longitudinal project tracking in the evolving renewable energy landscape.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Hydropower, geothermal, wind, and solar energy accounts for the most majority of Kenya's renewable energy production, which has contributed to the country's impressive 90% penetration rate. The country has taken the lead in Africa's renewable energy transition thanks to major projects like the Olkaria Geothermal Plants, the Lake Turkana Wind Power Project, and other grid-scale solar installations. To improve energy affordability, sustainability, and security, the government has prioritized the development of renewable energy sources through programs like the Least Cost Power Development Plan and Vision 2030 (Mwatika & Shalle, 2020). These projects would not have been possible without the assistance of Public-Private Partnerships (PPPs), which pool resources and knowledge from the private sector with those of the public sector. Project delays, cost overruns, financial sustainability concerns, and governance inefficiencies restrict the full potential of renewable energy projects in Kenya, despite the progress that has been made (Mungai et al., 2022). Many projects face funding constraints, bureaucratic hurdles, weak regulatory frameworks, and legal disputes, as seen in the stalled Kinangop Wind Park. Furthermore, corruption and inefficiencies in contract execution have led to inflated project costs and reduced investor confidence. While some studies have explored the impact of financing structures and market risks on renewable energy projects, there remains a need to examine the influence of key PPP drivers such as financial structuring,

stakeholder engagement, resource allocation, and risk management on project performance. Addressing these challenges is critical to ensuring that renewable energy projects contribute effectively to Kenya's long-term energy sustainability and economic development (Eze et al., 2022).

Financial structuring plays a fundamental role in the success of PPP-driven renewable energy projects, as it determines how capital is mobilized, allocated, and managed. The complexity and capital-intensive nature of renewable energy projects require innovative financial mechanisms, including public funding, private equity, concessional loans and green bonds (Amir & Khan, 2022). Well-structured financial arrangements ensure project bankability, attract private investors, and enhance project sustainability. However, inadequate financial structuring can lead to project delays, cost overruns, or even failure. Understanding the influence of financial structuring on project performance will provide insights into the most effective funding models and financial policies that can optimize the success of renewable energy projects in Kenya (Mwatika & Shalle, 2020).

In addition to financial structuring, stakeholder management is a critical determinant of project success. Renewable energy projects involve multiple stakeholders, including government agencies, private investors, regulatory bodies, local communities, and environmental groups (Antwi & Ley, 2021). Effective stakeholder management fosters collaboration, minimizes conflicts, and ensures that all parties are aligned toward common objectives. Poor stakeholder engagement can lead to opposition, regulatory bottlenecks, and social resistance, all of which can delay or derail projects. By assessing how stakeholder management influences the performance of renewable energy projects, this

study will provide strategies for improving engagement, communication, and participation to enhance project acceptance and sustainability (Eze et al., 2022).

Resource management is another essential factor that affects the performance of renewable energy projects. These projects require the efficient allocation of financial, human, and material resources to ensure smooth implementation and operational efficiency (Mungai et al., 2022). Resource mismanagement can result in inefficiencies, project delays, and increased costs, ultimately affecting the success of renewable energy initiatives. Proper resource planning, optimization, and distribution enhance project execution, enabling projects to meet their intended capacity, budget, and timeline. Establishing the influence of resource management on the performance of renewable energy projects will contribute to better project planning and execution strategies in the Kenyan energy sector (Chisika & Yeom, 2021).

Risk management is equally crucial in determining the performance of PPP-driven renewable energy projects. Such projects face various risks, including financial, operational, regulatory, environmental, and technological risks, which can impact their viability and sustainability (Eze et al., 2022). Effective risk assessment and mitigation strategies help in reducing uncertainties and ensuring project continuity. Without proper risk management frameworks, renewable energy projects may encounter financial losses, regulatory non-compliance, and environmental challenges, ultimately affecting their performance (Othman & Khallaf, 2022).

1.1.1 Performance of Renewable Energy Projects from a Global Perspective

United States: The United States has been a global leader in renewable energy deployment, with significant investments in wind, solar, and hydroelectric power. The country's renewable energy sector has experienced rapid growth, driven by federal tax incentives, state-level renewable portfolio standards, and private sector investments. The Production Tax Credit (PTC) and Investment Tax Credit (ITC) have played a key role in enhancing project viability and attracting investors (Mai et al., 2016). Despite these successes, challenges such as permitting delays, grid integration issues, and policy uncertainty have affected the efficiency of renewable energy projects. The offshore wind sector, for example, has faced bureaucratic and environmental challenges, slowing the implementation of large-scale projects like the Vineyard Wind project off the coast of Massachusetts. Additionally, fluctuations in federal energy policies have created uncertainties for long-term project financing and development, highlighting the need for stable regulatory frameworks to sustain renewable energy growth (Raghutla et al., 2021).

Germany's renewable energy transition, known as the *Energiewende*, has been one of the most ambitious in the world, with the country aiming to phase out nuclear power while increasing reliance on wind, solar, and biomass energy. The introduction of the Renewable Energy Sources Act (EEG) in 2000 facilitated the rapid expansion of renewable energy by guaranteeing fixed feed-in tariffs for producers. This policy spurred large-scale investments and significantly increased the share of renewables in the national energy mix (Cai et al., 2024). However, despite Germany's progress, the high costs of energy subsidies and grid congestion have posed significant challenges. The country has had to

scale back some financial incentives, leading to market uncertainty and project delays. Furthermore, integrating intermittent sources like wind and solar into the national grid has required substantial infrastructure upgrades, increasing the overall cost of the energy transition. Nevertheless, Germany remains a global benchmark for countries looking to transition towards renewable energy through strong policy support and stakeholder engagement (Kyei et al., 2025).

The Chinese government's strong policies and massive investments in renewable energy sources including wind, solar, and hydropower have propelled the country to the position of leading producer and consumer of renewable energy globally. The country accounts for nearly half of the world's installed renewable energy capacity, with massive projects such as the Tengger Desert Solar Park and the Three Gorges Hydropower Plant showcasing China's commitment to clean energy. Government support through subsidies, low-interest loans, and state-led initiatives has played a critical role in expanding renewable energy production (Cai et al., 2024). However, China's renewable energy projects have faced performance challenges, including grid curtailment issues, where excess power generated by wind and solar plants cannot be integrated into the grid due to transmission constraints. Additionally, rapid expansion has led to inefficiencies in project planning and execution, with some renewable energy plants struggling to operate at full capacity. Despite these challenges, China continues to lead global efforts in renewable energy expansion and technological advancements (Raghutla et al., 2021).

Australia has made significant strides in renewable energy, with wind and solar power contributing a growing share to the national electricity grid. Government policies,

including the Renewable Energy Target (RET) and various state-level incentives, have spurred investment in large-scale solar farms and wind projects. The country's strong solar potential has led to a surge in rooftop solar installations, making Australia one of the highest per capita users of solar energy globally (Carroll, 2023). However, despite these advancements, renewable energy projects in Australia have faced challenges related to grid reliability and energy storage. The intermittent nature of solar and wind power has created instability in the national grid, prompting the need for large-scale battery storage solutions such as the Tesla Big Battery in South Australia. Additionally, policy uncertainty and regulatory changes have led to delays in project approvals and investment decisions. While Australia continues to expand its renewable energy sector, addressing grid stability and policy consistency remains crucial to enhancing the long-term performance of its renewable energy projects (Kraal et al., 2025).

1.1.2 Performance of Renewable Energy Projects from a Regional Perspective

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in South Africa has been instrumental in attracting investors from around the world and allowing the country to make significant strides in renewable energy development. Through Public-Private Partnerships (PPPs), financial structuring has been optimized to encourage independent power producers (IPPs) to develop wind, solar, and hydro projects (Owusu-Manu et al., 2021). The program has led to the deployment of over 7 GW of renewable energy capacity, with projects like Jasper Solar Power Project (96 MW) and Kangnas Wind Farm (140 MW) benefiting from structured financing mechanisms such as power purchase agreements (PPAs). However, financial

sustainability remains a challenge, as Eskom, the state-owned utility, has faced liquidity issues, affecting payments to IPPs. To mitigate these risks, South Africa is working on alternative financing models such as green bonds and blended finance, ensuring long-term financial viability for renewable energy projects (Akomea-Frimpong et al., 2023).

According to Michaelowa et al. (2021), Morocco has successfully implemented large-scale renewable energy projects by fostering strong stakeholder collaboration between the government, private investors, international donors, and local communities. The government, through the Moroccan Agency for Sustainable Energy (MASEN), has played a pivotal role in coordinating renewable energy initiatives, ensuring that both private sector and public sector interests align. The Noor Ouarzazate Solar Complex (580 MW) stands as one of the best examples of well-executed stakeholder management, involving financing from international organizations such as the World Bank, African Development Bank (AfDB) and European Investment Bank (EIB). By integrating local communities into project planning and ensuring transparency in regulatory policies, Morocco has managed to minimize resistance to large-scale renewable developments. However, challenges such as balancing local job creation with foreign expertise in project implementation remain, requiring continued stakeholder engagement strategies to enhance long-term project acceptance (Chileshe et al., 2022).

Ethiopia's renewable energy sector is heavily dependent on hydropower, which contributes over 90% of the country's electricity generation. While large-scale projects such as the Grand Ethiopian Renaissance Dam (6.45 GW) offer immense potential, they also present significant risks related to climate variability, geopolitical tensions and

financial sustainability (Chileshe et al., 2022). Ethiopia has implemented risk mitigation strategies by diversifying its renewable energy portfolio, investing in wind and geothermal projects such as the Adama Wind Farm (153 MW) and Aluto-Langano Geothermal Plant (70 MW planned capacity). To address financial risks, the Ethiopian government has secured development financing from international institutions like the World Bank and AfDB, reducing dependency on state funding (Voumik et al., 2023). However, regional disputes over water rights with Sudan and Egypt pose geopolitical risks to Ethiopia's hydropower projects. Moving forward, Ethiopia must strengthen its risk management strategies by investing in energy storage, diversified renewables, and diplomatic engagement to ensure the long-term stability of its renewable energy sector (Barrie et al., 2024).

Ghana has taken a structured approach to financing its renewable energy sector, leveraging Public-Private Partnerships and development funding to scale up its clean energy capacity. The Bui Dam (400 MW) and Akosombo Dam (1,020 MW) have been financed through government-backed loans, international grants, and private investment, ensuring financial sustainability (Michaelowa et al., 2021). Ghana's Renewable Energy Act has facilitated structured financing models for off-grid solar mini-grids and commercial solar installations, improving energy access in rural areas. The Nzema Solar Plant (155 MW planned capacity) is an example of how Ghana has efficiently managed land and capital investments to expand its solar energy portfolio. However, the country faces financial risks due to fluctuating hydropower output caused by climate change. To mitigate this, Ghana is exploring private sector-driven wind and solar investments while

optimizing energy storage solutions to ensure continuous power supply even during periods of low hydroelectric generation (Oguanobi & Joel, 2024).

Rwanda has emerged as a leader in decentralized renewable energy solutions, focusing on solar mini-grids and off-grid electrification to expand energy access. The government has actively engaged local communities, private investors, and international partners to implement renewable energy projects, ensuring broad stakeholder support (Voumik et al., 2023). Projects like the Gigawatt Solar Plant (8.5 MW) and initiatives such as Scaling Solar Rwanda have been financed through PPPs and grants from organizations like the International Finance Corporation (IFC) and Green Climate Fund (GCF). Rwanda has also implemented risk management strategies by diversifying its renewable energy mix and reducing dependency on a single power source. However, limited grid capacity and financial constraints pose challenges to further expansion. To mitigate these risks, Rwanda is prioritizing energy storage investments, grid modernization, and policy incentives for private sector participation in renewable energy development (Sovacool, 2021).

1.1.3 Performance of Renewable Energy Projects from a Local Perspective

Kenya has made significant progress in renewable energy development through structured financing mechanisms that attract both public and private investments. The country has leveraged PPPs, concessional loans, green bonds, and donor funding to finance large-scale renewable energy projects (Oluoch et al., 2021). The KenGen and the GDC have played a pivotal role in securing financing for geothermal and hydroelectric projects (Chileshe et al., 2022). Notable initiatives include the Olkaria Geothermal Plants (over 800 MW combined capacity), which have been financed through a mix of government funding,

private sector investments, and loans from institutions such as the World Bank and the African Development Bank (AfDB). While financial structuring has enabled the growth of renewable energy, challenges such as high initial capital costs, financial risks, and limited private sector participation remain. To enhance sustainability, Kenya is exploring green financing mechanisms, energy auctions, and innovative investment models to reduce dependence on donor funding and increase private sector involvement (Barrie et al., 2024).

Effective stakeholder management has been crucial in the implementation of renewable energy projects in Kenya, involving government agencies, private investors, local communities, and international development partners. The Ministry of Energy, KenGen, Kenya Power, and the Energy and Petroleum Regulatory Authority (EPRA) have played a central role in policy formulation and project execution (Chileshe et al., 2022). Private sector participation has increased, with independent power producers (IPPs) contributing significantly to the energy mix through projects such as Lake Turkana Wind Power (310 MW) and Garissa Solar Power Plant (54 MW). Community engagement has also been prioritized, particularly in geothermal projects, where benefit-sharing agreements ensure that local communities receive economic and social benefits from energy developments. However, stakeholder conflicts have emerged, particularly over land acquisition, environmental concerns, and delays in compensation. Strengthening stakeholder coordination through transparent consultation processes, community development initiatives, and fair compensation mechanisms will be essential for the continued success of renewable energy projects (Ndi, 2024).

Kenya is endowed with abundant renewable energy resources, including geothermal, wind, solar, and hydroelectric power, which have been efficiently harnessed to enhance energy security. Geothermal energy, concentrated in the Rift Valley, has been well managed, making Kenya the leading geothermal producer in Africa. Hydroelectric power from dams along major rivers such as the Tana and Turkwel Rivers continues to contribute to the national grid (Mungai et al., 2022). The Lake Turkana Wind Power project has capitalized on strong wind currents in northern Kenya, while solar power initiatives like the Garissa Solar Plant demonstrate effective land and resource utilization. However, seasonal fluctuations in hydroelectric power due to droughts and climate change highlight the need for diversified energy production and energy storage solutions. To further improve resource management, Kenya is focusing on integrated energy planning, off-grid solutions for rural electrification, and investments in battery storage technology to optimize the use of intermittent renewable sources (Gannon et al., 2021).

Renewable energy projects in Kenya face several risks, including climate variability, regulatory uncertainties, financial constraints, and technological challenges. Hydropower projects are particularly vulnerable to droughts and changing rainfall patterns, which reduce water levels and affect electricity generation (Eze et al., 2022). Geothermal projects, while relatively stable, encounter seismic risks and high drilling costs, which can deter private investment. Regulatory risks also pose a challenge, as delays in power purchase agreements (PPAs), policy inconsistencies, and licensing hurdles can slow down project implementation. Project delays and cost overruns are also possible outcomes of environmental concerns and land acquisition problems. Kenya is implementing climate

resilience initiatives, reforming regulations, and fostering Public-Private Partnerships to make the renewable energy investment climate more stable, all in an effort to lessen the impact of these risks. Renewable energy projects need more adaptable funding models and more robust risk assessment frameworks if they are to succeed in the long run (Olando et al., 2024).

Integrating renewable energy projects into Kenya's national grid is a critical performance measure. More than three quarters of the population now has access to power, thanks in large part to the spread of renewable energy sources across the nation (Othman & Khallaf, 2022). The intermittent nature of renewable energy sources like wind and solar necessitates investments in smart grid and energy storage technologies, which add another layer of complexity to the management of grid stability. The government is working on solutions such as the Kenya Green Mini-Grid Program, which supports decentralized renewable energy projects to enhance rural electrification. Additionally, ongoing investments in grid modernization, transmission infrastructure, and interconnection with neighboring countries through the East African Power Pool (EAPP) will help improve the reliability of renewable energy integration (Odhiambo et al., 2020).

Kenya has positioned itself as a regional leader in renewable energy, with ambitious targets to achieve 100% clean energy by 2030. The country is expanding investments in green hydrogen, floating solar farms, and energy storage solutions to enhance the sustainability of its energy sector (Eze et al., 2022). Future projects, such as the Menengai Geothermal Expansion and the expansion of solar mini-grids will further diversify Kenya's energy mix and increase resilience against climate change. Additionally, Kenya

is exploring carbon trading and climate financing mechanisms to attract more investments in renewables. By addressing challenges related to financial sustainability, regulatory clarity, and stakeholder inclusivity, Kenya is well on its way to becoming a global model for clean energy transition and sustainable energy development (Olando et al., 2024).

1.2 Statement of the Problem

The adoption of renewable energy is a strategic initiative for Kenya in its quest to meet the growing energy demand and sustainability goals. Public-Private Partnerships (PPPs) have emerged as indispensable strategy for financing and implementing such projects. However, despite the potential, the success of renewable energy PPPs in Kenya remains inconsistent and often inefficient.

A significant challenge lies ensuring the financial sustainability of these projects. Many initiatives struggle with constraints such as unpredictable tariff regimes, high upfront costs and liquidity. These financial bottlenecks lead to project delays, cost overruns, and in some cases, complete abandonment, undermining the sector's growth and investor confidence.

These financial issues are aggravated by both institutional and governance weaknesses. Bureaucracy, weak coordination between private and public institutions, and concerns over rooted culture of corruption create an unreliable environment. Furthermore, lack of expertise specialized in PPP negotiations often results in skewed contracts that favor private entities at the detriment of public interests or ensure long term viability of the project.

While previous research has greatly managed to identify various influencing factors, a clear and direct understanding of how these drivers: financial structuring, resource management, risk management and stakeholder engagement collectively impact key performance metrics is still lacking. There is urgent need for a focused empirical investigation that links these drivers directly to outcomes like project completion rates, quality compliance, cost efficiency, and schedule adherence within the Kenyan context. Therefore, this study seeks to provide these empirical insights to identify the critical factors for enhancing the success of renewable energy PPPs in Kenya.

1.3 Research Objectives

This study adhered to the subsequent general and specific objectives:

1.3.1 General Objective

To determine the influence of public private partnership drivers on performance of renewable energy projects in Kenya.

1.3.2 Specific Objectives

The specific objectives included:

- i. To examine the influence of financial structuring on performance of renewable energy projects in Kenya.
- ii. To assess the influence of stakeholder management on performance of renewable energy projects in Kenya.
- iii. To establish the influence of resource management on performance of renewable energy projects in Kenya.

- iv. To establish the influence of risk management on performance of renewable energy projects in Kenya.

1.4 Hypotheses of the study

The study was guided by the following hypotheses

H₀₁: Financial structuring has no statistically significant influence on performance of renewable energy projects in Kenya.

H₀₂: Stakeholder management has no statistically significant influence on performance of renewable energy projects in Kenya.

H₀₃: Resource management has no statistically significant influence on performance of renewable energy projects in Kenya.

H₀₄: Risk management has no statistically significant influence on performance of renewable energy projects in Kenya.

1.5 Significance of the Study

1.5.1 Government Agencies and Policymakers

The findings will inform the development of policies and regulatory frameworks that foster effective collaboration between the public and private sectors. By understanding how financial structuring, stakeholder management, resource allocation and risk mitigation influence project performance, policymakers can formulate strategies that attract private investment while ensuring regulatory compliance and sustainability.

1.5.2 Private Sector Investors and Financial Institutions

Private sector investors and financial institutions will also gain from this study, as it will provide crucial insights into the financial structuring of renewable energy projects. Investors require clear, well-defined risk-return profiles before committing capital to large-scale projects. By highlighting effective financial strategies, risk management practices, and resource allocation models, the study will help financial institutions make informed lending and investment decisions. This will, in turn, encourage more private sector participation in Kenya's renewable energy sector, increasing the availability of funds for green energy projects.

1.5.3 Project Developers and Managers

Project developers and managers will benefit from an in-depth understanding of how to optimize stakeholder engagement, streamline resource management and mitigate risks associated with PPP-led renewable energy initiatives. Effective coordination between public and private entities is critical for project success and the study's findings will provide practical recommendations on how to navigate complex stakeholder

environments, improve operational efficiency, and ensure that projects meet their intended goals. This will lead to enhanced project sustainability, reduced implementation delays, and improved financial and environmental outcomes.

1.5.4 Academics and Researchers

This study lays the groundwork for future studies on Public-Private Partnerships (PPPs) in renewable energy production, which will benefit academics and scholars. This research will add to what is already known and provide light on potential new avenues for investigation by providing hard data on the connection between PPP drivers and project success. It will also contribute to academic discussions on sustainable development, energy policy, and infrastructure financing, thereby supporting continued innovation and scholarly contributions in these fields.

1.6 Scope of the Study

The study examined the influence of PPP drivers on the performance of renewable energy projects in Kenya, focusing on financial structuring, stakeholder management, resource allocation, and risk management. The unit of observation for the study was individual stakeholders involved in renewable energy projects under PPPs, including government officials, private investors, project managers, engineers, financial analysts, and utility company representatives. These individuals provided insights into the key PPP drivers that influenced project performance. The unit of analysis was renewable energy projects implemented under PPP arrangements in Kenya, with performance indicators evaluated at the project level, focusing on financial viability, stakeholder engagement effectiveness, resource utilization efficiency, and risk mitigation strategies.

The study was justified by the accessibility of these stakeholders, who were directly involved in decision-making, financing, implementation, and regulation of renewable energy projects, making them available for surveys, interviews, and secondary data collection. Their participation was relevant, as they interacted with the key PPP drivers affecting project performance. Additionally, the diversity of the population ensured that perspectives from both government institutions and private sector players were captured, providing a holistic view of PPP-driven renewable energy projects. The research was conducted over four months (March 2025 to June 2025), with activities including literature review, data collection, analysis, and reporting, ensuring a structured and comprehensive investigation into how PPP drivers impacted the performance of renewable energy projects in Kenya.

1.7 Limitations and Delimitations of the Study

This study was subject to several limitations that may have affected the scope and generalizability of its findings. First, the study relied on self-reported data from key stakeholders involved in renewable energy projects, which may have been prone to response bias, misrepresentation, or subjectivity. Additionally, variations in the level of expertise, understanding, and willingness of respondents to provide detailed insights may have influenced the accuracy and consistency of the data collected. Another limitation was the potential influence of external factors such as changes in government policies, economic fluctuations, and technological advancements, which may have impacted the performance of renewable energy projects but were beyond the control of the study. Furthermore, the study focused on a specific set of PPP drivers financial structuring,

stakeholder management, resource management, and risk management while other factors influencing project performance, such as political interference, environmental conditions, or market demand, may not have been fully accounted for.

Despite these limitations, the study had clear delimitations to maintain its focus and relevance. It was confined to renewable energy projects in Kenya that were implemented through Public-Private Partnerships, thereby ensuring that the findings specifically addressed the dynamics of PPP-driven energy initiatives in the country. The study also limited its scope to examining the influence of financial structuring, stakeholder management, resource management, and risk management on project performance, excluding other potential factors that may not have directly aligned with the research objectives. Data collection was restricted to selected stakeholders such as project managers, government agencies, private sector investors, and regulatory bodies, ensuring that responses came from individuals with direct involvement and knowledge of PPP operations in renewable energy. Additionally, the study focused on projects that were operational or in advanced stages of implementation, excluding those in early conceptualization phases to ensure the assessment of tangible outcomes. These delimitations helped ensure that the research remained manageable while providing valuable insights into the role of PPP drivers in enhancing the performance of renewable energy projects in Kenya.

1.8 Assumptions of the Study

This study assumed that the selected respondents provided reliable, accurate, and unbiased information regarding PPP in renewable energy projects, allowing for valid measurement of constructs related to financial structuring, stakeholder management, resource management, and risk management. The study further assumed that the data collection instruments were robust enough to capture relevant information and that any variations in project performance measures were attributable, at least in part, to the identified PPP drivers rather than external factors.

Additionally, the study presumed that the sampled renewable energy projects reflected the broader Kenyan context, ensuring that the findings were generalizable and applicable across similar settings in the country. It also assumed that all involved parties in the projects operated within the established legal and policy frameworks and that the macroeconomic environment remained sufficiently stable during the study period so as not to significantly distort the relationships under investigation. Moreover, the study took for granted that, throughout the study, the theoretical underpinnings of PPP drivers namely financial structuring, stakeholder engagement, resource allocation, and risk mitigation remained consistent, enabling their measurement and subsequent correlation with project performance to be meaningful and accurate.

1.9 Operational Definition of Key Terms

The research is based on the following basic terms as defined.

- Financial Structuring:** The process of planning a project's funding, capital allocation and investment strategies to ensure financial feasibility and sustainability (Cherkos & Jha, 2021).
- Performance of Renewable Energy Projects:** Assessment of renewable energy projects' efficiency, cost-effectiveness, sustainability, and energy output (Casady, 2021).
- Public-Private Partnership Drivers:** The key factors that influence the success and effectiveness of collaborations between the public and private sectors in delivering renewable energy projects, including financial structuring, stakeholder management, resource management, and risk management (Oluoch et al., 2021).
- Resource Management:** The strategic allocation, utilization and optimization of human, financial and material resources to ensure the successful implementation and sustainability of renewable energy projects (Othman & Khallaf, 2022).

Risk Management: The identification, assessment, and mitigation of financial, operational, regulatory and environmental risks that potentially affect renewable energy project execution and performance (Ndi, 2024).

Stakeholder Management: The methodical identification, engagement, and collaboration with individuals or groups interested in or affected by renewable energy projects to resolve their concerns and obtain their support for project success (Othman & Khallaf, 2022).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with the theoretical framework, the conceptual framework, empirical review and research gap.

2.2 Theoretical Framework

Theories that guided the current study include the pecking order theory, the stakeholder theory, the resource-based view theory and the prospect theory. However, the Stakeholder Theory underpins this study by providing a strategic framework for analyzing how PPP drivers influence the performance of renewable energy projects in Kenya. PPPs involve multiple stakeholders, including government agencies, private investors, regulatory bodies, local communities and utility companies, each with different interests, expectations, and levels of influence. According to Freeman (1984), organizations and projects do not operate in isolation but are shaped by their interactions with key stakeholders. In the context of renewable energy PPPs, effective stakeholder management is crucial for ensuring smooth project implementation, regulatory compliance, financial sustainability, and social acceptance.

2.2.1 The Pecking Order Theory

The Pecking Order Theory (POT), formulated by Myers and Majluf in 1984, serves as a financial framework elucidating the manner in which firms rank their financing alternatives. This hierarchy is grounded in the objective of reducing financing expenses

and addressing the challenges posed by information asymmetry (Zakaria & Ahmadian, 2021). The theory posits that enterprises and institutions tend to prioritize financing investments initially through retained earnings, subsequently through debt financing, and ultimately, as a final option, through equity issuance. The underlying rationale is that external financing particularly equity introduces risks due to market uncertainties and investor skepticism, making it less desirable. In the context of PPPs in renewable energy projects in Kenya, POT provides a framework for understanding how financial structuring decisions are made to enhance project performance while mitigating financial risks (Fleta-Asin & Muñoz, 2024).

In Kenya's renewable energy sector, financial structuring follows a hierarchy that aligns with POT. Government agencies and private sector investors prefer concessional loans and grants over commercial loans and private equity. Projects such as Olkaria Geothermal and Lake Turkana Wind Power have been funded through a mix of retained earnings, concessional loans from multilateral organizations like the World Bank, and private debt financing (Liu et al., 2023). These financing strategies reflect POT's assumption that low-cost financing is prioritized to minimize financial risk and ensure the project's economic sustainability. Additionally, the structuring of Power Purchase Agreements (PPAs) ensures revenue certainty before seeking additional financing, demonstrating the cautious financial approach that aligns with POT's hierarchy of funding preferences (Rocha & Camargos, 2023).

Another key aspect of financial structuring explained by POT is the reliance on debt financing before resorting to external equity. In Kenya, independent power producers

(IPPs) and state-owned energy firms often prefer structured debt instruments such as green bonds, syndicated loans and government-backed infrastructure funds to raise capital (Stritzke & Jain, 2021). Debt financing is seen as less risky than equity issuance, as it does not dilute ownership or subject projects to fluctuating market conditions. The government's preference for public debt, infrastructure financing from development banks, and private sector project loans aligns with POT's assumption that organizations seek to maintain control over financing while securing long-term project sustainability (Ha & Kumar, 2021).

Financial structuring in PPP-driven renewable energy projects is influenced by information asymmetry, a central concept in POT. Investors and lenders face uncertainty regarding project risks, regulatory changes and expected returns, leading to reluctance in providing financing without guarantees (Sovacool, 2021). This explains why many renewable energy projects in Kenya secure long-term PPAs with KPLC before finalizing financing arrangements. Furthermore, blended financing models combining public funds with private investments are commonly used to balance risk exposure and ensure project viability. The financial structuring of geothermal, wind, and solar projects in Kenya reflects the strategic selection of funding sources to minimize risks and optimize capital allocation, as proposed by POT (Voumik et al., 2023).

Despite its applicability, POT has limitations when explaining financial structuring in renewable energy PPPs. The theory assumes that debt is always preferable to equity, but in reality, high levels of debt can increase financial strain, especially in capital-intensive projects (Ha & Kumar, 2021). Additionally, POT does not account for government

policies, regulatory frameworks, and economic factors that significantly influence financial decisions in Kenya's energy sector. In some cases, equity financing though less preferred becomes necessary to diversify investment risks and attract long-term investors, particularly for high-risk, high-return energy projects. Furthermore, renewable energy financing requires flexible financial models that accommodate external investments, subsidies, and risk-sharing mechanisms, which POT does not explicitly address (Rocha & Camargos, 2023).

Despite these critiques, the Pecking Order Theory remains highly relevant in explaining financial structuring in PPP-driven renewable energy projects in Kenya. The theory provides a logical framework for understanding why governments and private investors prioritize certain financing sources over others. It helps explain why concessional loans, grants, and structured debt instruments dominate Kenya's renewable energy financing landscape while equity issuance remains limited. By applying POT, this study can effectively analyze financial structuring strategies used in renewable energy PPPs and their impact on project performance, offering insights for policymakers and investors on sustainable financing approaches for Kenya's clean energy sector.

2.2.2 Stakeholder Theory

According to Rocha and Camargos (2023), the Stakeholder Theory, which was created by Freeman (1984), contends that organizations do not function in isolation but are instead influenced by many stakeholders who have varying levels of influence on decision-making and the success of projects. These stakeholders share a variety of interests, expectations, and levels of influence. For the purpose of achieving long-term

sustainability and performance, the theory proposes that enterprises and projects should give priority to the interests of all stakeholders rather than just shareholders. In the context of PPP renewable energy projects in Kenya, stakeholder management plays a critical role in ensuring smooth project implementation, regulatory compliance, social acceptance, and environmental sustainability. The theory provides a strategic framework for managing interactions with government agencies, private investors, regulatory bodies, local communities, and environmental organizations, who all have a vested interest in the performance of renewable energy initiatives (Chisika & Yeom, 2021).

According to Chileshe et al. (2022), effective stakeholder management in Kenya's renewable energy sector requires identifying and engaging key players from project inception to execution. According to Stakeholder Theory, projects that integrate early and continuous stakeholder consultation are more likely to gain public support, secure regulatory approvals, and minimize opposition. For instance, the Lake Turkana Wind Power Project, the largest wind farm in Africa, faced legal challenges due to inadequate community involvement and land rights disputes. Applying Stakeholder Theory in such projects ensures that all affected parties are engaged proactively, reducing the likelihood of conflicts, delays, and financial losses. The theory encourages collaborative decision-making, ensuring that stakeholders contribute to project planning, risk assessment, and benefit-sharing agreements that enhance long-term project sustainability (Rocha & Camargos, 2023).

Another key aspect of Stakeholder Theory in renewable energy projects is the balancing of diverse stakeholder interests. In Kenya, government agencies focus on policy and

regulation, private investors prioritize financial returns, while local communities emphasize land rights and environmental sustainability (Oguanobi & Joel, 2024). Stakeholder Theory suggests that project developers must consider and integrate these concerns equitably, ensuring that projects deliver economic, social, and environmental benefits. For example, successful geothermal projects in Kenya, such as Olkaria Geothermal Power Plants, have established community compensation frameworks and corporate social responsibility (CSR) programs, reinforcing the importance of balancing stakeholder interests. Without such approaches, renewable energy projects risk community resistance, regulatory hurdles, and operational inefficiencies, ultimately affecting their performance (Chisika & Yeom, 2021).

Furthermore, Stakeholder Theory underscores the importance of transparency and trust-building in stakeholder management. In PPP renewable energy projects, lack of transparency can lead to mistrust, legal battles, and project delays. For instance, some solar energy projects in Kenya have faced scrutiny over unclear land acquisition processes and exclusion of local communities in decision-making (Mungai et al., 2022). Stakeholder Theory promotes open communication, regular stakeholder meetings, and participatory governance, ensuring that projects gain public legitimacy and long-term community support. By fostering stakeholder inclusivity, renewable energy projects can mitigate risks associated with social resistance, policy changes, and investor uncertainty, leading to improved performance and sustainability (Ali et al., 2024).

Despite its applicability, Stakeholder Theory has some limitations when explaining stakeholder management in renewable energy PPPs. The theory assumes that all

stakeholders have equal influence and can be effectively engaged, but in reality, power dynamics and conflicting interests often hinder fair engagement. In Kenya, private investors and government agencies may dominate decision-making, sidelining local communities and environmental organizations (Mungai et al., 2022). Additionally, the theory does not provide a structured framework for prioritizing stakeholders, making it challenging to manage competing interests effectively. Some critics argue that Stakeholder Theory is idealistic, as it assumes that organizations will always act ethically and equitably, whereas profit motives and political interests often drive project decisions. In complex PPP energy projects, where financial constraints, regulatory pressures, and political factors shape decision-making, the theory's emphasis on broad stakeholder engagement may not always be practical or achievable (Ali et al., 2024).

Despite these critiques, Stakeholder Theory remains a valuable framework for explaining stakeholder management in Kenya's renewable energy sector. The theory provides a structured approach to engaging key stakeholders, balancing competing interests, and fostering transparency, which are essential for the success and sustainability of PPP-driven renewable energy projects. It offers a proactive model for mitigating conflicts, ensuring regulatory compliance, and improving community relations, all of which contribute to enhanced project efficiency, financial performance, and long-term viability. By applying Stakeholder Theory, this study will provide insights into how effective stakeholder engagement strategies can enhance the performance of renewable energy projects in Kenya, making them more socially acceptable, economically viable, and environmentally sustainable.

2.2.3 The Resource-Based View Theory

Barney expanded upon the work of Wernerfelt in 1991, who had initially proposed the Resource-Based View (RBV) Theory in 1984. How a business gets, uses, and manages its resources determines its performance and competitive advantage (Casady, 2021). Persistent competitive advantage is supposedly offered by resources that are valuable, uncommon, unique, and cannot be replaced, as stated by the RBV. Successful public-private renewable energy projects in Kenya rely on well-managed resources to ensure long-term financial viability, efficient energy generation, and the development of necessary infrastructure. Improved project management and smart utilization of renewable energy sources should lead to longer-lasting and more efficient power generation (Mungai et al., 2022).

One of the key aspects of resource management in Kenya's renewable energy sector is the efficient utilization of natural resources such as geothermal, wind, solar, and hydro energy. Kenya is rich in renewable energy potential, but underutilization due to land acquisition challenges, grid limitations, and lack of investment in advanced energy storage has hindered progress (Fleta-Asin & Munoz, 2021). The RBV Theory emphasizes that organizations with exclusive access to high-value natural resources can achieve a strategic advantage if they manage these resources efficiently and sustainably. For example, Kenya's geothermal power plants, particularly Olkaria Geothermal, have leveraged Kenya's unique geothermal resource endowment, making the country a leader in geothermal energy production in Africa. However, untapped wind and solar potential in

various regions remains underexploited, calling for better resource management strategies (Yurdakul et al., 2022).

Another crucial resource in renewable energy projects is infrastructure and technological capabilities. The RBV Theory suggests that firms or organizations that invest in high-quality and rare technological resources can outperform their competitors. In Kenya, energy transmission infrastructure remains a challenge, with a 16% system loss due to weak transmission networks (Masyuko, 2024). Without adequate energy storage solutions and grid modernization, generated renewable energy cannot be fully utilized. By applying RBV principles, Kenya can enhance project performance by investing in advanced transmission systems, smart grids, and hybrid energy storage technologies that maximize efficiency. Infrastructure, when managed effectively as a strategic resource, contributes to improved energy reliability, cost reduction, and increased project scalability (Olando et al., 2024).

Beyond physical resources, human capital is a critical factor in renewable energy resource management. Kenya faces a shortage of skilled professionals in geothermal drilling, wind turbine maintenance, and solar photovoltaic systems (World Bank, 2023). The RBV Theory argues that firms with specialized expertise and rare technical skills have a competitive advantage. In PPP-driven energy projects, lack of expertise can lead to inefficient project execution, delays, and increased operational costs. Investing in training programs, knowledge transfer partnerships, and skill development in renewable energy technology can improve Kenya's capacity to manage its renewable energy resources more

effectively, ensuring sustainable energy generation and project performance (Olando et al., 2024).

Despite its applicability, RBV Theory has some limitations when explaining resource management in PPP renewable energy projects. The theory overemphasizes internal resources while ignoring external environmental factors, such as government policies, economic conditions, and technological advancements that influence resource management (Mungai et al., 2022). Additionally, RBV assumes that resources alone create competitive advantage, but in reality, effective management strategies, regulatory frameworks, and market dynamics also play a critical role. In Kenya, PPP projects are affected by external factors like land disputes, financing bottlenecks, and policy inconsistencies, which RBV does not fully account for. Furthermore, RBV does not offer practical guidelines for managing resource interdependencies, particularly in projects that rely on public-private collaboration (Olando et al., 2024).

Despite these critiques, RBV remains a relevant and powerful theory for explaining resource management in PPP renewable energy projects in Kenya. It provides a structured approach for understanding how the availability, uniqueness, and efficient utilization of resources influence project success. By applying RBV, this study will provide insights into how Kenya can enhance its renewable energy performance through strategic resource allocation, investment in infrastructure, skill development, and sustainable utilization of natural energy resources. The theory reinforces the need for a long-term resource management strategy that ensures economic efficiency, environmental sustainability, and

technological advancement, all of which are essential for the success of PPP-driven renewable energy projects in Kenya.

2.2.4 Prospect Theory

The Prospect Theory, developed by Kahneman and Tversky in 1979, explains how individuals and organizations assess and respond to risks and uncertainties in decision-making. The theory argues that decision-makers perceive gains and losses differently, often becoming risk-averse in situations where they expect gains but risk-seeking when faced with potential losses (Amolo et al., 2024). This behavioral tendency affects how stakeholders in PPPs renewable energy projects in Kenya manage risks, particularly regarding financial, regulatory, operational, and climate-related uncertainties. Given the high capital investment and long-term commitment required in renewable energy, understanding risk perception and mitigation strategies is crucial in ensuring project performance and sustainability (Ishola et al., 2024).

One of the key applications of Prospect Theory in risk management is investment decision-making in renewable energy PPPs. Private sector investors are often risk-averse, prioritizing projects with guaranteed returns, stable policies, and predictable revenue flows (Stritzke & Jain, 2021). However, governments and development agencies tend to be more risk-tolerant, offering subsidies, tax incentives, and concessional loans to reduce perceived risks and attract private participation. In Kenya, projects such as the Lake Turkana Wind Power Project (310 MW) required partial government guarantees and financial support from multilateral organizations to de-risk private investments. This aligns with Prospect Theory's assertion that actors facing uncertainty will seek ways to

minimize exposure to potential losses, influencing how risk-sharing mechanisms in PPP renewable energy projects are structured (Oluoch et al., 2021).

Another critical risk in PPP renewable energy projects is regulatory and policy uncertainty. The delays in Power Purchase Agreements (PPAs), changes in feed-in tariff policies, and inconsistencies in energy regulations create uncertainty for investors. According to Prospect Theory, investors perceive policy instability as a major risk factor, making them reluctant to commit funds unless regulatory frameworks are stable (Mungai et al., 2022). In contrast, governments may underestimate the impact of policy risks on investor confidence, assuming that public infrastructure projects inherently attract long-term investment. This misalignment in risk perception often results in delayed financial close, project cost overruns, and underperformance of PPP energy initiatives (Ishola et al., 2024).

Operational and climate-related risks also play a crucial role in renewable energy project performance. Kenya's reliance on hydropower (which contributes nearly 30% of the national grid) makes the sector vulnerable to climate variability, droughts, and changing rainfall patterns (Mouzaki & Stamou, 2023). Wind and solar projects also face challenges from intermittent energy supply and lack of storage solutions. Prospect Theory explains why project developers adopt risk-mitigation strategies such as diversifying energy sources, integrating hybrid systems, and securing weather insurance. These measures reduce exposure to extreme climate events and ensure energy reliability, thereby enhancing project resilience and long-term sustainability (Mungai et al., 2022).

Despite its applicability, Prospect Theory has limitations in explaining risk management in renewable energy PPPs. The theory focuses primarily on behavioral decision-making but does not fully account for institutional, market-driven, and technological risks that influence energy investments (Sourgens et al., 2024). Additionally, risk perception varies across different stakeholders, making it difficult to establish a universal approach to risk mitigation. For instance, financial institutions assess risks differently from project developers, and governments prioritize long-term economic benefits over short-term investment risks. Furthermore, Prospect Theory does not offer a structured framework for risk-sharing in PPPs, making its direct applicability to infrastructure projects somewhat limited (Mouzaki & Stamou, 2023).

Despite these critiques, Prospect Theory remains relevant in explaining risk management in PPP renewable energy projects in Kenya. It provides a behavioral perspective on how investors, governments, and project developers perceive and respond to risks, influencing financial structuring, policy frameworks, and climate adaptation strategies. By applying Prospect Theory, this study will analyze how risk mitigation strategies such as financial guarantees, regulatory stability, and climate adaptation measures enhance project performance and sustainability. The theory reinforces the need for balanced risk-sharing mechanisms in PPPs, ensuring that renewable energy projects in Kenya remain financially viable, environmentally resilient, and economically sustainable.

Figure 2.1

Theoretical Framework

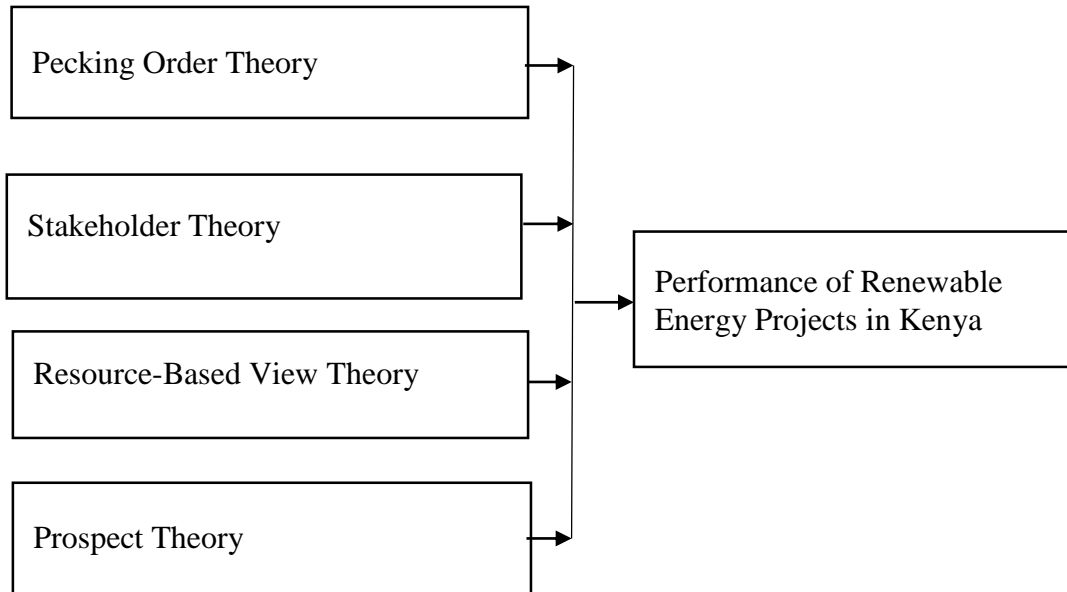


Figure 2.1 presents the theoretical framework underpinning this study, drawing on Pecking Order, Stakeholder, Resource-Based View, and Prospect theories. Collectively, these perspectives explain how financing choices, stakeholder relations, resource capabilities, and risk perceptions interact to shape the performance of renewable energy projects in Kenya.

This study is mainly based on stakeholder theory which was introduced by Freeman in 1984. It shows that the success of a project especially in renewable energy largely depends on properly identifying, involving, and managing all the people and groups who are affected or involved. These include government agencies, financiers, private investors, project managers, engineers, and local communities. The study also uses other theories like

the resource-based view, prospect theory and pecking order theory to better understand how resources are managed risks are handled and financial structures are set up.

2.3 Empirical Literature Review

2.3.1 Financial Structuring and Performance of Renewable Energy Projects

Nkadimeng and Tshehla (2022) undertook an investigation into the potential of developing nations' clean energy resources, focusing on the financial frameworks necessary for renewable energy independent power producers. Moreover, the research delves into the influence of capital market and banking borrowing conditions on the optimal capital structure of small independent power producers, especially within rural communities. The study employed qualitative methodologies and document analysis strategies to examine and assess secondary materials pertinent to renewable energy funding frameworks. The findings indicate that existing energy funding frameworks do not adequately integrate alternative financial instruments that offer minimal or zero interest rates, particularly those denominated in local currency, to support energy initiatives in developing economies. The implications of these concerns are clearly reflected in the influence of existing funding frameworks on the capital structure of REIPPs, particularly regarding the risk-return dynamics and their capacity to foster engagement from small and medium enterprises, as well as community involvement, as emphasized in the literature review. This research will consequently aid in closing the funding gap for small independent power producers and foster community engagement in renewable energy initiatives. This endeavor plays a pivotal role in establishing a funding

framework that is well-suited for renewable energy financing in emerging markets, with a particular focus on the SADC region.

Sourgens et al. (2024) conducted a study examining the collaborative efforts in renewable energy initiatives. The analysis examines critical commercial structuring issues pertinent to the financing and operation of renewable energy initiatives, highlighting the significance of collaborative efforts among various stakeholders. It underscores the regulatory framework and the intersection of regulation with commercial interests. An analysis of the economics surrounding joint operations elucidated the rationale behind collaborative efforts in power projects. Consideration is given to pertinent agreements, including operating and management agreements, power purchase agreements, and implementation agreements, while drawing parallels with the hydrocarbons sector to glean insights into performance challenges.

Mouzaki and Stamou (2023) undertook an investigation into the practical framework for structuring and financing renewable energy initiatives in Greece, specifically focusing on photovoltaic plants. The research sought to deliver a succinct and pragmatic legal framework concerning the structuring, licensing, and financing prerequisites for extensive renewable energy initiatives, with a particular emphasis on photovoltaic installations in Greece. This research aimed to provide a comprehensive examination of the conventional framework governing large-scale energy initiatives in Greece, the licensing requirements essential for the legal functioning of photovoltaic installations, and the regulatory challenges that could influence these endeavors, alongside an analysis of the characteristics and consequences of project financing. The study discusses project

financing for renewable energy projects, particularly photovoltaic plants in Greece, emphasizing limited or non-recourse financing and cash-flow-based structures. It highlights the importance of understanding the financial implications of these structures, which can significantly affect project performance. The authors provide insights into the typical financial arrangements and the regulatory barriers that may impact the financing process, ensuring that stakeholders are well-informed about the financial landscape of large-scale renewable energy projects.

Using Kenyan hydroelectric power plants as an example, Amolo et al. (2024) looked into how hedging derivatives affect project performance. Using a descriptive survey design and the pragmatism paradigm, this study polled 94 people quantitatively and qualitatively through the use of questions and an interview guide. After administering the instruments to 10% of the individuals for pretesting, accuracy and reliability were determined to be 0.775 and 0.781, respectively. For the goal of triangulation, descriptive and inferential statistics were run on the quantitative data using a significance threshold of 0.05 for correlation and regression. Additionally, qualitative data was thematically analyzed. There was a rejection of the null hypothesis (H_0), which proposed that hedging derivatives had no discernible effect on the efficiency of Kenya's hydroelectric power projects. Findings indicate that hedging derivatives significantly affect Kenyan hydroelectric power project performance. Hydropower projects can be better managed and financed with the help of hedging derivatives and derivative trading on the stock market, both of which can increase accessibility. How to effectively apply hedging derivatives in Kenyan power projects is an area that needs further research.

Listed companies in Kenya's energy and petroleum industries were the focus of Luganji and Miroga (2023) investigation of the impact of capital structure on financial performance. The primary goals of the research were to ascertain the effects of debt and equity financing on the financial performance of Kenyan energy and petroleum corporations listed on stock exchanges, and to draw comparisons between these two sets of companies. Two theories, pecking order theory and trade-off theory, guided the research. In order to accomplish its aims, this study used a correlational research strategy. Using the SPSS software version 26, researchers utilized multiple regression, correlation, and analysis of variance techniques to determine the existence (or lack thereof) of the study's link between the dependent and independent variables. The audited financial statements that were downloaded from the firms' websites were analyzed using a census method. The goal was to arrive at detailed and well-informed conclusions. The study's findings demonstrated that the independent factors significantly impacted the financial performance of energy and petroleum companies listed in Kenya. Based on the results of the F-test, the model accurately anticipated the relationship between the variables. Management should take into account the study's recommendations when making future decisions. The study mainly suggests that firms should increase their use of internal equity to boost profitability, as it doesn't cost anything to acquire, unlike external equity and debt financing. When deciding on external financing, management should choose the option with the lowest investment risk and proportional costs. Future researchers in the field of finance will be able to build on the study's findings and add to the current body of knowledge in related and unrelated fields.

2.3.2 Stakeholder Management and Performance of Renewable Energy Projects

To ensure the smooth launch of renewable energy projects in local communities, Ishola et al. (2024) investigated stakeholder communication frameworks. Local communities, government agencies, project developers, and NGOs are among the many types of stakeholders that this study aims to address through its proposed strategic framework for communication. As guiding principles, the framework for community-based renewable energy initiatives stresses openness, trust-building, and participation in order to meet the specific needs of these projects. Selecting suitable channels for tailored, ongoing discourse, identifying important stakeholders, and establishing clear communication goals are all critical components. As a first step, the framework details how to identify important stakeholders by taking their responsibilities, influence, and interests into account throughout the project's lifecycle. This allows for more targeted engagement by classifying stakeholders as either primary (directly affected) or secondary (indirectly affected). Community meetings, social media, local radio, and educational workshops are among the various channels of communication that the framework suggests next. This ensures that all stakeholders are effectively reached by selecting channels that are accessible, take stakeholder preferences into account, and are culturally appropriate. Transparent reporting on project milestones and impacts, participatory planning sessions, and regular feedback loops are all strategic engagement tactics that the framework incorporates to increase community participation. Through consistent communication, the project team can establish and maintain credibility, which in turn can allay fears and win over the community.

In order to build trust, obtain the necessary approvals, and minimize conflicts, Ezeh et al. (2024) stressed the importance of proactive stakeholder engagement in energy projects. It highlights the significance of open communication, honest procedures, and stakeholder engagement in decision-making for project longevity and community backing. The paper also highlights the importance of transparent decision-making and strong stakeholder relationships as outcomes of well-thought-out communication strategies that incorporate frequent updates, public consultations, and information sessions. Strategies to improve project acceptability and long-term benefits include adopting CSR initiatives, creating advisory committees, and reaching out through digital and social media platforms. Findings from the study indicate that a thorough and strategic approach is necessary to effectively engage stakeholders in energy projects. This approach should include recognizing stakeholder interests, keeping communication open and honest, encouraging collaboration, and resolving conflicts before they escalate. The energy industry can do its part to promote social responsibility and sustainable development by employing tactics like stakeholder mapping, strong communication plans, collaborative approaches, and dispute resolution mechanisms to increase the longevity of their projects, guarantee compliance, and win over the community.

The function of stakeholder involvement in improving renewable energy supply chain sustainability was investigated by Reynolds (2024). The research shows the importance and complexity of effective stakeholder engagement through a qualitative research approach, which includes in-depth interviews with important stakeholders including government agencies, industries, renewable energy companies, community groups, and

environmental organizations. Concerns about the environment, society, the economy, and regulations were among the many stated reasons for stakeholder involvement. Based on the findings, it is clear that customized engagement strategies are necessary to account for the diversity of stakeholders and meet their unique requirements and expectations. Pooling resources, exchanging knowledge, and tackling common problems are best accomplished through collaborative approaches like Public-Private Partnerships and multi-stakeholder initiatives. Nevertheless, difficulties arising from unequal power dynamics, competing agendas, and difficulties in conveying ideas were also identified. In order to shape stakeholder engagement practices and sustainability outcomes, government policies and regulatory frameworks were determined to play a crucial role. Significant concerns that could undermine sustainability initiatives were regulatory uncertainty and inconsistency. Solar power plants typically have a direct influence on nearby neighborhoods, so community involvement became an important consideration. Establishing credibility and gaining societal support necessitates active participation, which includes consultation and methods for sharing benefits. Marketing tactics and emotional intelligence were acknowledged as vital resources for successful stakeholder engagement, with an emphasis on the significance of understanding, attentive listening, and precise expression. Stakeholder engagement and sustainable supply chains in renewable energy must be approached holistically, according to this study's results. Accelerating the transition to a more sustainable energy future can be achieved through stakeholder collaboration, policy alignment with sustainability goals, and meeting the needs of diverse stakeholders.

The purpose of the study by Maarif et al. (2023) was to determine who the important players were in the renewable energy tourism village development project known as "Kampung Emas," what their duties were, and how to best manage the project's stakeholders. Researchers used the RACI Matrix to analyze data collected from interviews with project stakeholders. Village Head, Tourism Awareness Group Chair, Restaurant Manager, and Academician were the four primary stakeholders identified by the analysis. Each member of the team plays an important role: the village head acts as an information disseminator, the chair of the tourism awareness group is in charge of the most important parts of the project, the manager of the restaurant is in charge of both tactical and strategic matters, and the academic makes substantial contributions to the analysis of every task. The Village Head is tasked with disseminating information, the Tourism Awareness Group Chair with acting as the principal spokesperson, the Restaurant Manager with contributing to strategic decision-making, and the Academician with serving as a consultative partner according to the proposed stakeholder management strategy. The purpose of this strategy is to facilitate the development of a tourist village that relies on renewable energy sources.

Port energy transition stakeholders' management was the subject of an analysis by Alamoush et al. (2024). Insights regarding life cycle approach stakeholder management tools are the goal of this study. It is possible to manage PETPs' stakeholders through the use of stakeholder theory and the stakeholders' circle methodology. The five-step approach involves identifying, prioritizing, visualizing, engaging, and monitoring twenty-two groups of stakeholders with varying stakes that could be involved in the shift to and

implementation of PETPs. This will help manage and engage them while also overcoming any challenges that may arise. When port managers and practitioners use this life cycle approach, they are better able to pinpoint important stakeholders, create engagement strategies to connect with them, and keep those relationships strong. While viewed as a tool for guidance, the demonstrated life cycle approach encourages cooperation and trust, which in turn improves PETPs' decision-making and resource allocation. Despite being the first study to do so, it may be seen as a more in-depth use of stakeholder theory and the stakeholder circle method in relation to PETPs. Efficient port energy transition and stakeholder management are two areas that could benefit from the results of this study.

2.3.3 Resource Management and Performance of Renewable Energy Projects

Zakaria and Ahmadian (2021) investigated how competent project management impacts the results of green energy initiatives. In this study, a literature review and a survey questionnaire were utilized as part of a mixed-methods strategy to find out how project management talents impact the success of renewable energy projects. Knowledge sharing, transformational leadership, and human resource management practices were the three identified project management constructs that were examined in a quantitative research design that utilized the Pearson Correlation Coefficient test to determine the relationships between them and the effectiveness of energy projects. The results demonstrated that skills essential to good project management include information sharing, transformational leadership, and human resource management, all of which had a favorable correlation with the success of renewable energy projects. Training had the greatest influence on HRM practices among the evaluated variables, and the energy project success was most strongly

correlated with the vision variable within transformational leadership; this indicates the significance of strong leadership and staff development in improving project results.

Piwowar-Sulej et al. (2023) highlighted that resource management in renewable energy (RE) projects is crucial for enhancing project effectiveness and stakeholder cooperation. It emphasizes the need for effective project evaluation methods to optimize performance. The analysis indicates that future research should focus on the interplay between project management (PM) practices and technological advancements in RE, particularly in areas like wind energy and smart grid implementations, to improve overall project outcomes and sustainability in the energy sector. A substantial amount of research has been published in the multidisciplinary field of "project management-renewable energy" (PM-RE), with bibliometric analysis revealing that 335 papers written by 672 authors and published in 135 journals make up its scientific framework. The study found four clusters of related keywords that have common themes. In the field of project management, these clusters mainly deal with organizational issues, the effectiveness of projects, stakeholder cooperation, and evaluation methods. On the other hand, in the field of renewable energy, topics like wind energy, technological advancements, smart grids, photovoltaic systems, biomass projects, and geothermal resources are discussed at length.

Using Nigeria as a case study, Avwioroko (2023) investigated the possibilities, obstacles, and methods for increasing the use of renewable energy in developing nations. Renewable energy projects in Nigeria cannot be successful without proper management of available resources, according to the research. It emphasizes the need for policy reforms, financial incentives, and infrastructure development to optimize resource utilization. Additionally,

building technical capacity and fostering Public-Private Partnerships are essential strategies to enhance project performance. By addressing these factors, Nigeria can improve the efficiency and sustainability of its renewable energy initiatives, ultimately contributing to energy security and economic growth. The paper highlights how policy and regulatory challenges act as limitations to the widespread adoption of renewable energy in Nigeria. These barriers can include inconsistent or inadequate policies, lack of regulatory frameworks and bureaucratic hurdles that hinder the development and implementation of renewable energy projects. Another limitation discussed in the paper is the restricted access to financing for renewable energy projects in Nigeria. Insufficient financial resources, high upfront costs, and a lack of investment incentives can impede the scaling up of renewable energy initiatives in the country.

The oil, gas, and renewable energy sectors in Nigeria were the subjects of a study by Eleogu et al. (2023) that examined sustainable human resource management practices. The study defines sustainable HR management practices, examines their significance, and finds gaps in our current understanding through an extensive literature review. This analysis sheds light on the many sustainable HR practices used in these industries, as well as the ways in which they contribute to green initiatives and boost business results. To gain a better understanding of the opportunities and challenges that come with implementing sustainable HR practices in different sectors, a comparative analysis is carried out. This review's findings will be useful for both current and future studies on sustainable human resource management in the energy sector, as well as for organizations that want to improve their sustainability efforts through HR practices. Finally, the study

reflects on the significance of sustainable HRM practices for the long-term viability of Nigeria's energy sectors and provides insights into their contributions to the area.

Research by Ghorbany et al. (2022) examined the efficacy of the Copula Bayesian Network in assessing and improving the efficiency of PPP initiatives. The study highlights the significance of concentrating on these crucial areas by identifying key performance indicators (KPIs) such as regulations compliance, risk allocation, and innovation for financing. In the end, this improves the performance of PPP projects as a whole by letting the private sector make better use of scarce resources and by giving project managers better control over critical performance indicators. The study's authors zeroed in on a core set of seven KPIs that have a major impact on PPP project performance management. Financing innovation, feasibility studies, macro-environmental impacts, suitable financing options, risk identification, allocation, sharing, and transfer, financial infrastructure, and regulatory and legal compliance are all key performance indicators. The sensitivity analysis conducted in the study verified the importance of causation in managing PPP performance, allowing for a comprehensive understanding of the causal structure of KPIs. This insight enables project managers to focus on the most influential indicators, thereby optimizing resource allocation and enhancing project outcomes.

2.3.4 Risk Management and Performance of Renewable Energy Projects

In their study, Mahwish et al. (2023) looked at how the solar PV industry could improve their financial performance and sustainability through enterprise risk management. As a result, the impact of ERM on financial performance is the focus of this research. By regulating and coordinating offset risks throughout the firm, Enterprise Risk Management

(ERM) allows for the holistic management and integration of all risks. Therefore, this paper offers a theoretical and conceptual framework for how solar PV industry corporations use risk management to reduce capital costs and improve sustainable development. The proposed theoretical and conceptual framework, which is based on legitimacy and stakeholder theory, lays the groundwork for testing the interdependent variables through empirical means. Enterprise risk management, financial performance, and sustainability performance are some of the variables that should be measured using frameworks and recommendations from major organizations, as well as prior research. Using sustainability and risk management as a framework, this paper aims to assist solar PV companies in Malaysia. Management of enterprise risk, sustainability, solar photovoltaics, and financial results are all related terms.

The efficiency frontiers of solar, wind, and biodiesel energy generation were compared across three different US locations (Newark, Lincoln, and Los Angeles) by Rocha and Camargos (2023). Optimal resource allocation may differ according to regional traits and environmental factors; this study shed light on the risk-return profiles of different energy resources. An all-encompassing strategy for managing risks associated with Distributed Energy Resources (DERs) was the goal of the research, which sought to accomplish this by incorporating financial technology models into decision-making. A more balanced supply-demand relationship and better dynamic pricing strategies are the end results of this approach's assistance to renewable energy decision-makers in making well-informed choices that take into consideration regional variations, climatic conditions, and long-term performance trends. Utilizing ideas from Modern Portfolio Theory (MPT) and the Capital

Asset Pricing Model (CAPM), this study examines the efficiency frontiers of renewable energy resources in various US locations using a return-risk approach that is typical in equity portfolio management. To do this, we must compare the efficiency and output capacities of solar, wind, and biodiesel power generation by analyzing their risk-return profiles. The analysis is based on real data collected from the National Renewable Energy Laboratory (NREL) covering three years of solar radiance and wind speed for Newark, New Jersey. The study states that the relative return-based efficiency frontier computations are unaffected by the derivative values that are included in the analysis to improve the comprehension of risk and return.

In green energy projects, Fleita-Asín and Munoz (2024) examined how the public and private sectors divide up the risk. The research looks at data from 22,215 projects in 73 developing nations. Solar, hydro, wind, waste, biogas, biomass, and geothermal power were all a part of these projects that ran from 1997 to 2019. Based on the findings, risk allocation strategies have a major impact on how well renewable energy projects turn out. In particular, private investors are more likely to put money into projects when the private partner takes on more risk. Findings from the research highlight the importance of shifting project risk to the private sector and how this factor interacts with other project and institutional aspects to improve the success and longevity of such endeavors. Stakeholders seeking to maximize investment in renewable energy projects must have a firm grasp of these dynamics.

Liu et al. (2023) aimed to explore the risk analysis of renewable energy based on the Gaussian Mixture Model (GMM) method and data measurement algorithms, in order to

provide strategies for the utilization of renewable energy and always adhere to the concept of environmentally friendly development. This article introduced the current development status of renewable energy and the importance of risk analysis. This article elaborated on the basic principles and implementation process of GMM method and data measurement algorithm, and illustrated the application of these two methods in renewable energy risk analysis through examples. By using case validation and statistical methods, GMM algorithm and data measurement methods were used to analyze the risks of renewable energy. According to survey data, the theoretical reserve of hydropower resources had an annual power generation capacity of 6943.8 billion kWh. This paper reveals the key factors associated with risk in the renewable energy industry, and provides the potential impact of these factors on the operation and investment of renewable energy projects.

2.4 Research Gaps

Despite the growing research on PPP drivers and renewable energy projects, significant contextual and conceptual gaps remain, warranting further investigation. Contextually, existing studies primarily focus on general financing models, stakeholder engagement strategies, resource utilization, and risk allocation in renewable energy projects globally and regionally, but limited research specifically examines how PPP drivers influence the performance of renewable energy projects in Kenya. Additionally, while financial structuring studies have been conducted in developed economies and regions such as the SADC (Nkadimeng & Tshehla, 2022) and Greece (Mouzaki & Stamou, 2023), they do not capture Kenya's unique financing challenges, such as access to concessional loans, power purchase agreement delays, and currency fluctuations. Similarly, while Sourgens

et al. (2024) examined the joint operations of renewable energy projects globally, their findings may not fully apply to Kenya's policy environment, where government-backed guarantees and infrastructure constraints impact private sector participation differently. These gaps create a need for empirical studies focusing on how financial structuring within Kenyan PPP frameworks affects the viability and long-term sustainability of renewable energy investments.

In terms of stakeholder management, previous studies, such as Ishola *et al.* (2024) and Ezeh *et al.* (2024), emphasize stakeholder communication frameworks and engagement strategies in community-based renewable energy projects. However, these studies lack a specific focus on how stakeholder management dynamics in Kenyan PPP renewable energy projects impact overall project performance. While stakeholder engagement has been extensively studied in global energy transitions (Reynolds, 2024; Maarif *et al.*, 2023), there is limited research examining the effectiveness of Kenya's existing public-private stakeholder collaboration mechanisms, particularly in addressing land acquisition disputes, regulatory bottlenecks, and environmental concerns. Given that some Kenyan renewable energy projects, such as the Lake Turkana Wind Power Project, have faced legal challenges related to stakeholder involvement, there is a need for research that explores best practices in balancing government, private sector, and community interests to enhance project success.

Regarding resource management, studies such as Zakaria and Ahmadian (2021) and Piwowar-Sulej *et al.* (2023) highlight the role of human resource skills, technological innovations, and infrastructure development in renewable energy projects. However, these

studies are predominantly focused on European contexts, where access to financing, advanced technology, and a well-established regulatory framework differs from Kenya's energy sector challenges. Additionally, Avwioroko (2023) examined renewable energy adoption barriers in Nigeria, which share similarities with Kenya but do not fully address how resource management—specifically in geothermal, wind, and solar PPP projects in Kenya—impacts overall project performance. Furthermore, while Ghorbany et al. (2022) developed a model for optimizing resource allocation in PPP projects, their study lacks specific insights into how resource allocation constraints in Kenya, such as grid connectivity and skilled labor shortages, affect project implementation and efficiency. These gaps necessitate research that contextualizes resource management challenges within Kenya's renewable energy sector.

In the area of risk management, studies such as Mahwish et al. (2023) and Rocha and Camargos (2023⁴) focus on enterprise risk management in renewable energy markets, highlighting financial and operational risks. However, these studies do not directly examine how risk allocation frameworks impact the performance of renewable energy projects under PPPs in Kenya. Fleta-Asín and Munoz (2024) provide insights into risk allocation in green energy projects across multiple developing countries, but Kenya's unique risks—such as regulatory inconsistencies, delayed tariff adjustments, and climate-related vulnerabilities require specific investigation. Similarly, Liu et al. (2023) applied data measurement models to assess renewable energy risks, but their findings lack direct applicability to Kenya's PPP-driven renewable energy projects, where policy risks and investor confidence play a significant role in project success. Therefore, there is a need

for empirical research that examines how risk management strategies within Kenya's PPP framework influence the financial sustainability, operational efficiency, and long-term viability of renewable energy investments.

Conceptually, most existing studies on PPPs and renewable energy projects focus on general investment structures, stakeholder engagement frameworks, resource allocation models, and financial risk analysis. However, few studies comprehensively integrate financial structuring, stakeholder management, resource allocation, and risk management into a single framework for analyzing the performance of renewable energy projects. Additionally, while Pecking Order Theory, Stakeholder Theory, Resource-Based View (RBV) Theory, and Prospect Theory have been applied in various studies, there is limited research testing the applicability of these theories within Kenya's specific energy sector. Current research fails to examine the interaction between financial decision-making, stakeholder collaboration, resource efficiency, and risk mitigation strategies in PPP-driven renewable energy initiatives. Given the complexities involved in Kenya's renewable energy investment landscape, policy environment, and project financing mechanisms, a more integrated, Kenya-specific research approach is required to bridge these conceptual gaps.

In summary, while numerous studies have explored PPP structures, stakeholder engagement, resource allocation, and risk management in renewable energy projects globally and regionally, there remain significant contextual and conceptual gaps in the Kenyan context. The lack of empirical research focusing on Kenya's unique regulatory, financial, and operational challenges highlights the need for further investigation.

Additionally, existing studies do not provide a holistic, theory-driven analysis of how financial structuring, stakeholder management, resource allocation, and risk management collectively influence the performance of PPP-driven renewable energy projects in Kenya. Addressing these gaps contributed to developing tailored policy recommendations, improving project implementation strategies, and enhancing the sustainability of Kenya's renewable energy sector.

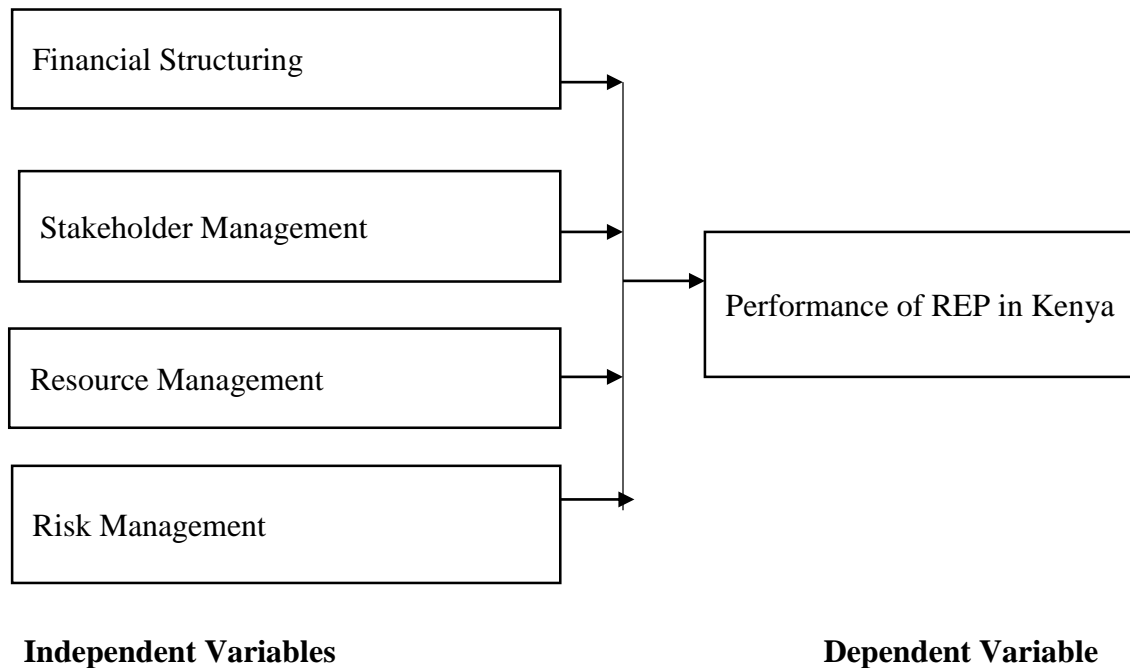
2.5 Conceptual Framework

The conceptual framework illustrates the relationship between key PPP drivers and the performance of renewable energy projects in Kenya. It identifies four independent variables; financial structuring, stakeholder management, resource management, and risk management that influence the dependent variable, which is the performance of renewable energy projects in Kenya. Financial structuring refers to the mechanisms used to mobilize and allocate funds, ensuring project viability and long-term sustainability. Stakeholder management encompasses the processes of engaging and coordinating various actors, including government agencies, private investors, local communities, and regulatory bodies, to align interests and enhance project success. Resource management focuses on the efficient allocation and utilization of financial, human, and technical resources to optimize project implementation. Risk management involves identifying, assessing, and mitigating financial, regulatory, environmental, and operational risks to minimize project disruptions and failures. The framework posits that effective management of these four key drivers enhances project completion rates, cost efficiency, sustainability, and overall performance. By empirically examining these relationships, the study aims to provide

insights into optimizing PPP models for improved renewable energy project outcomes in Kenya.

Figure 2.2

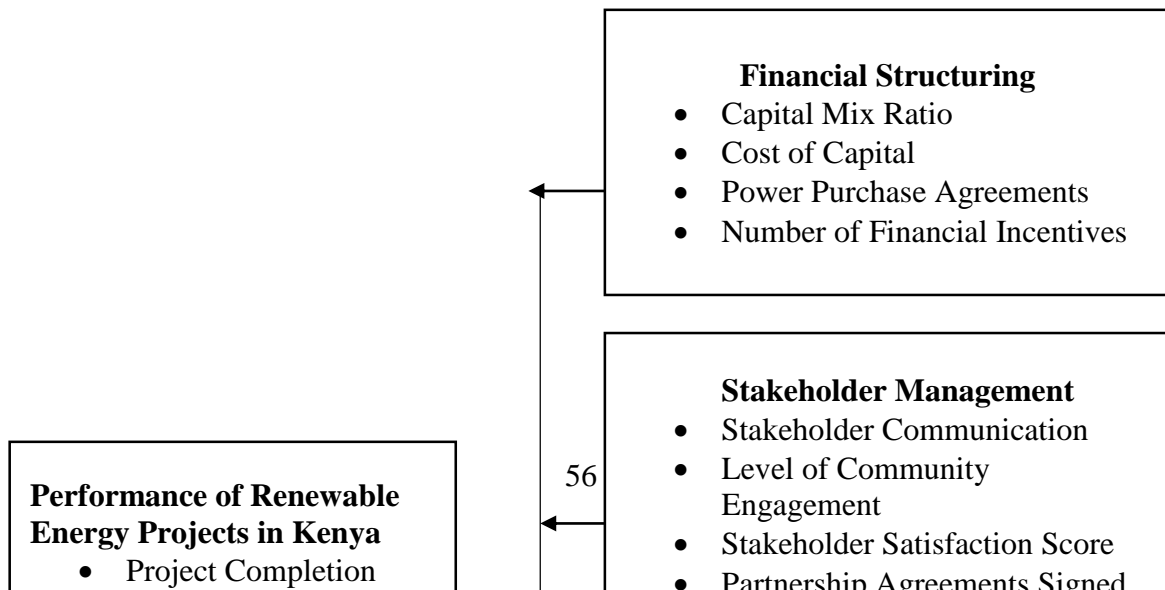
Conceptual Framework



2.6 Operational Framework

Figure 2.3

Operational Framework



Dependent Variable

Independent Variables

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter delineated the research design employed in the study. It further elucidated the population, sampling frame, sampling technique, sample size, instruments employed, pilot test, data analysis and presentation, along with additional diagnostic assessments.

3.2 Research Design

An explanatory research design is a structured approach that seeks to establish cause-and-effect relationships between variables by analyzing how one factor influences another. It goes beyond simply describing phenomena and aims to explain why and how specific factors contribute to certain outcomes (Dzwigol, 2022). This design is particularly useful when testing hypotheses, identifying patterns, and analyzing relationships through statistical methods such as regression analysis, correlation, and hypothesis testing (Ghauri & Gronhaug, 2020). In the context of this study, an explanatory research design was appropriate as it helped determine the direct and indirect effects of financial structuring, stakeholder management, resource management, and risk management on the performance of renewable energy projects in Kenya.

The choice of an explanatory research design was justified because the study sought to analyze causal linkages between PPP drivers and project performance. Since renewable energy projects involved complex financial arrangements, multi-stakeholder engagements, resource allocations, and risk management strategies, it was essential to quantify their impact and explain how variations in these drivers influenced project success or failure. This research design allowed for empirical testing of relationships using statistical tools, ensuring that findings were data-driven and generalizable. Additionally, the explanatory approach provided insights for policy formulation, investment decision-making, and project management strategies to enhance the sustainability and effectiveness of PPP-driven renewable energy projects in Kenya.

3.3 Target Population

The term "target population" is used to describe the totality of the people, groups, or organizations that are applicable to a study because of their shared traits. For the sake of drawing conclusions, it stands in for the whole population (Gujarati, 2020). The target population for this study consisted of key stakeholders directly involved in the planning, financing, implementation, and management of PPP renewable energy projects in Kenya. The unit of analysis in this study was the renewable energy projects developed under PPP frameworks in Kenya. This meant the study focused on how financial structuring, stakeholder management, resource management, and risk management influenced the overall performance of these projects. However, to obtain data on these projects, the unit of observation was individual professionals and key informants from relevant organizations, including government agencies, private investors, project management teams, financial institutions, and utility companies who had direct experience with these projects.

The choice of this target population was justified based on the need to capture insights from multiple key players who influence renewable energy project performance. Government officials provide policy direction and regulatory oversight, ensuring that projects align with national energy goals. Private sector investors and IPPs bring capital, technical expertise, and operational efficiencies that enhance project feasibility. Project managers and engineers are responsible for execution, ensuring that energy projects meet the required technical, environmental, and quality standards. Financial analysts play a critical role in evaluating investment risks, financial sustainability, and funding models,

while utility company representatives ensure the integration of energy into the national grid and oversee distribution. Since these professionals are actively engaged in the different aspects of financial structuring, stakeholder management, resource allocation and risk management, their perspectives provided valuable data for analyzing the performance of PPP renewable energy projects in Kenya. The distinction between unit of analysis (projects) and unit of observation (individual professionals involved in these projects) ensured that the study collects reliable and practical data while maintaining a broad project-level assessment of performance trends, challenges, and success factors.

Table 3.1

Target Population

Category	Population
Government Officials	49
Private Sector Investors & Independent Power Producers	78
Project Managers	59
Engineers	88
Financial Analysts	39
Utility Company Representatives	68
Total	380

Kenya Energy Transition & Investment Report (2024)

3.4 Sampling Frame

Every possible unit that could be a part of a sample makes up the sampling frame, which is a physical representation of the target population (May & Perry, 2022). The sampling frame consisted of key organizations, agencies and institutions actively involved in financing, developing, and managing renewable energy projects under the PPP framework. The government agencies and regulatory bodies that were included in the sampling frame are the Ministry of Energy and Petroleum, EPRA, KenGen, GDC, REREC

and the National Treasury's PPP Directorate. These institutions are responsible for setting energy policies, approving projects, and providing regulatory oversight, making them essential in understanding the role of government support in renewable energy PPPs.

The private sector investors and IPPs in the sampling frame included a list of registered IPPs in Kenya, renewable energy investors from the Kenya Investment Authority (KenInvest) and development banks or private equity firms financing renewable energy projects. These entities contribute capital, share financial risks, and influence financial structuring within PPP arrangements. Additionally, project developers and managers were drawn from registered project management firms, engineering, procurement, and construction (EPC) contractors, and renewable energy consultancy firms. These professionals oversee project execution, ensuring that resource allocation, engineering designs, and project timelines align with the performance expectations of PPP-driven renewable energy projects.

The sampling frame also incorporated utility companies and energy distributors, including KPLC, off-grid energy providers, and private electricity distribution firms. These entities play a crucial role in integrating renewable energy into the national grid and ensuring energy distribution efficiency. Furthermore, financial institutions and analysts involved in energy sector investments were included, specifically banks, financial institutions offering project financing, investment banks, and energy sector financial analysts who assess financial risks and project sustainability. Additionally, risk management experts working in renewable energy projects were included in the sampling frame to capture insights on risk mitigation strategies within PPPs.

To ensure a well-rounded representation, professional bodies and industry associations were part of the sampling frame. This included the Kenya Renewable Energy Association (KEREAA), Association of Independent Power Producers (AIPPs), and the Engineers Board of Kenya (EBK), where licensed engineers specializing in energy projects are registered. These organizations offer insights into industry standards, stakeholder engagement best practices, and technical challenges in project execution. The selection of this sampling frame was justified by its comprehensiveness, accessibility, and diversity, as it ensured that data collection captures perspectives from public sector regulators, private sector investors, financial institutions, project developers and industry professionals. This approach enhanced the reliability and generalizability of the study's findings by ensuring that the selected sample is representative of the broader population engaged in renewable energy PPPs in Kenya.

3.5 Sample Size and Sampling Technique

The stratified random sampling technique was the most appropriate approach for this study on the influence of PPP drivers on the performance of renewable energy projects in Kenya. This method ensured that each stakeholder category involved in renewable energy PPP projects was proportionally represented, improving the reliability and accuracy of the study's findings. Given that the target population consisted of different groups with distinct roles, responsibilities, and levels of influence, stratified random sampling allowed for the division of the population into homogeneous subgroups (strata), ensuring that all key stakeholders were included in the sample (Mehmetoglu & Jakobsen, 2022). These strata were based on government officials, private sector investors and independent power

producers, project managers, engineers, financial analysts, and utility company representatives, as they played critical roles in project implementation, financing, regulation, and performance assessment.

The choice of stratified random sampling was justified by its ability to capture diversity within the target population while maintaining representativeness. Stratified random sampling ensured that respondents from all categories are included proportionally, preventing dominance from any one group (Dzwigol, 2022). This is particularly useful in PPP projects, where different stakeholders contribute to financial structuring, stakeholder management, resource allocation and risk management, and their perspectives must be adequately captured.

Another advantage of this method is its capacity to enhance statistical precision and comparability across groups. Since each category will have a representative sample based on its proportion in the target population, it will be possible to compare the experiences, challenges and contributions of different stakeholder groups to project performance (Bickel, 2020). Moreover, stratified random sampling improves efficiency in data collection, ensuring that the selected sample is both manageable and representative. Since renewable energy projects are capital-intensive and involve multiple decision-makers at various levels, selecting a truly representative sample using random methods alone might not be practical (Gujarati, 2020). By pre-defining specific categories (strata) and selecting respondents randomly within each, the study ensured that the data collected is balanced, unbiased, and reflective of the actual population involved in PPP renewable energy

projects. This also reduced sampling errors and ensured that findings was generalized to the broader sector.

The stratified random sampling was carried out by first dividing the target population into six distinct strata based on stakeholder categories: government officials, private sector investors and independent power producers (IPPs), project managers, engineers, financial analysts, and utility company representatives. The proportion of each stratum in the total target population of 380 was determined, ensuring that each category was represented according to its actual size within the industry. Once the strata were established, a random selection method was applied within each group to randomly pick participants for the study, ensuring that each selected respondent had an equal chance of participation. The final sample size of 195 respondents was allocated across the strata based on their proportion in the target population. This approach ensured that each stakeholder category was adequately represented, eliminating bias and improving the reliability and generalizability of the findings on how PPP drivers influenced the performance of renewable energy projects in Kenya. The researcher utilized the Yamane (1967) sampling formula.

$$n = \frac{N}{1+N(e^2)}$$

$$n = \frac{380}{1+380(0.05^2)}$$

$$n = 195$$

Table 3.2

Sample Size

Category	Population
Government Officials	25
Private Sector Investors & Independent Power Producers	40
Project Managers	30
Engineers	45
Financial Analysts	20
Utility Company Representatives	35
Total	195

3.6 Data Collection Instruments

The data collection instruments for this study included structured questionnaires and document review checklists, ensuring a comprehensive and reliable approach to gathering both primary and secondary data. Structured questionnaires were used to collect quantitative data from respondents across various stakeholder categories, including government officials, private sector investors, project managers, engineers, financial analysts, and utility company representatives. The questionnaire featured closed-ended questions using a Likert scale to assess the extent to which financial structuring, stakeholder management, resource allocation, and risk management influenced project performance. This instrument was ideal for ensuring standardized responses, allowing for statistical analysis, comparison across groups, and identification of patterns or trends. The structured format also enhanced response reliability, reduced subjectivity, and simplified data processing (Golder & Golder, 2021).

Additionally, a document review checklist was used to analyze secondary data sources, such as PPP policy documents, project financial records, regulatory guidelines, feasibility reports, and renewable energy sector performance reports. This instrument ensured that

the study incorporated verified and objective data, complementing the insights gathered from primary sources. Reviewing official records and industry reports allowed for a deeper understanding of existing financial structuring models, risk mitigation strategies, stakeholder engagement frameworks, and project evaluation methods. The document review also helped cross-check and validate the findings obtained through questionnaires, reducing the risk of bias.

The choice of structured questionnaires and document review checklists was justified because they complemented each other, ensuring a balanced and data-driven analysis of PPP drivers in renewable energy projects. Structured questionnaires provided quantifiable insights from direct stakeholders, while document reviews offered historical and policy-based context to support the findings. This combined approach enhanced the credibility, reliability, and comprehensiveness of the study, ensuring data triangulation and robust conclusions on how PPP models impacted the performance of renewable energy projects in Kenya.

3.7 Data Collection Procedures

The researcher secured approval from the appropriate parties, including the university, NACOSTI, and the projects in question. After the researcher got the green light, they contacted the participants via email and invited them to take part in the study. The informed consent form was attached to the email. It explains the research's purpose, participants' roles, the researcher's contact information, the procedures, the benefits, how the data will be used, confidentiality assurances, and that participation is voluntary. A link to the online survey was emailed out when the informed consent procedure was

finished. In order to ensure comprehensive analysis, the questionnaire was disabled after two weeks.

3.8 Pilot Study

A pilot study was conducted before the main data collection process to test the reliability, validity, and effectiveness of the research instruments. This small-scale preliminary study helped identify ambiguities, inconsistencies, and potential challenges in the structured questionnaires and document review checklists, ensuring that they were refined before full deployment (Singh, 2022). The pilot study involved a small sample of respondents, approximately 10% of the total sample size, drawn from the same categories as the target population, including government officials, private sector investors, project managers, engineers, financial analysts, and utility company representatives. The selection ensured that feedback was obtained from all key stakeholder groups, allowing for comprehensive instrument testing.

The pilot study was carried out in a structured manner, starting with the distribution of questionnaires to selected participants. Respondents were asked to complete the questionnaires and provide feedback on aspects such as clarity, relevance, length, and ease of understanding. Any difficult or ambiguous questions were revised or eliminated based on their input. In addition, a document review test was conducted by analysing a sample of policy documents, financial records, and project reports to ensure that the checklist effectively captured relevant project performance indicators. The pilot study also assessed the time required for respondents to complete the questionnaire, helping to refine the structure and sequencing of questions to improve response rates.

By carrying out the pilot study, the research ensured that the final data collection process was smooth, effective, and yielded high-quality responses. This approach helped eliminate errors, refine the research instruments, enhance reliability and improve the overall credibility of the study on the influence of PPP drivers on the performance of renewable energy projects in Kenya.

3.8.1 Reliability

Reliability in this study referred to the consistency, accuracy, and dependability of the data collection instruments in measuring the influence of PPP drivers on the performance of renewable energy projects in Kenya. Ensuring reliability was critical, as it guaranteed that the results obtained were repeatable and not influenced by errors or inconsistencies in the measurement tools. In this study, reliability was tested using internal consistency, test-retest reliability, and inter-rater reliability to ensure that the structured questionnaires and document review checklists produced stable and consistent results over time and across different respondents (Tabachnick & Fidell, 2020).

To assess internal consistency, the study used Cronbach's alpha, a statistical test that measured how well the questionnaire items related to each research variable—financial structuring, stakeholder management, resource allocation, and risk management—were correlated. A Cronbach's alpha coefficient above 0.7 indicated that the questionnaire items were sufficiently reliable (Bickel, 2020). This test was conducted after the pilot study, analyzing responses from the pilot participants to determine whether any questions required rewording, restructuring, or elimination to improve consistency. If the alpha

value was low, necessary modifications were made to enhance coherence among items measuring similar concepts (Clark et al., 2021).

Additionally, test-retest reliability was conducted by administering the questionnaire to a small subset of respondents at two different points in time, with a two-week interval. The responses were then compared to assess whether they remained consistent over time. A high correlation between the two sets of responses confirmed that the questionnaire maintained stability and reliability. If significant discrepancies were found, adjustments were made to clarify ambiguous questions and reduce response variability.

For the document review checklist, inter-rater reliability was tested by having two independent reviewers analyze the same set of policy documents, financial reports, and project records using the checklist. Their findings were compared to ensure consistency in data extraction and interpretation. If significant variations occurred, refinements were made to the checklist to ensure that all reviewers interpreted and categorized information in a standardized manner.

By ensuring high levels of reliability, the study enhanced the credibility and validity of its findings, allowing for accurate conclusions on how PPP drivers impacted renewable energy project performance. The use of multiple reliability tests Cronbach's alpha for internal consistency, test-retest for stability over time, and inter-rater reliability for document analysis ensured a robust and scientifically sound approach to measuring the study variables.

3.8.2 Validity

The term validity was used to describe how well the data collection tools in this study measured the impact of PPPs on the efficiency of Kenya's renewable energy projects. Ensuring validity was crucial, as it determined whether the findings of the study truly reflected the real-world relationships between financial structuring, stakeholder management, resource allocation, risk management, and project performance. To achieve validity, the study assessed content validity, construct validity, and criterion validity, ensuring that the research instruments were both conceptually sound and practically applicable (Roy et al., 2023).

To establish content validity, the study ensured that the questionnaire and document review checklist comprehensively covered all key aspects of the study variables. This involved consulting subject matter experts, industry professionals, and academic advisors in renewable energy and PPP management to review the research instruments. Their feedback helped verify whether the questions and checklist items were relevant, clearly defined, and aligned with the study objectives (Mahuika & Mahuika, 2020). Any ambiguous, redundant, or missing components were revised before full-scale data collection to ensure the instruments fully captured the dimensions of PPP drivers and project performance.

Construct validity was assessed to determine whether the research instruments accurately measured the theoretical concepts of financial structuring, stakeholder management, resource allocation, and risk management. This was done through factor analysis, where responses from the pilot study were analyzed to check whether the questionnaire items grouped logically under their respective variables (Tabachnick & Fidell, 2020). If any

question failed to align with its intended construct, modifications were made to ensure each item truly reflected its theoretical concept. This ensured that the questionnaire correctly captured the underlying dimensions of PPP drivers in renewable energy projects.

The study also established criterion validity by comparing the responses collected from structured questionnaires with existing performance reports, regulatory frameworks, and financial models in renewable energy PPP projects. The document review checklist helped cross-check whether the findings from primary data collection aligned with documented industry trends, policy reports, and expert evaluations. A strong correlation between the two data sources confirmed that the research instruments were valid in assessing project performance through the lens of PPP drivers.

By ensuring high levels of validity, the study enhanced the accuracy, reliability, and applicability of its findings. The use of expert reviews for content validity, factor analysis for construct validity, and cross-verification through document analysis for criterion validity ensured that the research instruments provided credible, meaningful, and actionable insights into the role of PPPs in renewable energy project success in Kenya.

3.9 Data Analysis and Presentation

The data analysis for this study was conducted using quantitative methods, with all statistical processing carried out in SPSS Version 28. The analysis involved both descriptive and inferential statistics to ensure a comprehensive examination of the influence of PPP drivers on the performance of renewable energy projects in Kenya. The structured questionnaire responses were coded and entered into SPSS 28, where data

cleaning was performed to eliminate errors, handle missing values, and ensure data accuracy before analysis.

Descriptive analysis was used to summarize the distribution of responses. This provided an initial understanding of data trends and allowed for comparisons across different stakeholder categories, including government officials, private investors, project managers, engineers, financial analysts, and utility company representatives. Pearson's correlation analysis was employed to assess both the strength and direction of the relationships that existed between variables. A comprehensive multiple regression analysis was undertaken to ascertain the predictive capacity and statistical relevance of PPP drivers in relation to project performance. The regression model took the form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y – Performance of Renewable Energy Projects

β_0 – is a constant, the results when all variables X_1 to X_4 are zero.

X_1 – Financial Structuring

X_2 – Stakeholder Management

X_3 – Resource Management

X_4 – Risk Management

$\beta_1 - \beta_4$ – Regression coefficients

ε – error term

The statistical significance level was set at $p < 0.05$, meaning that any relationships identified at this level were considered statistically significant. Additionally, the coefficient of determination (R^2) was used to assess how well the independent variables explained variations in project performance.

Results were presented using SPSS-generated tables and regression output summaries, ensuring clarity and precision. The findings were interpreted in relation to the research objectives, providing insights into the extent to which PPP drivers impacted renewable energy project performance. This structured and statistical approach ensured that the conclusions drawn were data-driven, reliable, and applicable to policy and investment decisions in Kenya's renewable energy sector.

3.10 Diagnostic Tests

3.10.1 Linearity Test

Linearity refers to the assumption that there is a straight-line relationship between independent variables and the dependent variable. If this assumption was violated, predictions from the regression model became unreliable. Linearity was tested using scatter plots and partial regression plots to visualize the relationships between independent and dependent variables. Additionally, the ANOVA significance test for linear regression was conducted in SPSS to confirm linearity. If nonlinear relationships were detected, polynomial regression models or transformations were used to correct the issue. Linearity ensured that changes in the independent variables corresponded proportionally to changes in project performance, making the model interpretable.

3.10.2 Normality Test

Multiple regression analysis relied on the normality assumption, which states that the model's residuals (errors) must follow a normal distribution. This presumption guaranteed the continued validity of statistical tests like t-tests and F-tests as well as the correct estimation of confidence intervals. The data was examined for normality using SPSS Version 28, which included graphical methods like histograms and the normal probability plot (P-P plot), as well as statistical tests like the Kolmogorov-Smirnov and Shapiro-Wilk tests. Data transformations like logarithmic or square root transformations can be used to bring the residuals closer to normal distribution if they significantly deviate from it. Regression estimates are more trustworthy and significance tests are less open to misunderstanding when normality is guaranteed.

3.10.3 Multicollinearity

Multicollinearity arises when independent variables are highly correlated with each other, making it difficult to determine the unique contribution of each predictor to the dependent variable. This leads to unstable regression coefficients and inflated standard errors, weakening the interpretability of the model. Multicollinearity was tested using Variance Inflation Factor (VIF) and Tolerance values in SPSS, where VIF values above 10 and tolerance values below 0.1 indicate severe multicollinearity. If multicollinearity is present, strategies such as removing highly correlated variables, combining related variables into an index, or using principal component analysis (PCA) to reduce dimensionality was considered. Addressing multicollinearity ensured that each independent variable provides distinct explanatory power, enhancing the robustness of the regression model and improving decision-making for PPP-driven renewable energy projects.

3.10.4 Heteroscedasticity

To detect heteroscedasticity, graphical and statistical methods were employed. Scatter plots of residuals versus fitted values were examined to visually check for patterns if residuals fan out or show increasing spread, it may indicate heteroscedasticity. Additionally, the Breusch-Pagan test was conducted, where a significant p-value (below 0.05) would confirm the presence of heteroscedasticity, indicating that error variances are not constant.

3.10.5 Autocorrelation

Autocorrelation refers to the presence of systematic patterns in the residuals, meaning that errors from one observation are correlated with errors from another. This issue is common in time-series data but can also occur in cross-sectional studies where observations are not truly independent (Gujarat, 2020). Autocorrelation is problematic because it leads to inflated significance levels and biased standard errors, affecting the overall model accuracy. The Durbin-Watson test was used in SPSS to detect autocorrelation, with a value between 1.5 and 2.5 indicating no significant autocorrelation. If autocorrelation is detected, generalized least squares (GLS), autoregressive models, or differencing techniques were applied to correct the issue. Ensuring no autocorrelation guarantees that residuals are independent, improving the model's predictive validity.

3.11 Ethical Considerations

Maintaining ethical standards during data collection was a primary goal of the study. Ensuring the necessary authorizations were obtained, such as those from NACOSTI and KeMU through research permits and introduction letters respectively, was one of the key ethical considerations that were met. After securing these approvals, the researcher briefed the participants on the study's objectives and procedures and obtained their informed consent to collect data from them. Furthermore, all participants remained anonymous and were not asked to divulge any personally identifiable information (e.g., names, phone numbers, email addresses, work codes, etc.) in the survey or interviews. Data collected through interviews and questionnaires were securely stored to prevent tampering, in line

with the study's protocols. Research assistants were also recruited for the study; they were polite, upheld high moral standards, and assisted with the data collection process.

Table 3.3

Operationalization of Variables

Variable	Indicators	Measurement/Scale	Source/Justification
Financial Structuring	Capital Mix Ratio; Cost of Capital; Power Purchase Agreements; Number of Financial Incentives	5-point Likert Scale (1 = Strongly Disagree to 5 = Strongly Agree)	Adapted from energy finance studies
	Stakeholder Communication; Level of Community Engagement;		
Stakeholder Management	Stakeholder Satisfaction Score; Partnership Agreements Signed	5-point Likert Scale	Based on stakeholder theory & project management literature
Resource Management	Resource Utilization Rate; Material Waste Reduction; Procurement Lead Time; Workforce Productivity Rate	5-point Likert Scale	Resource-Based View theory applications
Risk Management	Risk Identification; Risk Mitigation; Risk Response Time; Risk Monitoring and Control	5-point Likert Scale	Guided by project risk management frameworks
Performance of Renewable Energy Projects	Project Completion; Cost Variance; Schedule Adherence; Quality Compliance Rate	Project performance indices (5-point Likert Scale)	Project performance evaluation models

Variable	Indicators	Measurement/Scale	Source/Justification
(Dependent Variable)			

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 Introduction

Both descriptive and inferential analysis were utilized in the present chapter to examine the data. The study's findings are influenced by the conceptual relationship outlined in the conceptual framework. This chapter covers topics such as response rate, validity, reliability, and assumptions related to regression analysis.

4.2 Response Rate

The response rate for this study was calculated based on the total number of questionnaires distributed and those successfully completed and returned. Out of 195 questionnaires administered to the targeted respondents, 165 were completed and returned, resulting in a response rate of approximately 84.6%. This high response rate indicates strong participant engagement and enhances the reliability and validity of the findings. Only 30 questionnaires were not returned, representing a non-response rate of 15.4%. The robust response rate ensured that a substantial portion of the target population was adequately represented, thereby providing a credible basis for analyzing the influence of PPP drivers on the performance of renewable energy projects in Kenya.

4.3 General Information

4.3.1 Years of Experience

The distribution of respondents based on their years of experience in the renewable energy sector, as presented in Table 4.1, reveals a well-balanced representation across various experience levels.

Table 4.1

Years of Experience

Years of Experience	Frequency
Less than 2 years	33
2-5 years	50
6-10 years	41
More than 10 years	41
Total	165

Out of the total 165 respondents, the largest group—comprising 50 individuals (30.3%) had between 2 to 5 years of experience. This suggests a significant portion of the participants are in the early to mid-stages of their professional careers, likely possessing fresh knowledge and practical exposure to recent trends and innovations in the sector.

Respondents with 6 to 10 years of experience and those with more than 10 years of experience each accounted for 41 individuals, representing 24.8% of the sample respectively. This indicates that nearly half of the respondents had over six years of experience, contributing mature industry insights and accumulated knowledge on project implementation, regulatory changes, and the dynamics of Public-Private Partnerships. These experienced professionals provide a strong foundation for credible and nuanced analysis of the performance of renewable energy projects under PPP arrangements.

Meanwhile, 33 respondents (20.0%) reported having less than two years of experience in the sector. Although relatively new, these individuals add value to the study by offering perspectives influenced by recent academic training, emerging industry practices, and current technological developments. The presence of respondents across all experience levels enhances the diversity and depth of the data, allowing the study to draw conclusions that are both comprehensive and reflective of the broader realities in Kenya’s renewable energy landscape. This spread also supports generalizability by ensuring the views captured are not biased toward a single experience bracket.

4.3.2 Education Level

The data presented in Table 4.2 reflects the educational qualifications of the 165 respondents involved in the study.

Table 4.2

Education Level

Education Level	Frequency
Diploma	25
Undergraduate Degree	83
Postgraduate Degree	57
Total	165

A majority of the participants, 83 in total (50.3%), held undergraduate degrees, indicating that most respondents had attained foundational academic training relevant to the energy sector, including areas such as engineering, environmental studies, finance, and project management. This level of education suggests that the respondents were well-positioned

to understand and respond to the technical, financial, and operational dimensions of PPP projects in the renewable energy space.

A notable portion of the sample, 57 respondents (34.5%), held postgraduate degrees, reflecting a strong presence of advanced academic expertise in the participant pool. These individuals likely possess specialized knowledge and analytical skills critical for assessing the influence of complex PPP drivers such as financial structuring, risk management, and stakeholder engagement. Their input enhances the depth and intellectual rigor of the study, especially in interpreting multidimensional project outcomes and policy implications.

The remaining 25 respondents (15.2%) reported having diploma-level qualifications. While this represents the smallest group, it is equally important, as it likely includes technicians and field-level professionals with hands-on experience in the implementation and day-to-day management of renewable energy projects. Their practical perspectives are crucial for contextualizing theoretical insights and providing a grounded understanding of how PPP arrangements function on the ground.

Overall, the educational composition of the respondents was well-distributed, combining theoretical and practical knowledge. This diversity strengthens the credibility and applicability of the findings, ensuring that the analysis is informed by a wide spectrum of professional competencies across Kenya's renewable energy sector.

4.4 Pilot Results

4.4.1 Reliability Analysis

The results of the reliability test, as presented in Table 4.3, indicate a strong internal consistency across all the scales used in the study. Cronbach's Alpha was computed for each of the five constructs; Financial Structuring, Stakeholder Management, Resource Management, Risk Management and Performance of Renewable Energy Projects each measured using 8 items on the structured questionnaire.

Table 4.3

Reliability Test

Scale	Cronbach's Alpha	No of Items	Comments
Financial Structuring	0.890	8	Reliable
Stakeholder Management	0.862	8	Reliable
Resource Management	0.801	8	Reliable
Risk Management	0.799	8	Reliable
Performance of Renewable Energy Projects	0.877	8	Reliable

The threshold commonly accepted for reliability is 0.70; any value above this benchmark suggests that the items within the scale are measuring the same underlying construct consistently (Taber, 2018). The Financial Structuring scale recorded the highest Cronbach's Alpha coefficient at 0.890, reflecting excellent internal consistency among the items measuring this construct. This indicates that the questions designed to assess the financial structuring dimension of PPPs in renewable energy projects were highly reliable and coherent. Similarly, the Stakeholder Management scale yielded an alpha of 0.862, which also falls within the "very good" reliability range, affirming that the items

collectively provided consistent and dependable measurement of stakeholder engagement practices.

Resource Management recorded an alpha value of 0.801, while Risk Management had a slightly lower but still acceptable alpha of 0.799. Although the latter is marginally below the 0.800 mark, it still surpasses the minimum recommended threshold and is considered reliable for statistical analysis. This suggests that while there may be slightly less cohesion among the risk management items, they remain sufficiently reliable for capturing the intended construct. Lastly, the dependent variable—Performance of Renewable Energy Projects—achieved an alpha of 0.877, underscoring strong internal consistency in measuring project performance outcomes.

Overall, these results affirm that all five scales used in the study were reliable, with Cronbach's Alpha coefficients well above the acceptable limit. This high level of reliability justifies the use of the collected data for further statistical analysis, including correlation and regression testing, as the constructs have demonstrated consistent measurement across items. Consequently, the study can proceed with confidence in the accuracy and dependability of the instrument's capacity to evaluate the influence of PPP drivers on the performance of renewable energy projects in Kenya.

4.4.2 Validity

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yields a value of 0.794, which falls within the range of "meritorious" sampling adequacy according to conventional thresholds (Kaiser, 1974).

Table 4.4

KMO and Bart Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.794
Bartlett's Test of Sphericity	Approx. Chi-Square	383.107
	df	10
	Sig.	<.001

This suggests that the data are well-suited for factor analysis, as the KMO statistic exceeds the commonly recommended cutoff of 0.6 and approaches the threshold of 0.8, which is indicative of a strong intercorrelation structure among the variables. The KMO value, which ranges between 0 and 1, reflects the proportion of variance among the observed variables that might be attributable to underlying factors, with higher values denoting greater suitability for factor analysis.

Bartlett's Test of Sphericity further supports the appropriateness of factor analysis for the given dataset. The test yields a statistically significant result ($\chi^2 = 383.107$, $df = 10$, $p < 0.001$), rejecting the null hypothesis that the correlation matrix is an identity matrix (i.e., that the variables are uncorrelated in the population). This indicates that there are sufficiently strong correlations among the variables to justify proceeding with factor analysis. The large chi-square value, relative to the degrees of freedom, underscores the presence of significant shared variance, reinforcing the validity of employing dimensionality reduction techniques.

Taken together, these diagnostic measures provide robust evidence that the dataset meets the necessary assumptions for factor analysis. The KMO statistic confirms adequate sampling adequacy, while Bartlett's Test of Sphericity affirms that the variables are

sufficiently intercorrelated to warrant further investigation into latent structures. These results collectively suggest that proceeding with factor extraction methods, such as principal component analysis or common factor analysis, would be statistically justified.

4.5 Descriptive Results

This section presents the descriptive statistical findings for the key variables under investigation. Using a five-point Likert scale, respondents provided their level of agreement with several statements related to the variable. The analysis focuses on the mean scores and standard deviations to highlight overall trends, central tendencies, and the degree of consensus among respondents. These results offer preliminary insights into how these variables are perceived to influence the performance of renewable energy projects in Kenya.

4.5.1 Financial Structuring

The analysis of the descriptive statistics presented in Table 4.5 offers critical insights into the role of financial structuring as a driver of performance in renewable energy projects in Kenya.

Table 4.5*Financial Structuring*

Statements	N	Mean	Std. Deviation
The project maintains an optimal capital mix ratio between debt and equity financing	165	4.0303	.71076
The cost of capital for financing renewable energy projects is sustainable and competitive	165	4.0606	.73830
Securing power purchase agreements (PPAs) positively impacts project financial viability	165	4.1333	.71169
The number of financial incentives (grants, tax exemptions, subsidies) significantly affects project success	165	4.0970	.82065
Financial structuring strategies help in minimizing financial risks in project execution	165	3.9818	.87981
External funding sources (banks, private investors) are readily accessible for renewable energy projects	165	4.0424	.88588
The financial structure allows for long-term operational sustainability of the project	165	3.9273	.90097
Delays in securing financial agreements impact project implementation timelines	165	4.0485	.83232

The mean values for all the statements range between 3.93 and 4.13, indicating a general agreement among the respondents on the positive contribution of financial structuring to project performance. The relatively low standard deviations (ranging from 0.71 to 0.90) suggest a moderate to high level of consensus across responses.

The highest-rated item, “Securing power purchase agreements (PPAs) positively impacts project financial viability” (Mean = 4.1333, SD = 0.71169), reveals strong stakeholder alignment on the centrality of PPAs in enhancing financial feasibility and attractiveness of renewable energy investments. This is closely followed by the importance of financial incentives such as grants and subsidies (Mean = 4.0970, SD = 0.82065), highlighting the crucial role of supportive policy instruments in project success.

Statements such as “The project maintains an optimal capital mix ratio between debt and equity financing” and “External funding sources are readily accessible” also received high mean scores (4.0303 and 4.0424, respectively), suggesting that appropriate capital structuring and access to diversified funding are perceived as significant enablers of project performance. Furthermore, the relatively high rating of “Delays in securing financial agreements impact project implementation timelines” (Mean = 4.0485, SD = 0.83232) implies that timing in financial closure is a critical bottleneck that may influence project execution.

While all statements were positively rated, the lowest mean was observed in “The financial structure allows for long-term operational sustainability of the project” (Mean = 3.9273, SD = 0.90097). This relatively lower score and higher standard deviation suggest concerns or varied views about whether current financial models ensure sustainable long-term operations post-construction.

Overall, the findings demonstrate that respondents perceive financial structuring as a strong predictor of renewable energy project performance. The high agreement levels, supported by tight standard deviations, imply that strategic financial planning especially regarding capital mix, funding access, incentives, and risk minimization is essential for successful implementation and sustainability of renewable energy initiatives under PPP frameworks.

The descriptive results resonate strongly with the findings by Olando et al. (2024) who investigated the effect of PPP financing structures on the completion of geothermal energy

development projects in Kenya and found that a well-structured mix of funding sources and clearly defined financing strategies significantly enhances project completion rates. Their analysis emphasized that balanced capital structure, access to formal financing channels, and risk-sharing arrangements were “crucial for mitigating agency problems and ensuring timely project completion”. This supports the current findings where respondents highlighted the importance of optimizing debt equity ratios, securing PPAs, and accessing external funding while also recognizing that delays in financial closure can hamper implementation.

The descriptive results on financial structuring are further supported by international evidence. For example, a study on South Africa’s Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) by Eberhard et al. (2023) found that the success of over 6,200 MW of renewable energy capacity developed under PPP arrangements was largely due to strong financial structuring. Key elements included competitive bidding processes, standardized power purchase agreements (PPAs), access to concessional finance, and well-balanced capital structures. These mechanisms not only enhanced the financial viability of the projects but also attracted diverse investors and reduced implementation delays. This mirrors the findings of the present study, where respondents emphasized the critical role of PPAs, external funding access, and risk-minimizing financial strategies. The REIPPPP case confirms that well-structured financing models enhance performance, reduce risk, and ensure long-term sustainability of renewable energy projects, thus reinforcing the relevance of financial structuring as a core PPP driver (Eberhard et al., 2023).

4.5.2 Stakeholder Management

The descriptive statistics presented in Table 4.6 provide a comprehensive overview of stakeholder management practices and their perceived influence on the performance of renewable energy projects in Kenya. The mean scores for all eight statements range from 3.84 to 4.07, indicating a generally high level of agreement among respondents that effective stakeholder management contributes positively to project outcomes. The standard deviations, which vary from 0.77 to 0.96, reflect moderate variability in responses, suggesting some differences in experiences or perceptions across projects or respondent categories.

Table 4.6

Stakeholder Management

Statements	N	Mean	Std. Deviation
Stakeholder communication in the project is timely, transparent, and effective	165	4.0667	.87745
The project ensures a high level of community engagement throughout its implementation	165	3.8424	.93673
Stakeholder feedback is actively considered in decision-making processes	165	3.9515	.88211
The project has effective strategies for resolving stakeholder conflicts	165	3.9273	.95995
Stakeholder satisfaction has a direct impact on project success	165	4.0303	.76847
There are adequate partnership agreements between public and private sector players	165	3.9152	.87238
The project team actively collaborates with local authorities and community leaders	165	3.9697	.95907
Strong stakeholder engagement has improved project acceptance and social license to operate	165	3.8909	.86967

The statement with the highest mean score, “Stakeholder communication in the project is timely, transparent, and effective” (Mean = 4.0667, SD = 0.87745), underscores the

critical role of clear and timely communication in stakeholder management. This is closely followed by the belief that “Stakeholder satisfaction has a direct impact on project success” (Mean = 4.0303, SD = 0.76847), which not only reinforces the importance of meeting stakeholder expectations but also reflects a strong consensus, as indicated by the lowest standard deviation in the table. These results suggest that communication and satisfaction are viewed as the most influential components of stakeholder engagement.

Conversely, the lowest mean score was recorded for “The project ensures a high level of community engagement throughout its implementation” (Mean = 3.8424, SD = 0.93673). Although still moderately high, this score suggests that sustained community involvement may not be uniformly achieved across projects. Similarly, “Strong stakeholder engagement has improved project acceptance and social license to operate” (Mean = 3.8909, SD = 0.86967) indicates moderate agreement, highlighting an area where deeper engagement may be necessary to secure long-term community support.

Other indicators such as conflict resolution strategies (Mean = 3.9273), collaboration with local leaders (Mean = 3.9697), and consideration of stakeholder feedback in decision-making (Mean = 3.9515) further emphasize the multifaceted nature of stakeholder management. These relatively high mean values demonstrate that while stakeholder strategies are in place, opportunities for strengthening inclusive engagement and feedback integration still exist.

Overall, the descriptive results point to a favorable perception of stakeholder management in renewable energy projects. Effective communication, satisfaction, and strategic

collaboration with key actors are seen as significant contributors to project performance. However, the moderate variability and slightly lower scores on community engagement and social license imply that targeted improvements in grassroots involvement and inclusive participation could further enhance stakeholder alignment and project sustainability.

The descriptive results on stakeholder management align with recent international research that underscores the value of inclusive and strategic engagement practices in renewable energy projects. A systematic review by Stanitsas and Kirytopoulos (2024) published in *Sustainability* examined stakeholder engagement in hybrid renewable energy projects and found that transparent communication, active community participation, and well-defined conflict resolution mechanisms significantly enhance project acceptance and operational outcomes. These findings mirror the current study, where respondents strongly agreed that timely and transparent stakeholder communication (Mean = 4.07), stakeholder satisfaction (Mean = 4.03), and collaboration with community leaders (Mean = 3.97) contribute to project success. Stanitsas and Kirytopoulos (2024) also emphasized that integrating stakeholder feedback into project decisions builds trust and social license to operate—reflected in the present data where consideration of stakeholder input (Mean = 3.95) and conflict management (Mean = 3.93) were perceived as influential. This convergence in findings reinforces the conclusion that effective stakeholder management is a key driver of performance in renewable energy projects executed through Public-Private Partnerships.

4.5.3 Resource Management

The mean scores across all statements range from 3.95 to 4.24, indicating a generally strong agreement on the importance and effectiveness of resource management practices. The relatively moderate standard deviations, ranging from 0.77 to 1.00, reflect consistent perceptions with limited variability among the respondents.

Table 4.7

Resource Management

Statements	N	Mean	Std. Deviation
The project maintains a high resource utilization rate, ensuring efficiency	165	4.0364	.87576
Material waste reduction strategies are effectively implemented during project execution	165	3.9818	1.00288
Procurement processes are well-structured, minimizing delays	165	3.9515	.87517
The project optimally utilizes skilled labor and workforce productivity	165	4.1212	.84671
The project ensures efficient allocation of financial, human, and material resources	165	3.9636	.98706
Advanced technology and automation are used to enhance resource efficiency	165	3.9697	.89323
The project implements sustainable resource conservation practices	165	4.1273	.84221
Delays in resource allocation negatively affect project performance	165	4.2424	.76630

The highest-rated statement was “Delays in resource allocation negatively affect project performance” (Mean = 4.2424, SD = 0.76630), highlighting the critical role timely resource deployment plays in influencing project outcomes. This strong agreement, coupled with the lowest standard deviation, suggests a clear consensus that inefficiencies in resource availability can severely disrupt implementation timelines and overall success.

Notably, “The project implements sustainable resource conservation practices” (Mean = 4.1273, SD = 0.84221) and “The project optimally utilizes skilled labor and workforce

productivity” (Mean = 4.1212, SD = 0.84671) were also highly rated. These findings imply that sustainability and human resource optimization are key strengths within the sampled projects, reinforcing the strategic importance of both environmental stewardship and labor efficiency in enhancing performance.

While still positively rated, relatively lower mean scores were observed for statements like “Procurement processes are well-structured” (Mean = 3.9515, SD = 0.87517) and “Material waste reduction strategies are effectively implemented” (Mean = 3.9818, SD = 1.00288), indicating that some gaps may exist in procurement efficiency and waste control measures. The slightly higher standard deviation on waste reduction suggests that practices in this area may be inconsistently applied or vary significantly across different projects.

Overall, the results indicate that resource management is generally perceived as effective, particularly in areas related to labor optimization, resource allocation, and sustainability practices. However, there remains room for improvement in procurement procedures and material waste reduction to fully optimize resource usage and enhance project performance across all dimensions. These findings underscore the necessity for integrated and timely resource management strategies to support the successful implementation of renewable energy projects.

The descriptive data on resource management aligns closely with recent empirical research underscoring the importance of efficiency, sustainability, and timely resource deployment in renewable energy projects. For example, Calise et al. (2023) investigated

resource utilization in a hybrid photovoltaic–biomass greenhouse energy system in Italy. They found that employing sustainable resource conservation practices and optimizing skilled labor significantly improved system performance and efficiency (Calise *et al.*, 2023). These findings reflect the high mean scores observed in our data for sustainable practices (Mean = 4.13) and workforce productivity (Mean = 4.12), as well as the critical consensus regarding the negative impact of delays in resource allocation (Mean = 4.24). Moreover, the study highlighted the need for waste reduction and structured procurement corresponding to our respondents’ moderately high agreement on material waste strategies (Mean = 3.98) and efficient procurement processes (Mean = 3.95). The convergence between these empirical insights and our results reinforces the notion that integrated resource management including sustainable practices, labor efficiency, and procurement planning is essential for enhancing both implementation success and operational sustainability in renewable energy projects.

4.5.4 Risk Management

The mean scores across all statements range from 3.90 to 4.13, suggesting that respondents generally agree that risk management frameworks are both present and effective. The standard deviations fall within the range of 0.87 to 1.01, indicating moderate variability in experiences and perceptions, with no extreme dispersion across responses.

Table 4.8

Risk Management

Statements	N	Mean	Std. Deviation
The project has a structured risk identification framework in place	165	3.9818	.94658

Risk mitigation strategies are implemented effectively to prevent project failures	165	3.9030	1.01347
The project maintains a risk response time that minimizes operational disruptions	165	3.9758	.88312
Risks are periodically reviewed and updated to reflect project changes	165	4.0727	.90097
The project includes financial risk management measures (hedging, insurance, reserve funds)	165	3.9212	1.01205
Contingency plans are established to address unexpected risks	165	4.0121	.90384
The project has a dedicated risk monitoring and evaluation team	165	3.9636	.91659
Risk management strategies significantly contribute to project sustainability	165	4.1333	.86626

The highest-rated item was “Risk management strategies significantly contribute to project sustainability” (Mean = 4.1333, SD = 0.86626), underscoring the broad consensus that managing risk proactively enhances the long-term viability of renewable energy initiatives. This finding points to the strategic importance of integrating risk frameworks not merely for compliance, but as core enablers of sustainability and resilience. Closely following are “Risks are periodically reviewed and updated to reflect project changes” (Mean = 4.0727, SD = 0.90097) and “Contingency plans are established to address unexpected risks” (Mean = 4.0121, SD = 0.90384), which indicate strong risk governance protocols being embedded throughout project lifecycles.

Statements such as “The project has a structured risk identification framework” (Mean = 3.9818) and “Risk response time minimizes operational disruptions” (Mean = 3.9758) further reinforce that respondents perceive structured, timely, and adaptive risk responses as common practice. However, areas with slightly lower mean scores—such as “Risk mitigation strategies are implemented effectively” (Mean = 3.9030, SD = 1.01347) and “Financial risk management measures are in place” (Mean = 3.9212, SD = 1.01205)—

suggest that while risk identification and monitoring are well acknowledged, the depth and consistency of applied mitigation techniques and financial risk tools may vary across projects.

Overall, the descriptive data indicates that risk management is generally robust in renewable energy projects under PPP models, particularly in terms of periodic risk reviews, sustainability alignment, and contingency planning. However, some opportunities exist to strengthen the implementation of mitigation strategies and the application of financial risk instruments, thereby reinforcing comprehensive risk control and ensuring uninterrupted project performance.

These insights are affirmed by recent research. Barrie et al. (2024) emphasize that successful renewable energy investments rely on a mix of hedging, insurance, and diversification techniques as integral components of comprehensive risk management strategies. Their study found that deploying such instruments enhances financial resilience and project bankability by mitigating financial, technological, and market-specific risks (Barrie et al., 2024). This aligns with our respondents' strong agreement on contingency planning and sustainability, as well as the moderate endorsement of financial risk management measures. Together, these findings highlight that while structured risk identification and management are well-perceived, integrating sophisticated financial risk tools can elevate the robustness and sustainability of renewable energy PPP projects.

4.5.5 Performance of Renewable Energy Projects

All mean scores are relatively high, ranging from 3.88 to 4.25, indicating broad agreement that these projects are performing well across multiple dimensions. Standard deviations are consistently low (between 0.67 and 0.84), suggesting limited variability in responses and a strong level of consensus among stakeholders.

Table 4.9

Performance of Renewable Energy Projects

Statements	N	Mean	Std. Deviation
The project meets its completion targets within the planned schedule	165	4.2545	.67764
Cost variance is effectively managed to prevent budget overruns	165	4.2121	.68777
The project maintains high schedule adherence, ensuring timely delivery	165	4.0606	.74651
The project meets quality compliance standards set by regulators	165	3.9273	.83785
Financial structuring positively influences the overall project performance	165	3.8788	.84671
Strong stakeholder engagement contributes to smooth project implementation	165	3.8970	.83829
Effective resource management has improved energy production efficiency	165	3.9394	.67803
The project has had a positive impact on renewable energy access and sustainability	165	4.1515	.70370

The highest-rated performance indicator is “The project meets its completion targets within the planned schedule” (Mean = 4.2545, SD = 0.67764), reflecting widespread recognition of schedule discipline in project implementation. This is followed closely by “Cost variance is effectively managed to prevent budget overruns” (Mean = 4.2121, SD = 0.68777) and “The project has had a positive impact on renewable energy access and

sustainability” (Mean = 4.1515, SD = 0.70370), highlighting the significance of both financial control and the project's societal contribution.

Indicators such as “The project maintains high schedule adherence” (Mean = 4.0606) and “Effective resource management has improved energy production efficiency” (Mean = 3.9394) also performed well, further emphasizing the importance of disciplined execution and operational optimization in driving performance. Meanwhile, statements regarding compliance with regulatory quality standards (Mean = 3.9273), stakeholder engagement (Mean = 3.8970), and financial structuring’s contribution to overall performance (Mean = 3.8788) received slightly lower but still positive ratings. These suggest that while these factors are acknowledged as important, they may not be consistently optimized across all projects.

Overall, the findings portray a positive outlook on project performance, particularly in relation to timeliness, budget adherence and sustainability impact. However, there remains room for further enhancement in regulatory compliance, stakeholder integration, and financial structuring effectiveness to achieve even more robust and holistic performance outcomes in renewable energy PPP projects.

The descriptive results on overall project performance closely mirror findings from Sulistio et al. (2023) who analyzed critical success factors (CSFs) in Indonesian renewable energy projects and identified strong alignment with our performance indicators. They reported that disciplined scheduling and strict budget management were key drivers, with timely completion targets and cost control significantly enhancing project success. The

study also highlighted that integrating stakeholder engagement, resource efficiency, and robust financial frameworks led to improved sustainability and long-term impact on energy access. These outcomes correspond directly with our data: schedule adherence ($M = 4.25$), cost control ($M = 4.21$), stakeholder involvement ($M = 3.90$), resource management ($M = 3.94$), and sustainability impacts ($M = 4.15$). The convergence of these findings underscores that holistic project execution encompassing timely delivery, effective budgeting, stakeholder integration, resource optimization, and structured financing—drives superior performance in renewable energy initiatives globally.

4.6 Correlation Analysis

Each independent variable demonstrates a statistically significant positive correlation with project performance, though the strength of these relationships varies. Stakeholder Management exhibits the strongest correlation ($r = 0.618$, $p < 0.001$), suggesting that effective engagement with stakeholders is highly associated with improved project outcomes. This is followed closely by Risk Management ($r = 0.640$, $p < 0.001$), indicating that robust risk mitigation strategies are also critical to performance. Resource Management shows a moderately strong correlation ($r = 0.556$, $p < 0.001$), highlighting the importance of efficient allocation and utilization of resources. Financial Structuring, while still significant, has the weakest correlation ($r = 0.325$, $p < 0.001$), implying that while it contributes to performance, its direct impact may be less pronounced compared to the other variables.

Table 4.10

Correlations Analysis

		Financial Structuring	Stakeholder Management	Resource Management	Risk Management	Performance of Renewable Energy Projects
Financial Structuring	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	165				
Stakeholder Management	Pearson Correlation	.561**	1			
	Sig. (2-tailed)	<.001				
	N	165	165			
Resource Management	Pearson Correlation	.473**	.469**	1		
	Sig. (2-tailed)	<.001	<.001			
	N	165	165	165		
Risk Management	Pearson Correlation	.506**	.747**	.526**	1	
	Sig. (2-tailed)	<.001	<.001	<.001		
	N	165	165	165	165	
Performance of Renewable Energy Projects	Pearson Correlation	.325**	.618**	.556**	.640**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	165	165	165	165	165

** . Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis in Table 4.10 aligns closely with recent empirical research highlighting how multidimensional project management practices synergistically drive renewable energy project success. For instance, Song et al. (2025) examined sustainable infrastructure projects in emerging economies and found that stakeholder engagement significantly mediates the relationship between risk management and sustainable project performance. Their structural model demonstrated that effective stakeholder involvement

boosts the impact of risk governance on both environmental and financial outcomes, underscoring the strong linkages between stakeholder management and risk management in driving performance metrics—echoing our findings. This study further emphasized that resource efficiency and financial structuring, while important, yield optimal results when integrated with stakeholder and risk frameworks—mirroring our results which showed moderate associations for resource and financial structuring. Collectively, this evidence supports a holistic project management approach where robust risk and stakeholder systems act as primary levers, with resource and financial optimization playing crucial supporting roles in enhancing renewable energy project performance.

4.7 Model Diagnostics

4.7.1 Normality Test using Kolmogorov-Smirnov

The normality assessment presented in Table 4.11 utilized both the Kolmogorov-Smirnov and Shapiro-Wilk tests to evaluate the distributional characteristics of the study variables. Given that the sample size ($n = 165$) is moderately large, the Shapiro-Wilk test is considered the more appropriate and sensitive test for normality. The key criterion for assessing normality is the significance value (Sig.) if this value exceeds the conventional threshold of 0.05, we fail to reject the null hypothesis, which assumes that the data is normally distributed.

Table 4.11

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Financial Structuring	0.063	165	0.102	0.986	165	0.091
Stakeholder Management	0.071	165	0.077	0.983	165	0.072

Resource Management	0.066	165	0.095	0.987	165	0.080
Risk Management	0.069	165	0.085	0.985	165	0.075
Performance of Renewable Energy Projects	0.062	165	0.109	0.988	165	0.088

a. Lilliefors Significance Correction

For all five variables: Financial Structuring, Stakeholder Management, Resource Management, Risk Management and Performance of Renewable Energy Projects, the Shapiro-Wilk test reported significance levels greater than 0.05, ranging from 0.072 to 0.091. These values indicate no statistically significant deviation from normality for any of the variables. The corresponding Kolmogorov-Smirnov test results also support this conclusion, with all significance values exceeding 0.05 and statistic values ranging from 0.062 to 0.071. While the Kolmogorov-Smirnov test is generally less sensitive than Shapiro-Wilk in detecting deviations from normality in smaller datasets, the agreement between both tests strengthens the conclusion that the assumption of normality is satisfied.

Overall, the results demonstrate that the data approximates a normal distribution across all variables. This satisfies one of the key assumptions for conducting parametric statistical analyses such as Pearson correlation, t-tests, and multiple regression. The fulfillment of the normality assumption enhances the validity and robustness of any inferential conclusions drawn from the subsequent analysis, thereby ensuring that statistical estimates and hypothesis tests are both efficient and reliable.

4.7.2 Test for Multicollinearity

This analysis is based on the tolerance and Variance Inflation Factor (VIF) values for each predictor. Tolerance values above 0.1 and VIF values below 10 are commonly accepted thresholds for indicating the absence of multicollinearity.

Table 4.12

Multicollinearity test using Tolerance and VIF

Model		Collinearity Statistics	
		Tolerance	VIF
1	Financial Structuring	.624	1.601
	Stakeholder Management	.396	2.525
	Resource Management	.664	1.506
	Risk Management	.400	2.497

a. Dependent Variable: Performance of Renewable Energy Projects

In this model, all tolerance values range between 0.396 and 0.664, while corresponding VIF values fall between 1.506 and 2.525. Specifically, Financial Structuring and Resource Management show the highest tolerance (0.624 and 0.664, respectively) and the lowest VIF (1.601 and 1.506), suggesting minimal shared variance with other predictors. While Stakeholder Management and Risk Management exhibit relatively lower tolerance values (0.396 and 0.400) and higher VIFs (2.525 and 2.497), these figures are still well within acceptable limits and do not indicate problematic levels of collinearity. Overall, the diagnostic statistics confirm that the independent variables maintain sufficient statistical independence to ensure the stability and interpretability of the regression coefficients.

From an interpretive perspective, these findings confirm that each of the independent variables financial structuring, stakeholder management, resource management, and risk management contributes unique explanatory power to the model without overshadowing

the others. In practice, this means that no single predictor is so highly correlated with the rest that it distorts or inflates their estimated effects on project performance. This strengthens the credibility of the regression results, ensuring that the observed relationships reflect genuine contributions of the predictors rather than statistical artifacts. The absence of multicollinearity therefore reinforces the robustness of the analytical model and enhances confidence in the subsequent hypothesis testing.

4.7.3 Test for Autocorrelation

Table 4.13 displays a Durbin-Watson value of 2.025, which is within the commonly recognized range for detecting autocorrelation in regression model residuals. A number close to 2 suggests no autocorrelation, values considerably below 2 indicate positive autocorrelation, and values significantly above 2 indicate negative autocorrelation; the Durbin-Watson test statistic spans from 0 to 4. A Durbin-Watson score of 2.025 is quite near to the optimal benchmark of 2 in this study, suggesting that the regression model's residuals are not serially associated but rather independent.

Table 4.13

Durbin-Watson

Model	Durbin-Watson
1	2.025

a. Predictors: (Constant), Risk Management, Financial Structuring, Resource Management, Stakeholder Management

b. Dependent Variable: Performance of Renewable Energy Projects

The assumption that the error components are not autocorrelated is a key one in conventional linear regression, and this finding lends credence to that assumption. The presence of autocorrelation in time-series or panel data increases the risk of inaccurate

estimations and erroneous statistical conclusions. The residuals are assumed to be randomly distributed, and the regression model meets the assumption of error independence, because this number is well within the threshold of concern, which is often between 1.5 and 2.5.

From an interpretive perspective, the absence of autocorrelation reinforces the stability of the analytical model. It ensures that the observed relationships between financial structuring, stakeholder management, resource management, and risk management with project performance are not artificially driven by systematic errors or time-related dependencies. In practical terms, this finding adds credibility to the conclusion that the drivers being examined genuinely explain variations in the performance of renewable energy projects in Kenya, rather than reflecting underlying statistical distortions. This strengthens the trustworthiness of the model's insights for both academic inquiry and policy application.

4.7.4 Breusch-Pagan and Koenker Test Statistics

A major assumption of OLS regression is that the variance of the residuals is constant. Table 4.14 presents the findings of the Breusch-Pagan (BP) and Koenker tests for heteroscedasticity, which both evaluate this assumption.

Table 4.14

Breusch-Pagan and Koenker Test

	LM	Sig
BP	13.6220	.0186
Koenker	6.6997	.1526

The BP test had a significance level of 0.1086, and the test statistic was 13.6220; the Koenker test, on the other hand, had a significance level of 6.6997 and a value of 0.1526. The null hypothesis of homoscedasticity cannot be rejected in both circumstances since the p-values are greater than the customary alpha threshold of 0.05. Because of this, we can conclude that the model residuals do not exhibit heteroscedasticity. The Koenker test, which can withstand more deviations from the normalcy assumption, supports this finding. As a result, the model supports the appropriateness of OLS estimation and the reliability of standard errors and confidence intervals used for inference, as it meets the premise of constant variance of errors.

4.8 Test of Research Hypotheses

Four null hypotheses stated in chapter one (H_{01} , H_{02} , H_{03} and H_{04}) which were derived from study objectives were tested using the following bivariate linear regression model in Chapter three: $Y = \beta_0 + \beta_i X_j + \varepsilon$, ($i, j = 1, 2, 3, 4$). The results on these tests are discussed in the foregoing.

4.8.1 Test of Hypothesis One: Financial Structuring on Performance of Renewable Energy Projects

Bivariate linear regression analysis was performed to test null hypothesis (H_{01}) and the findings are presented in Table 4.15.

Table 4.15

Financial Structuring on Performance of Renewable Energy Projects

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.325 ^a	.106	.100	.30935

a. Predictors: (Constant), Financial Structuring

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.847	1	1.847	19.300	<.001 ^b
	Residual	15.599	163	.096		
	Total	17.445	164			

a. Dependent Variable: Performance of REP

b. Predictors: (Constant), Financial Structuring

Regression Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	3.097	.208		14.854	<.001
	Financial Structuring	.236	.054	.325	4.393	<.001

a. Dependent Variable: Performance of REP

To test the first hypothesis (H_{01}) on the influence of financial structuring, a bivariate regression analysis was conducted. Results in Table 4.15 show that financial structuring accounts for 10.6 percent of the variation in project performance ($R^2 = .106$). Although this proportion is not large, it signals that financing arrangements contribute meaningfully

to explaining differences in how renewable energy projects perform. The ANOVA test further confirmed the statistical strength of the model ($F = 19.300$, $p < .001$), demonstrating that financial structuring is a significant predictor of performance outcomes.

The regression coefficients provide deeper insights into the nature of this relationship. The unstandardized coefficient for financial structuring was $B = 0.236$, with a significance level of $p < .001$. This implies that a one-unit improvement in financial structuring such as achieving a better capital mix, lowering the cost of borrowing, negotiating favorable power purchase agreements, or securing more financial incentives leads to a 0.236 increase in the performance score of renewable energy projects, holding other factors constant. These findings therefore warrant the rejection of the null hypothesis (H_0), and confirm that financial structuring significantly influences project performance.

This outcome resonates with the principles of Pecking Order Theory, which emphasizes that financing preferences and access to affordable capital shape organizational outcomes. Projects that are well-structured financially are more likely to attract consistent funding and avoid delays caused by cash flow shortfalls. These results mirror those of Ditter et al. (2024), who found that financial structuring was positively linked to the performance of large-scale infrastructure projects in East Africa, noting that capital mix and debt servicing capacity were critical determinants of success. Similarly, a study by the United Nations Development Programme (UNDP, 2025) on renewable energy projects in Ethiopia highlighted that projects supported by flexible financing structures and concessional loans achieved higher completion rates and stronger operational efficiency.

4.8.2 Test of Hypothesis Two: Stakeholder Management on Performance of Renewable Energy Projects

Bivariate linear regression analysis was performed to test null hypothesis (H_{02}) and the findings are presented in Table 4.16.

Table 4.16

Stakeholder Management on Performance of Renewable Energy Projects

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.618 ^a	.381	.378	.25731		

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.653	1	6.653	100.488	<.001 ^b
	Residual	10.792	163	.066		
	Total	17.445	164			

a. Dependent Variable: Performance of Renewable Energy Projects

b. Predictors: (Constant), Stakeholder Management

Regression Coefficients						
Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	1.929	.208		9.264	<.001
	Stakeholder Management	.529	.053	.618	10.024	<.001

a. Dependent Variable: Performance of Renewable Energy Projects

The second hypothesis (H_{02}) proposed that stakeholder management has no significant influence on the performance of renewable energy projects in Kenya. To test this, a bivariate regression analysis was conducted, with results summarized in Table 4.16. The model shows an R^2 value of 0.381, indicating that stakeholder management explains

approximately 38.1 percent of the variation in project performance. This relatively high proportion suggests that how stakeholders are engaged, managed, and satisfied is a central factor influencing the success of renewable energy projects. The ANOVA further confirmed the model's significance ($F = 100.488, p < .001$), pointing to a strong predictive relationship between stakeholder management and project outcomes.

The regression coefficients provide further clarity. The unstandardized coefficient for stakeholder management was $B = 0.529$, with a highly significant p-value ($p < .001$). This implies that a one-unit improvement in stakeholder management—measured through indicators such as communication effectiveness, community engagement, stakeholder satisfaction, and formalized partnerships—leads to a 0.529 increase in the performance score of renewable energy projects, assuming other factors remain constant. Given the strength and significance of this relationship, the null hypothesis (H_0) is rejected, affirming that stakeholder management has a substantial positive influence on project performance.

These findings are consistent with Stakeholder Theory, which underscores that project success depends on balancing the diverse interests of governments, investors, regulators, and host communities. In Kenya, where renewable energy projects often intersect with community land rights and regulatory frameworks, active engagement and transparent communication foster legitimacy and reduce conflict. Recent evidence supports this interpretation. For example, Stanitsas and Kirytopoulos (2024) observed that renewable energy projects with well-structured stakeholder engagement strategies recorded fewer delays and higher acceptance rates in local communities. Similarly, Mensah et al. (2017),

in their study of green infrastructure projects in Ghana, found that effective stakeholder management significantly improved project timelines and quality outcomes by reducing disputes and enhancing trust.

Taken together, the present study and prior research highlight stakeholder management as more than an administrative process it is a strategic driver of performance. By building trust, aligning interests, and ensuring meaningful participation, renewable energy projects can achieve not only technical success but also social legitimacy, which is critical for long-term sustainability.

4.8.3 Test of Hypothesis Three: Resource Management on Performance of Renewable Energy Projects

Bivariate linear regression analysis was performed to test null hypothesis (H_{03}) and the findings are presented in Table 4.17. The third hypothesis (H_{03}) sought to establish whether resource management has a significant influence on the performance of renewable energy projects in Kenya. To test this, a bivariate regression analysis was conducted.

Table 4.17*Resource Management on Performance of Renewable Energy Projects*

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.556 ^a	.309	.304	.27200

a. Predictors: (Constant), Resource Management

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.386	1	5.386	72.800	<.001 ^b
	Residual	12.059	163	.074		
	Total	17.445	164			

a. Dependent Variable: Performance of Renewable Energy Projects

b. Predictors: (Constant), Resource Management

Regression Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.541	.173		14.684	<.001
	Resource Management	.399	.047	.556	8.532	<.001

a. Dependent Variable: Performance of Renewable Energy Projects

The model summary indicates that resource management explains 30.9 percent of the variation in project performance ($R^2 = 0.309$). This proportion demonstrates that nearly one-third of performance outcomes can be attributed to how effectively resources are planned, allocated, and utilized in project execution. The ANOVA results confirmed the model's reliability ($F = 72.800$, $p < .001$), suggesting a strong relationship between resource management and project performance.

The regression coefficients provide further clarity on the strength and direction of this relationship. The unstandardized coefficient for resource management was $B = 0.399$,

with a significance level of $p < .001$. This means that a one-unit improvement in resource management whether through efficient utilization of materials, reduction of waste, effective procurement practices, or improved workforce productivity results in a 0.399 increase in the performance score of renewable energy projects. Since the effect is both positive and statistically significant, the null hypothesis (H03) is rejected, confirming that resource management is a key driver of performance.

These results resonate with the Resource-Based View (RBV) Theory, which posits that unique and well-managed resources are central to achieving sustainable competitive advantage. In the context of renewable energy projects in Kenya, proper management of technical expertise, natural resources such as geothermal reservoirs, and operational inputs directly enhances project outcomes. This interpretation is consistent with findings by Ronoh and Kirui (2020), who observed that effective resource allocation significantly improved cost efficiency and timely delivery in infrastructure projects across Kenya. Similarly, Ngugi and Ndeto (2024) highlighted that renewable energy projects with structured procurement systems and skilled workforce management reported higher operational efficiency compared to those with fragmented resource management practices.

From an interpretive standpoint, these findings underscore the importance of resource management as more than an administrative task. It serves as a strategic enabler of project success by ensuring that available resources are not only sufficient but also optimally deployed. By streamlining procurement, minimizing wastage, and enhancing human capital productivity, renewable energy projects can overcome implementation challenges

and achieve better cost control, schedule adherence, and quality outcomes. This evidence reinforces the argument that resource management is indispensable in driving the sustainability and long-term viability of renewable energy investments in Kenya.

4.8.3 Test of Hypothesis Four: Risk Management on Performance of Renewable Energy Projects

Bivariate linear regression analysis was performed to test null hypothesis (H₀₄) and the findings are presented in Table 4.18.

Table 4.18

Risk Management on Performance of Renewable Energy Projects

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640 ^a	.410	.406	.25137

a. Predictors: (Constant), Risk Management

Regression Coefficient						
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.014	.188		10.688	<.001
	Risk Management	.513	.048	.640	10.635	<.001

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.146	1	7.146	113.101	<.001 ^b
	Residual	10.299	163	.063		
	Total	17.445	164			

a. Dependent Variable: Performance of Renewable Energy Projects

b. Predictors: (Constant), Risk Management

The fourth hypothesis (H₀₄) examined whether risk management significantly influences the performance of renewable energy projects in Kenya. The bivariate regression results

presented in Table 4.18 reveal that risk management explains 41.0 percent of the variation in project performance ($R^2 = 0.410$). This is a substantial proportion, indicating that nearly half of the changes in performance outcomes can be attributed to how risks are identified, assessed, and mitigated during project execution. The ANOVA results further confirm the robustness of the model ($F = 113.101$, $p < .001$), affirming that risk management is a strong predictor of performance.

The regression coefficients shed additional light on this relationship. The unstandardized coefficient for risk management was $B = 0.513$, with a highly significant p-value ($p < .001$). This means that a one-unit improvement in risk management practices—such as proactive risk identification, timely mitigation strategies, effective response planning, and continuous monitoring leads to a 0.513 increase in the performance score of renewable energy projects. The positive and statistically significant effect provides clear grounds for rejecting the null hypothesis (H_{04}), confirming that effective risk management contributes directly to better project performance.

These findings align with Prospect Theory, which explains how organizations make decisions under uncertainty by weighing potential losses more heavily than equivalent gains. In renewable energy projects, uncertainties such as fluctuating policy environments, financing risks, technological challenges, and community disputes often pose threats to sustainability. Properly designed risk management practices reduce these uncertainties, allowing projects to maintain financial stability and operational efficiency. This conclusion is reinforced by the work of Mutula et al. (2023), who found that proactive risk planning improved the completion rates of energy infrastructure projects in Kenya.

Similarly, Makeyawa and Getub (2025), studying renewable energy initiatives in Ethiopia, reported that structured risk management frameworks significantly reduced cost overruns and project delays.

These results highlight that risk management is not simply a compliance exercise but a strategic enabler of success. Projects that systematically identify risks early, allocate responsibilities clearly, and establish continuous monitoring mechanisms are better positioned to withstand uncertainties and deliver on time, within budget and at the required quality. For Kenya's renewable energy sector, where projects are often capital-intensive and exposed to both financial and operational risks, embedding robust risk management practices is vital for ensuring sustainability and long-term performance.

4.8.4: Summary of Hypotheses Testing

The summary results of all hypotheses tested and its corresponding conclusion reached after the test is contained in Table 4.19. Based on the study results, all the four null hypotheses in this study were rejected based on the aforementioned test results on each variable. This study utilized different tests for hypotheses as shown in Table 4.19.

Table 4.19*Summary of Hypotheses Tested*

Hypotheses Variable	Null Hypothesis	Type of Analysis	Condition	Conclusion
Financial Structuring	H₀₁ No significant influence	Pearson Correlation Bivariate Linear Regression	$p < 0.05$ reject null hypothesis $p > 0.05$ fail to reject null hypothesis	Study results indicated $R=0.325$, $B=0.236$, $P<0.05$ H_{01} was rejected
Stakeholder Management	H₀₂ No significant influence	Pearson Correlation Bivariate Linear Regression	$p < 0.05$ reject null hypothesis $p > 0.05$ fail to reject null hypothesis	Study results indicated $R=0.618$, $B=0.529$, $P<0.05$ H_{02} was rejected
Resource Management	H₀₃ No significant influence	Pearson Correlation Bivariate Linear Regression	$p < 0.05$ reject null hypothesis $p > 0.05$ fail to reject null hypothesis	Study results indicated $R=0.556$, $B=0.399$, $P<0.05$ H_{03} was rejected
Risk Management	H₀₄ No significant influence	Pearson Correlation Bivariate Linear Regression	$p < 0.05$ reject null hypothesis $p > 0.05$ fail to reject null hypothesis	Study results indicated $R=0.640$, $B=0.513$, $P<0.05$ H_{04} was rejected

4.9 Overall Regression Analysis

4.9.1 Model Summary

The model summary provides key indicators of the overall goodness-of-fit for the regression model predicting the performance of renewable energy projects based on four independent variables: Risk Management, Financial Structuring, Resource Management, and Stakeholder Management.

Table 4.20*Overall Model Summary*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.724 ^a	.525	.513	.22763

a. Predictors: (Constant), Risk Management, Financial Structuring, Resource Management, Stakeholder Management

The multiple correlation coefficient (R) is reported as 0.724, indicating a strong positive linear relationship between the combined predictors and the dependent variable. The R Square value of 0.525 implies that approximately 52.5% of the variability in the performance of renewable energy projects is explained by the independent variables included in the model. This suggests a substantial explanatory power and indicates that the model captures more than half of the systematic variance in the outcome variable.

Taking into consideration the ratio of predictors to sample size, the Adjusted R Square is marginally lower at 0.513. By penalizing for potential overfitting, this adjusted metric gives a more conservative estimate of the model's explanatory power, especially when several predictors are included. The independent variables make a significant contribution to the model without increasing the variance explained by multicollinearity or redundant predictors, as indicated by the small difference between R Square and Adjusted R Square. Finally, the average distance that the observed values fall from the anticipated regression line is indicated by the Standard Error of the Estimate, which is 0.22763. The accuracy of the model's predictions is increased when the standard error decreases. The model's ability to describe the performance results of renewable energy projects is supported by robust statistics and substantive meaning, as shown by these statistics taken together.

4.9.2 Analysis of Variance (ANOVA)

To assess the combined effect of all four predictors on project performance, an overall analysis of variance was conducted. The results presented in Table 4.21 summarize the contribution of financial structuring, stakeholder management, resource management, and risk management to the regression model. This analysis provides a comprehensive test of whether the predictors, taken together, significantly influence the performance of renewable energy projects in Kenya.

Table 4.21

Overall Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.155	4	2.289	44.175	<.001 ^b
	Residual	8.290	160	.052		
	Total	17.445	164			

a. Dependent Variable: Performance of Renewable Energy Projects

b. Predictors: (Constant), Risk Management, Financial Structuring, Resource Management, Stakeholder Management

With four degrees of freedom, the regression model produces a mean square of 2.289 and a sum of squares of 9.155. At the standard alpha level of 0.05, the F-statistic is 44.175 and the p-value is less than 0.001, indicating that it is very significant. All things considered, this proves that the four predictor variables Risk Management, Financial Structuring, Resource Management, and Stakeholder Management contribute significantly to the variance in renewable energy projects' effectiveness. Put another way, the total amount of variance explained by the regression model in the dependent variable is far higher than what would be predicted by chance alone. A large part of the variation in project

performance is explained by the model's predictors, as evidenced by the tiny residual sum of squares (8.290) compared to the regression sum of squares (9.155).

Therefore, the ANOVA results confirm that the model provides a good fit to the data and that the predictors, taken together, make a meaningful and statistically significant contribution to the explanation of project performance within the renewable energy sector. This statistical evidence supports the continued use and interpretation of the regression coefficients in the subsequent analysis.

4.9.3 Regression Coefficients

To determine the individual contribution of each predictor while controlling for the others, a multiple regression analysis was conducted. Table 4.22 presents the regression coefficients for financial structuring, stakeholder management, resource management, and risk management. This analysis highlights the relative strength and significance of each factor in explaining the performance of renewable energy projects in Kenya.

Table 4.22

Overall Multiple Regression (Coefficients)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.558	.202		7.713	<.001
	Financial Structuring	.121	.050	.167	2.427	.016
	Stakeholder Management	.284	.074	.331	3.821	<.001
	Resource Management	.227	.048	.316	4.727	<.001
	Risk Management	.250	.069	.311	3.616	<.001

a. Dependent Variable: Performance of Renewable Energy Projects

$$Y = 1.558 + 0.121X_1 + 0.284X_2 + 0.227X_3 + 0.250X_4$$

The unstandardized coefficients (B values) indicate the amount of change in the dependent variable for each one-unit change in the respective predictor, holding all other variables constant. The constant term (intercept) is 1.558 and is statistically significant ($p < .001$), representing the estimated baseline level of performance when all independent variables are zero.

All four independent variables demonstrate positive and statistically significant effects on the dependent variable, as all p-values are less than 0.05. Financial Structuring has a coefficient of 0.121 ($p = .016$), indicating a modest yet significant positive effect. Stakeholder Management exhibits a stronger influence, with a coefficient of 0.284 and a standardized beta of 0.331, which implies that it is a relatively powerful predictor of project performance. Similarly, Resource Management ($B = 0.227$, $Beta = 0.316$, $p < .001$) and Risk Management ($B = 0.250$, $Beta = 0.311$, $p < .001$) both have substantial and significant effects, confirming their critical roles in influencing successful project outcomes.

The standardized beta coefficients further reinforce the comparative strength of each variable. Stakeholder Management emerges as the strongest predictor, followed closely by Risk Management and Resource Management, while Financial Structuring although still significant has the weakest effect in relative terms. Overall, the regression coefficients confirm that all four variables make unique and meaningful contributions to the model, supporting the hypothesis that effective structuring, engagement, resource allocation, and risk mitigation are key drivers of renewable energy project performance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings, conclusions drawn from the study, and recommendations based on the empirical analysis conducted. The study investigated the influence of PPP drivers specifically financial structuring, stakeholder management, resource management and risk management on the performance of renewable energy projects in Kenya. It utilized a descriptive and inferential research approach, incorporating both primary and secondary data from key stakeholders in the renewable energy sector. The chapter also identifies policy directions and areas for further research to strengthen the performance of PPP-driven renewable energy projects.

5.2 Summary of the Study

5.2.1 Influence of Financial Structuring on Performance of Renewable Energy Projects

The study established that financial structuring significantly influences the performance of renewable energy projects in Kenya. Projects that adopted structured financing models such as concessional loans, green bonds, syndicated loans, and public equity were more likely to achieve timely implementation, cost efficiency, and long-term financial sustainability. The regression analysis revealed a positive and statistically significant coefficient for financial structuring, indicating that well-designed financing frameworks reduce liquidity constraints and attract private sector participation. The results affirm the

relevance of the Pecking Order Theory, where stakeholders preferred low-cost internal financing and concessional external funds over equity due to risk aversion.

5.2.2 Influence of Stakeholder Management on Performance of Renewable Energy Projects

Stakeholder management was found to have a strong and statistically significant influence on project performance. Projects that prioritized stakeholder mapping, engagement, communication, and benefit-sharing mechanisms experienced fewer implementation delays, enhanced regulatory compliance, and higher social acceptance. The study noted that community involvement and transparent grievance redress mechanisms were especially critical in minimizing project opposition. These findings support the Stakeholder Theory, underscoring the importance of addressing the interests and expectations of all parties involved to ensure project success.

5.2.3 Influence of Resource Management on Performance of Renewable Energy Projects

Resource management was another significant predictor of renewable energy project performance. The study found that efficient allocation of human, material, and financial resources was strongly associated with better project outcomes. Projects that implemented integrated resource planning, skills development, and timely procurement achieved greater adherence to timelines and budgets. The Resource-Based View (RBV) Theory was validated through these findings, suggesting that projects that optimize rare and valuable resources such as skilled labor, advanced technology, and strategic natural sites gained a competitive advantage in project delivery and sustainability.

5.2.4 Influence of Risk Management on Performance of Renewable Energy Projects in Kenya

Risk management emerged as a crucial determinant of project performance. The results indicated that projects with established risk assessment frameworks, climate resilience strategies, and financial risk hedging mechanisms were more resilient and successful. Risk identification, allocation, and mitigation through tools such as insurance, contractual safeguards, and diversified energy portfolios reduced exposure to both internal and external shocks. These findings align with Prospect Theory, highlighting how varying risk perceptions among stakeholders influence the structuring and implementation of PPP renewable energy projects.

5.3 Conclusions

5.3.1 Financial Structuring

The study concludes that financial structuring plays a critical role in determining the success of renewable energy projects in Kenya. Access to affordable financing, coupled with innovative structuring such as blended finance and green bonds, directly enhances project viability and investor confidence. Poorly structured financial models, by contrast, limit scalability and hinder project sustainability.

5.3.2 Stakeholder Management

Effective stakeholder management is indispensable in ensuring the performance and acceptability of renewable energy projects. The research concludes that inclusive engagement, participatory planning, and responsive communication foster trust and

collaboration, reducing conflicts and legal disputes. Ignoring stakeholder interests often results in project delays and reputational damage.

5.3.3 Resource Management

The study concludes that optimal resource utilization, including strategic deployment of skilled personnel, timely procurement, and efficient use of land and technology, enhances project execution. Projects that lacked proper resource planning often experienced budget overruns and missed milestones, affirming the centrality of resource management in project success.

5.3.4 Risk Management

The study concludes that proactive risk management contributes significantly to the sustainability and continuity of renewable energy projects. Projects that adopted structured risk analysis and mitigation strategies were better equipped to withstand environmental shocks, regulatory uncertainty, and financial volatility. Risk-sharing mechanisms embedded in PPP contracts provided additional layers of resilience.

This study shows that renewable energy projects built on strong PPP foundations can play a vital role in helping Kenya reach its goal of 100% clean energy by 2030. When financing is innovative, governance is inclusive, resources are managed wisely, and risks are addressed proactively, PPPs not only improve project performance but also support global goals such as affordable clean energy (SDG 7) and climate action (SDG 13). Strengthening PPP frameworks will therefore place Kenya in a better position to safeguard its energy security, protect the environment, and stimulate economic growth as part of its wider energy policy agenda.

5.4 Recommendations

To enhance the performance of PPP-driven renewable energy projects, the study proposes:

Short-Term Recommendations

- Strengthen financial structuring by expanding access to concessional financing, green bonds, and blended finance models.
- Establish transparent stakeholder engagement frameworks, including structured grievance redress systems and community benefit-sharing agreements.
- Build technical capacity through training programs for project managers, engineers, and regulatory staff.
- Institutionalize project-specific risk registers and climate adaptation measures to identify and mitigate risks early.

Long-Term Recommendations

- Develop a centralized renewable energy financing hub to mobilize sustainable capital and reduce reliance on external donors.
- Institutionalize participatory governance in PPP frameworks, ensuring community representatives have formal roles in decision-making bodies.
- Invest in grid modernization and energy storage systems to optimize the use of intermittent renewable sources.

- Strengthen regulatory frameworks by embedding clear risk-sharing clauses in power purchase agreements and ensuring policy consistency across electoral cycles

5.5 Areas for Further Research

While this study has significantly contributed to understanding the influence of PPP drivers on the performance of renewable energy projects in Kenya, several areas warrant further scholarly inquiry. Future research could explore the mediating role of regulatory governance in the relationship between stakeholder management and project performance, particularly within complex and politically dynamic jurisdictions. There is also scope to investigate the influence of technological innovation and digital infrastructure such as smart grids and AI-enabled monitoring on the efficiency and adaptability of PPP energy projects.

Moreover, a comparative analysis of PPP renewable energy project outcomes across East African countries could yield insights into best practices and region-specific constraints. Longitudinal studies tracking project lifecycle performance metrics over extended durations would further illuminate the sustainability dimensions of financing, stakeholder alignment, and risk management. Finally, qualitative investigations involving case study methodologies could enrich understanding of context-specific socio-political dynamics and institutional behavior influencing project success or failure in Kenya's renewable energy landscape.

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APPENDICES

Appendix I: Letter of Introduction to Respondents

Dear Sir/Madam,

RE: AUTHORITY TO CONDUCT RESEARCH AT YOUR INSTITUTION

Currently a Master of Project Management student from Kenya Methodist University, I am Kenyan Methodist University. My study underlines the "**Influence of Public Private Partnership Drivers on Performance of Renewable Energy Projects In Kenya.**"

The questionnaire attached to the letter should take about fifteen minutes to finish. Please correctly address every question.

The material will only be used for academic interests.

Good wishes,

Philiph K.A Chamdany

BUS-3-3140-3/2023

Appendix II: Consent Form

Title: Influence of Public-Private Partnership Drivers on the Performance of Renewable Energy Projects in Kenya

Sponsor: Self-Sponsored / Kenya Methodist University (KeMU)

Principal Investigator: Philip K.A Chamdany

Address: Kenya Methodist University, Department of Business Administration, P.O. Box P.O. Box 267, NAIROBI

1. Introduction

This Consent Form contains information about the research named above. In order to be sure that you are informed about being in this research, we are asking you to read (or have someone read for you) this Consent Form. You will also be asked to sign it (or make your mark in front of a witness). We will give you a copy of this form. This consent form might contain some words that are unfamiliar to you. Please ask us to explain anything you may not understand.

2. Reason for the Research

You are being asked to take part in research to examine the impact of financial structuring, stakeholder management, resource management, and risk management on the performance of PPP renewable energy projects in Kenya.

3. General Information about Research

This study employs structured questionnaires and document reviews to collect quantitative and qualitative data on PPP renewable energy projects. Data analysis will be conducted using SPSS Version 28, applying statistical tests including correlation and

multiple regression analysis. The research aims to provide empirical insights to enhance PPP policy frameworks, investment decisions, and project implementation strategies in Kenya's renewable energy sector

4. Your Part in the Research

If you agree to be in the research, you will Participants will complete a structured questionnaire covering aspects of financial structuring, stakeholder management, resource allocation, and risk management in PPP renewable energy projects. The process will take approximately 15-20 minutes. Your part in the research will last Approximately 4 months. About 195 respondents from government agencies, private investors, project managers, engineers, financial analysts, and utility representatives. will take part in this research.

5. Possible Risks

Minimal risks anticipated, mainly confidentiality concerns. However, responses will be anonymized, and data stored securely to ensure privacy.

6. Possible Benefits

Findings will provide empirical insights into improving PPP project structuring, stakeholder collaboration, and risk management, contributing to policy and investment decision-making in Kenya's renewable energy sector.

7. If You Decide Not to Be in the Research

You are free to decide if you want to be in this research. Your decision will not affect the health care you would normally receive.

8. Confidentiality

We will protect information about you and your taking part in this research to the best of our ability. You will not be named in any reports. However, the staff of [list all groups that may access the research records] may sometimes look at your research records.

Someone from the IRB might want to ask you questions about being in the research, but you do not have to answer them. A court of law could order medical records shown to other people, but that is unlikely.

[When applicable: If you miss a scheduled visit, we may contact you at home by phone, mail or in person to schedule another visit and to see if you still want to take part in the research. When this contact is made you will not be identified as being in this research.]

9. Compensation

There is no financial compensation for participating. Your contribution is voluntary and greatly valued.

10. Staying in the Research

Participation is voluntary. If you choose not to participate, it will not affect your work or access to services.

11. Alternatives to Participation

You may withdraw at any time without penalty. If you wish to stop, inform the investigator, and your responses will not be used.

12. Leaving the Research

You may leave the research at any time. If you choose to take part, you can change your mind at any time and withdraw.

13. If You Have a Problem or Have Other Questions

For any concerns, you may contact:

Principal Investigator: Philip Chamdany, Tell: 072033012, email-
pchamdany3140@stu.kemu.ac.ke

Kenya Methodist University, Nairobi Campus: KeMU Towers, University Way.,
Tel:020-002248172/(+254)-725751878/(+254)-735701311

14. Your rights as a Participant

This research has been reviewed and approved by the IRB of Kenya Methodist University. An IRB is a committee that reviews research studies in order to help protect participants. If you have any questions about your rights as a research participant you may contact Institutional Review Board, Kenya Methodist University, Nairobi Campus: KeMU Towers, University Way., Tel:020-002248172/(+254)-725751878/(+254)-735701311

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research titled Influence of Public-Private Partnership Drivers on the Performance of Renewable Energy Projects in Kenya has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

Date

Signature or mark of volunteer

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Date

Signature of Witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Date

Signature of Person Who Obtained Consent

Appendix III: Questionnaire

SECTION A: GENERAL INFORMATION

1. How many years of experience do you have in the renewable energy sector?

Less than 2 years 2 – 5 years 6 – 10 years More than 10 years

2. Please indicate your level of education (please tick your appropriate level)

Diploma Undergraduate Degree Postgraduate Degree

Please indicate on the scale provided below by ticking the extent to which you agree with the following statements.

Strongly Agree=5, Agree=4, Uncertain=3, Disagree=2, Strongly Disagree=1

	Statement: Financial Structuring	1	2	3	4	5
B1	The project maintains an optimal capital mix ratio between debt and equity financing.					
B2	The cost of capital for financing renewable energy projects is sustainable and competitive.					
B3	Securing power purchase agreements (PPAs) positively impacts project financial viability.					
B4	The number of financial incentives (grants, tax exemptions, subsidies) significantly affects project success.					
B5	Financial structuring strategies help in minimizing financial risks in project execution.					
B6	External funding sources (banks, private investors) are readily accessible for renewable energy projects.					
B7	The financial structure allows for long-term operational sustainability of the project.					
B8	Delays in securing financial agreements impact project implementation timelines .					

	Statement: Stakeholder Management	1	2	3	4	5
C1	Stakeholder communication in the project is timely, transparent, and effective.					
C2	The project ensures a high level of community engagement throughout its implementation.					
C3	Stakeholder feedback is actively considered in decision-making processes .					
C4	The project has effective strategies for resolving stakeholder conflicts .					
C5	Stakeholder satisfaction has a direct impact on project success.					
C6	There are adequate partnership agreements between public and private sector players.					
C7	The project team actively collaborates with local authorities and community leaders .					
C8	Strong stakeholder engagement has improved project acceptance and social license to operate .					
	Statement: Resource Management	1	2	3	4	5
D1	The project maintains a high resource utilization rate , ensuring efficiency.					
D2	Material waste reduction strategies are effectively implemented during project execution.					
D3	Procurement processes are well-structured, minimizing delays.					
D4	The project optimally utilizes skilled labor and workforce productivity .					
D5	The project ensures efficient allocation of financial, human, and material resources .					

D6	Advanced technology and automation are used to enhance resource efficiency.					
D7	The project implements sustainable resource conservation practices .					
D8	Delays in resource allocation negatively affect project performance.					
	Statement: Risk Management	1	2	3	4	5
E1	The project has a structured risk identification framework in place.					
E2	Risk mitigation strategies are implemented effectively to prevent project failures.					
E3	The project maintains a risk response time that minimizes operational disruptions.					
E4	Risks are periodically reviewed and updated to reflect project changes.					
E5	The project includes financial risk management measures (hedging, insurance, reserve funds).					
E6	Contingency plans are established to address unexpected risks .					
E7	The project has a dedicated risk monitoring and evaluation team .					
E8	Risk management strategies significantly contribute to project sustainability .					
	Statement: Performance of Renewable Energy Projects	1	2	3	4	5
F1	The project meets its completion targets within the planned schedule .					
F2	Cost variance is effectively managed to prevent budget overruns.					

F3	The project maintains high schedule adherence , ensuring timely delivery.					
F4	The project meets quality compliance standards set by regulators.					
F5	Financial structuring positively influences the overall project performance .					
F6	Strong stakeholder engagement contributes to smooth project implementation .					
F7	Effective resource management has improved energy production efficiency .					
F8	The project has had a positive impact on renewable energy access and sustainability .					

Appendix IV: Budget

Budget Item and Units	No of Units	Rate per unit in Ksh.	Cost in Ksh.	
1	Communication			
	Airtime:	1	5000	20,000
	Internet	1	10000	20,000
	Sub-total 2: Communication	2		40,000
2	Travel, Stationery and Accommodation			
2.1	Travel	1	10000	10,000
2.2	Stationery and Equipment			
	Laptop	1	40000	40,000
	Printer	1	15000	15,000
	Stationery	1	5000	5,000
2.3	Accommodation and Incidental Consumables	1	25,000	25,000
	Sub-total 3: Travel, Stationery and Accommodation	1		90,000
3	Library Access and Literature Material	1	10,000	5,000
4	Journal Publishing	1	15,000	15,000
	Total			150,000
5	10% Contingency			15,000
	TOTAL			170,000

Appendix V: List of Renewable Energy Projects in Kenya

	Project	Developers	SPV or Not
1	Olkaria III Geothermal Power Plant	Ormat Technologies	Yes, Ormat Africa SPV
2	Menengai Geothermal Project (Phase 1)	GDC & IPPs	Yes, IPPs form SPVs
3	Lake Turkana Wind Power Project	Lake Turkana Wind Power Limited	Yes, SPV formed
4	Kipeto Wind Power Project	Kipeto Energy Limited	Yes, SPV formed
5	Malindi Solar Power Plant	Malindi Solar Group (Globeleq)	Yes, SPV formed
6	Eldosol and Radiant Solar Plants	Private developers	Yes, SPVs formed
7	Baringo-Silali Geothermal Project	GDC & Private Investors	Yes, SPV involved
8	Suswa Geothermal Project	Private developers & Government Agencies	Yes, SPV formed
9	Meru Wind Power Project	Meru County Investment & Private Investors	Yes, SPV formed
10	Bubisa Wind Power Project	Private developers	Yes, SPV formed
11	Longonot Geothermal Power Project	AGIL & Government	Yes, SPV formed

Source: Kenya Energy Transition & Investment Plan 2023 – 2050

Appendix VI: Ethical Clearance Letter



KENYA METHODIST UNIVERSITY

P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171

FAX: 254-64-30162
EMAIL: info@kemu.ac.ke

Our Ref: KeMU/ISERC/BUS/22/2025

April 10, 2025

PHILIPH K.A CHAMDANY
BUS-3-3140-3/2023

Dear Philip,

SUBJECT: INFLUENCE OF PUBLIC PRIVATE PARTNERSHIP DRIVERS ON PERFORMANCE OF RENEWABLE ENERGY PROJECTS IN KENYA

This is to inform you that Kenya Methodist University Institutional Scientific Ethics and Review Committee has reviewed and approved your research proposal. Your application approval number is KeMU/ISERC/BUS/22/2025. The approval period is 10th April, 2025 – 10th April, 2026.

This approval is subject to compliance with the following requirements:-

- I. Only approved documents including (informed consents, study instruments, MTA) will be used.
- II. All changes including (amendments, deviations, and violations) are submitted for review and approval by Kenya Methodist University Institutional Scientific Ethics and Review Committee.
- III. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KeMU ISERC within 72 hours of notification.
- IV. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KeMU ISERC within 72 hours.
- V. Clearance for export of biological specimens must be obtained from relevant institutions.

- VI. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- VII. Submission of an executive summary report within 90 days upon completion of the study to KeMU ISERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.



DR. HERBERT KIBEBE
CHAIR (ISERC)

Appendix VII: Introduction Letter to NACOSTI



KENYA METHODIST UNIVERSITY

P. O. Box 267 Meru - 60200, Kenya

Fax: 254-64-30162

Tel: 254-064-30301/31229/30367/31171

Email: deanrd@kemu.ac.ke

DIRECTORATE OF POSTGRADUATE STUDIES

Our Ref: KEMU/NACOSTI/BUS/22/2025

April 11, 2025

Commission Secretary
National Commission for Science, Technology and Innovations
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: PHILIPH K.A CHAMDANY-BUS-3-3140-3/2023

This is to confirm that the above named is a bona fide student of Kenya Methodist University, in the Department of Business Administration, undertaking a Master's degree in Business Administration. He is conducting research on; *"Influence of Public Private Partnership Drivers on Performance of Renewable Energy Projects In Kenya"*.

We confirm that his research proposal has been defended and approved by the University.

In this regard, we are requesting your office to issue a research license to enable him collect data.

Any assistance accorded to him will be highly appreciated.

Yours sincerely,


Dr. Nancy Rintari (PhD)
Director, Board of Postgraduate Studies

Cc: Dean, School of Business
CoD, Business Administration
Postgraduate Coordinator - BA
Supervisors

Appendix VIII: NACOSTI Research Permit

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 342191	Date of Issue: 15/May/2025
RESEARCH LICENSE	
	
<p>This is to Certify that Mr., Philip K.A Chamdany of Kenya Methodist University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Garissa, Kajiado, Kakamega, Kisumu, Kwale, Mombasa, Nairobi, Nakuru, Nyandarua, Taita-Taveta, Tanariver, Turkana on the topic: INFLUENCE OF PUBLIC PRIVATE PARTNERSHIP DRIVERS ON PERFORMANCE OF RENEWABLE ENERGY PROJECTS IN KENYA for the period ending : 15/May/2026.</p>	
License No: NACOSTI/P/25/4173376	
342191	
Applicant Identification Number	Deputy Director NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code
	
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