

**CARBON FINANCING AND PROFITABILITY OF RENEWABLE ENERGY
FIRMS REGISTERED UNDER THE ENERGY AND PETROLEUM
REGULATORY AUTHORITY, KENYA**

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DECLARATION

Declaration by candidate:

I declare that I am the only author of this work. To the best of my knowledge, the literature provided in this thesis has never been published or produced by any other person in another institution for any qualification.

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DEDICATION

I dedicate this work to my family, whose boundless love, support, and encouragement, have been the foundation of my journey. To my parents Paul and Mary, who instilled in me the value of education and perseverance, my wife Mumbi, and my two lovely daughters, Gift and Grace whose belief in me have been my constant source of strength. This work is also dedicated to all those who strive to make a difference in the world, reminding us that persistence and passion can lead to meaningful change.

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OPERATIONAL DEFINITION OF TERMS

| | |
|---|---|
| Carbon Credits | <p>They represent a tradable unit that quantifies the removal of one metric ton of carbon dioxide or its equivalent in other greenhouse gases, such as nitrous oxide and methane. This variable will be measured by the percentage of revenue from carbon units sold.</p> |
| Carbon Financing | <p>The aggregate financial mechanisms through which renewable energy firms in access and benefit from carbon-related initiatives.</p> |
| Carbon Market | <p>This is a market used to trade carbon emissions in order to prompt or help companies reduce their carbon dioxide emissions. Carbon credit markets trade “carbon credits.” Each credit corresponds to the removal of one metric ton of carbon dioxide equivalent (CO₂e) from the planet’s atmosphere. These credits are allotted to verified carbon projects by carbon credit standards like Plan Vivo, Gold Standard, or Verra. Once the carbon credits are issued, they can be sold in carbon markets where entities seeking to reduce their carbon footprint can purchase and utilise credits to offset their carbon emissions.</p> |
| Credit Issuance and Transactional cost | <p>This refers to all the expenses related to creating, certifying, and trading the carbon credits, including project validation, verification, registration fees, and brokerage costs. Both issuance and transactional cost define the essential steps and associated costs in bringing carbon credits to market. This variable will be measured by the percentage of the issuance and transactional costs.</p> |
| Firm Size | <p>The scale and magnitude of a company's operations, typically measured by its financial and operational metrics. This variable will be measured using revenues.</p> |
| Initial Project Costs | <p>This refers to the total monetary expenditure required for the planning, execution, and completion of carbon financing projects within a defined timeframe and scope. This variable will be measured by the percentage of financial costs of the projects.</p> |
| Renewable Energy firm | <p>This is any company that specializes in the production, distribution, or development of energy from renewable sources in this context solar and biogas, focusing on sustainable energy solutions.</p> |
| Tax Incentives | <p>These refer to government-provided tax reductions, exemptions, or credits aimed at encouraging investments in projects that lessen or remove the emission of greenhouse gases. These incentives lower the financial burden on organizations or individuals undertaking carbon credit projects, making emission reduction efforts more economically viable and attractive.</p> |

ABBREVIATIONS AND ACRONYMS

| | |
|------------------------|---|
| AREI | Africa Renewable Energy Initiative |
| CDM | Clean Development Mechanism |
| CDP | Carbon Disclosure Project |
| CERs | Certified Emission Reductions |
| CO_{2e} | Carbon Dioxide Equivalent |
| EPRA | Energy and Petroleum Regulatory Authority |
| EU ETS | European Union Emissions Trading Scheme |
| EUA | European Union Allowances |
| GHGs | Green House Gasses |
| GOK | Government of Kenya |
| IEA | International Energy Agency |
| NEMA | National Environmental Management Authority |
| R&D | Research & Development |
| SDGs | Sustainable Development Goals |
| UNFCCC | United Nations Framework Convention on Climate Change |

ABSTRACT

Erratic profitability for renewable energy firms has pushed them to looking for additional sources of funding and carbon financing has emerged as a critical source which also contributes to achieving sustainable growth. By allowing businesses to generate revenue through the sale of carbon credits, carbon financing offers a powerful incentive for investing in cleaner technologies and processes. This financial mechanism not only supports companies in meeting regulatory climate commitments but also opens new revenue streams, increasing profitability and enhancing their financial resilience. Despite Kenya's rich potential, high capital costs, inconsistent regulations, limited financing, and operational inefficiencies hinder firms' financial sustainability. Additional issues like grid connectivity, market competition, and currency fluctuations further complicate their profitability. The study's principal aim was to establish a link between carbon financing and profitability of renewable firms registered under Kenya's Energy and Petroleum Regulatory Authority. More precisely, the study examined key carbon financing variables that include carbon credits, project initial cost, credit issuance and transactional costs, tax incentives and their effect on profitability. Profitability was assessed using Return on Investment, which revealed varying trends across firms, with higher return on investment generally associated with effective utilization of carbon financing mechanisms. The size of the firm was the moderating variable. The study was based on and supported by the resource-based view theory, market-based theory, agency theory, and firm size theory. The study employed a descriptive survey design and adopted a positivist research philosophy. The research design relied on primary data collected using a structured questionnaire that relates to carbon financing. The target population was fifty (50) renewable energy companies registered under Energy and Petroleum Regulatory Authority, and a population approach was used. Both descriptive and inferential statistics was used for data analysis with the help of Scientific Package Social Sciences. Descriptive statistics including mean and standard deviation. A multiple regression model was performed to estimate the relationship between carbon financing and profitability. The results were presented on frequency tables, charts, and graphs. The results revealed that carbon credit, tax incentives, credit issuance and transactional costs and projects costs have significant effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority. Further, firm size does have a significant moderating effect on the relationship between carbon financing and profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority. Therefore, the hypotheses on carbon credits, initial project cost, credit issuance and transactional cost and tax incentives moderated by firm size were not supported. The study concluded that carbon financing has significant effect on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority and this effect is strengthened by firm size. The study recommended that management should consider diversifying the types of carbon credit projects in which the firm engages. Expanding into various carbon credit initiatives, such as forest preservation and renewable energy projects, can help mitigate risks associated with fluctuations in carbon credit prices and market demand. The government should continue to support the development and growth of carbon credit markets, both locally and internationally. Policies should focus on creating a stable and transparent regulatory framework that encourages both local and foreign investments in carbon credit projects.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The adoption of the Sustainable Development Goals (SDGs) by the UN General Assembly in 2015 marked a significant step towards combating climate change and saving the planet for future generations (Schwerhoff and Sy, 2017). As Schwerhoff and Sy (2017) informed, increasing renewable energy (RE) production can contribute significantly to attaining many SDGs. Some of these SDS include improving health and education, protecting forests, combating climate change, and ending poverty. In essence, increased adoption of RE can play an integral role in solving some of the world's major challenges. However, financing is a major challenge hindering the adoption of RE. According to Taghizadeh-Hesary and Yoshino (2020), global investments in RE and energy-efficient projects reduced in 2017 and 2018 by 1% and 3%, respectively, and there is a risk that such reductions could be experienced in the future. Given the role RE and energy-efficient projects can play in attaining SGDs, it is imperative to overcome the challenge of financing.

The International Energy Agency (IEA) [2023] notes that while Africa comprises 20% of the world's population, the continent only attracts 3% of energy investment globally. For Africa to attain its energy development goals, it will need to reach an annual investment of USD 200 billion per year by 2030 (IEA, 2023). A key challenge of financing RE projects in Africa lies in the cost of supply and installation of equipment. According to the African Renewable Energy Initiative (AREI) [2015], the cost of supply and installation of RE equipment is higher in Africa than elsewhere, meaning that it requires large amounts of

capital. Carbon financing offers a way in which firms can reduce the emission of greenhouse gases (GHGs) and shift to RE.

Carbon financing refers to the financial mechanism by which projects or activities that reduce greenhouse gas emissions or enhance sustainable development are incentivized and supported (Mohsin et al., 2021). It encompasses the trading of carbon credits or offsets, which correspond to the decrease of one metric ton of carbon dioxide equivalent (CO_{2e}) emissions (Simon et al., 2012). By offering a monetary value to emission reductions, carbon financing encourages firms to invest in cleaner technologies as well as renewable energy initiatives.

Carbon financing has been implemented in many parts across the world and has yielded significant results in reducing the emissions of greenhouse gases (GHGs). In an inquiry conducted by Lee et al. (2023) in China, the researchers were able to establish that even after robustness tests like regression models replacement and endogeneity treatment, green finance was significant in contributing to energy efficiency. The authors found that green financing enhances efficiency of energy through energy structure optimisation and the promotion of green technology (Lee et al., 2023). In another investigation, Xu et al. (2023) examined the risks and mitigation approaches linked with the funding of carbon credit projects. In this case, the foremost risks identified in the Chinese carbon markets included operational risks, financial risks, and regulatory and policy risks (Xu et al., 2023). The mitigation approaches suggested by the study include enhancing stakeholder relations, developing financial stability, and boosting transparency (Xu et al., 2023). In essence, it is evident that while carbon financing has enhanced energy efficiency in China, it faces significant risks that must be mitigated.

The profitability of renewable energy firms refers to their ability to generate revenues higher than expenses and while at it, achieve a sustainable growth. The primary purpose of any business organisation is to achieve profitability. RE firms aim to achieve profitability by participating in carbon markets, simultaneously playing a role in combating climate change. Fernández-Cuesta et al. (2019) probed the connection between environmental and financial performance across European companies. The inquiry's findings showed that firms with a better carbon performance were in an enhanced position to receive long-term debt to fund financial investments (Fernández-Cuesta et al., 2019). Another analysis focusing on Europe by Makridou et al. (2019) assessed the financial performance of companies taking part in the European Union Emissions Trading Scheme (EU ETS). The researchers found that firms' profitability in the scheme is affected by a country's economic environment, the company's internal characteristics, and energy performance and policies (Makridou et al., 2019). Energy-efficient firms were found to be more profitable, while those that reduced their CO₂ emissions performed better in terms of profitability.

There are limited studies from the US on carbon financing, but according to a study by Hashmi et al. (2015), which focused on American firms, financial incentives by the federal government and carbon trading revenue can make the adaptation of sustainable business practices a good business practice. With the US not having approved the Kyoto Protocol that mandates reductions in GCG emissions, companies in the country participate in carbon trading out of their own volition. (Hashmi et al., 2015). In the investigation by Hashmi et al. (2015), 37% of respondents pointed out that they traded carbon credits in their US operations. Qin et al. (2022) examined whether sustainable financing and renewable energy can help the US attain carbon neutrality. In this case, sustainable financing refers to the

behaviour that takes into account social, environmental, and governance factors in investment decisions (Qin et al., 2022). As per the study, compared to renewable energy, sustainable financing has a prolonged and more substantial direct impact on facilitating carbon neutrality in the US.

In the Indian context, Desai et al. (2021) examined how carbon emissions impacted the companies' financial performance in the Asian country. The researchers utilised data from companies reporting their emission data as per the Carbon Disclosure Project (CDP) and learnt that carbon emissions had a significant negative effect on how the organizations performed financially. In another study, Kumar and Firoz (2018) evaluated how the cost of debt is impacted by carbon emissions among Indian companies. Utilizing data from 2011 to 2014 from firms disclosing their data under CDP, Kumar and Firoz (2018) found that a higher coefficient of carbon emission was associated with a higher cost of debt. Therefore, it is evident that in India, the failure to reduce carbon emissions can have costly financial implications for companies.

Several studies from Africa have also focused on carbon financing. Ganda and Milondzo (2018) examined carbon emissions' impact on the financial performance of South African firms. The researchers examined included return on investment (ROI), return on equity (ROA), and return on sales (ROS) as financial measures in the study. As per the conclusions of the study, firms that embrace green investment initiatives are better placed to manage their financial performance. Just like the Indian studies, Ganda and Milondzo (2018) found that carbon emissions negatively impacted financial performance. In essence, the authors believe that lowering carbon emissions within corporate operations can sustain and improve an organization's financial performance. In a different inquiry, Akhanolu et

al. (2022) analysed the influence of carbon disclosure on the financial performance of Nigerian manufacturing firms. The findings of the analysis showed that carbon disclosure had a positive effect on the return on equity of the firms.

In the context of Kenya, the Energy and Petroleum Regulatory Authority (EPRA) has the responsibility of regulating the country's energy sector, including renewable energy. Kenya has been making substantial efforts to promote the utilization of renewable energy as a means to deal with climate change and diversify its energy sources. There are a number of Kenyan studies that have explored carbon financing and its impact. In their study, Gatimbu and Wabwire (2016) evaluate how environmental disclosure shape the financial outcomes of companies listed at the Nairobi Securities Exchange. The financial measures utilised by the authors are leverage and ROE. The study's results suggest that environmental disclosure is linked with enhanced financial performance. Another study by Baimwera (2018) examined the factors that determined carbon financing update in RE projects. The study's findings showed that the project sizes, the degree of carbon technology utilized, and the project's carbon market affiliation determined carbon finance inflows into projects. Furthermore, key constraints to accessing carbon finance, as identified in the research, include a lack of adequate capital and high transaction costs for carbon credits.

Carbon financing can provide several financial benefits to renewable energy firms in Kenya. One benefit is the provision of an additional revenue stream through the sale of carbon credits. By implementing clean energy projects, these firms can generate carbon credits, which they can sell to individual or organisations that aim to offset their own

emissions (Bridge et al., 2020). This additional income from carbon credits can enhance the financial strength and success of renewable energy firms and profitability thereon.

Moreover, carbon financing can attract investment opportunities for renewable energy firms. Investors, including private equity firms, impact investors, and clean energy funds, are increasingly interested in supporting projects with strong environmental credentials. Accessing carbon financing can demonstrate the commitment of renewable energy firms to sustainability and attract funding that can further fuel their growth and expansion plans.

Furthermore, participating in carbon financing schemes can enhance the reputation and market positioning of renewable energy firms. Being registered under EPRA and involved in carbon financing demonstrates compliance with regulatory standards and highlights a commitment to sustainable development. This positive reputation can lead to increased customer trust, improved access to markets, and the ability to attract new customers, ultimately contributing to better profitability.

1.1.1 Carbon Financing

Carbon financing is a financial tool that employs carbon credits to address carbon emission reduction in organizations through investments or requirement fulfilment of emission allowances (Chen & Wu, 2022). In its essence, carbon financing entails funding from financial institutions for projects that offer environmental, economic, and health improvements through the sale of GHG emission reductions. According to Baimwera et al. (2017), carbon financing relates to the finance cost of doing business in a world constrained by carbon, where carbon levees a cost in the form of GHG emissions. As such, it operates using the principle that trading in GHG emissions can potentially lower the cost of reducing

emissions (Baimwera, 2018). In this study, carbon financing is defined as the aggregate financial mechanisms through which renewable energy firms in Kenya access and benefit from carbon-related initiatives.

Carbon credits are one of the essential building blocks of carbon financing, as they give the amount of emission limits an interpretable unit. A carbon credit is a metric used to determine the legislated emission cap in organizations operating within markets that operate the cap and trade system (Baimwera, 2018). In the context of carbon financing, they act as an additional revenue stream when sold in domestic or international markets. Their value directly impacts firm profitability, depending on demand, pricing, and the firm's capacity to generate verifiable emission reductions. Carbon credits are available only in locations that operate under cap and trade systems and equate one credit with one tonne of CO₂e that the company is permitted to emit.

Another important aspect of carbon financing is credit issuance and transaction costs, which refer to the financial and administrative expenses incurred by renewable energy firms in obtaining, certifying, and trading carbon credits. These include costs for validation, monitoring, verification, registry fees, and brokerage charges. As noted by Phan et al. (2017), incorporating these costs is critical for project design evaluation, as they impact the overall economic efficiency and cost-effectiveness of carbon financing mechanisms. In carbon financing, such costs reduce net benefits from carbon credit revenues, making their efficiency a critical determinant of whether carbon financing contributes positively to profitability of RE firms.

Initial project costs are the upfront financial investments required to design, establish, and operationalize renewable energy projects eligible for carbon financing. EEP Africa (2023) has noted that the high costs of dealing with the carbon market are one reason that can prevent small firms from being involved in the market. It costs firms up to half a million US dollars (KS 65.07 million) in registration and verification in the carbon market (EEP Africa, 2023). Some of the costs of carbon registration and commercialization include the cost incurred on project documentation, validation, implementation, and monitoring, as well as the cost of verification of credits, issuance of them, and their commercialization. It is also important to acknowledge that other expenses such as transaction costs, research and development (R&D) costs, and the cost of financing also epitomize costs incurred during CAR financing, which can affect profitability.

Tax incentives within carbon financing include exemptions, deductions, or rebates offered by government to promote renewable energy projects engaged in emission reduction. Tax incentives play a strategic role in carbon financing by lowering firms' financial burdens and encouraging investment in low-carbon technologies. Through exemptions, deductions, or rebates, governments create an enabling environment that attracts green investment, fosters innovation, and supports RE adoption. Well-designed incentives, such as corporate tax holidays, or VAT reductions for clean technologies, directly improve firm performance and profitability. However, their effectiveness can be constrained by high production costs linked to carbon taxes, weak measurement and verification systems, and policy coordination gaps that limit their impact on long-term emission reduction goals..

The context of the delivery of carbon financing is highly applicable given that Kenya, as a developing country, is very much affected by climate change. Kenya's economy is ranked

at USD 113.42 billion (World Bank, 2022) and is gravely impacted by climate change owing to its over-reliance on natural resources such as tourism and agriculture. As highlighted by Abbas et al. (2023), the Paris Climate Agreement and the Kyoto Protocol have sought to provide a financial structure that would see the producers indemnify the sequesters of gas emissions. From the previous literature, the thought of the danger of climate change not sidelining Kenya, a middle and low-income nation with limited mechanisms of adapting and mitigating the impacts, is validated (Santoso et al., 2022). The approach is more structured here to emphasize the interaction between measures such as carbon credits, emissions reductions, project costs, and policy implications on climate change in developing economies.

1.1.2 Profitability Of Renewable Energy Firms Registered Under EPRA.

The ultimate target of all organizations is to achieve profits. RE companies pursue profitable objectives when accessing carbon finance markets to lessen climate change consequences. Achieving the breakeven is crucial to securing the existence of RE companies as they gear toward future markets. The inability to attain profitability is another factor hindering RE projects from attracting investors, escalating to failures. Net Profit Margin (NPM) and Return on Investment (ROI) remain the most commonly used indicators to assess profitability for renewable energy enterprises, given their unique advantage of showing direct tangible results in terms of financial gains and cost inputs. Besides carbon financing, it is crucial to state that renewable energy firms' revenue generation and profitability act based on other determinants. They include market factors, government incentives, rivalry, productivity, and fund accessibility (Simon et al., 2012).

ROI is appropriate for evaluating firms' profitability in the RE industry regarding carbon financing since it can directly show investment efficiency. Kopecká (2018) defines ROI as helping to distinguish the efficiency of various investments using the rate of net income and investment costs. This makes it a suitable prospect for RE firms since it creates a convenient way of measuring any number of projects' fiscal profitability while not compromising capital investment and operational expenses. Other profitability measures include Return on Assets (ROA), Economic Value Added (EVA), and Return on Equity (ROE). Still, ROI is unique when assessing specific project-based investments typical in the renewable energy sub-industry (Kopecká, 2018). Therefore, ROI provides a clear and practical indicator of how effectively RE firms convert carbon financing initiatives into tangible financial returns.

Another issue of concern regarding carbon financing projects within the Kenyan setting is cost recovery and profitability, which may, on some occasions, hinder the growth and sustainability of this sector. Another factor would be the volatility and substantial differences in carbon credit prices that prevail in the international market and affect profitability. For instance, the price of Certified Emission Reductions (CERs) of CDM was as high as €20 per ton in 2008 and as low as below €1 per ton in the current financial year of 2023 (State Department of Energy, 2023). This has led to such a variation in pricing in ROIs that, on average, carbon projects in Kenya have shown a return on investment ranging between 8% to +12 %, as indicated below (UNEP, 2024). It causes high price risk, which makes project developers unable to determine the possible revenues, mobilize long-term funds, or obtain stable returns on investment.

Further, the expenses of developmental, validation, and verification of projects are frequently inaccessible, thus placing most Kenyan enterprises, small and medium, in need of more capital. For carbon project development in Kenya, a UNEP study shows that costs range from US \$ 50000 to US \$ 250000 depending on the type and size of a project (UNEP, 2024). Such high initial costs combined with market risks have resulted in an average payback of 6–8 years, with little over 30% of the projects possibly guaranteed to be financially unprofitable for the first decade of their operation (State Department of Energy, 2023). These relatively high initial costs associated with unpredictable revenues from market volatility are a hurdle and an embodiment of constant profitability challenges to many prospective project developers. Project development times for forestry projects range from 7 to 10 years, which is not good for profitability or for attracting investors in need of quick returns; few firms have enough working capital, and project cash flows are severely stretched (Leley et al., 2022).

Another factor that significantly impacts the ROI of carbon financing projects in Kenya is the inadequacy of local demand for carbon credits, forcing project developers to rely immensely on export markets. It exposes projects to other risks, including exchange rate volatilities and changes in climate policies in other countries, which pose extra risks to the revenue and profit of the project. A study into the financial ratios of carbon projects in Kenya for the last five fiscal years reflects the worst trend of ROI and only an average profit percentage of about 18% projected for 2023. Secondly, variability in the ROI is demonstrated by gross profit margin fluctuation in the years under analysis project by project, ranging from (-25%) to (+20%) (State Department of Energy, 2023). Moreover, the organization of the carbon markets and the abilities required to understand these

markets include operational capability, which demands hiring international consultants and modifiers, thus cutting fabulous profit. The Kasigau Corridor REDD+ Project in Kenya was a real-life case to determine whether the project was in a position to sell carbon credits. However, these credits slot back approximately \$30 million to global middlemen and consultants, thus depressing the project's ROI (Ndichu, 2016).

1.1.3 Firm Size

Industry type acts as another moderator in assessing how carbon financing influences the financial performance of renewable energy companies based on firm size. According to Mutunga and Owino (2017), firm size is posited as one of the core determinant elements regarding the financial performance of an organisation based on its capacity to mediate various business relationships. The choice of firm size as a moderation variable stems from the fact that it determines the possibility of organizations harnessing financing through carbon instruments. Lopez-Valeiras et al. (2016) did a meta-analysis of prior research to find that this literature stream showed that firm size exhibits theoretical moderation of the financial performance relationships. Big firms acquire superior capacity to derive optimum benefit from carbon financing since these can secure superior resource mobilization and access better market opportunities to attain large-scale advantages in the re-investment in renewable power. In addition, large firms have more leverage over stakeholders, such as the buyers of carbon credits and validators of carbon projects, than small firms. This advantageous position, coupled with greater network access to international carbon markets, means that firm size can form a critical determinant of how carbon financing results in improved financial prospects for such players in the renewables sector. In the conceptual framework, firm size is proposed to be an interacting variable regulating the

nature and intensity of the association between carbon financing and financial performance.

1.1.4 Renewable Energy Firms Registered Under Regulatory Authority of Kenya

Renewable Energy (RE) companies are organisations that deal with energy generated from natural sources with higher replenishment rates than consumption rates. RE companies seek to produce energy from sunlight, wind, geothermal reservoirs, hydropower reservoirs, biomass, and oceans. This study centred more on the solar and biogas companies in Kenya. RE sources are contrasted with non-renewable sources of energy like oil, coal and gas.

The body mandated to regulate the production and supply of energy in Kenya is the Energy and Petroleum Regulatory Authority (EPRA). EPRA's Renewable Energy department plans, develops, implements, promotes, and executes structures for RE development (EPRA, n.d.). Other key roles of the department include collection and maintenance of RE data, preparation of RE national plans, maintaining a list of accredited energy auditors, licensing and monitoring RE regulations, and developing RE codes of practice (EPRA, n.d.). In this sense, the operations of RE companies in Kenya are regulated by the body. RE companies registered and licensed by EPRA was the subject of this study. Unregistered firms were excluded from this study because they lack consistent financial records, making it impossible to generate reliable measures of profitability and carbon financing variables. In addition, unregistered entities are often outside the regulatory and tax frameworks where carbon credits, incentives, and compliance costs apply, meaning they cannot accurately reflect the mechanisms under investigation.

1.2. Statement of the Problem

Cost recovery and profitability continue to be significant concerns within carbon financing projects across the Kenyan context, where these aspects may sometimes impede growth and the sustainability of this sector. There is also a significant variance and unpredictability of carbon credit prices in international markets, which concerns profitability. For instance, under the Clean Development Mechanism (CDM), the cost of Certified Emission Reductions (CERs) ranged from more than €20 per ton in 2008 to less than €1 per ton in the current financial year (State Department of Energy, 2023). This price volatility has resulted in erratic profitability trends, with average returns on investment (ROI) for carbon projects in Kenya fluctuating between -8% to 12% annually over the past five years (UNEP, 2024). It leads to high price risk that inhibits project developers from predicting the probable revenues, attracting long-term funds, or attaining stable returns on investment. Moreover, the costs involved in developing, validating, and verifying projects are often prohibitive, forcing most Kenyan enterprises, tiny and medium, to need more capital. As per the United Nations Environment Programme (UNEP) study, carbon project development costs in Kenya vary from fifty to two hundred and fifty thousand US dollars, depending on the type and size of a project (UNEP, 2024). These substantial initial investments, coupled with market uncertainties, have led to an average payback period of 6-8 years, with approximately 30% of projects struggling to break even within the first decade of operation (State Department of Energy, 2023). These relatively high initial costs combined with unpredictable revenues because of market fluctuations become a significant obstacle and constant profitability issues for many potential project developers. The long gestation periods that take 7-10 years for forestry projects do not help the cause of

profitability or attract investors looking for quick returns on their investments; working capital requirements and project cash flows are incredibly stretched (Leley et al., 2022). In other words, the potential of financing projects through carbon credit sales in Kenya is undermined by the unpredictable carbon market prices, substantial initial costs, and longtime horizons to break even, potentially presenting a challenging and even unfavorable environment for pro-carbon financing projects.

Another element that significantly influences the profitability of carbon financing projects in Kenya is the relatively low local demand for carbon credits, which makes project developers depend enormously on export markets. It makes projects vulnerable to other risks, such as fluctuating exchange rates and changes in climate policies in foreign nations, which create additional risks and affect a project's revenue and profit potential. Analysis of financial data from carbon projects in Kenya over the past five years reveals a declining trend in profitability, with average profit margins dropping from approximately 18% in 2019 to just 7% in 2023. Furthermore, the volatility in profitability is evident, with year-on-year changes in profit margins for individual projects ranging from -25% to +20% (State Department of Energy, 2023). Furthermore, the structure of carbon markets and the skills and knowledge necessary to work with them involve operational capacity, which calls for the involvement of international consultants and modifiers, hence reducing possible profits. A real-life example of the Kasigau Corridor REDD+ Project in Kenya established that although this project was able to produce the sale of carbon credits, the project returned about \$30 million of that amount to international intermediaries and consultants, thus diminishing the profitability of the project (Ndichu, 2016). Another reason for such dependence on highly-priced internationals in carbon market operations and project

development is this chronic need for more local capacity. Moreover, there are also additional profitability issues due to the duration of many carbon projects, particularly those in the forestry and land-use sectors, which are long-term (State Department of Energy, 2023). On average, carbon projects in Kenya require 4-6 years to generate their first carbon credits, during which time they operate at a loss. This extended period of negative cash flow has contributed to a project failure rate of approximately 35% within the first seven years of operation (Ndichu, 2016). At the same time, most funding sources are short-term funding from investors and donors. Promoters face the critical problem of the inability to source patient capital that will be able to wait for the long payout time inherent in carbon projects, hence the issues of cash flow and profits. In essence, the feasibility of carbon financing in Kenya is equally threatened by market saturation, weak local demand, fluctuating global markets, high intermediation costs, as well as temporal and spatial investment and project misalignment.

While carbon financing schemes have gained traction globally, their impact on the profitability of RE firms registered under EPRA in Kenya is not well understood. Given the value of profitability on the sustainability of RE firms, it is important to examine how it is shaped by carbon financing variables. Therefore, the problem addressed in this inquiry was to explore the potential relationship between carbon financing and the profitability of these RE firms.

1.3 Justification of the Study

Despite the growing global interest in carbon financing as an instrument for promoting renewable energy, limited empirical evidence exists on how it directly influences firm

profitability, particularly within developing economies like Kenya. Existing studies reveal conceptual, methodological, and contextual gaps that this research seeks to address. There exist conceptual gaps in relationship between the constructs of carbon finance (carbon credits, carbon issuance and transactional cost, initial project costs, and tax incentives) and return on investment (ROI). There are limited studies that have sought to link these variables with profitability of RE firms. Furthermore, studies have tended to focus on general performance of organisations, utilising measures such as ROA, Tobin's q, and ROS. Therefore, it was the intention of this study to establish how these key variables relate with ROI as a measure of profitability in RE firms in Kenya.

Methodological gaps exist in the sense there is a dearth of studies in literature utilizing both primary and secondary data to document the relationship between carbon financing and profitability. The few studies that have used primary and secondary data have neglected firm size as a moderating variable. This study utilised primary data gathered with the help of structured questionnaires sent to the target companies. Furthermore, secondary data from EPRA records was utilised in developing findings. There are limited research that have utilised multiple regression analysis to demonstrate the relation between carbon financing and profitability. With this study, not only was multiple regression was employed, the data was also diagnosed to determine compliance with normality, collinearity, and autocorrelation requirements.

Contextually, while there are studies done on carbon financing in Kenya, there are none focused on how carbon financing shaped the profitability of RE firms in the country. Therefore, in the context of Kenya there exist a literature gap not only on the profitability of RE firms but also on how it is influenced by carbon financing.

Overall, the study's objective was to fill the knowledge gap regarding the impact of carbon financing on the profitability of RE firms registered under EPRA in Kenya. The findings would enhance the understanding of the potential benefits and challenges associated with carbon financing, thereby yielding important insights for major stakeholders including policymakers, investors, and renewable energy companies.

1.4 Research Objectives

The objective of this research was to systematically investigate the impact of carbon financing on the profitability of renewable energy firms in Kenya. The target was to offer insights about how carbon financing mechanisms can support financial sustainability and growth in Kenya's renewable energy sector.

1.4.1 General Objective

This inquiry's general objective was to establish the effect of carbon financing on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority (EPRA), Kenya.

1.4.2 Specific Objectives

- i. To establish the effect of carbon credits on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.
- ii. To determine the effect of credit issuance and transactional costs on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

- iii. To establish the effect of initial projects costs on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.
- iv. To determine the effect of tax incentives on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.
- v. To establish the moderation effect of firm size on profitability on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

1.5 Research Hypothesis

H₀₁: Carbon credits have no significant effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

H₀₂: Credit issuance and transactional costs have no significant effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

H₀₃: Project costs have no significant effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

H₀₄: Tax Incentives have no significant effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

H₀₅: Firm size has no significant moderation effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority.

1.6 Scope of the Study

This research explored carbon financing and profitability of renewable energy (RE) firms registered under the Energy and Petroleum Regulatory Authority in Kenya. The specific period of focus was between 2019 and 2023. The use of latest data of RE companies is necessary because the industry is undergoing significant advancements as countries and organisations seek to combat climate change. Contextually, literature has linked carbon financing variables such as carbon credits, emission reductions, project costs, and policy impacts to financial performance of companies. This research examined these variables and their influence on profitability of RE firms in the Kenyan context. This research obtained data majorly from two types of renewable energy areas of biogas and solar. This window is consistent with the agreement of the Kyoto Protocol, which grants Kenya the capability to implement Clean Development Mechanism (CDM) projects. While the development of renewable energy remains the largest receiver of carbon finance, there has been little efforts in developing countries to establish their relationships. The research also examined literature from different researchers and scholars to determine the connection between renewable energy and carbon finance.

1.7 Significance of the Study

This research explored carbon financing and profitability of renewable energy firms registered under EPRA. Renewable energy has been instrumental in reducing carbon emissions and earning revenue for carbon project developers. Since the country is part of international ratification that advocates the carbon finance utilization as a mean of reducing

carbon emissions, the research would be crucial to many stakeholders including the government, academic researchers, project developers, and climate change advocates.

This research would inform the development of government policy tailored towards addressing climate change. The potential of Kenya in generating renewable energy is enormous. However, the adoption rate of carbon finance by RE developers relatively low given the projects that have been registered under CDM board. Despite the government of Kenya providing a conducive environment for participating in the voluntary market and the CDM, the framework of helping producers of renewable energy access carbon markets in the international arena has been missing (NEMA, 2016). By providing data about carbon financing and profitability of renewable energy firms registered under EPRA, the study would help government in formulation of policies and capitalising carbon finance to enhance the development of RE in the country.

The researcher would also offer valuable findings for academic researchers. Academic literature on the role of carbon finance in enhancing investments in RE is hardly available in developing countries. Despite having a handful studies of carbon finance in Kenya, majority of them is in form of policy papers, which cannot be viewed as having authentic conclusions and findings. The research of carbon finance is scarce in the country of study, Kenya, and the better part of the African continent, which casts doubt on the severity of African scholars and researchers on the aspect of carbon finance. Majority of the previous research is affiliated to the European Union, likely due to the organisation's emissions trading system, which has been quite successful. This paper would supplement knowledge of carbon finance in Kenya. Again, it would be a foundation of the country's academic

literature the use and access of carbon finance, from where future researchers can infer and grow their knowledge in this subject.

Energy project developers would also find the results of this study useful. Majority of developers in the RE sector do not comprehend the nature of carbon finance. The role played by projects of renewable energy cannot be downplayed. In developing countries like Kenya, financing projects to completion remain difficult. This study presents information regarding the prerequisites that RE developers need to address to achieve and sustain carbon finance.

Through this study, climate change advocates would find a research basis for policy advocacy. There are significant social and economic challenges that the contemporary world is facing today. Informing people on the importance of addressing climate change is not only environmentally healthy but also developmental. This paper is therefore substantial in informing the public on the importance and impact of carbon finance in achieving green energy to curb climate change.

1.8 Limitations of the Study

The target firms being non-public listed does not have such data that would be useful in this study publicly shared, respondents would most likely hesitate in sharing the same which would pose a significant challenge. The researcher however carefully approached the respondents assuring them of confidentiality and further clearly stating that the collected data was only used for the purposes of this research. Should there need be then a non-disclosure agreement was also proposed. Enough resources were also allocated to facilitate the process to finalization.

1.9 Organisation of the Study

This paper was structured into different chapters. Its first chapter begins with the background of the deployment renewable energy and carbon finance and sets the foundation for the stimulation of the research, problem statement, research objectives, and research questions. The second chapter examined the study's theoretical framework, illustrating the models and theories that govern the basis of exploring the relationship between carbon finance and profitability of RE firms registered under EPRA. The applicability of the provided theories together with their corresponding empirical data is also indicated in the second chapter. Chapter two also encompassed literature review on the justification and nature for carbon finance utilisation in RE projects. It also provided insights on carbon finance utilization in Kenya as well as the problems faced in the course of implementing carbon finance. In an effort to contextualise the study, it reviewed the Kenya's potential in renewable energy and market landscape. Finally, the chapter included a conceptual framework that explores the link between different variables under study. Chapter three described the research methodology utilized in the study including the research philosophy, design, target population, data collection instruments and procedures, proposed data analysis and presentation tools as well as the diagnostic tests. Ethical considerations were also mentioned in the chapter. The fourth chapter provides a meticulous assessment and discussion of the findings and their implications. The last chapter (five) offers a summary of the facts, conclusions, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The part covered the pertinent literature for the research topic in order to assess key concepts, theories, and studies conducted.

2.2 Theoretical Review

Theory is a term used to describe a framework that asserts a connection exists between two or more occurrences. It entails a collection of linked notions that help the researcher shed light on the relationship between two or more variables (Kivunja, 2018). It creates the foundation for further research and prepares the ground for projections. The agency theory, market-based theory, resource-based view (RBV) theory, and theory of Firm size were explored in the subsections below.

2.2.1 Agency Theory

The agency theory was officially put forth in 1976 by Michael Jensen and William Meckling. The theory analysed how the separation of ownership and control creates agency costs, which are costs arising from monitoring, bonding, and residual losses due to misalignment of goals between owners and managers. The agency theory considers a firm as an agreement among individuals with self-interests. According to Panda and Leepsa (2017), Adam Smith, who is recognized as the father of modern economics, was the first to recognize the presence of the agency problem in 1776 through his book, *The Wealth of Nations*. The economist predicted that if a firm is operated by people other than its real

owners, chances are they may not work for the owner's good (Panda & Leepsa, 2017). The agency theory was also later shaped in the 1970s by Stephen Ross and Barry Mitnick. While Ross considered the agency problem an issue of incentives, Mitnick attributed the problem to institution structure (Panda & Leepsa, 2017). Nonetheless, the idea behind both perspectives is similar.

Agency theory is centred on the interaction between shareholders (principals) and managers (agents) [Panda & Leepsa, 2017]. According to Panda and Leepsa (2017), investors anticipate managers to maximise shareholder value in order to operate in their best interests. The aims of managers may, however, be different from those of the shareholders, such as job security, personal wealth creation, or following personal aspirations.

The possibility of conflicts of interest between principals and agents is acknowledged by agency theory (Abbas et al., 2023). When making choices about the distribution of resources, including carbon financing, managers may be inclined to put their own interests ahead of those of shareholders. Managers might, for instance, allocate carbon finance funds to initiatives that boost their own reputations or benefit them personally rather than those that increase shareholder value.

The narrow focus on self-interest and financial incentives, which frequently ignores fundamental reasons like trust, loyalty, and organisational culture, is a complaint levelled at agency theory, despite the fact that it has been crucial in comprehending the dynamics between principals and agents. Because it ignores cognitive biases and irrationalities, the theory's emphasis on rational choice assumptions oversimplifies human behaviour.

Furthermore, by encouraging a transactional rather than relational dynamic, agency theory's emphasis on formal, frequently expensive monitoring techniques can lead to inefficiencies and lower agents' intrinsic motivation. Its applicability in multi-stakeholder and quickly changing contexts is further constrained by its narrow focus on addressing collective goals and adaptability in dynamic environments, while more comprehensive methods like stewardship and stakeholder theories may provide deeper insights.

The concept of moral hazard, or the possibility that agents may neglect their duties or act contrary to the interests of principals, is also highlighted by agency theory. In this sense, managers may be motivated to misuse or improperly allocate resources in the context of carbon financing, which could result in loss or reduced profitability for the company.

Agency theory highlights the significance of overseeing and putting in place suitable governance systems in order to address agency issues (Panda & Leepsa, 2017). Monitoring tools including performance reviews, financial reporting, and audits can support the alignment of managers' and shareholders' interests. Managers can be held responsible for their decisions and actions by having clear performance measures and targets connected to the efficient use of carbon finance (Panda & Leepsa, 2017).

In order to reduce agency issues, agency theory emphasizes the significance of contracts between principals and agents. Contracts can outline each party's obligations, rights, and performance standards, as well as the proper application of carbon finance resources. A framework for coordinating the interests of managers and shareholders as well as preventing potential agency conflicts can be found in well-designed contracts.

Agency costs, which are associated with solving agency issues, are acknowledged by agency theory (Panda & Leepsa, 2017). These charges include monitoring costs, creating suitable contracts, and possible losses brought on by poor managerial choices. The potential benefits of aligning managerial behaviour with shareholder interests and enhancing financial performance should be balanced against the expenses involved in minimising agency concerns (Panda & Leepsa, 2017).

The principal-agent problem exists in carbon financing of RE energy projects. The investors in RE projects require returns not only in the form of the production of environmentally friendly energy but also financial returns. It is for this reason that RE projects seeking financing from the carbon markets must undergo a thorough and costly verification process. This added to the costs of projects, which consequently affects profitability.

2.2.2 Market-Based Theory

Developed in the 1930s and 1950s by Mason and Bain, the theory focused on the external environment's impact on the operations of an organisation. The market-based theory emphasises strongly on how enterprises adapt to the demands and preferences of customers. Strong demand for renewable energy presents businesses with an opportunity to benefit from carbon financing incentives. As more consumers look for green energy options, businesses can increase their customer base, bring in more money, and enhance their profitability (McGee, 2015). In Kenya, the level of demand for renewable energy is a significant determinant of how businesses finance their carbon emissions.

The market-based theory acknowledges how crucial competition is to influencing corporate behaviour and performance. In efforts to realize a competitive advantage in the RE sector, businesses may turn to alternate forms of funding, such as carbon financing. Businesses may stand out in the market, draw in environmentally concerned clients, and improve their profitability by taking part in carbon offset initiatives and displaying a commitment to decreasing carbon emissions (Ji et al., 2023). As per the theory, the market shapes to a great extent the operations of a business.

Regulation and market incentives have an impact on market conditions as well. Government initiatives like incentives, subsidies, and RE objectives have a big impact on how the market for RE companies operates (Ji et al., 2023). Firms may be persuaded to explore carbon financing via favourable regulatory frameworks and market incentives. By providing financial resources and incentives, these policies can establish a favourable institutional environment that will enable businesses to use carbon finance effectively to increase their profitability.

The relevance of market entry and expansion strategies for firm performance is highlighted by market-based theory. Companies may choose to explore carbon financing as part of their market entry or expansion strategies in the RE field. To encourage the development of new projects, the expansion of the infrastructure, and the entry into new market areas, carbon finance can offer additional financial resources. Businesses can expand their market reach, seize development possibilities, and boost their profitability by utilising carbon financing.

The renewable energy sector's innovation can be influenced by market pressures. According to the market-based theory, businesses should introduce novel goods, services, and business strategies in order to adapt to changing market environments as well as consumer preferences. In the carbon markets, the ability of projects to reduce emissions influences the carbon credit prices. In this sense, market-based theory drives RE energy companies to invest in tools and technologies that contribute to the reduction of emitted gases.

2.2.3 Resource-Based View (RBV) Theory

Resource-based View (RBV) theory was put forth in 1959 by Edith Penrose, who provided valuable information about the acquisition, use, and expansion of resources to help organisations attain competitive advantage (Burvill et al., 2018). According to the theory, not all resources are created equal. Physical, financial, human, and organisational capital are all distinct resources that any firm has access to. A renewable energy company's resources might include access to renewable energy sources, technological know-how, human capital, financial resources, connections to stakeholders, and market knowledge (Weiglet & Shittu, 2016) According to RBV, businesses should seek and develop resources that are valuable, hard to duplicate, and unusual since they can give them a sustained competitive edge (Burvill et al., 2018).

The link between corporate resources and financial success is highlighted by RBV. Renewable energy companies can bolster their financial performance by using and exploiting their resources more effectively. For instance, companies may be able to modernise infrastructure, increase market reach, and engage in RE projects with the help of carbon financing resources.

The RBV theory places a strong emphasis on creating and constructing capabilities around valuable resources (Weiglet & Shittu, 2016). Businesses that use renewable energy can improve their financial performance by consistently making investments in the expansion of their resources and skills. For instance, funding R&D can result in technical developments, increased energy efficiency, and creative solutions. In addition to improving the firm's competencies and resource base, developing excellent relationships with stakeholders like suppliers, consumers, and governmental organisations can also help the company perform financially.

Resources deemed to be valuable, rare, unique, and non-substitutable (VRIN) offer continuous competitive advantage (Nason and Wiklund, 2018). The capacity to obtain and efficiently use carbon money as a resource can give renewable energy companies a competitive edge.

Businesses may be able to acquire more capital, reduce financial risks, and carry out ecologically friendly projects thanks to the availability of carbon financing option. Businesses can attain differentiation in the market, draw in clients, and outperform rivals by leveraging carbon financing resources effectively, which boosts financial performance.

As per Lubis (2022), resource integration and complementarity inside a corporation are significant in firm performance. By integrating and coordinating their resources and capabilities, renewable energy companies can create synergies and improve their financial performance. For instance, combining carbon financing with currently available renewable energy assets and capabilities can result in cost savings, higher operational effectiveness,

and better financial results. Enhancing financial performance can be achieved by ensuring that resources for carbon finance are allocated and coordinated effectively.

RBV theory acknowledges that long-term competitive advantage depends on the sustainability of resources. Businesses that produce renewable energy should concentrate on creating resources that are robust and challenging to duplicate or replace (Bridge et al., 2020). When it comes to carbon finance, businesses may improve profitability by actively managing their carbon assets, funding carbon-reduction initiatives, and exhibiting a dedication to sustainability over the long term (Jeong & Kim, 2019). Businesses are able to maintain their competitive advantage and financial performance over time by regularly refilling and renewing their resources (Jeong & Kim, 2019).

2.2.4 Theory of Firm Size

The theory of firm size is a key framework in economics that seeks to elaborate on the optimal size of a firm in regard to financial performance. The theory was pioneered in the late 19th century by Alfred Marshall who argued that firms exist to exploit economies of scale, which means the cost benefits that an organisation achieves as it expands in size (Foss, 1994). As per Marshall, larger firms have the ability to spread their fixed costs over a larger output, thereby shrinking their average costs, and consequently leading to higher profits.

Several assumptions underlie the theory of firm size. First, the theory assumes that organisations seek to improve their profits by reducing costs and increasing revenues (Foss, 1994). Another assumption characterizing the theory is that organisations operate in a competitive business environment, where they have to compete for resources with other

companies. Despite its value, the theory of firm size has faced several criticisms. One criticism is that it relies too heavily on the assumption of rational decision-making and perfect information, which may not correspond with real-world scenarios (Foss, 1994). Additionally, critics argue that the theory overlooks other factors that affect firm size, such as managerial priorities, organisational culture, and social norms. Furthermore, the theory has been criticized for its stationary view of firm size, which fails to consider the dynamic nature of markets and the evolutionary processes that shape the performance of firms over time.

Nonetheless, the theory of firm size is integral in showing how an organisation's size in regards to its market value, the workforce size, and financial strength can influence its profitability. Therefore, from the theory of firm size, it can be deduced that larger RE energy firms can attain higher profitability due to economies of scale. Therefore, investors in RE energy can prefer larger firms over smaller firms.

2.3 Empirical Review

Although the origin of carbon financing and ecological economics dates back to the 20th century, it is in contemporary world that it has attracted attention of financial academics. The fundamental question related to financing lies in the relationship between financial and environmental performance. The link between financial and environmental performance was first highlighted in the work of Hart and Ahuja (1996) when they posed the question; "does it pay to green?" Existing literature has yielded evidence of a poor, positive and neutral relationship between environmental and financial performance. There are different reasons for these inconsistent results. First, King and Lenox (2001) assert that

the question is wrongly structured and should be “when does it pay to be green?” Second, Busch et al. (2022) argue that the sophisticated issues need to be freed so that a reasonable answer can be obtained. According to the authors, there are various environmental aggressions with varying effects in the financial outcomes of different business organizations (Busch et al., 2022). According to different scholars, corporate governance, level of environmental disclosure figures, the initial level of environmental performance, and type of environmental strategy developed are some of the numerous aspects that influence the performance of firms. Surprisingly, the same firm may exhibit both negative and positive relationship between financial and environmental outcomes regarding the financial measure used.

Researchers have turned their attention on the significance of carbon financing on the sustainable development of the world. Wavelet power spectrum approach has been used to examine the link between carbon financing and RE around the globe (Ali et al. (2020). In the study, the analysis depicted a unidirectional relation between carbon financing and RE (Ali et al., 2020). In a more recent investigation, Zhou and Xu (2022) explored the effect of carbon financing on regional financial improvement. From the research, the findings depicted a U-shaped relation among the variables. According to a data analysed within a year, research revealed a progressive relationship between carbon financing and financial outcomes of renewable energy firms. Dong et al. (2021) explored the correlation between financial performance and varying degrees of carbon financing. The researchers believe that green financing has positive implications on green innovation as well as good performance of firms financially. Dong et al. (2021) has detailed the how carbon financing shapes carbon dioxide emission from 2007 and 2018.

2.3.1 Carbon Credits and Profitability

Carbon credits are generated and traded under the regime of international climate change and voluntary offset market where individuals and firms can willingly decide to compensate for emitting greenhouse gases. In the recent past, the number of offsets produced has risen significantly while their prices have varied depending on particular reasons. Zhang et al. (2023) sought to explore how carbon markets influence the monetary performance of Chinese power suppliers. The researchers utilized difference-in-differences (DID) model of 51 listed hydropower and thermal firms to find link between carbon markets and the power producers' financial performance. The findings signified that the activation of carbon markets negatively influenced the companies' financial outcomes of the companies. The study examined the carbon market in general while this study examined changes in carbon credit prices. Furthermore, the study focused on Kenyan RE companies

A study by Kangas (2016) sought to examine the profitability factors through examining carbon pricing mechanism and carbon risks. The author utilized sensitivity analysis to assess carbon price increases and their influence on profitability of 328 European firms. According to findings of the study, an increase in carbon pricing was associated with reduced profitability of companies not engaging in clean energy. In the long term, Kangas (2016) shows that companies investing in cleaner technology are profitable. The study used sales as a measure of sustainability, which limited compared to ROI that this study used.

In yet another study, Scholtens and van der Goot (2014) examined how carbon prices affect the value of companies under the EU's ETS. The key variable of focus in the study was the value of the companies in terms of stock returns. Equally weighted portfolios of the

companies were used to evaluate the link between variations in carbon prices and stock market returns. As per inquiry's outcomes, while the volatility of carbon price had a weighty effect on stock market returns, there was no influence on the volatility of the market values of companies. Nonetheless, Scholtens and van der Goot (2014) conclude that EU ETS has little but significant effects on the values of companies. The focus of the study on EU ETS limited its applicability in the local setting. Furthermore, the study focused on stock returns as a measure of the value of firms. In this study, focus was on ROI.

Conte and Kotchen (2010) examined the factors shaping the inconsistency in voluntary carbon offset prices. The study analysed data from providers in North America, Australasia, and Europe. The authors observe that voluntary market prices can be determined by whether the project is established, that is whether it is in a developing or developed country. Projects in developing nations like Kenya attract steeper prices. While the study does not focus on profitability, it explores the price of carbon credits, which influences profitability. The current study sought to find how carbon credit price changes influences the profitability of RE firms.

The continued changes of offset prices have impacted the implementation of carbon finance across the world and it is imperative to explore how they are associated with the profitability of firms. This research sought to explore how the changing prices of carbon credits in the international markets have impact on the profitability of renewable energy firms in Kenya.

2.3.2 Credit Issuance and Transactional Costs, and Profitability

Carbon credit release in Kenya is a highly structured issue and is almost entirely dependent on the feasibility of financing carbon projects. Clean Development Mechanism (CDM) has been the most widespread, and other recognized standards include the Gold Standard and the Voluntary Carbon Standard (VCS). Before undertaking project activities in different countries, they are supposed to adhere to standards provided by the National Environment Management Authority (NEMA). Naeku (2020) offered a comprehensive legal examination of climate change legislation in Kenya and laid down the established legal instruments of climate change management (Naeku, 2020). However, the study was criticized because it needed to discuss implementation issues in depth or provide an economic perspective on climate change policies. For example, the Kenya Agricultural Carbon Project promotes sustainable management of agricultural land and sells carbon credits under the VCS methodology 2014 (Kenya Private Sector Alliance, 2022). It then emerged as the pioneer soil carbon project in the African region. Based on this legal foundation, Robinson et al. (2023) focused on household-scale biogas plants and energy ecosystems and developing new intelligent monitoring concepts to enhance the fairness and equity of energy systems (Robinson et al., 2023). Despite these strengths, the research was tainted by a limited scope of household-based projects and inadequate consideration of other carbon financing strategies

A new exploration of the geography of carbon financing in Kenya indicates that high transaction costs negatively affect project profitability. Such costs include development, validation, verification, and credit-giving costs. By estimating transaction costs for the different types and volumes of projects in the present study, it was noted that the lowest of

the transaction cost was 0.3 USD/tCO₂eq, and the higher end was 2.7 USD/tCO₂eq. More recently, Rotich et al. (2024) took the study a notch higher by surveying the state of RE in Kenya, thus establishing its current level and impediments to uptake. However, their study was criticized for not examining the details of the financial policies that underpin renewable energy projects. The researchers noted the need to further expand the study of these critical issues. For example, a community-based forest carbon project from Kenya said they incurred nearly 40% of their prospective carbon revenue in transaction costs (Kenya Forest Service, 2020). Such high costs significantly reduce the gross profit margin arising from the carbon credit sales, reducing the financial viability of projects and turning off the would-be investors.

While capital credit issuance helps project implementation, the time lag between issuance and revenue realizations hampers the overall sustaining ability of most projects, which is a big issue for most small and medium-sized enterprises (SMEs) who are unable to wait for lengthy periods before realizing revenues to cover their spare capital expenditures used for issuing such capital credits. Credit issuance ensures the credibility and value of the carbon projects in Kenya but discourages profitability and may take a long time to ensure promising outcomes. All in all, therefore, while the potential exists for carbon financing within Kenya, the cost on a transaction basis poses a robust threat to the financial viability of carbon financing projects of this nature and frameworks, especially those tiny in scale and which may require assistance to bear the general cost surrounding entry into a carbon financing deal.

2.3.3 Initial Project Costs and Profitability

Project costs are a key consideration for companies before investing in any initiative. According to EEP Africa (2023), small projects have a high impact on carbon prices but they are more expensive. Furthermore, AREI (2015) notes that the cost of supplying and installing RE equipment is higher in Africa than elsewhere, meaning that it requires large amounts of capital. Key costs associated with carbon financing projects include transaction costs, investment and R&D costs, and costs of financing.

Prokopenko et al. (2023) explored the effects of long-term investments and R&D expenses in RE technologies on the economic outcomes of ten major firms in the sector. It is important to recognize that investment and R&D costs are key project costs that can impact the profitability of a firm. The study's results show that R&D spending and long-term investments positively impact the indicators of profitability an organisation such as net income, ROI, earnings before interest and tax, and earnings before interest, taxes, depreciation, and amortization. In essence, if companies invest in RE technologies including their R&D, there is potential for positive financial performance.

Steffen (2020) investigated the cost of capital for different RE technologies and how it differs across different countries. The study assessed the cost of capital for RE technologies in 46 countries from 2009 to 2017. The findings indicate that the cost of capital increased from solar to onshore wind with offshore wind power bearing the highest cost. Furthermore, the study's findings show that developing countries have a higher cost of capital compared to industrialized countries. In essence, the high cost of capital in developing countries can increase project costs.

In another study, Jung et al. (2018) investigated whether investors take into account an organisation's exposure to carbon risk when making lending decisions. Specifically, the authors sought to find out if lenders increased the cost of financing if a company is exposed to high carbon risk. With 255 firms in its sample, the study explored the historical carbon emissions of the companies and measured the willingness of the firms to undertake the Carbon Disclosure Survey (CDS) [Jung et al., 2018]. The results of the inquiry depicted a positive link between cost of financing and carbon risk. This means that companies having high carbon risks face a greater cost of debt. While the study fails to link the high cost of debt to profitability, it is instrumental in documenting that a firm's carbon risk can elevate its debt cost.

In their investigation, Pearson et al. (2014) examined how transaction costs shaped carbon sequestration projects. Sequestration projects are initiatives intended to capture and store atmospheric carbon dioxide, which can be significant in addressing global climate change. The study investigated four case studies and found that transaction costs range from 0.3 to 270 % of the expected income, depending on carbon price as well as project size. The main cost categories included insurance costs, monitoring costs, and regulatory approval costs. Other transaction costs examined by Pearson et al. (2014) included negotiation costs, feasibility study costs, and search costs. It was the conclusion of the authors that carbon sequestration costs are underestimated by up to 30% primarily due to the failure to take into account the transaction costs. While the inquiry concentrated on sequestration projects, the present investigation focused on RE projects.

2.3.4 Tax Incentives and Profitability

Organisational and governmental policies shape the operations of an organisation and can influence its profitability. Inzunza et al. (2021) delved into the influence of environment-related policies on the risks facing the electricity generating industry in Chile. The authors explored two policies, carbon taxes and renewable portfolio standards (RPS) and how they impact risk exposure when changes in fossil fuel prices are taken into account. The study's findings show that when both policies are implemented, investors are incentivised into investing in portfolios of electricity producing companies. In essence, the findings of the study indicate that if RPS and carbon taxes are implemented, risk exposure of the energy generation market is reduced. This can contribute to profitability. The current study investigated whether tax incentives influence profitability.

Several tax incentives have been incorporated into the Kenyan taxation system to boost the profitability of carbon financing projects because of the perceived environmental and economic advantages. One ongoing policy excludes revenue credit sales from Value Added Tax liabilities under the Value Added Tax Act of 2013. This exemption directly extends the net profit from business in carbon credits that directly augments project viability. Furthermore, regarding accelerated depreciation, the Income Tax Act also leans towards the company's favour, stating that capital expenditure relating to a renewable energy business shall be written off by fifty per cent in the first year and twenty-five per cent in the subsequent years (KRA, 2021). Ndiritu and Engola (2020) embarked on a performed policy analysis and policy performance assessment of feed-in-tariff policy in Kenya (Ndiritu & Engola, 2020). However, the variables that their research measured to determine the effectiveness of these policies was the generation of renewable electricity, and their study was also faulted for

offering a relatively brief overview of the long-term fiscal feasibility of RE projects. Based on this research, Oluoch et al. (2021) used the choice experiment technique to examine Kenyan people's attitudes toward renewable energy sources. Their research helped determine the beliefs and attitudes of the public toward the various renewable energies under consideration. Still, it lacked some critical aspects through inadequate analysis of the economies of renewable energy hindrances. These studies highlight the mixed bag that is the state of renewable energy in Kenya and the many directions in which further research is necessary to provide a comprehensive information on this process and its numerous associated difficulties.

Out of all this provision's advantages, the most distinct is the accumulation of taxation costs at the beginning of a project and the corresponding increase in cash flows and profitability. In addition, the Government has exempted from customs duty any machinery and equipment imported for power generation from renewable sources, which partially helps carbon financing projects in renewable power generation by helping reduce their preliminary investment cost. Together, these tax incentives are expected to improve the global financial climate of carbon projects, focusing on some of the profitability difficulties accompanied by the sector. In brief, the tax incentives of carbon financing in Kenya are tax reliefs and start-up costs, which have enormous potential to enhance the financial feasibility and profitability of the projects.

The role of these incentives in the profitability of carbon financing projects in Kenya has been well realized, while some hurdles still exist in adequately utilizing the same. According to a study by the Kenya Association of Manufacturers (KAM), tax incentives have boosted investment in renewable energy between 2016 and 2020 by 23%, and many

of these projects undertake carbon credit generation (Kenya Association of Manufacturers, 2021). Among those, the VAT exemption for carbon credit sales has boosted the profitability of the existing projects and facilitated new investments. The Lake Turkana Wind Power project that deals in carbon credits is a good case example. The project got a raw deal from the two provisions by being exempted from VAT while benefiting from accelerated depreciation of its fixed assets (Kenya Association of Manufacturers, 2020). Nonetheless, these incentives for promoting profitability are often associated with numerous impediments, such as being more relaxed and providing adequate publicity to the target beneficiaries. According to the survey conducted by the KEPSA, out of all the firms eligible for carbon financing, only 45% of them had comprehensive information concerning the various tax incentives available for financing the projects (Kenya Private Sector Alliance, 2022). This lack of awareness means that most projects cannot maximize these profitability measures. However, more than tax incentives are needed to overcome the rest of the factors that threaten carbon projects' cost coverage and profitability, including high initiation costs and market risks. In summary, studies reveal that tax incentives positively affect the profitability of carbon financing projects in Kenya. Further improvement in realizing the potential of improving project viability through better implementation and awareness could be realized.

2.3.5 Carbon Financing, Firm Size, and Profitability

The theory of firm size has it that the size of an organisation in terms of market value, workforce size, and resources affect its performance. A research by Morina et al. (2021) probed the elements that drove the profitability of RE companies in the EU, between 2004 and 2018. The authors utilized Tobins' q and ROA as measures of profitability and

employed random effect Generalized Least Squares (GLS) and ordinary least square (OLS) models to analyse the data. The study's results denote that firm-specific forces influence the profitability of RE companies more than macroeconomic factors. An important finding in the study was that firm size positively influenced profitability on all models. While the study utilized ROA and Tobin's q as profitability measures, the current study seeks to use ROI.

Abeyrathna and Priyadarshana (2019) performed an analysis to understand the influence of organisation size on the profitability of twenty manufacturing firms in the Sri Lankan context. Utilizing data from the firms' annual reports from (2014–2017), the authors employed regression and correlation analyses to find the link between firm size and profitability. The study utilized net profit and ROA as measures of profitability as well as total assets and sales as measures of firm size. As per the findings of the inquiry, the size of an organisation does not significantly shape the profitability of Sri Lankan manufacturing firms.

Research on European listed firms found that the impact of RC on profitability measures (COGS, interest expenses, and EPS) is significantly affected by size (Corvino et al., 2019). Furthermore, size also moderates the impact of carbon productivity on performance, with small, high carbon-intensive firms benefiting most from productivity improvements in market-based measures.

Mutunga and Owino (2017) designed their study to examine the link between production capacity and financial outcomes in Kenyan manufacturing companies. Through a survey of 180 companies and the use of regression and correlation analyses, the authors found that

production capacity explained the financial performance. The authors found that the production capacity of the manufacturing firms positively influenced financial performance measures, which included market share, profitability, and wealth maximisation. While the study focused on manufacturing firms, the current one focused on RE companies.

In another study, Lopez-Valeiras (2016) explored how indebtedness influenced the link between an organisation's size and financial performance. The study analysed archival data from 83 firms in the livestock sector. Moreover, the study utilized multiple linear regression analysis to explore the link between organisation size and financial outcomes. Through the use of ROA as a financial performance measure, the study showed that indebtedness can help organisations attain the benefits of being large. However, interestingly, the findings show that as indebtedness level increases, the effect is negative on financial outcomes, which can be due to transaction costs. The current study focused on the RE energy sector and utilize ROI as a measure of profitability.

2.4 Summary of Literature Review and Study Gaps

A review of literature has shown little effort among researchers to assess the link between carbon financing and the profitability of RE firms in the context of Kenya. Empirically, the review provided varied outcomes on the effect of carbon financing variables on profitability of RE energy companies. In regards to carbon credits, there are few studies linking changes in the prices of carbon offsets to profitability. Even those that link changes of carbon credit price to profitability have not explored the Kenyan context. When it comes to issuance and transactional costs, studies have tended to focus on international

companies, particularly those in the Fortune 500 list. As for project costs, studies have failed to find a link between the costs of carbon financed projects and profitability. Similarly, there is a scarcity of literature that links policy to the profitability of RE firms. In sum, while the review was significant in exploring the variables and forms the foundation from which the research hypothesis is derived, it does not establish the significance of these variables in carbon finance.

Table 2.1 Summary of Study Gaps

| Author(s) | Objective | Findings | Research Gaps | Addressing the gap |
|--|---|---|---|--|
| Zhang et al. (2023) | To study the influence of carbon markets on financial outcomes of energy companies | Carbon markets negatively affects the financial outcomes of firms. | Focused on Chinese firms Examined the influence of carbon markets | Current study focused on Kenyan market. Examined the effect of carbon credit prices |
| Prokopenko et al. (2023) Europe | To examine the influence of investment and R&D spending in RE technologies on the financial performance of firms. | Investment and R&D spending positively impacts profitability indicators | Focused on the largest international companies | Current study focused on the Kenya RE companies |
| Abbas et al. (2023) | To delineate the impact of RE investment on the performance of Chinese energy firms | Renewable energy investment correlates with increased electricity output. | Study focused on electricity output of firms and not financial performance. | Current study focused on the impact of renewable energy investment on profitability |
| Qin et al. (2022) | | | | |

| | | | | |
|-----------------------------|---|---|--|--|
| USA | To investigate whether renewable energy and sustainable finance could help the US attain carbon neutrality. | Consumption of renewable energy and development of sustainable finance could promote carbon neutrality in the US. | Focused on carbon neutrality for the whole country, USA. | Current focused on profitability of renewable energy firms in Kenya. |
| Busch et al. (2022) | To analyse whether higher carbon emissions are related with long-term and short-term financial performance | Higher carbon emissions correspond to both short-term and long-term financial performance. | Little focus on carbon financing. Focused on ROA as dependent variable. | Current explored the impact of carbon financing Utilised ROI as dependent variable. |
| Zhou and Xu (2022) China | To explore the effect of carbon financing on regional financial enhancement. | A progressive relationship exists between carbon financing and financial performance of renewable energy firms | Focused on Chinese firms | Current study focused on the Kenyan context. |
| Dong et al. (2021) | | | Focused on US public firms | |

| | | | | |
|------------------------------------|--|---|--|--|
| USA | To probe the correlation between financial performance and carbon financing at different levels. | Green financing has positive implications for on green innovation and consequently financial performance. | | Current study focused on Kenyan firms |
| Hassan (2021) Nigeria | To analyse the effect of RE policies on the performance of energy firms | RE policies stimulate better financial performance of energy companies | Study focused on all energy firms. Study utilized ROCE, EPS, and share price as financial performance measures. | The current study focused specifically on RE firms. Study utilised ROI as measure of profitability. |
| Inzunza et al. (2021) Chile | To examine how environmental policies shape risks in the energy generating sector. | Carbon taxes and renewable portfolio standards (RPS) policies can reduce risks | Focused on Chilean sector Focused on impact of policy on risk | Focused on the Kenyan sector Focused on impact of policy on profitability |
| Ji et al. (2021) | | | | |

| | | | | |
|-------------------------------------|--|--|--|---|
| Europe | To compare renewable energy investments to traditional investments | Renewable energy investments underperform traditional investments | Study focused on investments in Europe | Current study focused on investments in Kenya. |
| Morina et al. (2021) Europe | To examine the drivers of profitability of RE companies | Firm specific factors tend to explain profitability more than macroeconomic factors | Focused on RE firms in the EU Utilized ROA and Tobin's q | Current study focused on RE companies in Kenya Current study utilizes ROI |
| Liu et al. (2019) China | To investigate the link between government subsidies, R&D input, and performance of listed Chinese energy firms. | Government subsidies resulted in improved performance of the companies after two years | The study focused on Chinese firms. The study utilized sales to estimate a firm's performance. | In the current study, focused is on Kenyan firms. ROI was used to measure profitability. |
| Abeyrathna and Priyadarshana (2019) | To evaluate the influence of organisation size on the | An organisation's size does not have a significant | Focused on Sri Lankan manufacturing firms | Focused on Kenyan RE firms |

| | | | | |
|-------------------------------------|---|--|--|--|
| Sri Lanka | profitability of manufacturing companies. | effect on the profitability of the firms. | Utilized net profit and ROA as measures of profitability. | Current study employed ROI as a profitability measure. |
| Compernelle et al. (2019) Europe | To examine the policies impacting the profitability and risk of geothermal projects | Heat premium policy is best policy instrument | Focused on Europe The study utilized benefit to cost ratio and abandonment rate as performance indicators | Focused on Kenyan firms. Utilised ROI |
| Alexopoulos et al. (2018) Greece | To probe the link between environmental performance and financial outcomes | Avoidance of environmentally-friendly investments was associated with better financial performance | Focused on green companies Utilize ROA and ROS as measures of performance | Current study focuses on Kenyan RE companies Current study utilizes ROI |
| Baimwera (2018) | | | | |

| | | | | |
|-------------------------------|---|--|--|---|
| Kenya | To examine carbon finance uptake determinants in Kenya | The size of RE project, carbon market affiliation, and utilisation of low carbon technologies influenced the uptake of carbon finance by RE developers | Focused on elements shaping carbon finance uptake | Present study focused on the effect of carbon financing on profitability. |
| Mutunga and Owino (2017) | To assess the link between production capacity and financial outcomes of Kenyan manufacturing companies | Production capacity explained the financial outcomes of Kenyan firms. | Focused on Kenyan manufacturing firms | Focused on Kenyan RE firms |
| Lewandowski (2017) Germany | To analyse the influence of a firm's carbon performance on financial outcomes | Companies with superior carbon performance have better financial performance | Focused on the performance of international firms. Utilized ROS and Tobin's q | Focused on the profitability of Kenyan RE firms Uses ROI |

| | | | | |
|--|--|--|---|---|
| Jung et al. (2016) Australia | To investigate whether lenders take into account carbon-risk in determining financing cost | Carbon risk is positively related with cost of finance | Study failed to link cost of financing to profitability Focused on Australian firms. | Currents study sought to link project costs with profitability Focuses on Kenyan firms |
| Kangas (2016) Europe | To investigate the impact of carbon pricing on profitability of companies | Carbon pricing increase negatively affects profitability | Study focused on Europe and used sales as measure of profitability | Study focused on Kenya and uses ROI as profitability measure |
| Lopez-Valeiras et al. (2016) Spain | To evaluate the relationship between firm size and financial performance and the impact of indebtedness on the relationship. | Indebtedness leverages the impact of firm size on financial performance | Focused on companies in the livestock industries in Spain. Utilised ROA. | Currents study focused on the RE companies in Kenya Utilized ROI |
| Gallego-Alvarez et al. (2015) Spain | To examine how carbon emission reductions influences the operational and financial performance of companies | There is a positive link between emission reductions and corporate performance | Examine Fortune 500 internal companies | Current study examined RE firms in Kenya |

| | | | | |
|--|---|---|---|---|
| <p>Pearson et al. (2014)</p> <p>USA</p> | <p>To investigate the transaction costs associated with Carbon sequestration projects in forests and their significance</p> | <p>Transaction costs amounted up to 270% of the expected income.</p> | <p>Study focused on sequestration projects</p> <p>Study failed to link project costs to profitability</p> | <p>Current study focused on carbon financing projects</p> <p>Current study explored how project costs influence profitability</p> |
| <p>Scholtens and van der Goot (2014)</p> <p>Europe</p> | <p>To examine the influence of volatility of carbon price on the value of firms</p> | <p>The volatility of carbon price has significant impact on stock market returns but no influence on the volatility of the market values of companies</p> | <p>Study focused on carbon price in Europe</p> | <p>Current study examined the influence of carbon price variations in Kenya.</p> |
| <p>Conte and Kotchen (2010)</p> <p>USA</p> | <p>To examine the variability in the price of voluntary carbon offsets.</p> | <p>Voluntary market prices are determined by whether the project is established in</p> | <p>Did not explain the effect of variability on profitability.</p> | <p>Current study examined how variation of carbon offset prices impacts financial performance of RE companies.</p> |

| | | | | |
|---------------------------------|--|--|---|--|
| | | developed or developing country. | | |
| King and Lenox (2001) USA | To determine whether it pays to have high environmental performance | Lower pollution was found to be associated with high financial valuation | Focused on US manufacturing firms between 1987-1996 | Current study focused on records of Kenyan RE firms registered under EPRA on profitability between 2019-2023 |
| Hart and Ahuja (1996) USA | To determine whether reducing emission is a cost burden or saves money | Firms with high emission levels stand to gain | Focused on S&P 500 firms | Current study focused on firms registered under EPRA |

Source: Researcher (2024)

2.5 Conceptual Framework

The conceptual framework of a research entails fundamental variables, concepts and factors that can be explored and their inter-relationships. It presents a visual illustration of how the variables of the research are connected to one another. The conceptual framework of this study examines how carbon financing influences the profitability of RE firms in Kenya. Profitability is the dependent variable, while the independent variables include carbon credits, credit issuance and transactional costs, initial project costs and tax incentives. Carbon credits represents a revenue stream that directly supplements firm income whereas credit issuance and transaction costs reduce net gains from carbon markets through compliance and trading expenses. Initial project costs determine the financial barrier to entry and long-term return on investment while tax incentives enhance profitability by lowering firms' tax burden. Firm size is introduced as a moderating variable, since larger firms often have greater capacity to absorb costs, access incentives, and leverage carbon financing mechanisms more effectively than smaller counterparts

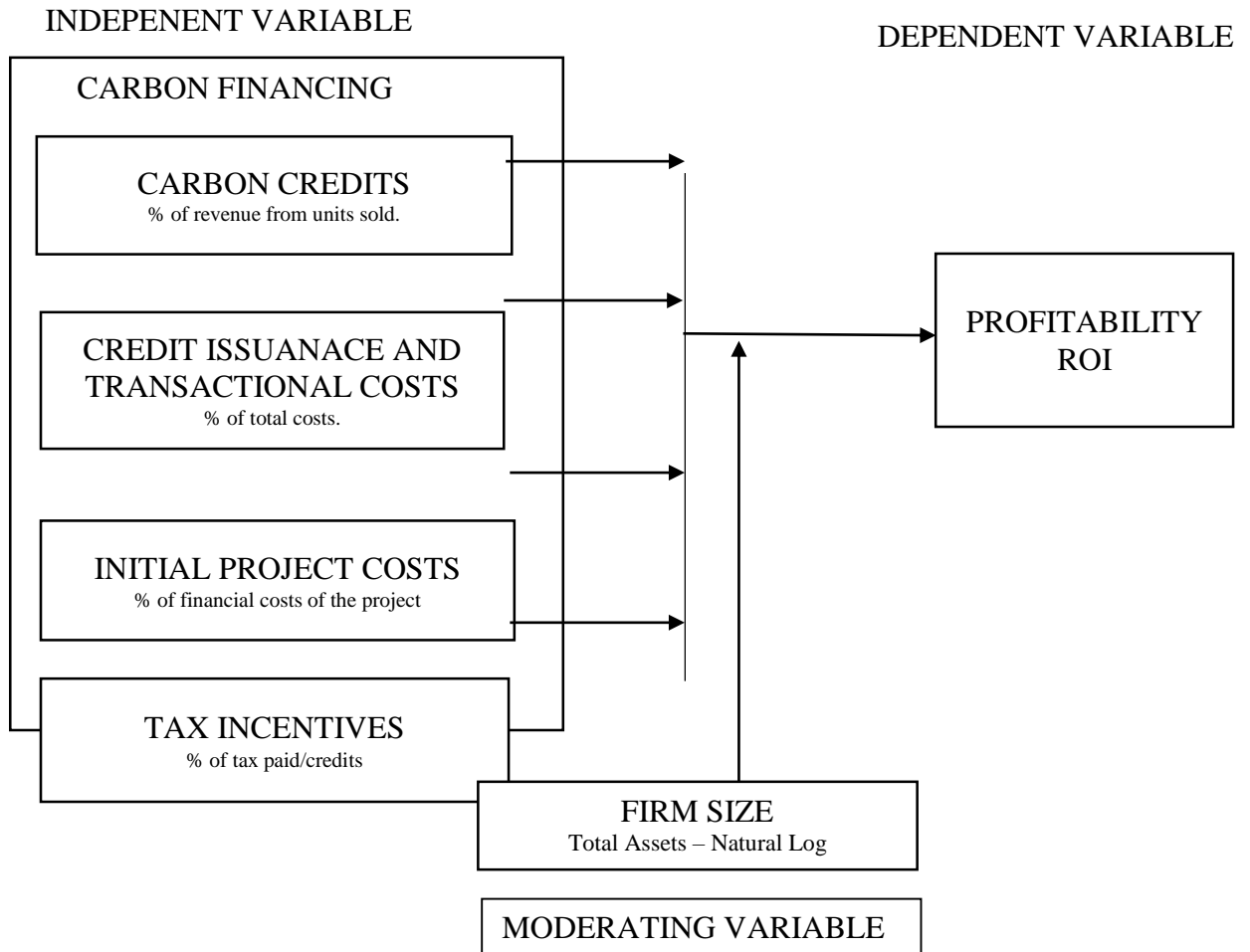


Figure 2.1: Conceptual Framework
Source: Researcher (2024)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

A study's research methodology is essential since it describes the techniques the researcher used to obtain data. This part covered the statistical model, the operationalization and measurement of variables, the target population, sampling strategy, information gathering, processing, and presentation.

3.2 Research Philosophy

Any research should adopt an approach that uses philosophical assumptions and different procedures and methods used by the researcher to solve the study problem (Nickerson, 2022). The philosophy applied in this study explained how knowledge can be developed so as to attain a wider and broader view of the research objectives. To launch a proficient probe and attain a good comprehension of carbon financing in the context of Kenya, this research adopted the post-positivism philosophy (Nickerson, 2022). Under this philosophy, different methods were adopted for analysis and data collection, which could attain goals and vast findings on how RE in Kenya has been impacted by carbon finance.

According to Nickerson (2022), there is a deterministic philosophy in post-positivists which can be significant in establishing a relationship between renewable energy and carbon finance. He believed that this philosophy is substantial in instances where the research begins with a theory, obtains data which proves or disapproves it, and thereafter performs appropriate rectifications and runs extra checks to refute or support the theory.

The disposition towards theory was supported by the evaluation of prior literature by reviewing literature from past carbon finance research.

3.3 Research Design

A conceptual framework served as a guide for the researcher throughout the study, offering a structured approach for planning, data gathering, and analysis. It also provided an implementation framework to ensure the research process was done in a systematic way. Additionally, the study design played an essential role in getting the answers to the research questions, guiding data collection and evaluation, and facilitating how the researcher interpreted the findings (Knight, 2010).

The research made use of a causal research design to explore the link between carbon financing variables (carbon credits, carbon issuance and transactional costs, project initial costs, and tax incentives) and profitability. Firm size was the moderator variable, which shapes the relationship between the independent variables and the independent variable.

Krauss (2005) point out a causal study helps the researcher in modelling and developing the causal influence of one variable on another. Therefore, this study's research strategy was valuable.

3.3.1 Empirical Model

In this study a multiple regression analysis of the data collected from 2019 to 2023 was performed using the SPSS software. The researcher made use of the multiple linear regression model below.

$$\text{ROI} = \beta_0 + \beta_1\text{CC} + \beta_2\text{C} + \beta_3\text{IPC} + \beta_4\text{TI} + \varepsilon \dots\dots\dots (i)$$

Where:

ROI: Return on Investment

CC: Carbon Credits

C: Issuance & Transactional costs

IPC: Initial Project Costs

TI: Tax Incentives

β_0 = constant

β_1 = coefficient of Carbon Credits

β_2 = coefficient of Credit Issuance and transactional cost

β_3 = coefficient of Initial Project Costs

β_4 = coefficient of Tax Incentives

ε = stochastic error term

3.3.2 Moderating Effect Model

In a moderating effect model, the predicted value of the dependent variable (Y) based on the independent variable (X) varies across different levels of a third variable (Z). Moderator variables alter the strength and/or direction of the relationship between the predictor and the outcome, thereby influencing the predictor's overall effect (Fairchild & MacKinnon, 2009). For testing moderation, Fairchild and MacKinnon (2009) suggested a two-step process. As shown in the following equations, the first step does not include an interaction term.

$$ROI = \beta_0 + \beta_1CC + \beta_2C + \beta_3IPC + \beta_4TI + \beta_5SIZE + \varepsilon \dots \dots \dots (i)$$

$$ROI = \beta_0 + \beta_1CC + \beta_2C + \beta_3IPC + \beta_4TI + \beta_5SIZE + \beta_6SIZECC + \beta_7SIZEC + \beta_8SIZEIPC + \beta_9SIZETI + \varepsilon \dots \dots \dots (ii)$$

Where;

β_0 = constant

SIZE: Size (Natural logarithm of firm sales)

$\beta_1, \beta_2, \beta_3$ and β_4 are coefficients of independent variables.

β_5 is the coefficient of the moderating variable.

$\beta_6, \beta_7, \beta_8, \beta_9$ are coefficients of the interaction term.

ε = stochastic error term

The regression coefficients for the interaction term ($\beta_6, \beta_7, \beta_8, \beta_9$) estimate the moderation effect. A statistically significant difference from zero for $\beta_6, \beta_7, \beta_8,$ or β_9 indicates substantial moderation by size.

If $\beta_1, \beta_2, \beta_3,$ and β_4 are not statistically significant while $\beta_6, \beta_7, \beta_8,$ and β_9 are statistically significant, this indicates full moderation. Conversely, if $\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 are statistically significant but $\beta_6, \beta_7, \beta_8,$ and β_9 are not, this suggests partial moderation. If none of the coefficients (β_1 through β_9) are statistically significant, there is no evidence of moderation.

3.4 Target Population

The population that was targeted in this research was fifty (50) RE firms registered under Kenya’s EPRA. This sample size was chosen based on feasibility (available firms willing

to share financial data, time, and resource constraints for data collection) and an analytical rationale. With four primary independent variables and one moderating variable (firm size), the sample provides adequate power to detect large effects of carbon-financing components on firm profitability. The generation of renewable energy has been monumental in the reduction of carbon emissions. The option of picking Kenya was purposed to ascertain data homogeneity and that it is a third world country, and thus desirable to host CDM projects. The population for the current investigation was obtained from the register of RE firms registered under EPRA among other relevant sources. To ascertain consistency of reactions and attain objectives set for the research, projects of renewable energy for the incorporation in the study was included. The included projects were those established between 2019 and 2023. The reason for this preference was that Kenya signed to the Kyoto Protocol in 2005 and the emissions of carbon prior to that time is termed as non-additional (Clifton, 2022).

3.5 Data Collection Instrument

This thesis's primary data collection instrument was a structured questionnaire designed to realize the objectives and correspond with the stated research questions. The questionnaire included closed and open-ended sections to ensure that the research acquires both qualitative and quantitative data. This strategy aimed to obtain accurate and credible information from the participants and enhance the research issue's exploration. The researchers took the following steps to enhance the credibility of the developed data collection instrument. First, the content validity of the questionnaire was conducted; the questionnaire was reviewed by a panel of academics, industry, and policymakers to ensure the identified options cover the constructs of interest. The questions for the survey were discussed in the panel regarding the level of relevance, clarity, and appropriateness of the

questions suggested, and any changes that might be thought necessary was made as advised by the panel. Furthermore, the questionnaire itself had to pass face validity, where a few potentially interested participants looked through the questionnaire and suggested where they found comprehension problems or issues with the wording or arrangement of the questions.

The validity of the data gathering instrument was estimated with a pilot probe involving a small set of participants. The pilot study, therefore, entailed the pre-testing of the questionnaire to a sample of the targeted population and the use of Cronbach's alpha coefficient in establishing the reliability of the internal responses. This ensured no proof of the reliability of the questionnaire items before going for the large-scale scale large-scullion. Due to the complexity of the questions, various methods were adopted to administer the questionnaire, including face-to-face interviews, online questionnaires, and others. The face-to-face interview indeed gave the researcher the chance to explain questions that may be misunderstood and also make deeper questioning of the participant. At the same time, online surveys also were helpful due to their convenience and easiness of completion for the participant. In the pilot test, only a few participants were selected to evaluate the instrument's effectiveness, to know the existing issues, and to resolve them before moving on to a large number of participants. It ensured that the final developed questionnaire is high quality, credible, and reliable to get accurate data to respond to the research questions.

3.6 Data Collection Procedure

The primary data collection procedure for this thesis comprised a methodical and organised approach to gain authentic data directly from the target audience. To identify gaps and

create research questions, the process started with an extensive study of the body of prior literature and research. Then, a pilot study was used to design and verify a relevant data gathering instrument like questionnaire or interview guide. At all times during the data gathering procedure, participants' informed consent, confidentiality, and anonymity was rigorously observed. A carefully chosen population representative of the whole population was given the chosen data collection tool using a variety of techniques, such as online surveys, phone interviews, or in-person contacts. Increased focus was placed on improving response rates.

3.7 Operationalization and Measurement of Research Variables

Operationalization involves defining a variable in a way that it can be measured, while measurement involves collecting and analyzing data using appropriate measures and instruments. Both are important steps in the research process as they ensure the validity and reliability of research findings, (Henrekson & Sanandaji, 2020).

Table 3.1: Operationalization and Measurement of Variables

| Variables | Nature of Variables | Operationalizations | Measurements |
|---|----------------------------|--|----------------------|
| Carbon Credits | Independent Variable | Percentage of revenue from units sold. | Ordinal/Likert Scale |
| Credit Issuance and Transactional Costs | Independent Variable | Percentage of total costs. | Ordinal/Likert Scale |
| Initial Project Costs | Independent Variable | Percentage of financial costs of the project | Ordinal/Likert Scale |
| Tax Incentives | Independent Variable | Percentage of tax paid/credits | Ordinal/Likert Scale |
| Firm Size | Moderating Variable | Total Assets – Natural Log | Ordinal/Likert Scale |
| Profitability | Dependent Variable | Return on Investment | Ordinal/Likert Scale |

Source: Researcher (2024)

3.8 Data Analysis and Presentation

To obtain valuable insights from the gathered data, the data analysis and presentation process in this project was performed rigorously and meticulously. The structured questionnaire's quantitative results were examined using relevant statistical methods, including regression analysis, inferential statistics, and descriptive statistics. To make sure that the analysis was accurate and consistent, the data was arranged, cleansed, and coded. A thorough grasp of the study problem was provided by integrating both quantitative and qualitative data. Clear and succinct tables, charts, graphs, and narratives was used to display the results, guaranteeing a structure that is reader friendly.

3.9 Diagnostic Tests

It is imperative to perform a diagnostic test to avoid compromising Classical Linear Regression Model assumptions. Breaching of the Classical Linear Regression Model can cause misleading results because the regression model was not granted better linear unbiased estimates. Normality, Linearity, heteroscedasticity, multicollinearity, stationarity and Hausman tests was assessed in this research.

3.9.1 Test for Normality

Normalcy testing enabled researchers to ascertain how appropriate distribution of data is represented by normal distribution. The data should be distributed regularly so as to perform regression analysis. In essence, Shapiro-Wilk test explored normality, which evaluated the relation between the associated usual scores and the data. If the tests would have shown non-normal data, rectification can be done by utilising the Johnston system of distributions to change it to normal distribution.

3.9.2 Test for Linearity

Since numerous regressions necessitate linear relationship between independent and dependent variables, it is imperative to ascertain that indeed this is the case in the data utilised for this evaluation. In the event that the model is not linear, a logarithmic transformation was used to change it to a linear model.

3.9.3 Test for Heteroscedasticity

The changes of the residual are not the same across the regression line that can lead to skewed results and a weakened analysis. To evaluate heteroscedasticity data, the Breusch-pagan test was used. In case of heteroscedasticity, OLS with large standard errors was employed to estimate the model parameters, and the variance estimates was rectified for consistency.

3.9.4 Test for Multicollinearity

Multicollinearity happens when excessive resemblance is present in the independent variables. Therefore, Variance Inflation Factor was utilized to assess for multicollinearity. In the event that the Variance Inflation Factor exceeded 10, the coefficients of the regression models are under-estimated as a result of severe multicollinearity. If the data contains multicollinearity, dividing the independent variables into little uncorrelated sets was done using the partial least squares regression approach.

3.10 Ethical Considerations

In a research undertaking, ethical considerations require researchers to publish well-researched information (Akaranga et al., 2016). Ethical consideration incorporates vital concepts like objectivity, respect for intellectual property, honesty, as well as non-discrimination, confidentiality, and social responsibility. This study adhered to research

ethics by seeing to it that all gathered data and information were utilized solely for research purposes. The researcher guaranteed respondents that their confidentiality would be preserved. Additionally, all sources of information were appropriately cited and acknowledged. The Kenyatta University administration and other relevant stakeholders was also consulted.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

The purpose of this study was to probe the effect of carbon financing on profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority (EPRA). This chapter presents and analyses the study's outcomes based the stated research objectives and methodology.

4.2 Questionnaire Response Rate

The current inquiry managed to contact 50 respondents and was able to collect data from the 50 RE firms registered under Kenya's EPRA. This represented 100.0% response rate.

4.3 Demographic Information

This section aimed to explore the demographics of the respondents, including their gender, educational background, years of experience, department, and whether they had secured any form of carbon financing. Majority of the respondents 64% (32 respondents), indicated No, meaning their institutions have not accessed carbon financing. In contrast, 36% (18 respondents) reported Yes, indicating that their institutions have successfully secured some form of carbon financing. The study outcomes were as presented.

4.3.1 Gender of the Respondents

The results indicate that 82% (41 respondents) were male, while 18% (9 respondents) were female. These findings highlight a notable gender disparity, with a significantly higher proportion of male respondents compared to females as demonstrated in figure 4.1 below.

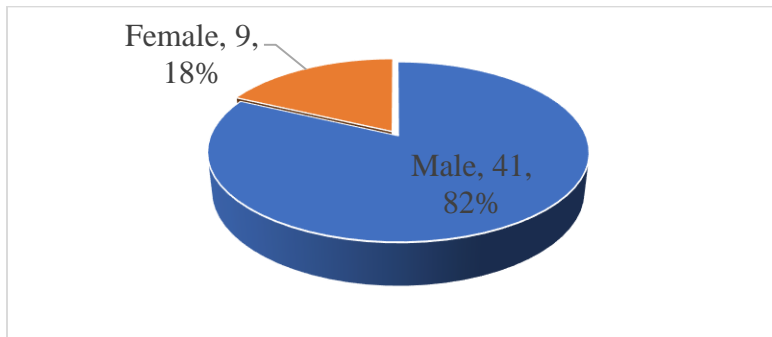


Figure 4. 1: Gender of Respondents

4.3.2 Educational Background of the Respondents

The data provided represents the respondents' educational background. Out of a total of 50 respondents, 80% (40 respondents) reported having a Bachelor's degree as their highest educational attainment, while 20% (10 respondents) had completed a Master's degree. This indicated that the majority of participants have attained undergraduate education, with only a smaller proportion advancing to postgraduate studies.

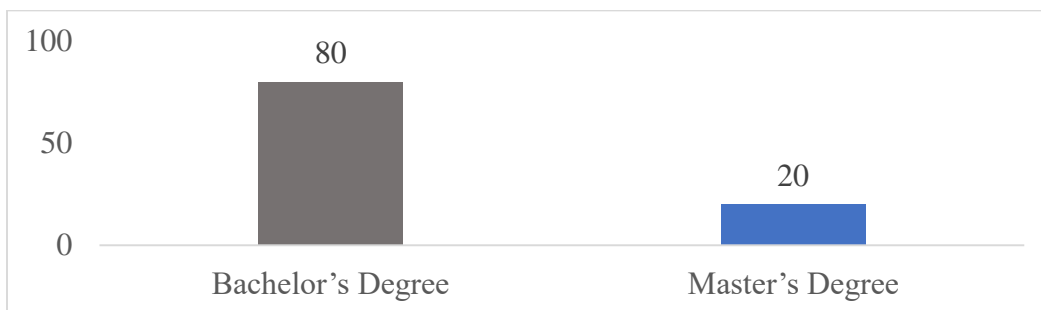


Figure 4. 2: Educational Background

4.3.3 Years of Experience of the Respondents

Table 4.1 displays the participants' years of service in their respective institutions. Out of a total of 50 respondents, the majority, 46% (23 respondents), have been employed in their organizations for 2 to 5 years, followed closely by 44% (22 respondents) who have 6 to 10 years of experience. Only 10% (5 respondents) have served for over 10 years. This distribution shows that most employees have moderate experience (2–10 years), which could indicate a relatively young workforce or recent expansion within the RE firms registered under EPRA.

Table 4. 1: Years of Experience of the Respondents

| Years | Frequency | Percent |
|---------------|------------------|----------------|
| 2 - 5 years | 23 | 46.0 |
| 6 - 10 years | 22 | 44.0 |
| Over 10 years | 5 | 10.0 |
| Total | 50 | 100.0 |

4.3.4 Level of Seniority of the Respondents

The data on the respondents' seniority level reveals that out of a total of 50 participants, the majority, 54% (27 respondents), are in management positions. This indicates that over half of the respondents are actively involved in overseeing operations and strategic decision-making within their organizations. Additionally, 26% (13 respondents) hold Team Lead roles, reflecting a significant proportion of mid-level leadership responsible for supervising teams and ensuring the implementation of organizational goals. A smaller group, comprising 20% (10 respondents), are in Senior Executive positions, representing the top leadership tier within the institutions.

Table 4. 2: Level of Seniority

| | Frequency | Percent |
|------------------|------------------|----------------|
| Management | 27 | 54.0 |
| Senior Executive | 10 | 20.0 |
| Team Lead | 13 | 26.0 |
| Total | 50 | 100.0 |

4.3.5 Renewable Energy Operating in

The data on the RE field in which respondents operate shows that the majority, 92% (46 respondents), are involved in the solar energy sector. This highlights solar energy as the dominant focus area among renewable energy firms registered under EPRA.

The findings on RE technologies, as exemplified in Table 4.3, offers a snapshot of the types of renewable energy projects currently in operation among firms registered under the EPRA in Kenya. The table shows that solar energy is overwhelmingly dominant, with 46 firms (92.0%) reporting the use of solar technology. This significant adoption of solar energy is attributed to its affordability, ease of implementation, and the availability of abundant solar resources in Kenya, making it an ideal choice for both rural and urban areas. In contrast, only 4 firms (8.0%) reported operating biogas energy projects. The limited adoption of biogas may stem from the higher costs and complexity associated with biogas systems, as well as the lack of widespread infrastructure and technical expertise needed for its implementation.

Table 4. 3: Renewable Energy Operating in Kenya

| | Frequency | Percent |
|--------------|------------------|----------------|
| Biogas | 4 | 8.0 |
| Solar | 46 | 92.0 |
| Total | 50 | 100.0 |

4.3.6 Secured Any Form of Carbon Financing

The data on whether institutions have secured any form of carbon financing shows that the majority, 64% (32 respondents), indicated No, meaning their institutions have not accessed carbon financing. In contrast, 36% (18 respondents) reported Yes, indicating that their institutions have successfully secured some form of carbon financing. These findings suggest that whereas a significant portion of renewable energy firms have not yet accessed carbon financing, a notable minority has successfully utilized this financial mechanism.

Table 4. 4: Secured Any Form of Carbon Financing

| | Frequency | Percent |
|--------------|------------------|----------------|
| No | 32 | 64.0 |
| Yes | 18 | 36.0 |
| Total | 50 | 100.0 |

The data on the amount of carbon financing secured by institutions, among those that responded affirmatively to having received financing, shows a range of outcomes. 25% (3 respondents) reported securing 50,000 (currency unspecified), indicating smaller-scale financial support. A further 8.3% (1 respondent) mentioned securing carbon financing in the range of billions of shillings, suggesting a more substantial financial commitment. However, the majority, 66.7% (8 respondents), marked the financing amount as

confidential, indicating that they were unable or unwilling to disclose the specific details of the financial support.

Table 4. 5: Amount Secured

| | Frequency | Percent |
|-----------------------|------------------|----------------|
| 50000 | 3 | 25.0 |
| Billions of Shillings | 1 | 8.3 |
| Confidential | 8 | 66.7 |
| Total | 12 | 100.0 |

The data presented in Table 4.6 explains the reasons why institutions that have not secured any form of carbon financing have not done so. Among the 28 respondents who answered this question, the majority, 56.3% (18 respondents), cited bureaucracy in the application process as the reason they have not secured carbon financing. This suggests that the application procedures for carbon financing might be complex, time-consuming, or burdensome, which could discourage institutions from pursuing it. A smaller portion, 43.8% (14 respondents), indicated that they have not made an application for carbon financing, implying that the lack of financing might be due to the absence of effort or awareness in applying for such funding.

Table 4. 6 Reasons for Not Securing Funding

| | Frequency | Percent |
|------------------------------|------------------|----------------|
| Bureaucracy in application | 18 | 56.3 |
| We have not made application | 14 | 43.8 |
| Total | 32 | 100.0 |

4.4 Validity and Reliability Results

4.4.1 Reliability Tests

Reliability tests were performed using Cronbach's alpha for each variable, yielding values ranging from 0.904 to 0.959. According to Santos (1999), a reliability coefficient of 0.7 is deemed acceptable. Therefore, the test items were retained and deemed reliable, as presented in Table 4.7 below.

Table 4. 7: Reliability Table

| Variable | No of items | Cronbach alpha | Verdict |
|---|--------------------|-----------------------|----------------|
| Carbon Credits | 6 | 0.949 | Reliable |
| Credit issuance and transactional costs | 6 | 0.904 | Reliable |
| Project Costs | 6 | 0.959 | Reliable |
| Tax Incentives | 6 | 0.956 | Reliable |
| Summary | 24 | 0.942 | Reliable |

4.4.2 Validity Test

Main component analysis was carried out and the results for Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) are portrayed in the table 4.8

Table 4. 8: KMO Table for Study Variables

| Variables | Kaiser-Meyer-Olkin Measure of Sampling Adequacy | Bartlett's Test of Sphericity Chi-Square | df | Sig |
|---|--|---|-----------|------------|
| Carbon Credits | 0.895 | 320.269 | 15 | 0.000 |
| Credit issuance and transactional costs | 0.778 | 226.017 | 15 | 0.000 |
| Project Costs | 0.892 | 348.463 | 15 | 0.000 |
| Tax Incentives | 0.81 | 367.886 | 15 | 0.000 |

Table 4.8 displays the outcomes of the Kaiser-Meyer-Olkin (KMO) test, which measures sampling adequacy to determine the appropriateness of factor analysis. A KMO value ranging from 0.5 to 1.0 denotes that factor analysis is suitable (Tanasă, Horomnea, & Ungureanu, 2012). In regards to these results, the KMO values ranged to 0.778 and 0.895 signified factor analysis was fitting for this research. Taking into account Bartlett's test of sphericity the chi-square values, p-value of .000 which were significant at 95% confidence level indicating that items utilised in the research exhibited sampling adequacy.

In this inquiry, test items with factor loadings exceeding 0.4 were deemed better and retained for further analysis. Tabachnick and Fidell (2007) point out that factors having loadings greater than 0.40 should be retained, while those below 0.4 should be excluded from further analysis. Consequently, no factors were dropped, as they were deemed reliable and relevant. This process was applied to the four variables, as indicated in Appendix IV.

Table 4. 9: Summary of Factor Loadings for Study Variables

| | Min Factor Loading | Max Factor Loading | Average Factor Loadings | Verdict |
|---|---------------------------|---------------------------|--------------------------------|----------------|
| Carbon Credits | 0.726 | 0.948 | 0.8945 | Valid |
| Credit issuance and transactional costs | 0.732 | 0.94 | 0.8245 | Valid |
| Project Costs | 0.853 | 0.949 | 0.911333 | Valid |
| Tax Incentives | 0.841 | 0.939 | 0.907 | Valid |

4.5 Descriptive Analysis

The questionnaire on five-point Likert scale was developed and utilized by the researcher to collect responses. The respondents were to tick (√) the most befitting response for each of the questions that were provided in the table 4.10, 4.11, 4.12 and 4.13 if they: 1- Strongly disagree; 2 – Disagree; 3 –Neutral; 4- Agree; 5- Strongly agree with the statement as

indicated. Descriptive analysis in this section utilized percentages to present the participants' feedback, as illustrated in the tables in the subsections that follow.

4.5.1 Carbon credits

In this study, carbon credits were used as first independent variable in regards to establishing the effect of carbon credits on the profitability of renewable energy firms registered under EPRA. The study required the participants to specify their level of agreement in regards to the six statements, which were used to measure carbon credits. The results are provided in Table 4.10.

Table 4. 10: Carbon credits

| No | Carbon credits (N=50) | 5 | 4 | 3 | 2 | 1 | Mean | S.D |
|---------------------------|---|-----|-----|-----|-----|----|-------------|-------|
| 1. | The profitability of a renewable energy company is significantly influenced by the incomes from carbon credits. | 56% | 10% | 22% | 6% | 6% | 4.04 | 1.261 |
| 2. | As the sales of carbon credits increase, the profitability tends to increase. | 20% | 36% | 24% | 14% | 6% | 3.50 | 1.147 |
| 3. | Companies that have access to carbon credits generally exhibit superior profitability. | 38% | 32% | 12% | 12% | 6% | 3.84 | 1.235 |
| 4. | When making financial decisions, renewable energy companies consider carbon credits as a crucial factor. | 44% | 28% | 14% | 10% | 4% | 3.98 | 1.169 |
| 5. | The carbon credits are an important consideration for renewable energy companies when making financial decisions. | 44% | 20% | 16% | 14% | 6% | 3.82 | 1.304 |
| 6. | The carbon credits income significantly impacts the overall financial performance of a renewable energy company. | 36% | 20% | 28% | 10% | 6% | 3.70 | 1.233 |
| Summary Statistics | | | | | | | 3.81 | |

From table 4.10, the findings show that 56% of respondents strongly agreed and 10% agreed that the profitability of a renewable energy company is significantly influenced by incomes from carbon credits. This statement recorded a high mean score of 4.04 with a standard deviation (S.D.) of 1.261, denoting a strong agreement with moderate variability in responses. This suggests that a majority of the respondents perceive carbon credit incomes as a significant factor in profitability.

For the statement that as sales of carbon credits increase, profitability also tends to increase, 20% strongly agreed, and 36% agreed, resulting in a mean score of 3.50 (S.D. = 1.147). While this indicates moderate agreement, the slightly lower mean and standard deviation reflect some variation in perceptions about the direct correlation between sales of carbon credits and profitability. Regarding whether companies with access to carbon credits generally exhibit superior profitability, 38% strongly agreed and 32% agreed, producing a mean score of 3.84 (S.D. = 1.235). This highlights strong agreement among respondents, further emphasizing the perceived profitability advantage of companies utilizing carbon credits.

When asked if renewable energy companies consider carbon credits as a crucial factor in making financial decisions, 44% strongly agreed, and 28% agreed, yielding a mean score of 3.98 (S.D. = 1.169). Similarly, 44% strongly agreed, and 20% agreed that carbon credits are an important consideration in financial decisions, with a mean of 3.82 (S.D. = 1.304). Both statements highlight strong agreement, underscoring the role of carbon credits in financial planning and decision-making within firms. Finally, 36% strongly agreed with the statement while 20% agreed that carbon credit income significantly impacts the overall financial outcomes of a renewable energy organization. Hence, the statement produced a

mean score of 3.70 (S.D. = 1.233), reflecting general agreement with some variability in responses.

Overall, the average mean score for all six statements was 3.81, indicating that respondents generally agree on the positive influence of carbon credits on profitability, financial decision-making, and overall financial outcomes. The standard deviations, ranging from 1.147 to 1.304, implying moderate variability in responses, implying that while most firms acknowledge the importance of carbon credits, the degree of their perceived impact may vary based on organizational experiences or contexts.

4.5.2 Credit issuance and transactional costs

In this study, Credit issuance and transactional costs was used as second independent variable in regards to examining the effect of credit issuance and transactional costs on the profitability of renewable energy firms registered under EPRA. As per the questionnaire, the respondents needed to state the extent to which they agreed to the six statements which were used to measure credit issuance and transactional costs. The results of the answers are displayed in Table 4.11.

Table 4. 11: Credit issuance and transactional costs

| No | Credit issuance and transactional costs (N=50) | 5 | 4 | 3 | 2 | 1 | Mean | S. D |
|---------------------------|--|-----|-----|-----|-----|-----|-------------|-------|
| 1. | Do you think there is correlation between the incurred credit issuance and transactional and the overall profitability of carbon finance projects. | 32% | 38% | 18% | 2% | 10% | 3.80 | 1.212 |
| 2. | Incurred Credit issuance and transactional costs influence long-term profitability. | 32% | 24% | 20% | 14% | 10% | 3.54 | 1.343 |
| 3. | Costs incurred in issuing and transacting credits play part in enhancing a project's profitability | 18% | 34% | 34% | 8% | 6% | 3.50 | 1.074 |
| 4. | There are direct and indirect financial benefits observed by companies that optimize the process of issuance and transactions of credits | 18% | 40% | 26% | 10% | 6% | 3.54 | 1.092 |
| 5. | Operational efficiency savings associated with credit issuance and transactional costs affect a project's net profit. | 36% | 40% | 10% | 8% | 6% | 3.92 | 1.158 |
| 6. | Government subsidies for credit issuance and transactional costs enhance the profitability of carbon finance projects. | 36% | 32% | 16% | 8% | 8% | 3.80 | 1.245 |
| Summary Statistics | | | | | | | 3.68 | |

Respondents were queried on the degree to which they agreed with six statements designed to measure the effect of these costs; the outcomes are outlined in Table 4.11. The findings reveal that 32% strongly agreed and 38% agreed that there is a correlation between incurred credit issuance and transactional costs and the overall profitability of carbon finance projects. This statement recorded a mean score of 3.80 with SD of 1.212, signifying a

strong agreement and moderate variability in responses, suggesting that respondents generally believe that such costs influence profitability.

Similarly, 32% strongly agreed and 24% agreed that incurred credit issuance and transactional costs influence long-term profitability, yielding a mean of 3.54 (S.D. = 1.343). Although there is agreement, the slightly lower mean and higher standard deviation indicate a broader range of opinions. For the statement that costs incurred in issuing and transacting credits play a role in enhancing a project's profitability, 18% strongly agreed, 34% agreed, and another 34% were neutral, leading to a mean score of 3.50 (S.D. = 1.074). The higher percentage of neutral responses reflects a moderate agreement, with variability among respondents.

When asked if companies that optimize the issuance and transaction processes observe direct and indirect financial benefits, 18% strongly agreed, and 40% agreed, producing a mean of 3.54 (S.D. = 1.092). This indicates a moderate agreement that optimizing these processes can positively affect profitability. The statement regarding operational efficiency savings associated with credit issuance and transactional costs affecting net profit received the strongest agreement, with 36% strongly agreeing and 40% agreeing. The mean score of 3.92 (S.D. = 1.158) indicates widespread acknowledgment of the impact of operational efficiencies on net profit.

Finally, 36% strongly agreed and 32% agreed that government subsidies for credit issuance and transactional costs enhance the profitability of carbon finance projects. This statement recorded a mean of 3.80 (S.D. = 1.245), suggesting strong agreement and moderate variability in responses. The overall mean score across all statements was 3.68, indicating

general agreement that credit issuance and transactional costs influence profitability in various ways, including through operational efficiency, long-term profitability, and the benefits of government subsidies. The SDs, which ranged from 1.074 to 1.343, reflect moderate variability in responses, suggesting that while most respondents perceive these costs as significant, their degree of impact may vary depending on company-specific circumstances or operational contexts.

4.5.3 Projects Costs

In this study, projects costs were used as third independent variable in the quest to find out the effect of projects costs on the profitability of renewable energy firms registered under the EPRA. In the questionnaire, the respondents needed to specify to what level they concurred with six statements which were used to measure projects costs. The results are displayed in Table 4.12.

Table 4. 12: Projects costs

| No | Projects costs | 5 | 4 | 3 | 2 | 1 | Mean | S.D |
|---------------------------|--|-----|-----|-----|-----|----|-------------|-------|
| 1. | Initial capital expenditures (CAPEX) impact the long-term profitability of carbon finance projects | 16% | 38% | 30% | 12% | 4% | 3.50 | 1.035 |
| 2. | There is a relationship between operational expenditures (OPEX) and the net profit margins of carbon financing projects. | 20% | 38% | 28% | 10% | 4% | 3.60 | 1.050 |
| 3. | Project development and permitting costs influence the financial viability of carbon financing projects. | 24% | 36% | 26% | 10% | 4% | 3.66 | 1.081 |
| 4. | Financing costs (e.g., interest on loans, carbon credits) affect the profitability of carbon financing projects. | 36% | 30% | 24% | 6% | 4% | 3.88 | 1.100 |
| 5. | Project cost overruns impact the expected profitability of carbon financing projects. | 32% | 38% | 18% | 8% | 4% | 3.86 | 1.088 |
| 6. | Cost management is pivotal in enhancing the profitability of carbon financing projects. | 32% | 32% | 28% | 4% | 4% | 3.84 | 1.057 |
| Summary Statistics | | | | | | | 3.72 | |

Respondents were queried on the level to which they concurred with six statements related to project costs, with the results summarized in Table 4.12. The results show that 16% strongly agreed and 38% agreed that initial capital expenditures (CAPEX) impact the long-term profitability of carbon finance projects. This statement recorded a mean score of 3.50 with a standard deviation (S.D.) of 1.035, connoting moderate agreement and low variability in responses. For the relationship between operational expenditures (OPEX) and net profit margins, 20% strongly agreed and 38% agreed, yielding a mean score of 3.60 (S.D. = 1.050). These results suggest a general agreement that OPEX has a significant positive effect on profitability.

Regarding whether project development and permitting costs influence financial viability, 24% strongly agreed and 36% agreed, resulting in a mean score of 3.66 (S.D. = 1.081). This indicates a fairly strong agreement that such costs are critical to project success. The statement that financing costs, such as interest on loans and carbon credits, affect profitability received the strongest agreement, with 36% strongly agreeing and 30% agreeing, and a mean score of 3.88 (S.D. = 1.100). This highlights the considerable impact of financing costs on project profitability.

For the impact of project cost overruns on expected profitability, 32% strongly agreed and 38% agreed, producing a mean of 3.86 (S.D. = 1.088). These results emphasize the importance of avoiding cost overruns to maintain profitability. Lastly, 32% strongly agreed and 32% agreed that effective cost management enhances profitability, yielding a mean score of 3.84 (S.D. = 1.057). This underscores the critical role of cost management in optimizing financial outcomes.

The mean score for all statements was 3.72, signifying a general agreement that project costs significantly influence profitability through CAPEX, OPEX, financing costs, and cost management practices. The standard deviations, ranging from 1.035 to 1.100, reflect relatively low variability in responses, suggesting consistent recognition of the importance of managing project costs to achieve financial success in carbon financing projects.

4.5.4 Tax incentives

In this study, tax incentives were used as a moderating variable in to explore the tax incentives' moderating effect on the relationship between carbon financing and profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority. The participants were queried on how strongly they agreed/disagreed with the six statements which used to measure tax incentives. The results are revealed in Table 4.13.

Table 4. 13: Tax incentives

| Tax incentives | 5 | 4 | 3 | 2 | 1 | Mean | S. D |
|---|----------|----------|----------|----------|----------|-------------|-------------|
| 1. Renewable energy firms that are compliant are more likely to attract tax incentives. | 24% | 36% | 18% | 4% | 18% | 3.44 | 1.387 |
| 2. Tax incentives received from the government positively affects the profitability of our company. | 44% | 28% | 12% | 2% | 14% | 3.86 | 1.385 |
| 3. Renewable Energy firms that fail to leverage on tax incentives are at a higher risk of financial losses. | 16% | 50% | 14% | 2% | 18% | 3.44 | 1.312 |
| 4. Carbon financing investors actively monitor and assess the regulatory compliance of the renewable energy firms in their portfolio for purposes of enjoying tax incentives. | 24% | 40% | 18% | 0% | 18% | 3.52 | 1.359 |
| 5. Renewable energy firms should regularly conduct compliance audits to ensure observance to relevant laws to qualify for tax incentives. | 14% | 64% | 8% | 0% | 14% | 3.64 | 1.174 |
| 6. The government plays an instrumental role in setting and enforcing regulations that impact the renewable energy sector more specifically around tax incentives. | 26% | 34% | 22% | 4% | 14% | 3.54 | 1.313 |
| Summary Statistics | | | | | | 3.57 | |

The participants were queried on the extent to which they concurred with six statements relating to tax incentives, and the results are abridged in Table 4.13. The findings indicate that 24% strongly agreed and 36% agreed that renewable energy firms compliant with regulations are more likely to attract tax incentives, yielding a mean score of 3.44 and an SD of 1.387. While agreement is moderate, the variability in responses suggests mixed perceptions about the compliance-tax incentive link.

For the statement that tax incentives received from the government positively affect profitability, 44% strongly agreed and 28% agreed, resulting in a higher mean score of 3.86 (S.D. = 1.385), indicating strong agreement with some variation in responses. This highlights the perceived significance of government-provided tax incentives in enhancing firm profitability. Regarding whether firms that fail to leverage tax incentives are at a higher risk of financial losses, 16% strongly agreed and 50% agreed, with a mean of 3.44 (S.D. = 1.312). This reflects moderate agreement, with notable variability suggesting differing opinions on the risk of neglecting tax incentives.

The statement that carbon financing investors monitor regulatory compliance to enjoy tax incentives received 24% strong agreement and 40% agreement, yielding a mean score of 3.52 (S.D. = 1.359). This suggests moderate agreement on the importance of compliance monitoring to access tax incentives. For the recommendation that renewable energy firms should conduct compliance audits to qualify for tax incentives, 14% strongly agreed and 64% agreed, resulting in a mean score of 3.64 (S.D. = 1.174). This indicates strong agreement and less variability, emphasizing the importance of regular compliance audits.

Finally, 26% strongly agreed and 34% agreed that the government plays a crucial role in enforcing regulations related to tax incentives, with a mean of 3.54 (S.D. = 1.313). This highlights the significance of government involvement in shaping tax incentive policies for the RE sector. The overall mean score across all statements was 3.57, indicating general agreement that tax incentives significantly influence the profitability of renewable energy firms and are closely linked to compliance with regulations. The standard deviations, ranging from 1.174 to 1.387, connote moderate variability in responses, reflecting diverse perspectives on the role of tax incentives and compliance within the sector.

4.5.6 Firm Size

In this inquiry, firm size was utilized as moderating variable. The respondents were required to state their total asset as classified in Table 4.14

Table 4. 14: Firm Size

| Ksh | Frequency | Percentage |
|---------------------------------|------------------|-------------------|
| Less than 10,000,000 | 0 | 0 |
| Between 10,000,001-50,000,000 | 0 | 0 |
| Between 50,000,001-100,000,000 | 7 | 14.0 |
| Between 100,000,001-150,000,000 | 24 | 48.0 |
| Over 150,000,000 | 19 | 38.0 |

A small proportion of firms, 14% (7 respondents), reported total assets in the 50,000,001–100,000,000 Ksh category, suggesting that only a few firms operate at a relatively moderate scale. The majority, 48% (24 respondents), indicated total assets between 100,000,001–150,000,000 Ksh, highlighting this as the dominant category and reflecting the typical scale of operations for renewable energy firms in the study. Additionally, a significant 38% (19 respondents) reported total assets exceeding 150,000,000 Ksh, indicating a substantial number of large firms operating at an advanced financial and operational capacity. These

results demonstrate that the renewable energy firms in this study are predominantly medium to large-scale enterprises, with a notable concentration of firms in the 100,000,001–150,000,000 Ksh range.

4.5.7 Profitability

In this investigation, profitability was set as the dependent variable. The respondents were required to state return on investment between 2019 and 2023 as exhibited in Table 4.15.

Table 4. 15: Return on Investment between 2019 and 2023

| Ksh Millions | >15 | 10-15 | 5-10 | 1-5 | <1 | Mean | Std Dev |
|---------------------|---------------|--------------|-------------|------------|--------------|-------------|----------------|
| 2019 | 12% | 40% | 32% | 14% | 2% | 3.46 | 0.952 |
| 2020 | 12% | 50% | 24% | 12% | 2% | 3.58 | 0.928 |
| 2021 | 40% | 50% | 8% | 0% | 2% | 4.26 | 0.777 |
| 2022 | 50% | 34% | 12% | 2% | 2% | 4.28 | 0.904 |
| 2023 | 46% | 32% | 6% | 6% | 10% | 3.98 | 1.301 |

Respondents provided data on their ROI in Kenyan Shillings (Ksh), categorized into five bands: >15 million, 10-15 million, 5-10 million, 1-5 million, and <1 million, as shown in Table 4.15. The results were analyzed using the mean and standard deviation (S.D.), with thresholds applied to interpret the data. In 2019, 12% of firms reported returns exceeding 15 million Ksh, while the majority, 40%, earned between 10-15 million Ksh. Another 32% earned between 5-10 million Ksh, while 14% reported returns in the 1-5 million Ksh range, and 2% earned less than 1 million Ksh. The mean ROI for 2019 was 3.46, indicating average returns between 10-15 million Ksh, with an S.D. of 0.952, suggesting moderate variability in profitability.

In 2020, profitability improved slightly, with 12% of firms earning over 15 million Ksh, while 50% fell in the 10-15 million Ksh category, an increase from 2019. Additionally,

24% earned 5-10 million Ksh, while 12% and 2% reported returns of 1-5 million Ksh and <1 million Ksh, respectively. The mean ROI rose to 3.58, still reflecting average returns between 10-15 million Ksh, with a lower S.D. of 0.928, indicating reduced variability in profitability.

The year 2021 marked significant improvement in profitability, with 40% of firms earning over 15 million Ksh and 50% in the 10-15 million Ksh category. Only 8% reported returns of 5-10 million Ksh, while 0% earned 1-5 million Ksh, and 2% earned less than 1 million Ksh. The mean ROI was 4.26, indicating returns between 10-15 million Ksh, with an S.D. of 0.777, showing consistent profitability and reduced variability across firms.

In 2022, profitability remained high, with 50% of firms reporting returns over 15 million Ksh, and 34% earning 10-15 million Ksh. Additionally, 12% reported returns of 5-10 million Ksh, while 2% of firms each earned 1-5 million Ksh and <1 million Ksh. The mean ROI was 4.28, reflecting sustained returns between 10-15 million Ksh, with an S.D. of 0.904, indicating strong but slightly more variable financial performance.

In 2023, profitability showed slight variability, with 46% of firms earning over 15 million Ksh, and 32% in the 10-15 million Ksh category. However, 6% earned returns in both the 5-10 million Ksh and 1-5 million Ksh categories, while 10% of firms reported earnings below 1 million Ksh. The mean ROI decreased slightly to 3.98, still reflecting average returns between 10-15 million Ksh, but the S.D. increased to 1.301, suggesting greater disparities in profitability compared to previous years.

Overall, profitability improved consistently between 2019 and 2023, with mean ROI reaching its peak in 2021 (4.26) and 2022 (4.28), reflecting strong and consistent

profitability. However, the decline in mean ROI to 3.98 and increased variability in 2023 suggest emerging challenges that may have impacted some firms' profitability. Despite these variations, the majority of firms consistently reported returns in the 10-15 million Ksh or >15 million Ksh categories, demonstrating the profitability of renewable energy investments during the study period.

4.5.8 Open Ended Statement

Table 4. 16: Seeking Carbon Financing For Renewable Energy Firm

| | Frequency | Percent |
|---|------------------|----------------|
| Yes, actively exploring funding options. | 19 | 34.6 |
| Yes, but still evaluating the benefits and drawbacks | 17 | 30.9 |
| No, we are self-funded and not interested in external funding | 14 | 25.5 |
| No, we are exploring other financing methods | 5 | 9.1 |
| Total | 55 | 100.0 |

The data from the survey question "Have you considered seeking carbon financing for your renewable energy firm?" reveals important insights into the financing strategies of renewable energy firms registered under Kenya's EPRA. Out of the 55 firms that responded, the majority, accounting for 34.6% (19 firms), are actively exploring carbon financing as a funding option. This indicates that a considerable number of renewable energy firms recognize the potential benefits of carbon financing, which can provide them with additional financial resources for their operations and development.

Another 30.9% (17 firms) of the respondents are still in the process of evaluating the benefits and drawbacks of carbon financing. This suggests that while these firms are open to the idea of carbon financing, they are cautious and are carefully assessing whether it aligns with their business models and long-term goals. These firms might be analyzing

factors such as the complexities involved in obtaining carbon credits, the potential financial returns, and the regulatory requirements.

In contrast, 25.5% (14 firms) stated that they are self-funded and not interested in external funding, including carbon financing. These firms may have sufficient capital from internal resources or other sources and prefer to maintain financial independence without relying on external financing options like carbon credits. This group may value autonomy and the avoidance of any external financial obligations that could come with carbon financing.

Lastly, 9.1% (5 firms) reported that they are exploring other financing methods. This implies that while carbon financing may not be their preferred choice, these firms are still seeking alternative avenues to support their operations, which could include traditional loans, equity investment, or other types of government or private sector funding.

Table 4. 17: Most Critical Factor When Evaluating Carbon Financing Investors

| | Frequency | Percent |
|--|------------------|----------------|
| Experience and track record in the renewable energy industry | 28 | 50.9 |
| Willingness to provide mentorship and strategic guidance | 5 | 9.1 |
| Speed and efficiency in the funding process | 13 | 23.6 |
| The level of control and ownership they expect in return. | 5 | 9.1 |

The data provided reveals the priorities of renewable energy firms in Kenya when evaluating carbon financing investors. The responses reflect what these firms value most in potential investors, and the most critical factors influencing their decision-making process. Experience and track record in the renewable energy industry was considered the most critical factor by 50.9% (28 firms) of the respondents. This suggests that a majority of renewable energy firms regard highly the investor’s expertise and proven success in the renewable energy sector. A strong track record can offer firms confidence that the investor

understands the industry-specific challenges and opportunities, which could lead to better strategic support and successful outcomes for the projects.

Speed and efficiency in the funding process was cited by 23.6% (13 firms). This indicates that, while expertise is crucial, firms also prioritize the timely availability of funds. RE projects often require huge initial investment, and delays in funding can hinder project timelines. Therefore, firms are likely seeking investors who can provide quick and smooth access to capital without unnecessary bureaucratic hurdles.

Willingness to provide mentorship and strategic guidance was seen as important by 9.1% (5 firms). While mentorship is valued, it appears to be a secondary consideration compared to experience and efficiency. This suggests that some firms may see the added value of investors who offer not only capital but also strategic advice and industry insights. However, it's clear that this is less of a priority compared to the investors' track record and funding process.

The level of control and ownership they expect in return was also considered important by 9.1% (5 firms). This factor reflects the concern about how much influence or decision-making power the investor may seek in return for funding. Firms may prefer to maintain a particular control level over their operational activities and are cautious about investors who may demand excessive ownership or influence in their projects.

4.6 Inferential Analysis

This section presents inferences made on the whole population based on the sampled data. SPSS software version 26.0 aided in analysing the data. Multiple regression analysis

assisted the researcher to determine causal effect that existed between the variables. The study gives results on correlation coefficient, model summary, ANOVA and coefficient of regression that revealed statistical significance of differences in the variables.

4.6.1 Correlation Analysis

In this subsection, the correlation analysis outcomes are presented. The analysis examined the relationships between the dependent variable (profitability) and the independent variables, which include carbon credits, credit issuance and transactional costs, project costs, and tax incentives. Correlation analysis was used to analyse the linear associations among these variables.

The correlation coefficient ranges from -1 to +1, where a value of +1 denotes a perfect positive relationship between variables, and a value of -1 connote a perfect negative relationship. A coefficient value of 0 implies no relationship between the variables under consideration. A correlation coefficient ranging from 0.0 to 0.19 is delineated as very weak, 0.20 to 0.39 is weak, 0.40 to 0.59 is moderate, 0.60 to 0.79 is strong, and 0.80 to 1.0 is considered very strong.

Pearson's correlation analysis was utilized in this inquiry to test the degree of interdependence among the predictor variables and to detect any relationships between the response variable (profitability) and the predictor variables (carbon financing). The pertinent outcomes are outlined in Table 4.18.

Table 4. 18: Multiple Correlations Table

| | | CC | CITS | PC | TI | FS |
|--------------------|----------------|---------------------|-------------|-----------|-----------|-----------|
| CC: | Carbon | Pearson Correlation | 1 | | | |
| Credits | | Sig. (2-tailed) | | | | |
| | N | | 50 | | | |
| CITS: | Credit | Pearson Correlation | .337* | 1 | | |
| Issuance | | andSig. (2-tailed) | .017 | | | |
| Transactional Cost | N | | 50 | 50 | | |
| PC: | Project Cost | Pearson Correlation | -.101 | -.024 | 1 | |
| | | Sig. (2-tailed) | .486 | .867 | | |
| | N | | 50 | 50 | 50 | |
| TI: | Tax Incentives | Pearson Correlation | -.100 | .058 | .447** | 1 |
| | | Sig. (2-tailed) | .490 | .687 | .001 | |
| | N | | 50 | 50 | 50 | 50 |
| FS: | Firm Size | Pearson Correlation | .187 | .161 | .345* | .445** |
| | | Sig. (2-tailed) | .193 | .264 | .014 | .001 |
| | N | | 50 | 50 | 50 | 50 |
| Return | on | Pearson Correlation | .377** | .396** | .434** | .549** |
| Investment | | Sig. (2-tailed) | .007 | .007 | .002 | .000 |
| | N | | 50 | 50 | 50 | 50 |

** . At 0.01 level (two-tailed), correlation is significant.

* . At 0.05 level (two-tailed), correlation is significant.

Carbon credits show a moderate positive correlation with ROI, with a Pearson correlation coefficient of 0.377 and a p-value of 0.007. This indicates that firms involved in carbon credit activities tend to experience a higher ROI. The relationship is statistically significant, implying it is not likely to be the result of chance.

Similarly, credit issuance and transactional costs also exhibit a moderate positive correlation with ROI, with a Pearson correlation of 0.396 and a p-value of 0.007. This suggests that managing and reducing transactional costs associated with carbon credit

issuance could potentially improve the firms' ROI. The correlation's statistical significance further supports the idea that random fluctuations do not explain this relationship.

In terms of project costs, the correlation with ROI is 0.434, denoting a moderate to strong positive relationship. Firms which incur higher project costs tend to achieve better returns on investment. The statistical significance of this correlation is established by a p-value of 0.002, suggesting the relationship is robust and not coincidental.

The relationship between tax incentives and ROI is particularly noteworthy, with a Pearson correlation of 0.549. This strong positive correlation indicates that firms benefiting from tax incentives are more likely to see higher returns. The p-value of 0.000 confirms a highly significant connection, highlighting how tax incentives are valuable in enhancing the financial outcomes of renewable energy firms.

Finally, firm size shows the strongest correlation with ROI, with a Pearson correlation coefficient of 0.677. Larger firms tend to achieve significantly better returns on investment, likely due to advantages such as economies of scale, greater access to capital, and more efficient operations. The relationship is highly statistically significant, with a p-value of 0.000, signifying that firm size is a critical factor in driving profitability for renewable energy firms.

4.6.2 Diagnostic Tests

The following diagnostic tests were performed to avoid compromising linear regression assumptions.

4.6.2.1 Normality Test

The Shapiro-Wilk test, a widely used statistical method, was applied in assessing the normality of the data (Inthiran, 2022). This test evaluates the assumption that the data is regularly distributed. The normality test threshold, usually set at a significance level of 0.05, determines whether a dataset significantly deviates from normality or can be considered approximately normally distributed within the defined threshold. If the p-value obtained from the test is below the significance threshold (e.g., 0.05), the null hypothesis is dismissed, signifying that the data fails to follow a normal distribution pattern. From the results presented in Table 4.19, the null hypotheses for all four variables were rejected, as the significance levels for both the Kolmogorov-Smirnov and Shapiro-Wilk tests were below 0.05. This confirms that the datasets for these variables are not normally distributed

Table 4. 19: Tests of Normality

| | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
|---|---------------------------------|----|-------|--------------|----|------|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Carbon credits | .100 | 50 | .200* | .964 | 45 | .177 |
| Projects costs | .116 | 50 | .150 | .940 | 45 | .122 |
| Credit issuance and transactional costs | .128 | 50 | .064 | .934 | 45 | .051 |
| Firm size | .101 | 50 | .200* | .937 | 45 | .107 |
| Profitability | .108 | 50 | .200* | .935 | 45 | .140 |

a. Lilliefors Significance Correction

Based on the figure 4.3 below normal P-P plot of the four independent variables, the deviation from normality was not much as from the approximation to the line of fit. This is an indication that the data is approximately normally distributed and, therefore, suitable for regression analysis.

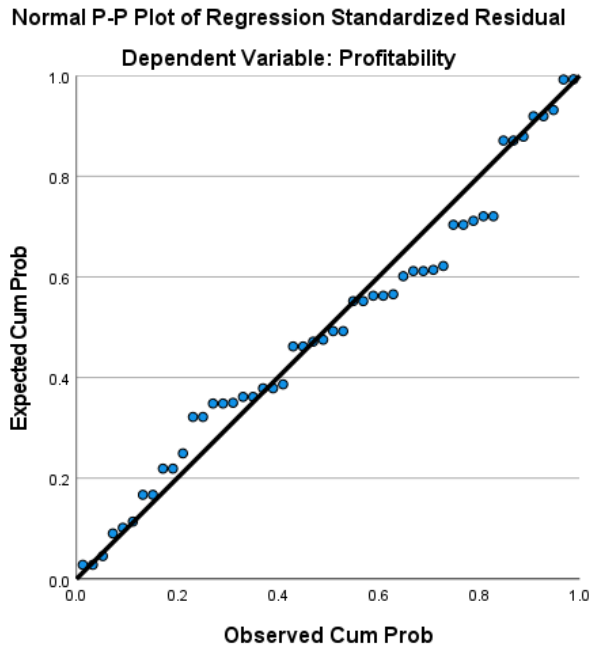


Figure 4. 3: Normal P-P Plot of Regression Standardized Residual

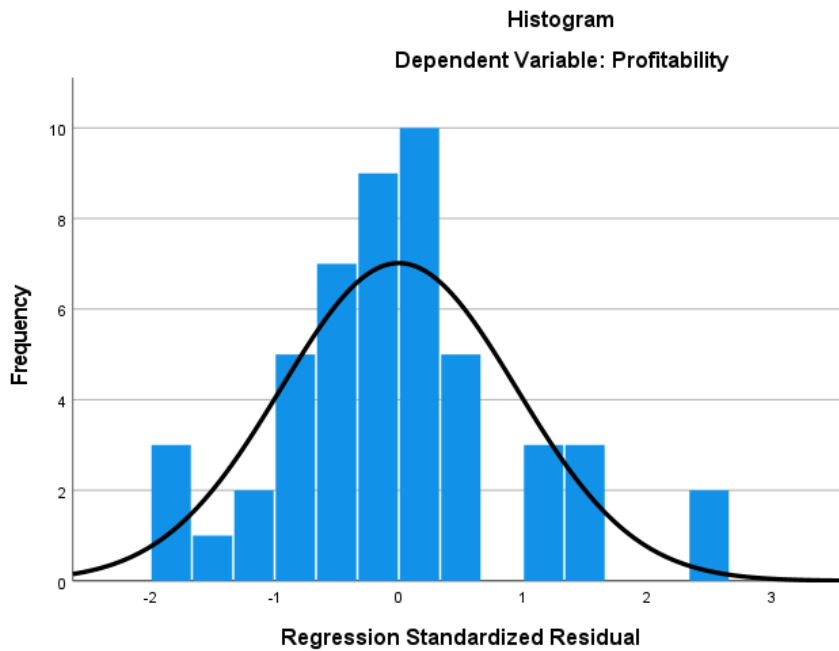


Figure 4. 4: Normal Histogram

4.6.2.2 Multi-collineality Test

The Variance Inflation Factor (VIF) is used here because of its usefulness in gauging the extent to which the correlations between the independent variables in a regression model are inflated. If the VIF for an independent variable is large, it indicates that there is likely to be no benefit to include it in the model (Thies, Huber, Bock, & Benlian, 2023). The VIF cutoff at a value of 5 is a popular criterion. Multicollinearity is present when the VIF of a predictor variable is over a cutoff value. That's why it's important for regression analysis to account for this issue (Thies, 2022). The VIF scores were below 10 and the tolerance level was 1 and below, hence there was no multi-collineality problem as exhibited in Table 4.20.

Table 4. 20: Collineality Statistics

| Independent variable | Tolerance | VIF |
|---|------------------|------------|
| Carbon credits | .821 | 1.218 |
| Credit issuance and transactional costs | .871 | 1.148 |
| Projects costs | .761 | 1.314 |
| Tax Incentives | .683 | 1.464 |

Dependent variable: Profitability

4.6.2.3 Linearity Test

The study intended to test linearity by adopting a linear regression model to the dataset and analyzing the statistical significance of the linear coefficients. Both the null and alternative hypotheses assume linearity, whereas the latter suggests a nonlinear relationship. The linearity test typically has a significance level of 0.05 as its threshold. When the probability value from the linearity test is below the cut-off, it may be concluded that the linear model

under consideration is inappropriate. As displayed in Table 4.21, the $P=0.131$ which was greater than 0.05 hence, there was linear relationship dependent and independent variables.

Table 4. 21: Levene's Test of Equality of Error Variances for Linearity Test

| DV: Profitability | Levene Statistic | Sig. |
|---|-------------------------|-------------|
| Carbon credits | 1.983 | .065 |
| Credit issuance and transactional costs | 1.632 | .137 |
| Projects costs | 1.632 | .205 |
| Tax Incentives | 2.044 | .057 |
| Firm Size | 1.120 | 0.529 |

4.6.2.4 Homoscedasticity Test

To check for heteroscedasticity, the study applied the established Breusch-Pagan test. The squared residuals were used in a regression analysis to predict the independent variables' influence. There is some wiggle room in the significance level you choose to test for heteroscedasticity, even though typically it's set at 0.05. If the regression coefficients are significant, we may infer the presence of heteroscedasticity, as suggested by Daryanto (2020). From the outcomes in Table 4.23, Heteroscedasticity problem was not present since $P=0.090$, which was greater than 0.05.

Table 4. 22: Heteroskedasticity Tests

| Breusch-Pagan Test for Heteroskedasticity ^{a,b,c} | | |
|--|----|------|
| Chi-Square | Df | Sig. |
| 2.074 | 1 | .150 |

a. Dependent variable: Profitability

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

c. Predicted values from design: Intercept + CITC + IPC + TI + CC + CITC * IPC + CITC * TI + CITC * CC + IPC * TI + IPC * CC + TI * CC + CITC * IPC * TI + CITC * IPC * CC + CITC * TI * CC + IPC * TI * CC + CITC * IPC * TI * CC

4.6.3 Regression Analysis

The primary objective of this inquiry was to establish carbon financing impact on profitability of RE firms registered under the Kenya's EPRA. This was attained through carrying out standard multiple regressions. The investigation aimed to document the effect of each of carbon financing constructs on profitability when the four constructs (Carbon credits, Tax incentives, Credit issuance and transactional costs and projects costs) were inputted as a block on the model. This helped in developing the study model's coefficients and R square, and consequently test the null research hypotheses further using Beta coefficients and t-statistics. The results are as provided in Table 4.25.

Table 4. 23: Model Summary of Multiple Linear Regression

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|--------------|-------------------|-----------------|--------------------------|-----------------------------------|
| 1 | .770 ^a | .593 | .557 | .50396 |

a. Predictors: (Constant), Projects costs, Tax incentives, carbon credits and credit issuance and transactional costs

b. Dependent Variable: Profitability

The multiple linear regression analysis presented in Table 4.25 evaluates the relationship between profitability, the dependent variable, and the predictors, which include project costs, tax incentives, carbon credits, and credit issuance and transactional costs. The results reveal a strong positive correlation between the predictors and profitability, as indicated by the multiple correlation coefficient ($R = 0.770$). This suggests that the combined effect of these variables is significantly linked with the profitability of RE firms.

The coefficient of determination ($R\text{ Square} = 0.593$) shows that approximately 59.3% of the profitability variability is explained by the predictors encompassed in the model. This demonstrates that the independent variables are collectively indispensable in determining profitability. Nonetheless, the remaining 40.7% of the variability may be attributed to other factors left out in the analysis. The adjusted R Square value of 0.557 further refines this measure by accounting for the number of predictors present in the model. This denotes that 55.7% of the profitability variance is explained by the predictors when adjusted for potential overfitting, suggesting that the model is both reliable and generalizable to other datasets. The findings also exhibited a small difference between the R square and the

adjusted R square, which demonstrates how the model fits the data appropriately when it comes to forecasting the association between carbon financing and profitability (Dhakal, 2019). In spite of this, the remaining 40.8% of fluctuations in the profitability were as a result of other factors that were excluded in the scope of the research.

Table 4. 24: ANOVA Results for Multiple Linear Regression

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|--------------|------------|-----------------------|-----------|--------------------|----------|-------------------|
| 1 | Regression | 16.664 | 4 | 4.166 | 16.403 | .000 ^b |
| | Residual | 11.429 | 45 | .254 | | |
| | Total | 28.093 | 49 | | | |

a. Dependent Variable: Profitability

b. Predictors: (Constant), Projects costs, Carbon credits, Tax Incentives, Credit issuance and transactional costs

The results of the ANOVA for the multiple linear regression model, as presented in Table 4.26, provide an overview of the model's overall significance in explaining the variability in profitability. According to Sawyer (2017), analysis of variance is used in research to delineate the relevance of the study outcomes and to offer insight into the amount of variability present in the regression model. In addition to this, it gives the researcher the ability to choose a model that offers relevant insights based on replies that have significant outcomes. A significant F-statistic denotes statistical significance of the regression model, meaning that the model is able to explain a significant proportion of the dependent variable's variance, beyond what would be expected by chance.

The p-value associated with the F-statistic is 0.000, a value well below the threshold of 0.05. This denotes that the regression model is statistically significant, denoting how

predictors collectively have a notable impact on profitability. The regression sum of squares being relatively high compared to the residual sum of squares further underscores the importance of these variables in influencing profitability. The ANOVA results confirm that the multiple linear regression model befits the data. The predictors—project costs, carbon credits, tax incentives, and credit issuance and transactional costs—significantly explain the profitability variation, as evidenced by the strong F-statistic and highly significant p-value.

Table 4. 25: Regression Coefficients Results for Multiple Linear Regression

| Model | Unstandardized Coefficients | | Standardize d | | Sig. | 95.0% Confidence Interval for B | |
|---|-----------------------------|------------|---------------|-------|------|---------------------------------|-------------|
| | B | Std. Error | Beta | T | | Lower Bound | Upper Bound |
| (Constant) | .460 | .455 | | 1.010 | .318 | -.457 | 1.377 |
| Carbon Credit | .257 | .070 | .372 | 3.645 | .001 | .115 | .399 |
| Credit Issuance and Transactional Costs | .179 | .079 | .231 | 2.274 | .028 | .020 | .337 |
| Initial Projects Costs | .215 | .083 | .276 | 2.594 | .013 | .048 | .382 |
| Tax Incentives | .284 | .068 | .449 | 4.193 | .000 | .147 | .420 |

a. Dependent Variable: Profitability

The study outcomes in Table 4.27 denoted that holding all carbon financing under the study constant, profitability would be 0.460. However, an introduction of carbon credits would increase profitability by ($\beta=0.257$, p-value=0.001) and credit issuance and transactional costs would enhance profitability by ($\beta=0.179$, p-value=0.028). Similarly, projects costs would increase profitability by ($\beta=0.215$, p-value=0.013) while tax incentives would increase profitability by ($\beta=0.284$, p-value=0.000). Hence, the multiple regression model transforms to;

$$Y = 0.460 + 0.247CC + 0.179CITC + 0.215PC + 0.284TI$$

Where; α is constant (intercept),

Y is Profitability

CC is Carbon credits

CITC is Credit issuance and transactional costs,

PC is Projects costs

TI is Taxable Incentives

The unstandardized coefficient for carbon credits is 0.257, meaning that for every unit increase in carbon credits, profitability rises by 0.257 units, supposing all other factors remain constant. The standardized beta coefficient of 0.372 indicates that carbon credits have a moderately strong positive effect on profitability relative to the other predictors. This relationship is statistically significant, with a t-value of 3.645 and a p-value of 0.001. The 95% confidence interval for this coefficient ranges from 0.115 to 0.399, further affirming the reliability of this result.

The unstandardized coefficient for credit issuance and transactional costs is 0.179, indicating that a unit rise in this variable is accompanied by a 0.179-unit rise in profitability, when other factors are held constant. The standardized beta coefficient of 0.231 suggests a smaller but meaningful impact on profitability compared to other predictors. This result is statistically significant, with a t-value of 2.274 and a p-value of 0.028. The 95% confidence interval spans from 0.020 to 0.337, confirming the robustness of this effect.

For project costs, the unstandardized coefficient is 0.215, signifying that a one-unit rise in project costs translates to a 0.215-unit rise in profitability, assuming all other variables remain constant. The standardized beta coefficient is 0.276, showing a moderate positive influence on profitability. This relationship is statistically significant, with a t-value of

2.594 and a p-value of 0.013. The 95% confidence interval for the coefficient ranges from 0.048 to 0.382, supporting the significance of this predictor.

Tax incentives have the strongest effect on profitability among the predictors, with an unstandardized coefficient of 0.284. This indicates that a when tax incentives rise by a unit, profitability depicts a 0.284-unit rise, holding other variables constant. The standardized beta coefficient of 0.449 highlights tax incentives as the most influential predictor. This effect is highly statistically significant, with a t-value of 4.193 and a p-value of 0.000. The 95% confidence interval ranges from 0.147 to 0.420, indicating high confidence in the result.

4.7 Discussion of the Findings

4.7.1 Effects of Carbon Credit on Profitability

The findings from this study on carbon credits and profitability in renewable energy firms in Kenya are consistent with the broader empirical literature, providing insight into how carbon credits impact profitability, specifically in the context of renewable energy companies under the Energy and Petroleum Regulatory Authority (EPRA). Respondents in this study generally agreed on the significant role of carbon credits, with an overall mean score of 3.81 and a higher mean score of 4.04, indicating strong agreement that carbon credit income has a significant influence on profitability. This parallels previous investigations such as Conte and Kotchen (2010), who found that carbon credit prices significantly impact the profitability of projects in developing countries like Kenya, where carbon offset prices tend to be higher.

The Pearson correlation analysis in this study revealed a direct and statistically significant relationship between carbon credits and profitability ($r = 0.377$, $P = 0.000$). This suggests that a one-unit rise in carbon credits translates to a rise in profitability for renewable energy firms. This positive correlation supports the findings of Kangas (2016), who argued that companies engaged in clean energy technologies are likely to see improved profitability over time. When it comes to Kenyan RE firms, the effective management and use of carbon credits have a direct and substantial effect on financial outcomes.

Moreover, the regression analysis from this study demonstrated that when controlling for other variables, such as credit issuance, transactional costs, and project costs, a unit rise in carbon credits translates to a significant rise in performance by 0.257 units ($\beta_1 = 0.257$, $P = 0.001$). This confirms that carbon credits are a crucial factor in enhancing financial performance, reinforcing the findings of Kangas (2016), who showed that clean energy investments can lead to improved long-term profitability. The regression results further underline the importance of carbon credits as a key revenue stream for renewable energy firms in Kenya, whose profitability is closely tied to their ability to access and utilize carbon markets effectively.

However, while carbon credits play a significant role, some variation exists in perceptions regarding the direct link between carbon credit sales and profitability. This is reflected in the moderately lower mean score of 3.50 regarding the direct impact of increased carbon credit sales on profitability. This suggests that some firms may face challenges in fully capitalizing on the financial benefits of carbon credits, such as fluctuations in carbon credit prices, certification and compliance costs, or limited access to carbon markets. These challenges align with the conclusions of Zhang et al. (2023), who established that while

carbon markets can be a source of financial benefits, their impact on profitability is contingent on a firm's ability to navigate market conditions effectively. The fluctuations in carbon credit prices and market volatility may partially explain why some firms experience a less direct link between carbon credit sales and profitability.

In comparison, the study by Scholtens and van der Goot (2014) examined the impact of carbon prices on the stock market returns of firms under the EU ETS, finding that while carbon price volatility affected stock returns, it did not portray a significant impact on the market value of companies. This study, although focusing on stock returns, highlights a similar issue of volatility, which is also observed in this study. While carbon credits in Kenya are identified as a key factor in profitability, the market conditions and the firms' ability to effectively manage carbon credit transactions appear to influence the degree of their impact.

Additionally, the findings from this study are further substantiated by the analysis of tax incentives, project costs, and credit issuance costs, which also play significant roles in profitability. This is consistent with the conclusions of Scholtens and van der Goot (2014), who found that tax policies, including those related to carbon credits, play a crucial role in influencing profitability. Furthermore, the study by Kangas (2016) highlighted that companies that invest in clean technologies benefit from higher profitability in the long term, reinforcing the study's finding that RE firms can leverage carbon credits to their advantage. The outcomes of the Pearson correlation analysis in this study also corroborate these findings, as they show that carbon credits have a statistically significant relationship with profitability ($r = 0.377$, $P = 0.000$), confirming the importance of clean energy and carbon credit utilization in financial performance.

The empirical findings of this inquiry offer strong evidence that carbon credits significantly enhance the profitability of renewable energy firms in Kenya. This aligns with the broader literature, such as Kangas (2016) and Conte and Kotchen (2010), which show that carbon credits can act as a substantial driver of profitability, especially for firms engaged in clean energy. While the volatility of carbon credit prices and market conditions can influence profitability, the study confirms that carbon credits, along with other factors such as tax incentives and effective cost management, are key contributors to the financial success of RE firms. The results, including the correlation ($r = 0.377$) and regression findings ($\beta_1 = 0.257$, $P = 0.001$), highlight the need for renewable energy firms to optimize their management of carbon credits to maximize profitability.

4.7.2 Effects of Credit Issuance and Transactional Costs on Profitability

The descriptive statistics revealed that respondents generally agreed on the significant impact of credit issuance and transactional costs on the profitability of RE firms in Kenya. With an overall mean score of 3.68, respondents acknowledged the importance of managing these costs effectively to improve financial outcomes. These outcomes are consistent with the literature, particularly Rotich et al. (2024), who found that high transaction costs are a significant barrier to the profitability of carbon finance projects. They noted that such costs, including those related to development, verification, and credit issuance, can severely reduce profit margins and diminish the financial viability of projects. This is similar to the current study's finding that transaction costs, though necessary for the credibility and operational success of carbon credits, can diminish profitability if not efficiently managed.

From the Pearson correlation analysis, it is clear that a significant positive relationship between credit issuance and transactional costs and profitability exists, with a correlation coefficient of $R = 0.396$ ($P = 0.007$). This signifies that as these costs increase, the profitability of firms also tends to increase, assuming efficient management of these costs. The findings from this study match the insights provided by Scholtens and van der Goot (2014), who observed that transaction costs in carbon markets significantly affect profitability, albeit with some complexity. While their study focused on the EU ETS and stock returns, the general relationship between costs and profitability holds relevance here. Specifically, the positive relationship between transaction costs and profitability in this inquiry suggests that firms that invest in managing these costs and carbon credits may see substantial returns, despite the initial costs of issuance and certification. Similarly, Conte and Kotchen (2010) discussed how voluntary carbon offset prices vary depending on the region and the scale of the projects, further indicating the broader influence of transactional and issuance costs on profitability.

The multiple regression analysis showed that credit issuance and transactional costs significantly influence profitability, with a regression coefficient of $\beta_2 = 0.179$ and $P = 0.028$. This indicates that even after controlling for other factors like carbon credits and project costs, a rise in these transactional costs causes a significant increase in profitability by 0.281 units. This demonstrates the critical role that transaction cost management has in enhancing financial outcomes for renewable energy companies. The conclusions from this analysis back up the argument presented by Rotich et al. (2024), who noted that the high transaction costs of carbon financing (such as those for development, validation, and verification) can severely limit profitability for renewable energy projects. The current

study's regression analysis, which suggests that careful management of these costs can still lead to significant profitability, aligns with Naeku (2020), who emphasized the role of the regulatory framework in managing these costs and ensuring financial viability. Moreover, Kangas (2016) suggested that while transaction costs can negatively impact profitability in the short term, firms that adopt efficient practices and invest in cleaner technologies will see higher long-term returns, a sentiment echoed in the regression findings of the current study.

4.7.3 Effects of Initial Projects Costs on Profitability

The descriptive statistics from this investigation offer important insights into the influence of project costs on the profitability of Kenyan RE firms. The overall mean score of 3.72 indicates that the majority of participants in the research recognize project costs as a vital factor influencing profitability, suggesting a broad consensus among RE firms. This finding coincides with pieces of literature that stresses the value of understanding and managing costs effectively to enhance financial outcomes. EEP Africa (2023) and AREI (2015) both emphasize that it is costlier to supply and install RE equipment in Africa than in other regions, adding substantial capital costs to projects. These higher costs are reflected in the respondents' assessments, where financing costs (mean = 3.88) and cost overruns (mean = 3.86) were highlighted as significant challenges for firms in the Kenyan context.

The rather low standard deviation (S.D. = 1.035–1.100) denotes that the responses were not widely dispersed, indicating a general agreement among study participants about the importance of project costs in determining profitability. This parallels the findings in Prokopenko et al. (2023), which pointed out that investment and R&D costs in RE

technologies impacted profitability significantly. It highlights that most firms are acutely aware of the financial burdens posed by high project costs, yet the consistency in responses also suggests that these challenges are well-understood across the sector.

The Pearson correlation analysis ($R = 0.434$, $P = 0.000$) demonstrates a statistically significant positive relationship between project costs and profitability, meaning that as project costs increase, profitability also tends to increase, albeit with some degree of variability. This result is especially relevant to the context of RE firms in Kenya, as it confirms the findings of Steffen (2020), who highlighted the high cost of capital in developing countries, including Kenya. The cost of financing in these regions tends to be higher than in industrialized nations, which directly impacts project costs and profitability. Moreover, Jung et al. (2018) discussed how high carbon risks companies tend to face higher financing costs, which can further increase project costs. The significant correlation observed in this study suggests that firms in Kenya may be experiencing similar challenges, where high financing costs and exposure to carbon risks lead to increased profitability, as firms strive to secure investments to cover their escalating costs.

The positive relationship denoted by the Pearson correlation underscores the complexity of the financial dynamics within renewable energy firms. While high project costs may seem detrimental, they could also signal that firms are investing in technologies and processes that yield higher returns in the long run, as suggested by Prokopenko et al. (2023). Their research found that R&D investments, although costly, ultimately enhance profitability by improving technology efficiency and reducing operational costs.

The multiple regression analysis ($\beta_3 = 0.215$, $P = 0.013$) further confirms the critical role of project costs in driving profitability. The analysis suggests that when other factors such as carbon credits and credit issuance/transactional costs are controlled for, a unit rise in project costs translates to a significant rise in performance by 0.215 units. This result concurs with the outcomes in Prokopenko et al. (2023), which concluded that long-term investments and R&D spending have a positive effect on profitability indicators, like ROI and net income, across large RE firms.

Additionally, the finding supports Steffen (2020), whose study indicated that renewable energy technologies in developing countries, including Kenya, are more capital-intensive. Therefore, firms in Kenya that can secure financing and successfully manage high capital expenditures (CAPEX) are likely to experience higher profitability in the long term, despite the initial financial burden. This is especially important given that developing countries tend to face higher financing costs compared to industrialized nations. Furthermore, the result corroborates findings from Jung et al. (2018), who noted that companies with higher exposure to carbon risks may face increased financing costs. In this study, it's plausible that higher project costs, driven by financing and carbon risk, are associated with higher long-term profitability, as firms look to offset higher expenses through innovative financing and operational efficiencies.

4.7.4 Effects of Tax Incentives on Profitability

The descriptive statistics in this section provide an overview of how tax incentives influence the profitability of renewable energy firms, particularly those registered under Kenya's EPRA. The mean score of 3.57 connotes that there is a broad consensus among

participants that tax incentives have a positive effect on profitability, with moderate variability (S.D. = 1.174–1.387). This variability suggests that while most firms recognize the benefits of tax incentives, there may be some uncertainty or differences in how these incentives are perceived or utilized across firms.

Among the key factors, government-provided tax incentives stand out with a high mean score of 3.86, reflecting strong agreement among respondents that these incentives are crucial for improving profitability. This result is in concurrence with Inzunza et al. (2021), who demonstrated that environment-related policies, including tax incentives, reduce risk exposure and encourage investment in the energy sector. In the context of RE firms in Kenya, tax breaks, exemptions, and other incentives, such as accelerated depreciation and VAT exemptions on carbon credit sales, likely enhance financial viability by reducing the tax burden and increasing available capital for reinvestment. This aligns with Ndiritu and Engola (2020), who emphasized the positive impact of tax incentives like feed-in-tariffs on renewable energy generation. On the other hand, compliance audits (mean = 3.64) are identified as crucial for firms to qualify for these tax incentives. While most respondents are in agreement on the importance of compliance, the slight difference in responses (mean = 3.44 for compliance awareness) suggests that not all firms are equally informed or equipped to navigate the compliance process. This aligns with findings from Kenya Private Sector Alliance (2022), where only 45% of firms had comprehensive information on available tax incentives. This highlights the need for better awareness and support from the government to help firms fully capitalize on these incentives.

The Pearson correlation ($R = 0.549$, $P = 0.000$) reveals a significant positive relationship between tax incentives and profitability. This means that as tax incentives increase, the

profitability of renewable energy firms also increases. This finding strongly supports the argument that tax incentives are a key driver of financial performance in RE firms, particularly in the Kenyan context. The positive correlation coincides with Inzunza et al. (2021), who proved that policies, including carbon taxes and renewable portfolio standards (RPS), encourage investments that can ultimately reduce risks and improve profitability. For renewable energy firms in Kenya, government-provided tax incentives, such as VAT exemptions on carbon credit sales and accelerated depreciation, reduce operating costs and increase cash flow, thereby directly enhancing profitability. Additionally, this outcome echoes the exploration by Oluoch et al. (2021), which indicated that public attitudes toward renewable energy, combined with favorable tax policies, could boost investment in the sector. The direct relationship between tax incentives and profitability shown in this study mirrors this concept, suggesting that such policies not only increase investor confidence but also contribute to better financial outcomes for firms.

The multiple regression analysis ($\beta_4 = 0.284$, $P = 0.000$) further emphasizes the importance of tax incentives in driving profitability. The result point out that when tax incentives rise by a unit, profitability rises by 0.284 units, even when controlling for other factors like carbon credits, project costs, and transactional costs. This statistically significant result confirms that tax incentives are not just correlated with profitability, but they are a significant driver of financial success for renewable energy firms. This aligns with the findings of Kenya Association of Manufacturers (2021), which reported a 23% increase in renewable energy investments between 2016 and 2020, partly due to favorable tax incentives. Case in point is the Lake Turkana Wind Power Project, benefiting from VAT exemptions and accelerated depreciation, which saw increased profitability, highlighting

the real-world financial benefits of such incentives. Additionally, KRA (2021) supports the notion that tax reliefs, such as customs duty exemptions and accelerated depreciation on renewable energy equipment, directly reduce capital costs, thereby improving the financial feasibility of renewable projects.

Moreover, Ndiritu and Engola (2020) pointed out that while tax incentives like feed-in-tariffs have been beneficial, they have not been universally applied or fully understood by all firms. The results of the regression analysis done in this inquiry suggest that a more systematic approach to applying tax incentives, along with improved communication of these benefits, could further increase profitability. The slight variation in compliance awareness, highlighted earlier, underscores the need for better dissemination of information and regulatory clarity to ensure that firms can fully benefit from these policies.

4.8 Moderating Influence of Firm size on the Relationship between Carbon financing and Profitability

The study's fifth objective was to demonstrate the moderation effect of firm size on profitability of renewable energy firms registered under the EPRA. Hierarchical regression analysis was done to find out whether firm size demonstrated a moderation impact on the association between carbon financing and profitability of RE firms registered under EPRA. The fifth null hypothesis denoted, **H₀₅**: Firm size has no significant moderation effect on the profitability of renewable energy firms registered under the Energy and Petroleum Regulatory Authority. The following regression model was estimated:

$$RO = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 M + \beta_6 X_1 M + \beta_7 X_2 M + \beta_8 X_3 M + \beta_9 X_4 M + \varepsilon$$

Where;

M - Firm size (Moderating Variable)

B₅– This is the moderating variable (Firm size) coefficient

β₆, β₇, β₈, β₉, - are the interaction term coefficients.

X₆M - carbon credits * Firm size

X₇M - Credit issuance and transactional costs * Firm size

X₈M - Projects costs * Firm size

X₉M – Tax incentives * Firm size

ε - Stochastic error term

To test this hypothesis, the researcher made use of the SPSS Process tool to analyse the moderation effect on the relationship between the dependent and independent variables. The researcher accomplished this through conducting hierarchical regression analysis comprising in three stages, resulting in four models. At each stage, changes in R², F-statistic, and significance levels were recorded.

Stage 1 the independent variables (carbon credits, tax incentives, projects costs, credit issuance and transactional costs) were inputted in the model. This gave rise to model 1.

Stage 2 the moderator variable (firm size) was introduced in the model to produce second model.

Stage 3 the interaction effect between the independent and moderating variables was inputted in the model, represented as the cross-product of firm size and individual independent variables, resulting in the third model.

To test for moderation, the study first standardized the predictor variables in order to address the issue of multicollinearity. A z-score was calculated to determine the exact position of each value in the distribution, showing if the score is above the mean (positive) or below the mean (negative). The z-score's numerical value represents the distance from the mean, expressed in terms of the number of SDs between X and μ . The resulting scores provide a distribution with a mean of 0 and an SD of 1.

Table 4.26: Hierarchical Regression Model Summary

| Model | R | R ² | Adj. R ² | Std. Error | R ² | F | Change Statistics | | Sig. F Change |
|-------|-------------------|----------------|---------------------|-----------------|----------------|--------|-------------------|-----|---------------|
| | | | | of the Estimate | Change | Change | df1 | df2 | |
| 1 | .770 ^a | .593 | .557 | .50396 | .593 | 16.403 | 4 | 50 | .000 |
| 2 | .836 ^b | .699 | .665 | .43808 | .106 | 15.553 | 1 | 44 | .000 |
| 3 | .897 ^c | .804 | .760 | .37075 | .105 | 5.358 | 4 | 40 | .001 |

a. Predictors: (Constant), Tax Incentives, Credit Issuance and Transactional Costs, Carbon Credit,

Projects Costs

b. Predictors: (Constant), Tax Incentives, Credit Issuance and Transactional Costs, Carbon Credit,

Projects Costs, Firm Size

c. Predictors: (Constant), Tax Incentives, Credit Issuance and Transactional Costs, Carbon Credit,

Projects Costs, Firm Size, Tax Incentives *Firm Size, Projects costs *Firm Size, Credit Issuance

and Transactional Costs *Firm Size, Carbon Credit *Firm Size

In Model 1, the independent variables (carbon credits, credit issuance and transactional costs, project costs, and tax incentives) were entered into the model. This yielded an R² value of 0.593, indicating that these variables collectively explained 59.3% of

the variance in profitability. The change in R^2 was statistically significant ($F=16.403$, $p<0.05$), highlighting the importance of these variables in predicting profitability. The significant R^2 value of 0.593 suggests that carbon financing components (carbon credits, credit issuance and transactional costs, project costs, and tax incentives) collectively have a strong predictive power in explaining profitability. This emphasizes that carbon financing is a critical driver of financial performance for RE firms.

In Model 2, the moderating variable (firm size) was added to the regression model, improving the R^2 value to 0.699. This means that firm size explained an extra 10.6% of the profitability variance. The change in R^2 was also statistically significant ($F=15.553$, $p<0.001$), confirming that firm size demonstrated a direct effect on profitability. Adding firm size as a predictor improved the model's explanatory power by 10.6%. This postulates that larger firms are poised to attain profitability due to factors such as economies of scale, access to more resources, and operational efficiencies

In the study's third model, Interaction terms between firm size and the independent variables were added. This further increased the R^2 value to 0.804, indicating that the interaction effects contributed an additional 10.5% of the variance in profitability. The change in R^2 was statistically significant ($F=5.358$, $p=0.001$), suggesting that firm size moderates the relationship between carbon financing and profitability. The inclusion of interaction terms between firm size and the independent variables further increased the R^2 value by 10.5%, confirming firm size's moderating role in the association between carbon financing and profitability. Specifically, the significant moderation effect suggests that the influence of carbon financing on profitability varies depending on the size of the company. Bigger firms may be better positioned to capitalize on carbon financing

opportunities, reducing transaction costs, leveraging tax incentives, and managing project costs effectively.

Table 4. 27: Regression Coefficient of Moderating influence

| Model | Unstandardized Coefficients | | Standardized Coefficients | | t | Sig. | 95.0% Confidence Interval for B | |
|--------------------------------|-----------------------------|------------|---------------------------|--|--------|------|---------------------------------|-------------|
| | B | Std. Error | Beta | | | | Lower Bound | Upper Bound |
| 1 (Constant) | .460 | .455 | | | 1.010 | .318 | -.457 | 1.377 |
| Carbon Credit | .257 | .070 | .372 | | 3.645 | .001 | .115 | .399 |
| Credit Issuance | and .179 | .079 | .231 | | 2.274 | .028 | .020 | .337 |
| Transactional Costs | | | | | | | | |
| Projects Costs | .215 | .083 | .276 | | 2.594 | .013 | .048 | .382 |
| Tax Incentives | .284 | .068 | .449 | | 4.193 | .000 | .147 | .420 |
| 2 (Constant) | -.492 | .463 | | | -1.062 | .294 | -1.426 | .442 |
| Carbon Credit | .198 | .063 | .286 | | 3.134 | .003 | .071 | .325 |
| Credit Issuance | and .158 | .069 | .204 | | 2.305 | .026 | .020 | .296 |
| Transactional Costs | | | | | | | | |
| Projects Costs | .154 | .074 | .198 | | 2.091 | .042 | .006 | .302 |
| Tax Incentives | .193 | .063 | .305 | | 3.049 | .004 | .065 | .320 |
| Firm Size | .426 | .108 | .387 | | 3.944 | .000 | .208 | .644 |
| 3 (Constant) | -4.035 | 2.199 | | | -1.835 | .074 | -8.479 | .408 |
| Carbon Credit | .757 | .567 | 1.096 | | 1.336 | .189 | -.388 | 1.903 |
| Credit Issuance | and 1.677 | .538 | 2.166 | | 3.115 | .003 | .589 | 2.764 |
| Transactional Costs | | | | | | | | |
| Projects Costs | -.560 | .387 | -.721 | | -1.447 | .156 | -1.343 | .222 |
| Tax Incentives | -.376 | .299 | -.594 | | -1.255 | .217 | -.981 | .229 |
| Firm Size | 1.502 | .593 | 1.363 | | 2.531 | .015 | .303 | 2.701 |
| Carbon Credit* Firm Size | -.159 | .131 | -1.182 | | -1.215 | .232 | -.423 | .105 |
| Credit Issuance and | -.342 | .114 | -2.347 | | -3.010 | .005 | -.571 | -.112 |
| Transactional Costs* Firm Size | | | | | | | | |
| Projects Costs* Firm Size | .138 | .085 | 1.034 | | 1.619 | .113 | -.034 | .310 |
| Tax Incentives* Firm Size | .110 | .071 | .927 | | 1.554 | .128 | -.033 | .253 |

a. Dependent Variable: Profitability

The second regression model in the study is as depicted below from regression coefficient of Table 4.29.

$$Y = -4.035 + 0.757X_1 + 1.677X_2 - 0.560X_3 - 0.376X_4 + 1.502M - 0.159X_1M - 0.342X_2M + 0.138X_3M + 0.110X_4M$$

Where

Y=Profitability of renewable energy firms registered under the EPRA

X₁=Carbon credits

X₂= Credit issuance and transactional costs

X₃= Projects costs

X₄= Tax Incentives

M= Firm size

In the first model, the independent variables—carbon credits, credit issuance and transactional costs, project costs, and tax incentives—were included as predictors of profitability. The constant (B=0.460, p=0.318) was not statistically significant, indicating that the model does not explain profitability when the independent variables are zero. Carbon credits (B=0.257, p=0.001) had a positive and statistically significant effect, suggesting that higher engagement in carbon credits improves profitability. Similarly, credit issuance and transactional costs (B=0.179, p=0.028) showed a significant positive impact, implying that managing and reducing these costs enhances financial performance. Project costs (B = 0.215, p = 0.013) also had a positive relationship, indicating that higher project investments lead to better returns. Tax incentives (B = 0.284, p = 0.000) emerged

as the most influential factor among the independent variables, emphasizing their critical role in boosting profitability.

In the second model, the moderating variable—firm size—was introduced. Firm size ($B = 0.426$, $p = 0.000$) was positively and significantly associated with profitability, indicating that larger firms are poised to be more profitable owing to their economies of scale, better resource management, and operational efficiencies. The coefficients for the independent variables remained significant, but their magnitudes decreased slightly, suggesting that firm size partially mediates their impact on profitability.

The third model introduced interaction terms between firm size and the independent variables to evaluate the moderating effect. Firm size ($B=1.502$, $p=0.015$) retained its positive and significant direct effect on profitability. Nonetheless, the interaction terms revealed varying effects. The interaction between firm size and carbon credits ($B=-0.159$, $p=0.232$) was not significant, indicating that firm size does not show a moderating role in the relationship between carbon credits and profitability.

The interaction between firm size and credit issuance and transactional costs ($B=-0.342$, $p=0.005$) was significant and negative. This suggests that as firm size increases, the profitability benefit derived from managing credit issuance and transactional costs diminishes. Smaller firms appear to benefit more significantly from improvements in these processes compared to larger firms. The interaction between firm size and project costs ($B=0.138$, $p=0.113$) was not significant, indicating no moderating influence of firm size on the relationship between project costs and profitability. The interaction between firm size

and tax incentives ($B=0.110$, $p=0.128$) was also not significant, suggesting that the effect of tax incentives on profitability is consistent regardless of firm size.

Overall, the analysis demonstrates that firm size is a critical profitability determinant and moderates specific aspects of the relationship between carbon financing and financial outcomes. While larger firms are inherently more profitable due to their structural advantages, smaller firms stand to gain more from improved credit issuance processes. These findings underpin the need to tailor carbon financing strategies to align with firm-specific characteristics, ensuring that both large and small firms maximize their profitability in the RE sector.

4.8.1 Moderation Effect of Firm Size on Profitability and Financial Performance

The descriptive statistics in this section shed light on the distribution of firm size in the RE sector in Kenya and how it is linked profitability. The study highlights that 38% of renewable energy firms have assets exceeding 150 million Ksh, which categorizes them as medium to large-scale firms. This suggests that a significant proportion of the firms in this sector are large enough to potentially benefit from economies of scale, access to more resources, and the ability to absorb operational costs. This distribution of firm size is important because it indicates that larger firms are more prominent in the RE sector, which could give them a competitive advantage.

The results in the current inquiry mirror the investigation by Morina et al. (2021), which found that larger firms in the RE sector, particularly in the EU, tend to be more profitable due to their ability to leverage economies of scale and have greater access to resources. These larger firms are better equipped to absorb fixed costs and expand their operations,

thus enhancing profitability. Similarly, Mutunga and Owino (2017) noted that in the manufacturing sector in Kenya, firms with greater production capacity (which correlates with larger firm size) tend to show better financial performance.

The Pearson correlation analysis ($R = 0.677$, $P = 0.000$) shows a strong positive relationship between firm size and profitability. This result indicates that larger firms in the renewable energy industry are more profitable, which is consistent with economic theories and previous empirical findings. The positive correlation hints that when a company grows in size, its profitability tends to rise too. This is because larger firms can spread operational costs across a larger output, take advantage of economies of scale, and utilize their larger asset base to generate more revenue and profit. This finding aligns with Morina et al. (2021), which reported that firm size positively influences profitability in the renewable energy sector. Similarly, Abeyrathna and Priyadarshana (2019) in their study of Sri Lankan manufacturing firms found that firm size impacted profitability significantly and positively. However, the study did not find such a clear impact on the Sri Lankan manufacturing firms as seen in renewable energy firms in this study. The positive correlation in the current study supports the notion that larger firms have a competitive advantage in absorbing costs and achieving higher profitability.

The regression analysis in this study revealed that when firm size was introduced as a moderating variable, the explanatory power of the model increased significantly. The variance explained by the carbon financing components alone was 59.3%, but when firm size was included, this increased to 69.9%, highlighting the importance of firm size in moderating the relationship between carbon financing components and profitability. This suggests that firm size significantly enhances the impact of carbon financing components

on profitability, as larger firms are better positioned to leverage financing strategies such as carbon credits, tax incentives, and cost management. The introduction of interaction terms between firm size and various financing factors, such as carbon credits, credit issuance/transactional costs, project costs, and tax incentives, further increased the explanatory power to 80.4%. This suggests that firm size not only impacts profitability directly but also moderates how different financial strategies and factors contribute to overall profitability.

From regression analysis ($B = 1.502$, $p = 0.015$), the result confirms that bigger firms experience higher profitability owing to their ability to scale operations and achieve greater efficiencies. This finding is in line with Mutunga and Owino (2017), who found that production capacity (a proxy for firm size) is a key driver of profitability. Larger firms can better manage the scale of operations and resources, contributing to their enhanced profitability. However, some of the interaction terms between firm size and specific factors did not show significant effects. For example, the interaction between firm size and carbon credits ($B = -0.159$, $p = 0.232$) was not significant, indicating that firm size does not significantly alter the relationship between carbon credits and profitability. This suggests that while carbon credits are beneficial for firms of all sizes, they may not have a particularly stronger impact on larger firms compared to smaller ones. This result contrasts with Lopez-Valeiras (2016), who found that indebtedness, as a function of firm size, can help large firms achieve better financial performance. However, the absence of significant interaction between firm size and carbon credits suggests that, for larger renewable energy firms, carbon credits do not behave as a unique advantage.

Conversely, the negative and significant interaction between firm size and credit issuance/transactional costs ($B = -0.342$, $p = 0.005$) suggests that smaller firms may be more adept at managing these costs. This is likely because smaller firms have greater agility and flexibility in decision-making and can better manage transaction costs, while larger firms might experience more bureaucracy and administrative overhead. The lack of significance in the interactions between firm size and project costs ($B = 0.138$, $p = 0.113$) and tax incentives ($B = 0.110$, $p = 0.128$) denotes that firm size does not significantly moderate how these factors shape profitability. This suggests that, irrespective of size, managing project costs effectively and leveraging tax incentives are key drivers of profitability in the renewable energy sector. These findings align with Abeyrathna and Priyadarshana (2019), who also found that factors such as total assets (a measure of firm size) did not significantly impact profitability in the Sri Lankan manufacturing sector.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the content discussed in the preceding chapters. It outlines the conclusions derived from the study's findings and provides recommendations along with suggestions for research in the future.

5.2 Summary of Findings

The study's core objective was to investigate the effect of carbon financing on profitability of RE firms registered under EPRA. The specific objectives were to demonstrate the effect of carbon credits on profitability, to determine the effect of credit issuance and transactional costs on the profitability, to establish the effect of projects costs on profitability, to determine the effect of tax incentives on the profitability and to demonstrate the moderation effect of firm size on profitability on profitability of RE firms registered under EPRA. Data was collected using questionnaire from 50 RE firms registered under EPRA, the analysis entailed both descriptive and inferential analysis. Hypothesis testing was conducted at a 95% confidence level ($p < 0.050$) to assess both the independent and combined effects. The summary of the findings is organized similarly in the sections that follow.

5.2.1 Effect of carbon credits on Profitability

The analysis reveals that carbon credits serve as a key financial lever enhancing the profitability of renewable energy firms under EPRA. By providing an additional income stream and strengthening firms' financial flexibility, carbon credits enable better investment decisions and sustainable growth. Their integration into financial planning also fosters a balance between profitability and environmental responsibility. Consequently, deliberate institutional and policy support is essential to expand access and optimize the benefits of carbon credit mechanisms across the renewable energy sector. Hence, therefore the research did not accept the first null hypothesis, which states: **H₀₁**: Carbon credits does not have a significant effect on the profitability of renewable energy firms registered under the EPRA.

5.2.2 Effect of Credit issuance and transactional costs on Profitability

The study highlights that the structure and management of credit issuance and transactional costs are critical determinants of financial performance among renewable energy firms. Firms that minimize inefficiencies and manage these costs effectively are better positioned to achieve operational and financial gains from carbon financing initiatives. Moreover, supportive fiscal measures—such as subsidies and streamlined credit processes—can further enhance profitability. Therefore, careful oversight of these costs is fundamental to sustaining profitability and competitiveness in the carbon finance market. In summary, there was satisfactory evidence to dismiss the second null hypothesis, which states: **H₀₂**: Credit issuance and transactional costs do not have significant effect on the profitability of renewable energy firms registered under EPRA.

5.2.3 Effect of Initial Projects costs on the Profitability

Findings indicate that the scale and management of project costs have a direct bearing on the profitability of renewable energy enterprises. Prudent handling of financing, development, and operational expenditures ensures that firms can maintain financial stability while executing carbon finance projects. Cost efficiency, particularly in CAPEX and OPEX, emerges as a cornerstone of long-term viability. Thus, rigorous budgeting, cost control, and monitoring systems are indispensable for maximizing returns and sustaining profitability in renewable energy investments. Thus, there was satisfactory evidence to dismiss the third null hypothesis that posits: **H₀₃**: Initial Projects costs do not have a significant effect on profitability of renewable energy firms registered under EPRA.

5.2.4 Effect of Tax Incentives on the Profitability

Evidence from the study points to tax incentives as a significant driver of profitability for renewable energy firms operating under EPRA. Well-designed tax relief programs not only reduce financial burdens but also encourage investment in clean energy technologies. Compliance and effective audit practices further determine a firm's ability to access and retain these benefits. Strengthening awareness and consistent enforcement of tax policies can amplify their impact, making tax incentives a vital policy instrument for promoting both profitability and sustainability in the renewable energy sector. In essence, there was satisfactory evidence to reject the fourth null hypothesis, which states that: **H₀₄**: Tax Incentives have no significant effect on the profitability of renewable energy firms registered under EPRA.

5.2.5 Moderating Effect of Firm size

The analysis establishes that firm size plays an important role in shaping the profitability of renewable energy firms registered under EPRA. Larger firms demonstrate stronger financial performance, largely due to economies of scale, greater operational efficiency, and enhanced capacity to leverage carbon financing opportunities. The moderating effect of firm size further strengthens the relationship between carbon financing components and profitability, highlighting that firm scale amplifies the financial benefits of well-structured carbon finance mechanisms. However, smaller firms appear to gain relatively more from efficient management of credit issuance and transactional costs, pointing to the need for tailored financial strategies based on firm size. Overall, the findings affirm that firm size is a critical determinant of profitability and a moderating factor in the effectiveness of carbon finance in the renewable energy sector.

5.3 Conclusion

The study established that carbon financing mechanisms are central in determining the profitability of renewable energy firms in Kenya. When effectively integrated into a company's financial strategies, carbon credits offer a realistic pathway to bolstering financial performance. Similarly, the way renewable energy firms manage their credit issuance and transaction costs is a key determinant of success, as operational efficiency can transform potential cost burdens into profitability.

Initial project costs, which are often considered barriers, were shown in this research to create long-term financial leverage when managed well, implying that disciplined cost control is vital for performance. Furthermore, tax incentives prove that the government can

play an important role in stimulating profitability, suggesting that policy frameworks are valuable in realizing the potential of investments in renewable energy.

The moderating role of the firm underpins the significance of scale, given that larger firms are better positioned to reap efficiency gains, though not all dimensions of carbon financing respond in the same way to size dynamics. Together, these findings confirm that carbon financing is a multidimensional driver of profitability, where firm-level strategies and conducive policy environments must align to ensure financial sustainability.

5.4 Recommendations

5.4.1 Recommendations for Practice

Management should diversify into high-quality, verified carbon credit projects such as reforestation, clean cooking, or renewable generation. These type of projects tend to command premium market prices. Firms should also invest in employee training and stakeholder awareness on carbon markets to improve strategic decision-making and fully leverage carbon credit opportunities.

Firms should streamline carbon credit issuance and trading processes by adopting automated tracking and reporting systems, or collaborating with aggregators with the goal of lowering transaction costs. Participation in industry associations can also be instrumental in strengthening bargaining power and reducing the high costs that limit smaller firms.

Given the strong link between project costs and profitability as revealed in the research, firms should seek to adopt rigorous cost-management frameworks that monitor capital and

operational expenditures throughout the project cycle. Where feasible, projects undertaken should be scaled strategically in order to maximize economies of scale, while still maintaining quality as well as compliance with carbon standards.

RE firms should plan to maximize the financial benefits of tax incentives by maintaining strict compliance with all tax regulations and conducting regular audits. This will ensure eligibility for exemptions or rebates, which can directly improve profitability. Firms should also lobby for broader application of renewable-related tax incentives through relevant industry coalitions.

Larger RE firms should exploit economies of scale by investing in advanced and modern technologies as well as expanding production capacity. Smaller firms, however, should consider cooperative approaches, such as pooling projects with other firms or working with carbon aggregators with the aim of reducing entry barriers and sharing transaction costs, which would consequently improve market accessibility.

To strengthen long-term profitability and the trust of the public, RE firms should invest in corporate social responsibility (CSR) initiatives that create tangible community benefits such as clean energy access, employment creation, and local infrastructural support while also enhancing the sustainability of carbon credit initiatives.

5.4.2 Recommendations for Policy

The government should stabilize and expand carbon markets through the provision of transparent regulatory framework as well as supporting platforms for efficient credit

trading. This will encourage private-sector participation and attract buyers from the international market.

Policies should promote efficient credit issuance processes through technical assistance, financial support for digital tracking systems, and low-interest loans for firms investing in cost-reducing technologies.

Government should ease the financial burden of high project costs by offering concessional financing, grants, or long-term low-interest loans especially targeting small businesses. This will lower capital and operational expenditure risks while at the same time boost investment in renewable projects.

Policy should focus on expanding and refining RE tax incentives, such as extending tax holidays, exempting carbon credit revenues from corporate tax, and reducing VAT on renewable technologies. With stronger and clearer incentives, profitability will be directly enhanced.

The government should formulate policies that support growth of small and medium RE firms, including financing schemes, mentorship programs, and incentives for partnerships with larger firms. This will not only reduce market concentration but also ensure more inclusive access to carbon financing opportunities.

5.5 Areas of Further Studies

While this study has made noteworthy contributions to the understanding of carbon financing and its relation the profitability of RE firms, there are a few areas for future researchers to consider. Firstly, the study's propositions stress the importance of

establishing efficient and effective carbon financing among RE firms registered under EPRA. The four independent variables of carbon financing explained up to 59.3% while inclusion of firm size moved it to 80.4% implying there are other factors that may have effect profitability of despite carbon financing which further studies should consider.

Methodologically, the research focused on renewable energy firms registered under Kenya's EPRA. This restricts the generalizability and applicability of the recommendations in the study to the other firms in Kenya. Therefore, further study should focus on renewable energy firms not registered under the regulatory body. Relatedly under methodology, the study used quantitative data, further studies should consider using a mixed methodology for the purpose of triangulation.

As this study's has revealed, firm size has significant moderating effect on profitability. However, insignificant moderating effect was observed in regards to credit issuance and transactional costs, tax incentives, and projects costs. Similar studies should consider using different moderating variable to find out similar observation can be maintained.

REFERENCES

- Abbas, J., Wang, L., Belgacem, S. B., Pawar, P. S., Najam, H., & Abbas, J. (2023). Investment in renewable energy and electricity output: Role of green finance, environmental tax, and geopolitical risk: Empirical evidence from China. *Energy*, 269, 126683.
- Abeyrathna, S. P. G. M., & Priyadarshana, A. J. M. (2019). Impact of Firm size on Profitability. *International Journal of Scientific and Research Publications*, 9(6), 561-564.
- Adom, P. K. The Socioeconomic Impact of Climate Change in Developing Countries in the Next Decades. <https://www.cgdev.org/sites/default/files/socioeconomic-impact-climate-change-developing-countries-next-decades.pdf>
- Akaranga, S. I., & Makau, B. K. (2016). Ethical considerations and their applications to research: A case of the University of Nairobi. *Journal of educational policy and entrepreneurial research*, 3(12), 1-9.
- Akhanolu, I. A., Benjamin, E., Adebayo, M., Awogbenja, B. B., & Bunmi-Alo, A. (2023). Carbon Disclosure, Board Climate Governance and Profitability of Listed Manufacturing Firms in Nigeria. *International Journal of Energy Economics and Policy*, 13(4), 187.
- Alexopoulos, I., Kounetas, K., & Tzelepis, D. (2018). Environmental and profitability. Is there a win-win or a win-loss situation? Evidence from the Greek manufacturing. *Journal of Cleaner Production*, 197, 1275-1283.

- Ali, A., Kamarulzaman, R., Soetrisno, F. K., & Razimi, M. S. A. (2020). Wavelet analysis of renewable, non-renewable energy consumption and environmental degradation as a precursor to economic growth: Evidence from Malaysia. *International Journal of Energy Economics and Policy*, 10(3), 182-189.
- AREI. (2015). Summary of the AREI Framework Document and Action Plan. <https://iea.blob.core.windows.net/assets/f76594a5-8a9f-4820-ba3e-2908e03b02a9/FinancingCleanEnergyinAfrica.pdf>
- Baimwera, B. (2018). Determinants of carbon finance uptake and its role in deployment of renewable energy projects in Kenya (Doctoral dissertation, Strathmore University). <https://su-plus.strathmore.edu/server/api/core/bitstreams/fbd0291d-0f99-4dea-9184-364235182bce/content>
- Baimwera, B., Wangombe, D., & Kitindi, E. (2017). The determinants of the uptake of carbon finance by renewable energy producers in Kenya. *African Journal of Economic and Sustainable Development*, 6(2-3), 184-215.
- Bridge, G., Bulkeley, H., Langley, P., & van Veelen, B. (2020). Pluralizing and problematizing carbon finance. *Progress in Human Geography*, 44(4), 724-742.
- Burvill, S. M., Jones-Evans, D., & Rowlands, H. (2018). Reconceptualising the principles of Penrose's (1959) theory and the resource based view of the firm: The generation of a new conceptual framework. *Journal of Small Business and Enterprise Development*, 25(6), 930-959.

- Busch, T., Bassen, A., Lewandowski, S., & Sump, F. (2022). Corporate carbon and profitability revisited. *Organization & Environment*, 35(1), 154-171.
- Chen, B., & Wu, R. (2023). Legal and policy pathways of carbon finance: Comparative analysis of the carbon market in the EU and China. *European Business Organization Law Review*, 24(1), 41-68.
- Clifton, S. J. (2022). A Critical Evaluation of Carbon Trading Projects in Kenya. *International Journal of Allied Sciences (IJAS)*, 13(10), 30-40.
- Conte, M. N., & Kotchen, M. J. (2010). Explaining the price of voluntary carbon offsets. *Climate Change Economics*, 1(02), 93-111.
- Corvino, A., Caputo, F., Pironti, M., Doni, F., & Bianchi Martini, S. (2019). The moderating effect of firm size on relational capital and firm performance: Evidence from Europe. *Journal of Intellectual Capital*, 20(4), 510-532.
- Desai, R., Raval, A., Baser, N., & Desai, J. (2022). Impact of carbon emission on profitability: empirical evidence from India. *South Asian Journal of Business Studies*, 11(4), 450-470.
- Dong, J. Q., Karhade, P. P., Rai, A., & Xu, S. X. (2021). How Firms Make Information Technology Investment Decisions: Toward a Behavioral Agency Theory. *Journal of Management Information Systems*, 38(1), 29–58. <https://doi-org.ezproxy.umgc.edu/10.1080/07421222.2021.1870382>

- EEP Africa. (2023). Carbon Credits Market Access for Smaller-Scale Clean Energy Projects. <https://eepafrica.org/wp-content/uploads/2023/12/Carbon-Credits-Market-Access-Publication.pdf>
- EPRA. (n.d.). Role of EPRA in the Renewable Energy Subsector. <https://www.epra.go.ke/services/renewable-energy-2/functions-of-the-renewable-energy/>
- Fairchild, A. J., & MacKinnon, D. P. (2009). A general model for testing mediation and moderation effects. *Prevention science*, 10, 87-99.
- Fernández-Cuesta, C., Castro, P., Tascón, M. T., & Castaño, F. J. (2019). The effect of environmental performance on financial debt. European evidence. *Journal of cleaner production*, 207, 379-390.
- Foss, N. J. (1994). The biological analogy and the theory of the firm: Marshall and monopolistic competition. *Journal of Economic Issues*, 28(4), 1115-1136.
- Freeman, R. E., Phillips, R., & Sisodia, R. (2020). Tensions in stakeholder theory. *Business & Society*, 59(2), 213-231.
- Gallego-Álvarez, I., Segura, L., & Martínez-Ferrero, J. (2015). Carbon emission reduction: The impact on the financial and operational performance of international companies. *Journal of Cleaner Production*, 103, 149-159.
- Gatimu, K. K., & Wabwire, J. M. (2016). Effect of Corporate Environmental Disclosure on Profitability of Firms Listed at Nairobi Securities Exchange, Kenya.

International Journal of Sustainability Management and Information Technologies
2(1): 1-6

Hart, S. and Ahuja, G. (1996) Does It Pay to Be Green? An Empirical Examination of the Relationship between Emission Reduction and Firm Performance. *Business Strategy and the Environment*, 5, 30-37.

Hashmi, M. A., Damanhour, A., & Rana, D. (2015). Evaluation of sustainability practices in the United States and large corporations. *Journal of Business Ethics*, 127, 673-681.

Hassan, A. (2019). Do renewable energy incentive policies improve the performance of energy firms? Evidence from OECD countries. *OPEC Energy Review*, 43(2), 168-192.

IEA. (2023). Financing Clean Energy in Africa. <https://iea.blob.core.windows.net/assets/f76594a5-8a9f-4820-ba3e-2908e03b02a9/FinancingCleanEnergyinAfrica.pdf>

Inzunza, A., Muñoz, F. D., & Moreno, R. (2021). Measuring the effects of environmental policies on electricity markets risk. *Energy Economics*, 102, 105470.

Jeong, Y.-C., & Kim, T.-Y. (2019). Between Legitimacy and Efficiency: An Institutional Theory of Corporate Giving. *Academy of Management Journal*, 62(5), 1583–1608.

- Ji, X., Chen, X., Mirza, N., & Umar, M. (2021). Sustainable energy goals and investment premium: Evidence from renewable and conventional equity mutual funds in the Euro zone. *Resources Policy*, 74, 102387.
- Jung, J., Herbohn, K., & Clarkson, P. (2018). Carbon risk, carbon risk awareness and the cost of debt financing. *Journal of business ethics*, 150, 1151-1171.
- Kangas, J. (2016). Carbon pricing and its effect on company profitability. https://lutpub.lut.fi/bitstream/handle/10024/123491/Thesis_Kangas_Juulia.pdf?sequence=2&isAllowed=y
- Kemp, L., Xu, C., Depledge, J., Ebi, K. L., Gibbins, G., Kohler, T. A. ... & Lenton, T. M. (2022). Climate Endgame: Exploring catastrophic climate change scenarios. *Proceedings of the National Academy of Sciences*, 119(34), e2108146119.
- Kenya Association of Manufacturers. (2020). Manufacturing Sector Resilience and Sustainability Strategy. <https://kam.co.ke/wp-content/uploads/2020/11/KAM-Resilience-and-Sustainability-Strategy-Report-2020-1.pdf>
- Kenya Association of Manufacturers. (2021). Policy and Sustainability. <https://kam.co.ke/wp-content/uploads/2022/06/KAM-Policy-Sustainability-Report-2021.pdf>
- Kenya Forest Service. (2020). Republic of Kenya Ministry of Environment and Forestry The National Forest Reference Level for REDD+ Implementation. https://redd.unfccc.int/media/kenya_national_frl_report-_august_2020.pdf

- Kenya Private Sector Alliance . (2022). Barrier and Challenges Analysis of Private Sector Investments in Climate Change. <https://admin.kepsa.or.ke/public/files/docs/16807032792.pdf>
- Kim, D. G., Grieco, E., Bombelli, A., Hickman, J. E., & Sanz-Cobena, A. (2021). A review. *Food Security*, 13, 457-476.
- King, A. A., & Lenox, M. J. (2001). Does it really pay to be green? An empirical study of firm environmental and profitability: An empirical study of firm environmental and profitability. *Journal of industrial ecology*, 5(1), 105-116.
- Kivunja, C. (2018). Distinguishing between theory, theoretical framework, and conceptual framework: A systematic review of lessons from the field. *International journal of higher education*, 7(6), 44-53.
- Kopecká, N. (2018). A literature review of profitability measures and value relevance. In *The Impact of Globalization on International Finance and Accounting: 18th Annual Conference on Finance and Accounting (ACFA)* (pp. 385-393). Springer International Publishing.
- KRA. (2021). Incentives for Investors. www.kra.go.ke. <https://www.kra.go.ke/ngos/incentives-investors-certificate/investing-in-kenya/incentives-investors>
- Kumar, P., & Firoz, M. (2018). Corporate Carbon Intensity Matter: Predicting Firms' Profitability. *SCMS Journal of Indian Management*, 15(4).

- Lee, C. C., Wang, C. S., He, Z., Xing, W. W., & Wang, K. (2023). How does green finance affect energy efficiency? The role of green technology innovation and energy structure. *Renewable Energy*, 219, 119417.
- Leley, N. C., Langat, D. K., Kisiwa, A. K., Maina, G. M., & Muga, M. O. (2022). Total Carbon Stock and Potential Carbon Sequestration Economic Value of Mukogodo Forest-Landscape Ecosystem in Drylands of Northern Kenya. *Open Journal of Forestry*, 12(01), 19–40. <https://doi.org/10.4236/ojf.2022.121002>
- Lewandowski, S. (2017). Corporate carbon and profitability: The role of emission reductions. *Business Strategy and the Environment*, 26(8), 1196-1211.
- Liu, M. (2010). The Hausman test in dynamic panel model. <https://www.diva-portal.org/smash/get/diva2:326974/FULLTEXT01.pdf>
- Liu, M., Liu, L., Xu, S., Du, M., Liu, X., & Zhang, Y. (2019). The influences of government subsidies on performance of new energy firms: A firm heterogeneity perspective. *Sustainability*, 11(17), 4518.
- Lopez-Valeiras, E., Gomez-Conde, J., & Fernandez-Rodriguez, T. (2016). Firm size and profitability: intermediate effects of indebtedness. *Agribusiness*, 32(4), 454-465.
- Lubis, N. W. (2022). Resource based view (RBV) in improving company strategic capacity. *Research Horizon*, 2(6), 587-596.
- Makridou, G., Doumpos, M., & Galariotis, E. (2019). The profitability of firms participating in the EU emissions trading scheme. *Energy Policy*, 129, 250-259.

- McGee, J. (2015). Market-based view. *Wiley Encyclopedia of Management*, 1-1.
- Mohsin, M., Taghizadeh-Hesary, F., Panthamit, N., Anwar, S., Abbas, Q., & Vo, X. V. (2021). Developing low carbon finance index: evidence from developed and developing economies. *Finance Research Letters*, 43, 101520.
- Morina, F., Ergün, U., & Hysa, E. (2021). Understanding drivers of renewable energy firm's performance. *Environmental Research, Engineering and Management*, 77(3), 32-49.
- Mutunga, D. & Owino E. (2017). Effect of Production Capacity on the Profitability of Manufacturing Firms in Kenya. *Journal of Economics*, 1(1), 15 - 24.
- Naeku, M. J. (2020). Climate change governance: An analysis of the climate change legal regime in Kenya. *Environmental Law Review*, 22(3), 170–183.
<https://doi.org/10.1177/1461452920958398>
- Nason, R. S., & Wiklund, J. (2018). An assessment of resource-based theorizing on firm growth and suggestions for the future. *Journal of management*, 44(1), 32-60.
- Ndichu, J. M. (2016). Assessing Contribution Of Carbon Markets In The Enhancement Of Carbon Sinks And Community Resilience To Climate Change: A Case Of Kasigau Redd+ Project, Kenya. *Erepository.uonbi.ac.ke*.
<http://erepository.uonbi.ac.ke/handle/11295/97807>

- Ndiritu, S. W., & Engola, M. K. (2020). The effectiveness of feed-in-tariff policy in promoting power generation from renewable energy in Kenya. *Renewable Energy*, *161*, 595–603. <https://doi.org/10.1016/j.renene.2020.07.082>
- NEMA. (2016). NEMA working towards ‘Zero Waste’ by 2030. <https://www.nema.go.ke/images/Docs/Mediacentre/Publication/NEMA%20News%20Magazine%20July-Sept%202016.pdf>.
- Nickerson, C. (2022). Interpretivism paradigm & research philosophy. *Simply Sociology*, *5*.
- Oluoch, S., Lal, P., Susaeta, A., & Wolde, B. (2021). Public preferences for renewable energy options: A choice experiment in Kenya. *Energy Economics*, *98*. <https://doi.org/10.1016/j.eneco.2021.105256>
- Panda, B., & Leepsa, N. M. (2017). Agency theory: Review of theory and evidence on problems and perspectives. *Indian journal of corporate governance*, *10*(1), 74-95.
- Pearson, T. R., Brown, S., Sohngen, B., Henman, J., & Ohrel, S. (2014). Transaction costs for carbon sequestration projects in the tropical forest sector. *Mitigation and Adaptation Strategies for Global Change*, *19*, 1209-1222.
- Phan, T. H. D., Brouwer, R., & Davidson, M. D. (2017). A global survey and review of the determinants of transaction costs of forestry carbon projects. *Ecological Economics*, *133*, 1-10.

- Prokopenko, O., Kurbatova, T., Khalilova, M., Zerkal, A., Prause, G., Binda, Js. ... & Komarnitskyi, I. (2023). Impact of investments and R&D costs in renewable energy technologies on companies' profitability indicators: Assessment and forecast. *Energies*, 16(3), 1021.
- Qin, M., Su, C. W., Zhong, Y., Song, Y., & Lobont, O. R. (2022). Sustainable finance and renewable energy: Promoters of carbon neutrality in the United States. *Journal of environmental management*, 324, 116390.
- Robinson, B. L., Clifford, M. J., & Selby, G. (2023). Towards fair, just and equitable energy ecosystems through smart monitoring of household-scale biogas plants in Kenya. *Energy Research & Social Science*, 98, 103007. <https://doi.org/10.1016/j.erss.2023.103007>
- Rotich, I. K., Chepkirui, H., & Musyimi, P. K. (2024). Renewable energy status and uptake in Kenya. *Energy Strategy Reviews*, 54, 101453–101453. <https://doi.org/10.1016/j.esr.2024.10145>
- Santoso, B., Widodo, W., Akbar, M. T., Ahmad, K., & Setianto, R. H. (2022). The Determinant of Sukuk Rating: Agency Theory and Asymmetry Theory Perspectives. *Risks*, 10(8), 150. <https://doi-org.ezproxy.umgc.edu/10.3390/risks10080150>
- Scholtens, B., & van der Goot, F. (2014). Carbon prices and firms' profitability: an industry perspective. *Carbon Management*, 5(5-6), 491-505.

- Schwerhoff, G., & Sy, M. (2017). Financing renewable energy in Africa—Key challenge of the sustainable development goals. *Renewable and Sustainable Energy Reviews*, 75, 393-401.
- State Department of Energy. (2023). Climate Investment Funds Renewable Energy Integration Program Investment Plan for Kenya. https://energy.go.ke/sites/default/files/KAWI/Other%20Downloads/CLIMATE%20INVESTMENT%20FUNDS%20DRAFT%20PLAN%2010-11-2023_0310.pdf
- The UN. (n.d.). What is renewable energy? <https://www.un.org/en/climatechange/what-is-renewable-energy>
- UNEP. (2024). Scaling up mangrove conservation in Kenya. UNEP - UN Environment Programme. <https://www.unep.org/technical-highlight/scaling-mangrove-conservation-kenya>
- UNFCCC. (1992). United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
- Waudu, S., Koske, J., & Waswa, F. (2023). More trees and more biomass energy options for increased energy security within households in Navakholo Sub-County, Kenya. *East African Journal of Environment and Natural Resources*, 6(1), 178-197.
- Weigelt, C., & Shittu, E. (2016). Competition, regulatory policy, and firms' resource investments: The case of renewable energy technologies. *Academy of Management Journal*, 59(2), 678-704.

World Bank. (2022). GDP (current US\$) – Kenya. The World Bank.
<https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=KE>

Zhang, X., Zhang, Q., Dai, Z., & Zhang, X. (2023). The impact of carbon markets on the profitability of power producers: Evidence based on China. *Energy Economics*, 127, 107119.

Zhou, H., & Xu, G. (2022). Research on the impact of green finance on China's regional ecological development based on system GMM model. *Resources Policy*, 75, 102454.

APPENDICES

Appendix I: Respondent Letter

Dear Participant,

I am a student at Kenyatta University, enrolled in the Master of Science (Finance) program.

I am currently engaged in a research project that aims to explore Carbon financing and profitability of renewable energy firms in Kenya.

To accomplish this, I kindly ask for your assistance in completing the enclosed questionnaire. Your responses are crucial for the successful completion of this study.

Please note that taking part in this survey is completely voluntary, and you are free to skip any question or withdraw from participating at any time. Your identity and responses will remain strictly confidential and will not be shared with any third party. The collected data will be combined and analyzed in a way that maintains anonymity, with all identifying details removed. Additionally, any information you provide will be kept confidential and used solely for academic purposes.

In addition, by completing and returning this questionnaire, you consent that your responses will be utilized for research purposes as explained above.

Thank you for your participation.

Appendix II: Questionnaire Guidelines:

Please complete the questionnaire by marking the appropriate options or providing the necessary information where applicable. To ensure the questionnaire's validity, kindly respond to all questions.

SECTION A: DEMOGRAPHIC DATA

Please, tick [] or fill in as appropriate.

1. What is your gender?

- a) Male
- b) Female
- c) Prefer not to say
- d) Other: _____

2. What is your educational background? (Please select the highest level completed)

- a) High School
- b) Bachelor's degree
- c) Master's degree
- d) Doctorate/Ph.D.
- e) Other: _____

3. Year of service in the institution.

- (a) 0 to 1 year []
- (b) 2 to 5 years []
- (c) 6 to 10 years []
- (d) Over 10 years []

4. Level Of Seniority

- (a) Board Member []
- (b) Senior Executive []
- (c) Management []
- (d) Team Lead []
- (e) Any other (Mention) []

5. Is your institution licensed by EPRA?

- Yes []
- No []

6. Which area of renewable energy are you operating in

- Solar []
- Biogas []
- Other (Mention) _____

7. Has your institution secured any form of carbon financing?

Yes [] No []

| | |
|--------------------|--|
| If yes, how much | |
| If no, explain why | |

SECTION B: CARBON CREDITS

8. Kindly rate each statement using a scale of 1 to 5, where 1 denotes a strong disagreement and 5 denotes a strong agreement:

1- Strongly disagree; 2 – Disagree; 3 –Neutral; 4- Agree; 5- Strongly agree

| No. | Questionnaires | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|---|
| a. | The profitability of a renewable energy company is significantly influenced by the incomes from carbon credits. | | | | | |
| b. | As the sales of carbon credits increase, the profitability tends to increase. | | | | | |
| c. | Companies that have access to carbon credits generally exhibit superior profitability. | | | | | |
| d. | When making financial decisions, renewable energy companies consider carbon credits as a crucial factor. | | | | | |
| e. | The carbon credits are an important consideration for renewable | | | | | |

| | | | | | | |
|----|--|--|--|--|--|--|
| | energy companies when making financial decisions. | | | | | |
| f. | The carbon credits income significantly impacts the overall profitability of a renewable energy company. | | | | | |
| | | | | | | |

SECTION C: ISSUANCE AND TRANSACTIONAL COSTS

9. Kindly rate each statement using a scale of 1 to 5, where 1 denotes a strong disagreement and 5 denotes a strong agreement:

1- Strongly disagree; 2 – Disagree; 3 –Neutral; 4- Agree; 5- Strongly agree

| No. | Questionnaires | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| a. | Do you think there is correlation between the incurred credit issuance and transactional and the overall profitability of carbon finance projects. | | | | | |
| b. | Incurred Credit issuance and transactional costs influence long-term profitability. | | | | | |
| c. | Costs incurred in issuing and transacting credits play part in enhancing a project's profitability | | | | | |
| d. | There are direct and indirect financial benefits observed by companies that optimize the process of issuance and transactions of credits | | | | | |
| e. | Operational efficiency savings associated with credit issuance | | | | | |

| | | | | | | |
|----|--|--|--|--|--|--|
| | and transactional costs affect a project's net profit. | | | | | |
| f. | Government subsidies for credit issuance and transactional costs enhance the profitability of carbon finance projects. | | | | | |

SECTION D: INITIAL PROJECT COSTS

10. Kindly rate each statement using a scale of 1 to 5, where 1 denotes a strong disagreement and 5 denotes a strong agreement:

1- Strongly disagree; 2 – Disagree; 3 –Neutral; 4- Agree; 5- Strongly agree

| No. | Questionnaires | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| a. | Initial capital expenditures (CAPEX) impact the long-term profitability of carbon finance projects | | | | | |
| b. | There is a relationship between operational expenditures (OPEX) and the net profit margins of carbon financing projects. | | | | | |
| c. | Project development and permitting costs influence the financial viability of carbon financing projects. | | | | | |
| d. | Financing costs (e.g., interest on loans, carbon credits) affect the profitability of carbon financing projects. | | | | | |
| e. | Project cost overruns impact the expected profitability of carbon financing projects. | | | | | |
| f. | Cost management is important in enhancing the profitability of carbon financing projects. | | | | | |

SECTION E: TAX INCENTIVES

11. Kindly rate each statement using a scale of 1 to 5, where 1 denotes a strong disagreement while 5 denotes a strong agreement:

1- Strongly disagree; 2- Disagree; 3 –Neutral; 4- Agree; 5- Strongly agree

| No. | Questionnaires | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| a. | Renewable energy firms that are compliant are more likely to attract tax incentives. | | | | | |
| b. | Tax incentives received from the government positively affects the profitability of our company. | | | | | |
| c. | Renewable Energy firms that fail to leverage on tax incentives are at a higher risk of financial losses. | | | | | |
| d. | Carbon financing investors actively monitor and assess the regulatory compliance of the renewable energy firms in their portfolio for purposes of enjoying tax incentives. | | | | | |
| e. | Renewable energy firms should regularly conduct compliance audits to ensure observance of relevant laws to qualify for tax incentives. | | | | | |
| f. | The government plays a crucial role in setting and enforcing regulations that impact the renewable energy sector more specifically around tax incentives. | | | | | |

10. What was the company's Return on investment for every year end in the past five years?

| Ksh | 2019 | 2020 | 2021 | 2022 | 2023 |
|-------------------------------|------|------|------|------|------|
| Less than 1,000,000 | | | | | |
| Between 1,000,001-5,000,000 | | | | | |
| Between 5,000,001-10,000,000 | | | | | |
| Between 10,000,001-15,000,000 | | | | | |
| Over 15,000,000 | | | | | |

10. What is the company's total assets?

| Ksh | Total Assets |
|---------------------------------|--------------|
| Less than 10,000,000 | |
| Between 10,000,001-50,000,000 | |
| Between 50,000,001-100,000,000 | |
| Between 100,000,001-150,000,000 | |
| Over 150,000,000 | |

SECTION F: OPEN-ENDED QUESTIONNAIRES

12. Have you considered seeking carbon financing for your renewable energy firm?

a) Yes, actively exploring funding options.

b) Yes, but still evaluating the benefits and drawbacks

c) No, we are self-funded and not interested in external funding.

d) No, we are exploring other credit issuance and transactional costs.

13. What do you consider the most critical factor when evaluating carbon financing investors?

e) Experience and track record in the renewable energy industry.

f) Willingness to provide mentorship and strategic guidance.

g) Speed and efficiency in the funding process.

h) The level of control and ownership they expect in return.

i) Other (please specify)

END: THANK YOU AND GOD BLESS YOU FOR YOUR RESPONSE.

Appendix III: Renewable Energy Firms In Kenya

| | | | |
|----|--|----|----------------------------------|
| 1 | Agsol | 26 | Mwangaza Light |
| 2 | ARIYA Finergy Holdings | 27 | Mwezi Solar |
| 3 | ASD(African Solar Design) | 28 | Norken International Ltd |
| 4 | Azuri Technologies | 29 | Omni Voltaic |
| 5 | BBOXX Capital Kenya | 30 | ORB Energy |
| 6 | BioLite Holdings Kenya Ltd | 31 | Flexi Biogas Solutions |
| 7 | BIONET | 32 | Powerpoint Systems (EA) LTD |
| 8 | Blue Sea Energy LTD | 33 | Premier Solar |
| 9 | BRENNERT Investment Ltd. | 34 | RIWIK East Africa Ltd |
| 10 | Byester International LTD The Green Diamond | 35 | Takamoto Biogas |
| 11 | Center for Alternative Technologies | 36 | Sunking Solar |
| 12 | Chloride Exide | 37 | Solagen Power |
| 13 | D.light | 38 | Solar Now Services(K) Ltd |
| 14 | Daima Energy Services Ltd | 39 | Solar Panda |
| 15 | Davis & Shirliff | 40 | Solilibrium |
| 16 | Deebabits Green Energy | 41 | Sollatek Electronics (Kenya) Ltd |
| 17 | East Africa Energy Analytics | 42 | SOWITEC Kenya Ltd |
| 18 | EcoCare International | 43 | SISTEMA Bio |
| 19 | EED Advisory | 44 | Steelstone Kenya Ltd. |

| | | | |
|----|---------------------------|----|-----------------------------------|
| 20 | ENGIE Energy Access Kenya | 45 | Strathmore Energy Research Centre |
| 21 | Flexi Biogas Solutions | 46 | Powerhive |
| 22 | Generic Energy Ltd | 47 | SunCulture |
| 23 | Greenlight Planet | 48 | Suntech Power Ltd |
| 24 | Homebiogas | 49 | SunTransfer |
| 25 | KENGEN | 50 | Technical Engineering Service Ltd |

Source: KERA Directory (2024),

Appendix IV: Validity Test

| KMO and Bartlett's Test | | |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .895 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 320.269 |
| | df | 15 |
| | Sig. | .000 |

| Total Variance Explained | | | | | | |
|---------------------------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4.836 | 80.605 | 80.605 | 4.836 | 80.605 | 80.605 |
| 2 | .592 | 9.865 | 90.471 | | | |
| 3 | .227 | 3.790 | 94.261 | | | |
| 4 | .125 | 2.086 | 96.347 | | | |
| 5 | .119 | 1.989 | 98.336 | | | |
| 6 | .100 | 1.664 | 100.000 | | | |

Method of Extraction: Principal Component Analysis (PCA).

| Component Matrix^a | |
|-------------------------------------|-----------|
| | Component |
| | |

| | |
|----------------------------|------|
| | 1 |
| CC1 | .910 |
| CC2 | .920 |
| CC3 | .947 |
| CC4 | .948 |
| CC5 | .916 |
| CC6 | .726 |
| Method of Extraction: PCA | |
| a. 1 components extracted. | |

| | | |
|--|--------------------|---------|
| KMO and Bartlett's Test | | |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .778 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 226.017 |
| | df | 15 |
| | Sig. | .000 |

| | | | | | | |
|---------------------------------|---------------------|---------------|----------|-------------------------------------|---------------|--------------|
| Total Variance Explained | | | | | | |
| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | | | Cumulati | | | |
| Component | Total | % of Variance | ve % | Total | % of Variance | Cumulative % |
| 1 | 4.111 | 68.514 | 68.514 | 4.111 | 68.514 | 68.514 |
| 2 | .695 | 11.578 | 80.093 | | | |

| | | | | | | |
|---------------------------|------|-------|---------|--|--|--|
| 3 | .522 | 8.708 | 88.801 | | | |
| 4 | .437 | 7.286 | 96.087 | | | |
| 5 | .166 | 2.758 | 98.845 | | | |
| 6 | .069 | 1.155 | 100.000 | | | |
| Method of Extraction: PCA | | | | | | |

| Component Matrix^a | | |
|--|--------------------|---------|
| | Component | |
| | 1 | |
| CITS1 | .769 | |
| CITS2 | .779 | |
| CITS3 | .888 | |
| CITS4 | .732 | |
| CITS5 | .940 | |
| CITS6 | .839 | |
| Method of Extraction: PCA | | |
| a. 1 components extracted. | | |
| KMO and Bartlett's Test | | |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | .892 | |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 348.463 |
| | df | 15 |
| | Sig. | .000 |

| Total Variance Explained | | | | | | |
|---------------------------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4.992 | 83.201 | 83.201 | 4.992 | 83.201 | 83.201 |
| 2 | .461 | 7.678 | 90.880 | | | |
| 3 | .214 | 3.571 | 94.451 | | | |
| 4 | .163 | 2.717 | 97.168 | | | |
| 5 | .111 | 1.843 | 99.011 | | | |
| 6 | .059 | .989 | 100.000 | | | |
| Method of Extraction: PCA | | | | | | |

| Component Matrix^a | |
|-------------------------------------|-----------|
| | Component |
| | 1 |
| PC1 | .916 |
| PC2 | .940 |
| PC3 | .949 |
| PC4 | .937 |
| PC5 | .873 |
| PC6 | .853 |
| Method of Extraction: PCA | |
| a. 1 components extracted. | |

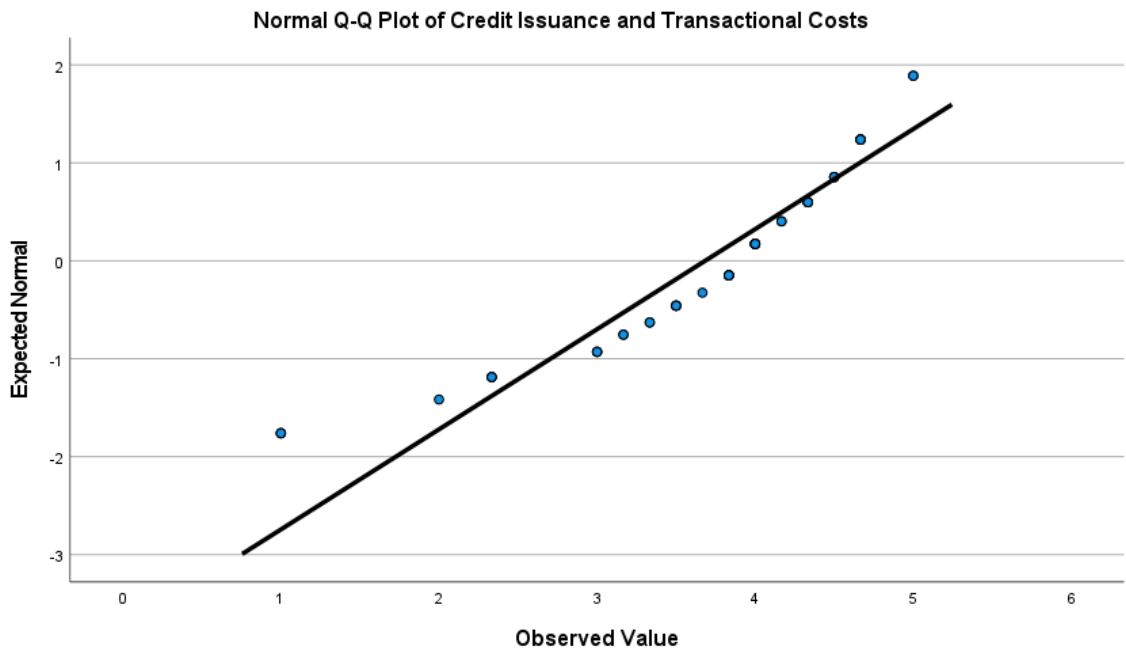
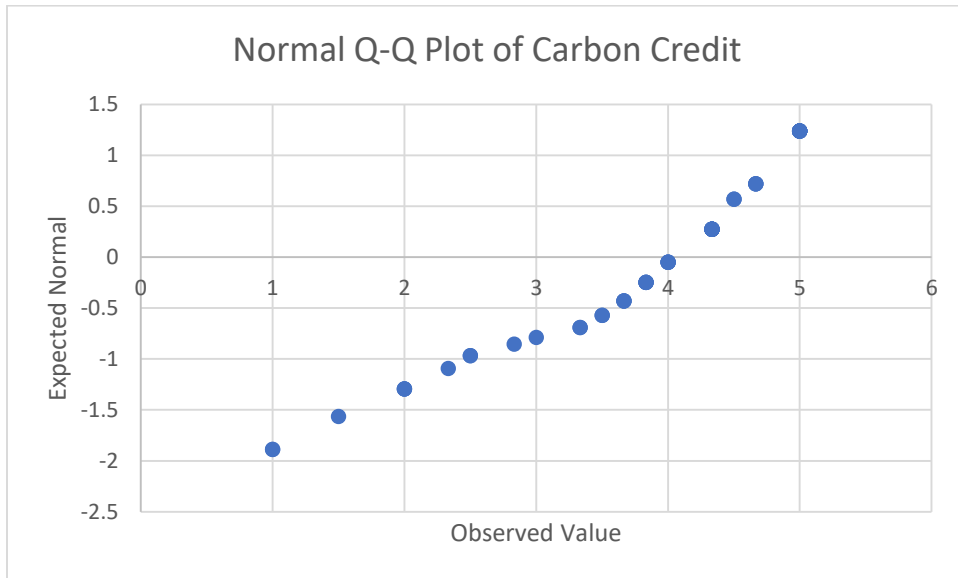
| KMO and Bartlett's Test | | |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .810 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 367.886 |
| | Df | 15 |
| | Sig. | .000 |

| Total Variance Explained | | | | | | |
|---------------------------------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4.940 | 82.342 | 82.342 | 4.940 | 82.342 | 82.342 |
| 2 | .525 | 8.750 | 91.092 | | | |
| 3 | .244 | 4.073 | 95.165 | | | |
| 4 | .174 | 2.905 | 98.070 | | | |
| 5 | .073 | 1.212 | 99.282 | | | |
| 6 | .043 | .718 | 100.000 | | | |
| Method of Extraction: PCA | | | | | | |

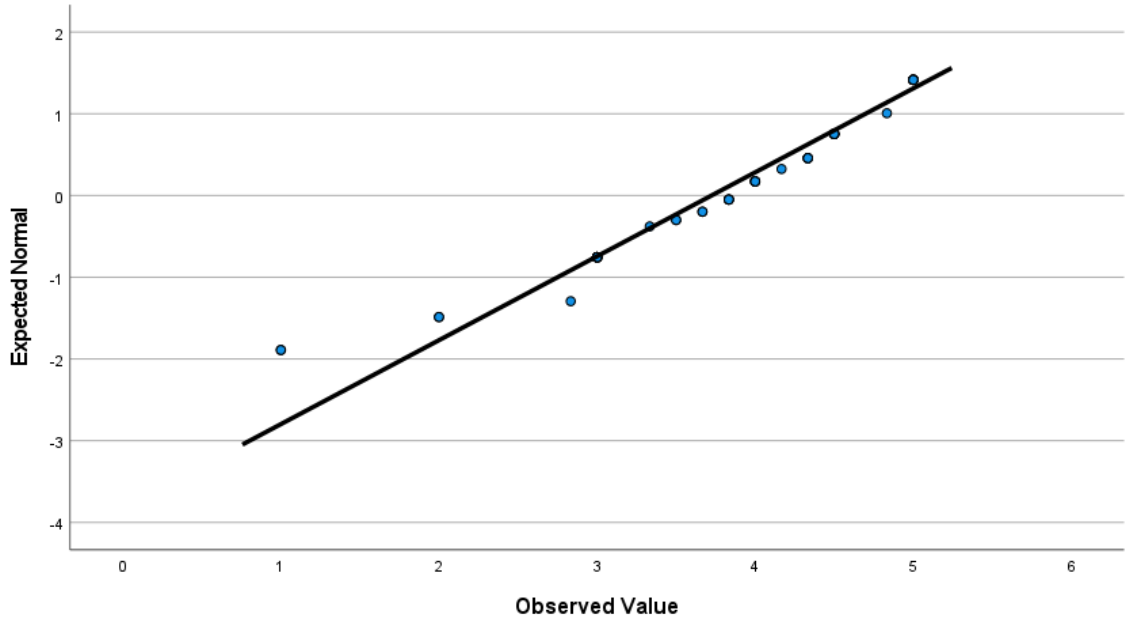
| Component Matrix^a | |
|-------------------------------------|-----------|
| | Component |
| | 1 |
| CA1 | .898 |

| | |
|----------------------------|------|
| CA2 | .841 |
| CA3 | .939 |
| CA4 | .917 |
| CA5 | .909 |
| CA6 | .938 |
| Method of Extraction: PCA | |
| a. 1 components extracted. | |

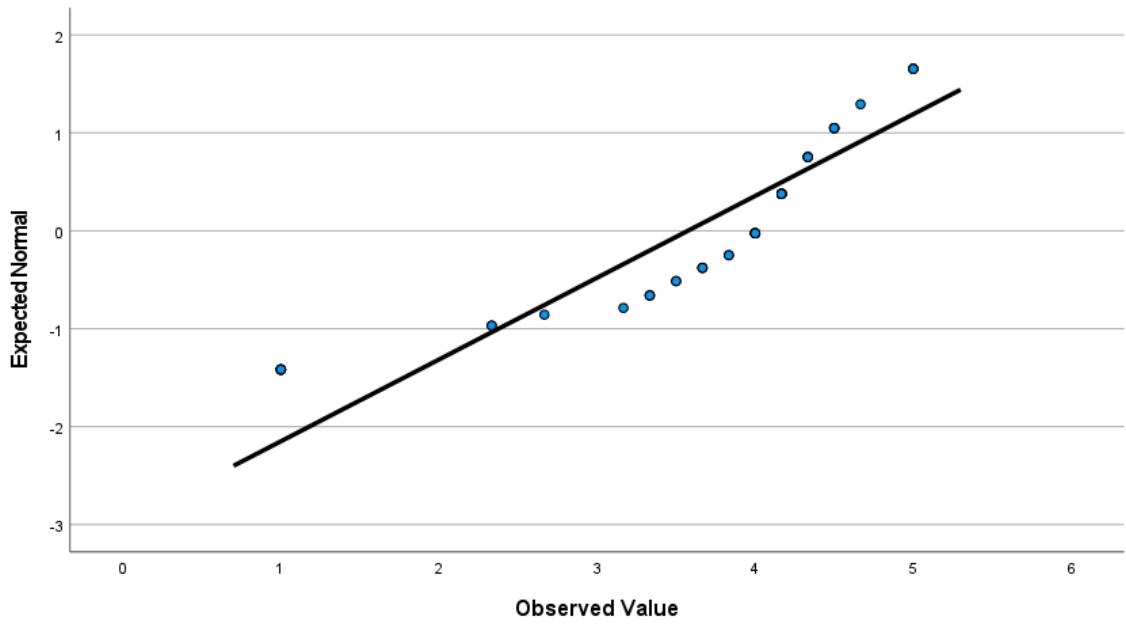
Appendix V: NORMALITY Q-Q PLOT



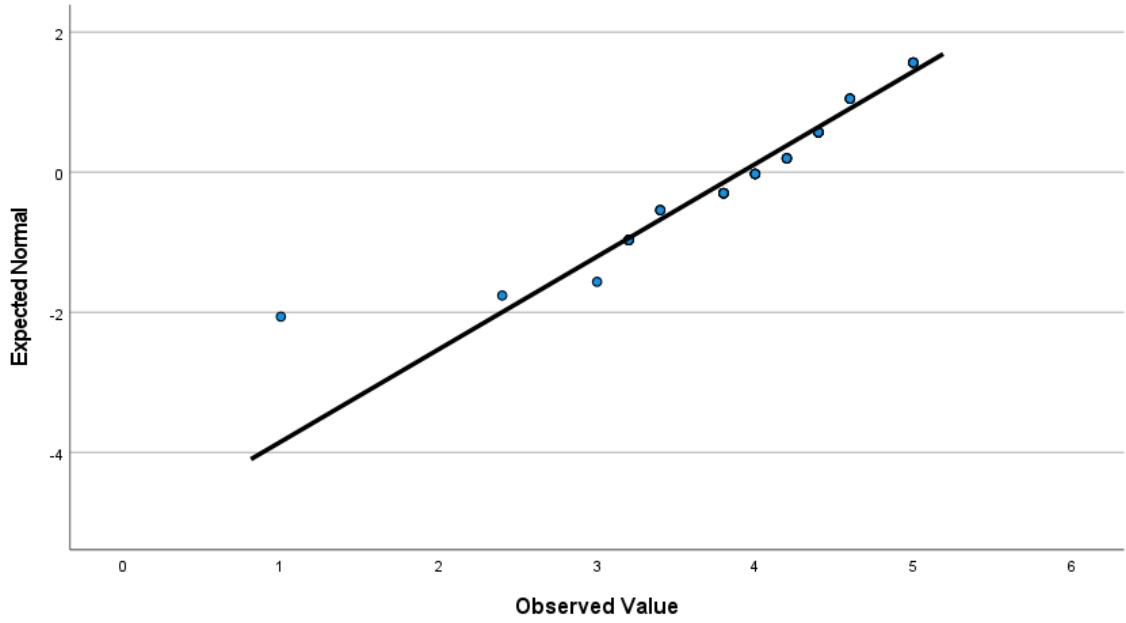
Normal Q-Q Plot of Projects Costs



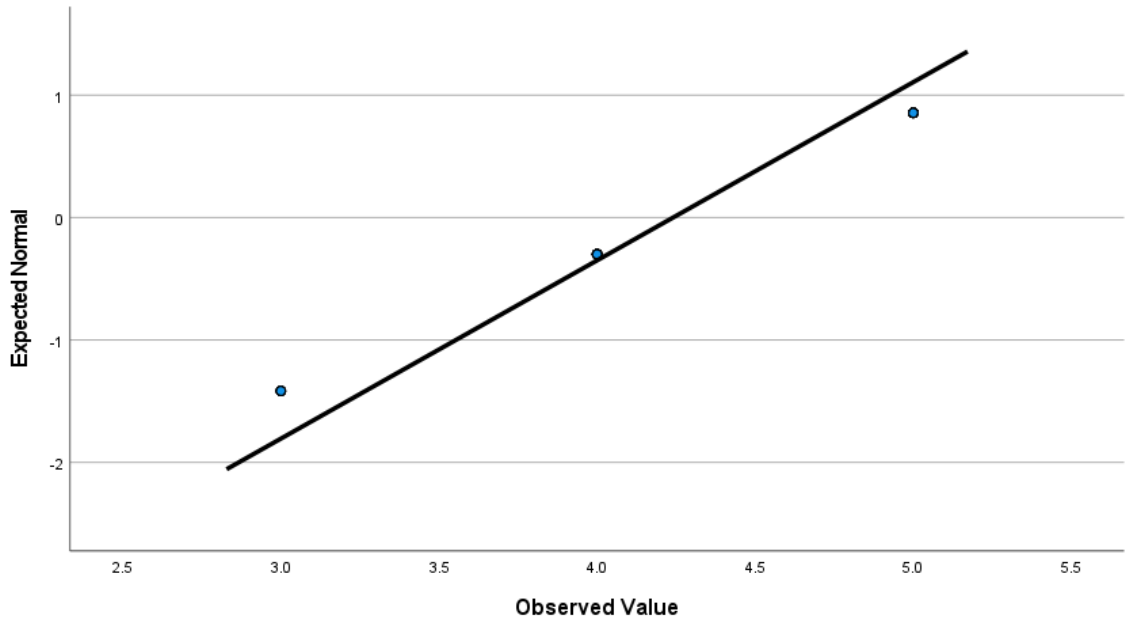
Normal Q-Q Plot of Tax Incentives



Normal Q-Q Plot of Profitability



Normal Q-Q Plot of Firm Size



Appendix VI: Research Authorization Letter

OFFICE OF THE EXECUTIVE DEAN GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke P.O. Box 43844, 00100
Website: www.ku.ac.ke NAIROBI, KENYA
Tel. 020-8704150

Our Ref: D58/CTY/PT/21557/2021 DATE: 21st January 2025

Director General,
National Commission for Science, Technology and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

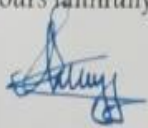
RE: RESEARCH AUTHORIZATION FOR MR. WAINAINA KARIETHI SAMUEL
REG. NO. D58/CTY/PT/21557/2021

I write to introduce Mr. Wainaina Kariethi Samuel who is a Postgraduate Student of this University. He is registered for M.sc degree programme in the Department of Accounting and Finance.

Mr. Wainaina Kariethi Samuel intends to conduct research for a M.sc. Thesis Proposal entitled, "*Carbon Financing and Profitability of Renewable Energy Firms Registered Under the Energy and Petroleum Regulatory Authority, Kenya*".


Any assistance given will be highly appreciated.

Yours faithfully,




F PROF. ELIUD N.M.NJAGI
EXECUTIVE DEAN, GRADUATE SCHOOL

Appendix VII: Research Permit NACOSTI


REPUBLIC OF KENYA

RefNo: 440851

RESEARCH LICENSE



Date of Issue: 10/February/2025

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION


This is to Certify that Mr.. Samuel Kareithi Wainaina of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: CARBON FINANCING AND PROFITABILITY OF RENEWABLE ENERGY FIRMS REGISTERED UNDER THE ENERGY AND PETROLEUM REGULATORY AUTHORITY, KENYA for the period ending : 10/February/2026.

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Director General
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