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POLICY FRAMEWORK AND ECONOMIC VIABILITY OF VOLUNTARY CARBON CREDIT MARKETS IN KENYA

BY

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DECLARATION

I, the undersigned, declare that this thesis is my original work and that it has not been presented in any other university or institution for academic credit.

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ACRONYMS

ASEAN	Association of Southeast Asian Nations
BDO	Binder Dijker Otte
EU	European Union
GDP	Gross Domestic Product
GIS	Geographic Information System
KFS	Kenya Forest Service
MRV	Monitoring, Reporting And Verification
NACOSTI	National Commission for Science, Technology and Innovation
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organization
RBV	Resource-Based View
SMEs	Small and Medium-Sized Enterprises
SPSS	Statistical Package for Social Sciences
TEC/ TEC	Theory of Transaction Cost Economics
UNCTAD	United Nations Conference on Trade and Development
VCS	Verified Carbon Standard
VRIN	Valuable, Rare, Imperfectly Imitable, Non-Substitutable

OPERATIONAL DEFINITIONS OF TERMS

Benefit-Sharing Mechanisms: The formal and informal mechanisms through which revenues are distributed to project developers, implementing organizations and participating communities (Healy *et al*., 2023). In this research study these are measured in terms of percentages of revenues allocated, community development agreements and payment transparency (Government of Kenya, 2024).

Carbon Credits: Certificates of one metric tonne of carbon dioxide equivalent of carbon dioxide that has been removed or sequestered in the atmosphere by eligible project activities in the agriculture and forestry sectors of Kenya and which are traded on voluntary carbon markets under internationally recognized standards such as the Verified Carbon Standard and the Gold Standard (Government of Kenya, 2024).

Economic Viability: Economic viability is the term used to describe the capability of participation in the voluntary carbon credit market to generate net positive financial returns to the smallholder farmers and forestry enterprises (UNCTAD, 2024), which in this research is operationalized in three quantifiable dimensions, namely, market participation rates, revenues generated through the sale of carbon credits, and transaction costs incurred by the stakeholders in the process of project registration and verification.

Enforcement Mechanisms: Refers to the mechanisms, procedures and instruments by which compliance with carbon market regulations is monitored and enforced (Li and Zhang, 2024), which in this study are measured by monitoring systems, compliance verification procedures by accredited auditors and penalty enforcement provisions under the Climate Change Carbon Markets Regulations 2024 (Government of Kenya, 2024).

Institutional Capacity: The organizational resources, technical expertise, staffing levels, and processing efficiency of regulatory bodies and implementing

institutions that regulate voluntary carbon credit markets (Shames *et al*., 2016), which in Kenya are the National Environment Management Authority, the Climate Change Directorate and multi-sectoral technical committees.

Market Participation: Refers to the smallholder farmers and forestry enterprises that are registered in voluntary carbon credit projects in the National Carbon Registry in Kenya and are actively participating in the carbon market based on the current policy framework conditions (Lee, 2017; Government of Kenya, 2024).

Policy Framework: The overall collection of regulatory tools, institutional structures, benefit-sharing provisions and enforcement mechanisms that regulate voluntary carbon credit markets in Kenya (North, 1990), which are mainly provided by the Climate Change Act 2016 as amended in 2023 and the Climate Change Carbon Markets Regulations 2024 (Government of Kenya, 2024).

Regulatory Frameworks: The official rules, guidelines, registration and approval procedures established by the Government of Kenya to control the operations of the voluntary carbon credit market (Manarte, 2022), quantified in this study by regulatory clarity, standardized application procedures and effectiveness of approval processes administered by the Designated National Authority (Government of Kenya, 2024).

Voluntary Carbon Markets: Market-based schemes whereby organizations and individuals can voluntarily buy carbon credits to cover their greenhouse gas emissions not covered by mandatory compliance schemes (UNDP, 2025), allowing project developers and community members in the agriculture and forestry sectors in Kenya to create and sell verified carbon emissions reductions to international and domestic purchasers.

ABSTRACT

Kenya's agriculture and forestry sectors presented significant opportunities for climate change mitigation and rural income generation through voluntary carbon credit markets. However, these markets lacked demonstrated economic viability for smallholder farmers and forestry enterprises, as average carbon prices remained far below the threshold required for land-based projects to generate positive financial returns. The overall objective of the study was to examine the influence of policy framework on the economic viability of voluntary carbon credit markets in Kenya. The specific objectives were to examine the influence of regulatory frameworks, assess the influence of benefit-sharing mechanisms, determine the influence of institutional capacity, and evaluate the influence of enforcement mechanisms on the economic viability of voluntary carbon credit markets in Kenya. The study was anchored on four theories: institutional theory, policy implementation theory, transaction cost economics, and the resource-based view. A pragmatist research philosophy guided the study. A cross-sectional mixed-methods research design was adopted, combining quantitative and qualitative approaches. Structured questionnaires were administered to 361 smallholder farmers and forestry enterprises across four agroecological regions, Western, Eastern, Central, and Coastal Kenya, selected through stratified random sampling. Semi-structured key informant interviews were conducted with 25 regulatory authorities, carbon project developers, and market intermediaries selected through purposive sampling. Data were analysed using descriptive statistics, Pearson correlation analysis, and ordinary least squares regression analysis. Diagnostic tests confirmed that the assumptions of normality, multicollinearity, and homoscedasticity were satisfied prior to regression estimation. The study found that regulatory frameworks had a significant positive influence on economic viability ($r = 0.681$, $\beta = 0.174$, $p = 0.000$). Benefit-sharing mechanisms had a significant positive influence on economic viability ($r = 0.617$, $\beta = 0.090$, $p = 0.000$). Institutional capacity was the strongest predictor of economic viability ($r = 0.727$, $\beta = 0.224$, $p = 0.000$). Enforcement mechanisms had a significant positive influence on economic viability ($r = 0.589$, $\beta = 0.063$, $p = 0.021$). The four policy framework dimensions jointly explained 64.1 percent of the variance in economic viability ($R^2 = 0.641$, $F(4, 356) = 158.891$, $p = 0.000$). Qualitative findings from key informant interviews confirmed and contextualised these quantitative results across all four dimensions. The study concluded that the climate change carbon markets regulations 2024 constituted a significant positive determinant of economic viability for voluntary carbon credit market participants in Kenya. The study recommended that the Government of Kenya prioritise institutional capacity building, strengthen benefit-sharing equity provisions, enhance regulatory communication, and improve enforcement consistency across the four agroecological study regions to maximise the economic viability of voluntary carbon credit markets as mechanisms for rural income generation, climate mitigation, and sustainable development in Kenya.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Background to the Study

Voluntary carbon credit markets became an important tool of climate change mitigation and rural income generation globally. Their economic success was greatly due to a strong policy environment. Countries with robust regulatory frameworks, equitable benefit-sharing arrangements, robust institutional capacity and effective enforcement had significantly higher economic viability of carbon markets, while countries with fragmented or nonexistent regulatory frameworks had lower economic viability of carbon markets (North, 1990; UNCTAD, 2024). In October 2023, the European Union (EU) implemented the Carbon Border Adjustment Mechanism (CBAM) (Regulation (EU) 2023/956). This set up standardised carbon pricing obligations and reporting procedures to avoid carbon leakage and enhance market integrity (European Parliament, 2023). The Climate Change Authority (CCA) has also undertaken a Review of the Carbon Credits Act 2011 (CCA Review 2023) for Australia in 2023. It found that market participants such as project investors and credit buyers need to be provided with adequate information to enable them to have confidence in the integrity of the credits. A lack of integrity mechanisms was identified as a driver of loss of investor confidence (Climate Change Authority, 2023).

Low performance of voluntary carbon markets at the regional level was due to low governance and poor institutional coordination in Africa. Barriers to African carbon markets ranged from high complexity in navigating carbon finance mechanisms, policy and regulatory gaps, weak institutional capacity, fragmented donor support, and lack of tailored market infrastructure (VCMI, 2024). Smallholders were unable to engage in meaningful and equitable participation due to these barriers. Geopolitical and governance issues also posed challenges for implementation, as communities were unable to access carbon revenues (Pagop and Savard, 2024). In Kenya, the country has emerged as the second largest carbon credit issuer in Africa in 2022 with 11 million credits. However, in 2023, the total amount of external financial flows in the country was 136 million dollars, which is only 3 percent of the total external financial flows (Atwood, 2024; Allied Offsets, 2025). The launch of the Climate Change Carbon Markets Regulations 2024 was a key

policy step. This led to the need to evaluate empirically the effectiveness of this framework in improving the economic viability of smallholder farmers and forestry enterprises in Kenya (Government of Kenya, 2024).

1.1.1 Policy Framework

Policy frameworks included the regulatory instruments, institutional structures, benefit-sharing mechanisms, and enforcement mechanisms that regulate voluntary carbon credit markets. The policy frameworks in countries with well-established policy frameworks had a significant impact on carbon market outcomes. They provided clarity, institutional capacity, benefit sharing mechanisms and effective enforcement mechanisms (North, 1990). The European Union (EU) has launched the Carbon Border Adjustment Mechanism (CBAM) in October 2023 with Regulation (EU) 2023/956 of the European Parliament and of the Council. This set a precedent for importers of carbon-intensive products and created a structured carbon pricing mechanism that will bring regulatory clarity and level playing field for market participants (European Parliament, 2023). The Climate Change Authority (CCA) has reviewed the Carbon Credits Act 2011 and recommended the scheme be continually improved to maintain its integrity in 2023. This involved transparent approaches, new baselines and improved governance to establish market confidence and investor trust (Climate Change Authority, 2023). The Climate Change Amendment Act was enacted in Kenya in 2023. In 2024, it published the Climate Change Carbon Markets Regulations, which offer a comprehensive policy framework for carbon project registration, benefit-sharing, and institutional oversight (Ernst & Young, 2024).

The main policy tool that regulated the voluntary carbon credit markets in Kenya was the Climate Change Carbon Markets Regulations 2024. The regulatory framework offered regulatory clarity through the setting of eligibility criteria for projects and standardised registration requirements through application processes which are reviewed by the Designated National Authority (Government of Kenya, 2024). Previously there was a legal vacuum and no guidelines for carbon markets. This put the participants at a disadvantage of uncertainty and exploitation (British Institute of International and Comparative Law, 2024). The benefit sharing provisions were: 40 per cent of the net earnings from land-based projects would be applied to community development and 25 per cent of the net earnings

from non-land-based projects would be applied to community development. These were formalised via Community Development Agreements which set out percentages of revenue to be paid and improved payment transparency (Ernst & Young, 2024). The framework also strengthened institutional capacity by facilitating coordination among stakeholders through the National Environment Management Authority (NEMA) and with the assistance of multi-sectoral technical committees and the Climate Change Directorate (CCD) to offer technical guidance (Oraro & Company Advocates, 2024).

1.1.2 Economic Viability of Voluntary Carbon Credit Markets

Economic viability of voluntary carbon credit markets is defined as the ability to make a positive net financial gain from participating in the market. In the study was operationalised in terms of market participation rates, revenue generation and transaction costs. Economic viability was constrained in all four dimensions of policy frameworks in African countries by major challenges. During 2020-2023, only 2 per cent of the land-based mitigation potential was realised in least developed countries. This was due to regulatory uncertainty, lack of institutional capacity, weak enforcement, and unfair benefit-sharing agreements (UNCTAD, 2024). Average carbon prices of around $10 per tonne were still well short of the $100 per tonne needed for land-based projects to be profitable. This suggested that the system was not functioning to create market conditions for proper pricing and to minimize transaction costs (Allied Offsets, 2025). In 2023, the least developed countries have received $403 million from voluntary carbon markets. This accounted for 1 per cent of bilateral development assistance, and was a reflection of basic economic viability constraints, due to poor policy settings (UNCTAD, 2024).

Kenya was very active in the voluntary carbon market, and in 2022 was the second largest issuer in Africa with 11 million credits (Atwood, 2024). The Kenya Agricultural Carbon Project helped 30,000 smallholder farmers to adopt sustainable farming practices and earn carbon credit income (World Bank BioCarbon Fund, 2024; Vi Agroforestry, 2025). The Farm Africa agroforestry project in Embu and Tharaka Nithi counties enabled 21,500 farmers to generate income. 80% of that income was directly to participants and emissions were reduced by 24,945 tonnes of carbon dioxide equivalent (Farm Africa, 2025). In 2023, however, Kenya received only 3 per cent ($136 million) of its external financial flows from

voluntary carbon markets. This indicated that the overall economic viability was still low, but there were some project successes (Allied Offsets, 2025). This structural disconnection led to important questions about the effectiveness of the policy framework elements in facilitating large-scale market participation, sufficient income generation and lower transaction costs for smallholder farmers and forestry enterprises.

Although Kenya has made strides in regulation, there was no empirical evidence to demonstrate the effectiveness of the regulatory frameworks in place to promote the economic viability of voluntary carbon credit markets. This study was an independent variable with four components: the policy framework. Regulatory frameworks were assessed for regulatory clarity and registration requirements and procedures. Revenue allocation percentages and community development agreements and payment transparency were used to evaluate benefit-sharing mechanisms. The institutional capacity was evaluated on the basis of the competency of the staff, technical expertise and processing efficiency. Monitoring systems, compliance verification procedures, and penalty enforcement were used to measure enforcement mechanisms (Government of Kenya, 2024). Evidence-based understanding of the components that drove economic viability was used to target policy optimisation for Kenya's voluntary carbon credit markets.

1.2 Statement of the Problem

There was no evidence of economic viability of voluntary carbon credit markets for smallholder farmers and forestry businesses in Kenya. This is despite Kenya being the second largest carbon credit issuer in Africa in 2022 with 11 million carbon credits (Atwood, 2024). Kenya's external financial flows in 2023 were 3 per cent from the voluntary carbon market. This was around $136 million, and was a very low level of revenue generation in comparison to the mitigation potential of the country (Allied Offsets, 2025). The average price of carbon credits in 2023 is $6.53 per tonne (Procton, 2024). This was well below the $100 per tonne that is needed for land-based projects to be profitable. The total number of voluntary carbon market transactions declined by 56 per cent between 2022 and 2023. The total market value decreased to $723 million during the same period (Procton, 2024). This price difference resulted in negative net returns, in which project

costs were higher than revenues. As a result, just 2% of the land-based mitigation potential was achieved in developing countries (UNCTAD, 2024).

Smallholder farmers were confronted with many problems that jeopardized economic viability. These included high transaction costs, technical know-how, and land tenure insecurity (Lee, 2017; Fonacier and Nordbotten, 2024). There was also a lack of financial resources and carbon prices, which made it difficult to generate revenue (Lee, 2017). Smallholder farmers were necessarily high transaction cost farmers. Low carbon revenue per farmer was achieved with small individual land parcels. Market participation was hindered by the set-up costs for soil sampling, data systems, validation and monitoring, reporting and verification. Only 38% of Kenya's carbon projects were able to go through validation processes (Odhiambo, 2025). Many failed to take off because of methodological requirements, high transaction costs and limited technical capacity (Odhiambo, 2025). In Kenya, large international project developers were able to capture about 70 per cent of the carbon market value (Odhiambo, 2025). This resulted in community-based initiatives being marginalised and not able to generate sufficient revenues. Before the 2024 Regulations, there was a legal loophole that allowed for exploitation and unfair sharing agreements (British Institute of International and Comparative Law, 2024; Hengeveld, 2023). The new Regulations mandated that land-based projects spend 40 per cent of their profits on community development (Ernst & Young, 2024). In the case of non-land based projects, 25 percent had to be allocated (Ernst & Young, 2024). But the empirical evidence of the effects of these provisions on market participation rates, revenue generation and transaction costs was not yet available.

In 2023, the Agriculture, Forestry and Fishing sector grew by 6.5 per cent. This highlighted the economic potential and revenues from the carbon market in the sector (Kenya National Bureau of Statistics, 2024). The Kenya Agricultural Carbon Project (KACP) assisted 30,000 smallholder farmers to boost their crop yields by 20 percent (World Bank BioCarbon Fund, 2024; Vi Agroforestry, 2025). Through the agroforestry project of Farm Africa, 21,500 farmers in Embu and Tharaka Nithi counties were able to generate income from carbon credits. 80% of this income was directly to participants (Farm Africa, 2025). But these projects were heavily dependent on external funding, donor technical assistance and institutional partnerships. This was not available for the smallholder farmers who work

individually. This posed important issues of scalability and replicability in normal market conditions.

There were still major governance gaps in spite of the Climate Change Carbon Markets Regulations 2024. These gaps affected the implementation and financing opportunities for smallholder farmers and forestry enterprises (Kisiwa *et al*., 2025). A risk to equitable outcomes was resource inequities, low enforcement capacity and limited stakeholder capacity (Omukuti *et al*., 2024). Only less than 20 per cent of the carbon revenues were allocated to indigenous communities and smallholder farmers. This was despite the fact that they are the main stewards of carbon-sequestering ecosystems (Odhiambo, 2025). Further investigations also found that some of the high-profile forest projects in Kenya overstated emission reductions by over 50 percent (Odhiambo, 2025). This undermined the integrity of monitoring systems and compliance verification procedures. The Regulations of 2024 introduced benefit-sharing thresholds and introduced a National Carbon Registry (Government of Kenya, 2024). But the empirical verification of the effect of these provisions on the participation rates, revenues and transaction costs of smallholder farmers was not yet done. This was the main issue that was explored in this study.

1.3 Research Objectives

1.3.1 General Objective

To examine the influence of policy framework on the economic viability of voluntary carbon credit markets in Kenya.

1.3.2 Specific Objectives

1. To examine the influence of regulatory frameworks on the economic viability of voluntary carbon credit markets in Kenya.
2. To assess the influence of benefit-sharing mechanisms on the economic viability of voluntary carbon credit markets in Kenya.
3. To determine the influence of institutional capacity on the economic viability of voluntary carbon credit markets in Kenya.
4. To evaluate the influence of enforcement mechanisms on the economic viability of voluntary carbon credit markets in Kenya.

1.4 Hypotheses

1. H_{o1}: Regulatory frameworks do not significantly influence the economic viability of voluntary carbon credit markets in Kenya.
2. H_{o2}: Benefit-sharing mechanisms do not significantly influence the economic viability of voluntary carbon credit markets in Kenya.
3. H_{o3}: Institutional capacity does not significantly influence the economic viability of voluntary carbon credit markets in Kenya.
4. H_{o4}: Enforcement mechanisms do not significantly influence the economic viability of voluntary carbon credit markets in Kenya.

1.5 Significance ~~(Justification)~~ of the Study

This study generated empirical evidence on the influence of policy frameworks on the economic viability of voluntary carbon credit markets in Kenya. The findings were relevant to multiple stakeholders across different sectors, each of whom stood to benefit from the evidence produced. The significance of the study is discussed below according to each stakeholder group.

1.5.1 Smallholder Farmers and Forestry Enterprises

This study is expected to make significant contributions to smallholder farmers and forestry enterprises by identifying the specific barriers to market participation and recommending targeted interventions that will improve their economic returns from carbon credit engagement. The study will be empirical in nature, examining the enabling and constraining factors in the policy context for market participation and quantify the potential carbon credit revenues and project transaction costs for market participation that can be reduced by smallholder farmers in Western, Eastern, Central and Coastal Kenya. The findings will also help forestry companies to understand the impact the Climate Change Carbon Markets Regulations 2024 have on their operations, and what it means for their potential to continue or expand their involvement in voluntary carbon credit markets in Kenya.

1.5.2 Carbon Project Developers and Financial Institutions

Carbon project developers including Vi Agroforestry, Farm Africa, World Vision Kenya and GrowGrounds will benefit from an understanding of the specific policy framework factors that contribute to farmer participation and project success under Kenya's evolving regulatory environment. This information will help project developers to better integrate their projects into the framework of the Climate Change Carbon Markets Regulations 2024, which will increase approvals and lower development costs. Better understanding of economic viability and risk of Kenyan agriculture and forestry carbon projects will help financial institutions consider financing carbon projects. The research will also be a driver for climate action as it seeks to identify opportunities for scaling up the voluntary carbon market as a tool to meet Kenya's nationally determined contribution (NDC) goal of cutting greenhouse gas (GHG) emissions by 32 percent from business-as-usual levels by 2030.

1.5.3 Government and Policy Institutions

The study will also generate policy-relevant information at the policy level, which can be directly applied to the governance of the carbon market in Kenya at the policy level by relevant policy makers in the government. The Ministry of Environment, Climate Change and Forestry will gain empirical knowledge to enhance the Climate Change Carbon Markets Regulations 2024 to make it more effective and inclusive. The National Environment Management Authority will be learning about the strengths and weaknesses of the regulatory framework that will assist them in the development of good governance of carbon market activities. Western, Eastern, Central and Coastal County Governments will gain knowledge on ways to maximize benefits to communities from carbon projects within county boundaries. The Climate Change Directorate and multi-sectoral technical committees will get evidence of the institutional gaps that should be closed to enhance the efficiency of processing and regulation of the VCM.

1.5.4 International Development Partners

International development partners and climate finance institutions will benefit from transferable lessons on effective approaches to channelling resources towards voluntary carbon market development across Sub-Saharan Africa. The study will offer insights into which parts of a policy framework will bring about the most improvements of market

participation, revenue generation and transaction cost reduction, which can guide the development of more specific technical assistance and capacity-building projects by development partners in the governance of carbon markets in developing countries. The empirical evidence which can be used to inform the scaling up of voluntary carbon markets as a mechanism for climate financing will be useful to multilateral institutions, such as the United Nations Conference on Trade and Development and the United Nations Development Programme, which are already involved in supporting the carbon market development in least developed countries through their regional and global policy frameworks.

1.5.5 Academic and Research Community

The study makes a significant contribution to the scholarly literature by offering empirical evidence on the economic sustainability of voluntary carbon credit markets in the context of developing countries and the impact of policy frameworks. The synthesis of Institutional Theory, Policy Implementation Theory, Transaction Cost Economics and the Resource-Based View (RBV) helps to understand the theoretical aspects of the impact of formal regulatory environments on market participation and performance of smallholder farmers and forestry enterprises. The study also adds to the literature on carbon market governance in Africa, which is mostly qualitative and policy-oriented, by employing a mixed methods approach that offers more robust and context-specific evidence.

1.6 Scope of the Study

This study focused on the voluntary carbon credit markets in the agriculture and forestry sector in Kenya. It examined the impact of policy framework elements, regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms on economic viability. Market participation rates, revenue generation and transaction costs were used to measure economic viability. The study spanned the years 2020-2024. This period is important because it covers the period of the Climate Change Amendment Act 2023 and the subsequent Climate Change Carbon Markets Regulations 2024 (Government of Kenya, 2024). It thus captured the latest and policy-relevant stage of the development of Kenya's voluntary carbon market.

Geographically, the study included four areas where carbon credit projects were active and operational. These areas were intentionally chosen as they had existing projects with

known numbers of participants and market data. The Kenya Agricultural Carbon Project, which has been in operation since 2009, covered Kisumu, Siaya and Bungoma counties in western Kenya (Vi Agroforestry, 2025). The Farm Africa Acorn Agroforestry project, which started in 2020, covered Embu and Tharaka Nithi counties in Eastern Kenya (Farm Africa, 2025). Nyeri County was covered by Central Kenya under the GrowGrounds Syntropic Agroforestry Coffee Project. There were other active land-based carbon projects in the Coast region. These four regions were different agroecological zones, providing geographical diversity and cross-regional comparability of results. Other areas in Kenya were not included as they did not have any documented and operational voluntary carbon credit projects with known participant numbers during the study period.

1.7 Conceptual Framework

Figure 1 presents the interrelationship of the study variables. The independent variable is the policy framework, a compound variable of four factors (indicators or proxies) including regulatory frameworks, benefit-sharing mechanisms, institutional capacity, and enforcement mechanism. The dependent variable is voluntary carbon credit markets proxy by revenue generation

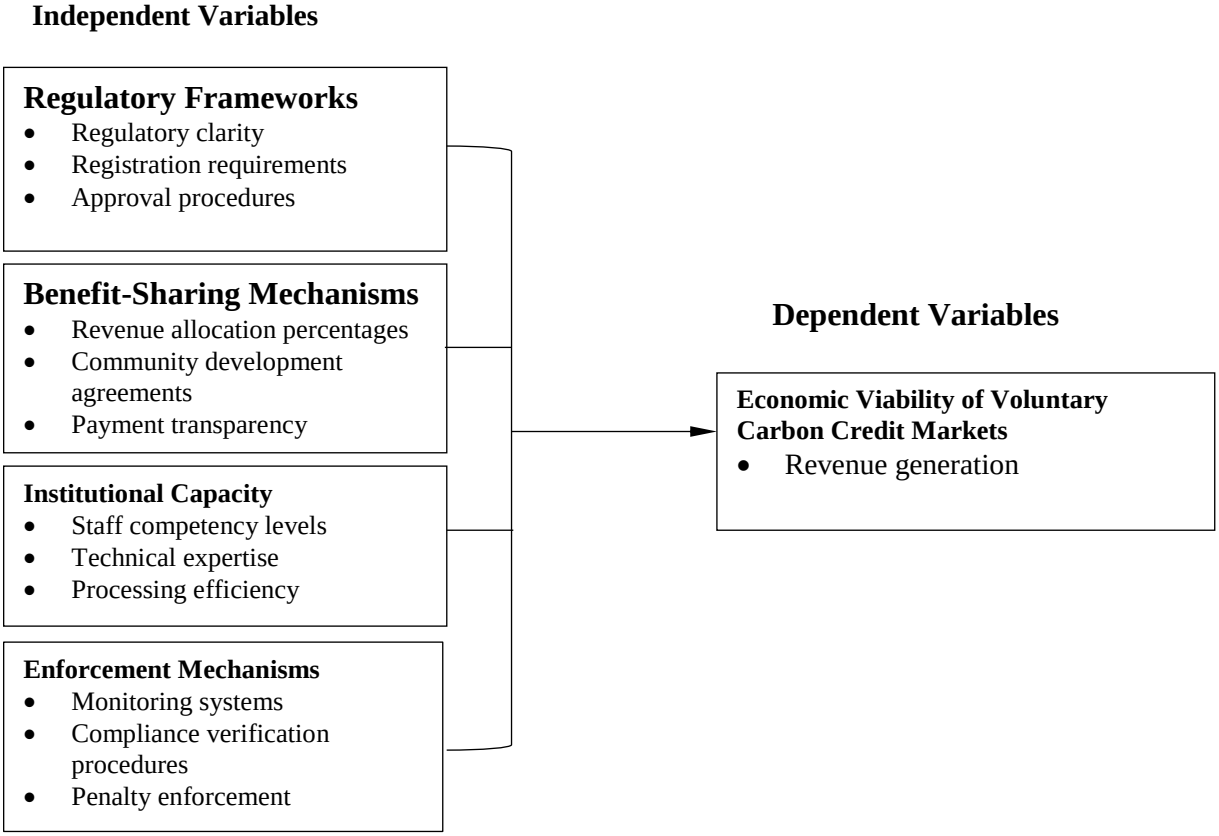


Figure 1: Conceptual Framework

1.7.1 Regulatory Frameworks

Regulatory frameworks referred to the official rules, guidelines, registration requirements, and approval procedures established by the Government of Kenya to govern the operations of the voluntary carbon credit market. In this study, regulatory frameworks were operationalised through three indicators: regulatory clarity, registration requirements, and approval procedures. Regulatory clarity referred to the extent to which the rules and guidelines for market participation were clearly communicated to smallholder farmers and forestry enterprises. Registration requirements referred to the standardised application procedures administered by the Designated National Authority under the climate change carbon markets regulations 2024. Approval procedures referred to the consistency, transparency, and timeliness of the project approval process under the same regulations (Manarte, 2022; Kisiwa *et al.*, 2025; Ernst and Young, 2024).

1.7.2 Benefit-Sharing Mechanisms

Benefit-sharing mechanisms were the formal and informal processes that were used to distribute the revenues from the sale of carbon credits among the project developers, implementing organisations and participating communities. Three indicators were used to measure benefit-sharing mechanisms for this study: percentage of revenue allocation, community development agreements and payment transparency. Revenue allocation percentages are calculated based on the minimum percentage that needs to be allocated to community development as per the climate change carbon markets regulations 2024 (40 percent for land-based projects and 25 percent for non-land-based projects). The formal contractual mechanisms that set out the terms for revenue sharing between project developers and communities were called community development agreements. Payment transparency was considered the openness and timeliness of payment records given to participants (Healy *et al*., 2023; Schilling, 2026; Kimani, 2025).

1.7.3 Institutional Capacity

Institutional capacity was considered as the organisational capacity, technical know-how, staffing and processing efficiency of the regulatory and implementing institutions of the

voluntary carbon credit markets in Kenya. Institutional capacity was assessed through three indicators: staff competency levels, technical expertise and processing efficiency for this study. Staff competency levels are related to the knowledge and skills of the staff of the National Environment Management Authority, the Climate Change Directorate and implementing organisations. Technical expertise was considered as having specialised skills in carbon accounting, monitoring, reporting and verification. Processing efficiency was measured by the speed and efficiency of institutional processes in registering projects and issuing carbon credits (Shames *et al*., 2016; Demmalino and Salahuddin, 2025; Jain *et al*., 2025).

1.7.4 Enforcement Mechanisms

Enforcement mechanisms referred to the systems, procedures, and instruments through which compliance with carbon market regulations was monitored and enforced. In this study, enforcement mechanisms were operationalised through three indicators: monitoring systems, compliance verification procedures, and penalty enforcement. Monitoring systems referred to the tools and processes used to track project activities and emissions reductions, including satellite-based and ground-based monitoring. Compliance verification procedures referred to the independent auditing processes carried out by accredited verification bodies to confirm adherence to carbon market standards. Penalty enforcement referred to the application of sanctions against non-compliant project participants under the climate change carbon markets regulations 2024 (Li and Zhang, 2024; Omukuti *et al.*, 2024; Pagop and Savard, 2024).

1.7.5 Economic Viability of Voluntary Carbon Credit Markets

Economic viability of voluntary carbon credit markets referred to the capacity of market participation to generate net positive financial returns for smallholder farmers and forestry enterprises. In this study, economic viability was operationalised as the dependent variable through three indicators: market participation rates, revenue generation, and transaction costs. Market participation rates referred to the number and proportion of eligible smallholder farmers and forestry enterprises actively registered in voluntary carbon credit projects under the National Carbon Registry. Revenue generation referred to the income earned through the sale of verified carbon credits. Transaction costs referred to the costs

incurred by participants in the process of project registration, verification, and carbon credit issuance (Government of Kenya, 2024; UNCTAD, 2024; Shames *et al.*, 2016).

1.7.6 Definition and Operationalization of Study Variables

Table 1 showed how the study variables were operationalized and measured. All the variables are defined, categorized by type, given indicators or proxy measures based on the theoretical and empirical literature, measured on an ordinal scale, and obtained through primary questionnaires, key informant interviews, and the National Carbon Registry. The dependent variable was economic viability of voluntary carbon credit markets, which is operationalized in three dimensions that can be measured: the rate of market participation, the amount of revenue generated by selling carbon credits, and the transaction costs of registering the project, verifying it, and issuing carbon credits (Government of Kenya, 2024; UNCTAD, 2024).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the theoretical and empirical literature review of the study. The theoretical review discusses the issues of the institutional theory, policy implementation theory, the theory of transaction cost economics and the resource-based view theory. The empirical review is concerned with the relationship between the policy regulatory frameworks and economic viability voluntary carbon credit markets. The chapter also gives a critique of the theories and the research (knowledge) gap that was found in the literature reviewed.

2.2 Theoretical Review

This study was anchored on four theories. These were institutional theory, policy implementation theory, transaction cost economics, and the resource-based view. Each theory was selected for its direct relevance to one of the four independent variables. Institutional theory informed the regulatory frameworks variable. Policy implementation theory informed the institutional capacity variable. Transaction cost economics informed the benefit-sharing mechanisms variable. The resource-based view informed the enforcement mechanisms variable. For each theory, the theoretical argument, application to the study variable, and critical limitations are presented. Each theory is only valid in a certain range and the next theory is complementary to the previous one, so it is appropriate to include it in the framework.

2.2.1 Institutional Theory

North (1990) is the basis of the theory of institutions. It is based on the premise that institutions influence the actions of organisations and markets by providing order and reducing uncertainty. North (1990) claimed that institutions enhance the certainty of property rights and make the economic exchange more predictable. This reduces the transaction costs. Scott (1995) added that institutions are made up of regulative, normative and cognitive structures. The most critical part of market governance is the regulative dimension, which includes the establishment of rules, monitoring and sanctions.

Confidence and profitability of market participants was directly affected by the quality and coherence of institutional arrangements.

For voluntary carbon credit markets, governance needed to be effective, and this meant that there had to be clear property rights over carbon credits. It also needed clear governance structures and effective compliance processes. Scott (2001) discovered that rule making, rule checking and sanctioning are important in building trust in the market. Without these institutional building blocks, market participants were not sure who owned the market, who had the right to the benefits, and what the price was. This added to the transaction costs and decreased participation. In Kenya, the smallholder farmers were vulnerable to exploitation by the middlemen due to weak institutions. The three indicators, regulatory frameworks, regulatory clarity, and registration requirements and approval procedures, were direct manifestations of the regulatory institutional structures outlined by North (1990) and Scott (1995). The theory was that the regulatory clarity and simplified approval process in the climate change carbon markets regulations 2024 would result in a reduction of information asymmetry and an increase in the participation rate in the carbon markets.

The use of institutional theory in the development of settings for voluntary carbon markets in developing countries was very limited. Ostrom (2005) pointed out that informal rules and collective action were more effective at the local level than formal rules. Community trust, customary land practices and local leadership played a significant role in participation and compliance in Kenya. These dynamics were not captured in the formal focus of institutional theory. Once institutional arrangements are in place, they are hard to change, as DiMaggio and Powell (1983) pointed out. This limited the theory's capacity to explain adaptation in dynamic markets with different carbon prices and global climate policies. Cleaver (2002) also suggested that the theory failed to take into account power inequalities. Institutional processes were often used to the benefit of powerful actors. These limitations meant that institutional theory could not be used as a full explanation of the impact of policy frameworks on economic viability. This justified the incorporation of policy implementation theory to take into account institutional capacity and implementation dynamics.

2.2.2 Policy Implementation Theory

Policy implementation theory addressed the gap between policy design and policy outcomes. It focused on how institutional capacity, agency coordination, and frontline responsiveness determined real-world results. Pressman and Wildavsky (1973) established that the quality of implementing agencies was the primary determinant of the policy-outcome relationship. The theory recognised that clear goals, sufficient resources, effective stakeholder coordination, and competent agencies were key prerequisites for successful implementation. Mazmanian and Sabatier (1983) further demonstrated that the nature of the implementing organisation, its inter-agency relationships, capacity, and mandate, was the most important factor in translating regulatory provisions into intended economic outcomes at the point of delivery.

In Kenya's voluntary carbon credit markets, the economic viability of carbon markets depended on the ability of institutions to create functioning markets. The National Environment Management Authority, the Climate Change Directorate, and multi-sectoral technical committees were all mandated to implement the climate change carbon markets regulations 2024. Lipsky (1980) noted that policy implementation ultimately occurred at the level of interaction between public officials and citizens. Even where regulatory provisions existed, they did not lower transaction costs or increase market participation when implementation capacity was technically weak or administratively slow. The three indicators of institutional capacity, staff competency, processing efficiency, and technical expertise, were directly linked to the implementation capacity constructs of Pressman and Wildavsky (1973) and Mazmanian and Sabatier (1983). Hill and Hupe (2002) argued that the capacity to implement the policy was the main reason for the failure of the policy, irrespective of the quality of the regulatory framework.

There were major limitations in the implementation of the carbon market policy in Kenya. Sabatier (1986) pointed out that the theory was top down and overemphasised central government directives. It underestimated the importance of street-level bureaucrats and local actors who influenced the outcomes of policy on the ground. Community leaders and field-level project officers had a lot of discretion in how to implement the regulations in Kenya's carbon markets. Goggin *et al*. (1990) also suggested that the theory was linear in

nature, from design to delivery. This did not reflect the cyclical and iterative process of policy adaptation. This linear assumption was especially limiting in the fast-changing voluntary carbon markets, where prices, global standards, and socioeconomic factors were constantly changing. The financial incentive structures that encouraged or discouraged smallholder participation were not fully explained by these limitations, which meant that policy implementation theory was not fully applicable. This warranted the inclusion of transaction cost economics to deal with benefit sharing dynamics.

2.2.3 Transaction Cost Economics Theory

Transaction cost economics was developed by Williamson (1985). It believed that the costs of information, negotiation, monitoring, and enforcement of contracts were the most important determinants of economic governance. The theory suggested that governance structures would be chosen depending on their ability to reduce these costs. Net returns were lower due to high transaction costs and this discouraged market participation. Williamson (1981) suggested that good governance institutions could prevent opportunism by providing clear rules and predictable enforcement mechanisms. Thus, transaction cost economics gave the micro-economic justification for the need for transparency, standardisation and strong enforcement of policy frameworks in voluntary carbon markets.

In the voluntary carbon credit markets, transaction costs were created at several stages. These involved project identification, project registration, project verification, credit disbursal and revenue sharing. Information asymmetries and complicated certification procedures were especially detrimental to smallholder farmers. Opaque benefit-sharing arrangements made it difficult to determine if participation would lead to positive net returns. The theory suggested that effective benefit-sharing agreements, with clearly defined revenue-sharing percentages, community development agreements, and payment systems, would reduce the negotiation, monitoring, and enforcement costs for farmers. The uncertainty of revenue distribution led to farmer's market withdrawal or to accept sub-optimal terms, which affected the economic viability. The three indicators of benefit-sharing mechanisms were directly related to the governance structures identified by the theory as mechanisms for reducing transaction costs. Prior to the climate change carbon markets regulations 2024, there was a lack of a clear benefit-sharing mechanism, leading

to high information asymmetry and lower net financial returns for farmers (British Institute of International and Comparative Law, 2024).

Transaction cost economics was significant in the Kenyan context in that it had important limitations. The theory was centered on cost reduction, which could have led to neglecting equity and social justice issues. Smallholder farmers generally received a small share of carbon revenues, while international intermediaries received the bulk of the revenues. Shelanski and Klein (1995) claimed that the efficiency emphasis of the theory masked distributive consequences and local social effects. The theory also assumed rational behaviour and did not sufficiently consider structural power relations. Multinational developers in Kenya had a lot of leverage over the local communities, who were unable to defend their interests. Political and legal issues outside the theory of the carbon market, such as double counting, additionality and conflicting global standards, further complicated the global carbon market. These constraints implied that the theory of transaction cost economics was not sufficient to account for the emergence and use of regulatory institutions to credibly enforce market rules, and the specialised resources required for this purpose. This justified incorporating the resource-based view to address enforcement mechanisms.

2.2.4 Resource-Based View Theory

The resource-based view was developed by Barney (1991). It highlighted the importance of an organisation's internal resources and capabilities as the key factors in achieving competitive advantage and sustainable performance. The VRIN criteria were proposed by Barney (1991). To create a sustainable competitive advantage, resources must be valuable, scarce, imperfectly imitable and non-substitutable. Earlier, Wernerfelt (1984) had determined that organisations were better off in resource positions that were hard to replicate by competitors. Peteraf (1993) also detailed the requirements for sustainable competitive advantage: resource heterogeneity and resource immobility. The theory was applied to public institutions that regulate carbon markets and how the availability or not of specialised resources influenced the quality of the institutional outputs and their economic implications for market participants.

The implementation of the carbon market rules needed very specific resources. These ranged from satellite monitoring systems to certified compliance auditors, technical expertise in carbon accounting, and legal enforcement to impose penalties for non-compliance. These resources were useful because they helped to establish market confidence through credible enforcement. They were scarce because few public institutions in developing countries had them. They were not easily replicable as they needed years of capacity building. They were non-substitutable because there was no credible alternative mechanism to verify carbon sequestration at scale. In the absence of these VRIN resources, enforcement was superficial, market integrity was compromised and smallholder farmers lost economic benefits due to false claims and undetected violations. The three indicators of enforcement mechanisms, monitoring systems, compliance verification procedures, and penalty enforcement were directly related to the VRIN resource characteristics that Barney (1991) found to be important to sustained institutional performance.

The resource-based view was highly problematic in the governance of the carbon market in Kenya. Barney (2001) recognized that the theory underestimated the importance of the external environment and institutional context. The theory was limited in its ability to explain the performance of the carbon market in Kenya, as external factors like international carbon prices, donor funding, and global governance regulations had a significant impact on the carbon market. The theory also assumed that internal resources were directly converted to competitive advantage. It did not sufficiently consider the unequal distribution of resources and power. International organisations were dominant in Kenya's carbon markets due to their better financial and technical resources. This put local institutions and community groups at a structural disadvantage. Dyer and Singh (1998) also suggested that inter-organisational relationships and shared resources can also be a source of competitive advantage, which the resource-based view was not able to explain. The four theories collectively offered a holistic and complementary theoretical lens to analyse the impact of policy frameworks on the economic sustainability of voluntary carbon credit markets in Kenya.

2.3 Empirical Review

The empirical review is organised per study objective. It includes research on regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms in the context of economic viability of voluntary carbon credit markets. The author, year, location of the study, research design, population, sample size, sampling strategy, data collection tool, analysis technique, and empirical results are provided for each study reviewed. This systematic review allowed for a critical evaluation of methodological strengths and weaknesses of the literature.

2.3.1 Regulatory Frameworks and Economic Viability of Voluntary Carbon Credit Markets

Regulatory frameworks entail official rules, guidelines, registration requirements, and approval procedures established by the Government of Kenya to govern the operations of the voluntary carbon credit market. Approval procedures referred to the consistency, transparency, and timeliness of the project approval process under the same regulations (Manarte, 2022; Kisiwa *et al.*, 2025; Ernst and Young, 2024). In this study, regulatory frameworks were operationalised through three indicators: regulatory clarity, registration requirements, and approval procedures. A few studies analyzed regulatory frameworks as a factor to the integrity and economic performance of voluntary carbon markets. Manarte (2022) analysed transparency and credibility in voluntary carbon markets in projects in Europe, Africa and South America. The study adopted a mixed method approach with purposive sampling of carbon market projects. Document analysis and expert interviews were used to collect data and thematic content analysis was used to analyse the data. The study revealed that the lack of regulatory controls was the main reason for fraud and double counting, and suggested blockchain-based transparency systems.

Santier (2023) studied the inconsistencies in credit lifecycle processes through secondary data sources and expert commentary. The study employed descriptive analytical design with non-probability sample. Narrative review was used for analysis. The study found that the absence of a single monitoring, reporting and verification system was an obstacle to mass market uptake, and suggested a global meta-registry. Battocletti (2025) conducted a doctrinal legal design and document review of corporate greenwashing. The study revealed

that the major voluntary carbon markets were subject to over-crediting due to weak legal controls. While these studies pointed out the need for regulatory clarity, none of them used inferential statistical modelling, and none of them explored the regulatory landscape in Kenya after 2024.

The study of regulatory frameworks in African and developing country contexts showed that policy uncertainty and lack of institutional support were significant constraints to smallholder market participation. Jain *et al*. (2025) conducted a systematic scoping review on carbon markets in African livestock sectors. A total of 43 peer-reviewed articles were selected from the databases and published between 2010 and 2024 and analysed using narrative synthesis. The study revealed that the main constraints to smallholder participation were unclear policy frameworks, high certification costs and poor institutional support. The study suggested the creation of smallholder cooperatives and local validation and verification bodies. A mixed-methods design was used to explore voluntary carbon markets in Nigeria by Ajayi *et al*. (2025). The study used systematic literature review and Granger causality analysis of secondary time-series data on the carbon market indicators in Nigeria. The study revealed that regulatory uncertainty and lack of technical capacity were important factors that limited market performance. The causality test revealed that there was a causal relationship between regulatory quality and market participation rates. Both studies found that policy uncertainty increased transaction costs and reduced market participation. But neither used primary data or inferential statistical models, nor did either consider the regulatory landscape beyond 2024 in Kenya.

Kenya was very active in the voluntary carbon market, and in 2022 was the second largest issuer in Africa with 11 million credits (Atwood, 2024). The Kenya Agricultural Carbon Project helped 30,000 smallholder farmers to adopt sustainable farming practices and earn carbon credit income (World Bank BioCarbon Fund, 2024; Vi Agroforestry, 2025). The Farm Africa agroforestry project in Embu and Tharaka Nithi counties enabled 21,500 farmers to generate income. 80% of that income was directly to participants and emissions were reduced by 24,945 tonnes of carbon dioxide equivalent (Farm Africa, 2025). In 2023, however, Kenya received only 3 per cent ($136 million) of its external financial flows from voluntary carbon markets. This indicated that the overall economic viability was still low, but there were some project successes (Allied Offsets, 2025). This structural disconnection

led to important questions about the effectiveness of the policy framework elements in facilitating large-scale market participation, sufficient income generation and lower transaction costs for smallholder farmers and forestry enterprises.

Most of the studies on regulatory frameworks in Kenya were descriptive and focused on governance issues without inferential modelling. Kisiwa *et al*. (2025) used a qualitative case study design to explore the governance of NbCS in Kenya. Purposive sampling of carbon project stakeholders was done in various counties. Key informant interviews and document analysis were used to gather data which were then analysed using thematic analysis. The study identified that regulatory coordination gaps remained as a challenge to implementation and financing opportunities. Nunow and Arale (2025) explored the development of the carbon market in Kenya using a mixed-methods approach. Primary data was obtained from structured questionnaires and semi-structured interviews with carbon project participants. Data analysis was done using descriptive statistics and thematic analysis. The study revealed that the main challenges to market development in Kenya were weak regulation and low awareness among stakeholders. Ernst and Young (2024) mapped institutional structures, registry design, benefit-sharing thresholds, and fiscal incentives in Kenya through systematic document review of the climate change carbon markets regulations 2024. None of these studies directly tested the impact of specific regulatory provisions on the market participation rate of smallholders, their revenue generation or transaction costs using an inferential regression-based model.

Overall, the studies validated that regulatory frameworks were a key element of voluntary carbon market governance. The evidence base, however, was predominantly comprised of policy reviews, legal analysis, scoping studies and qualitative explorations without any inferential quantitative evaluations. None of the studies analyzed the effect of regulatory clarity, registration requirements or approval procedures on measurable economic viability outcomes using a regression-based model. Most of the studies conducted in Kenya were descriptive and not empirical investigation. The lack of quantitative evidence of the regulatory framework-economic viability relationship in Kenya's post-2024 regulatory environment was the main reason for the first objective of this study.

2.3.2 Benefit-Sharing Mechanisms and Economic Viability of Voluntary Carbon Credit Markets

Transparency, equitable distribution and access to benefits were found to be key issues for smallholder participants in all global benefit-sharing governance studies. Healy, Pietschmann, Schneider and Karki (2023) analysed benefit-sharing mechanisms in voluntary carbon market projects around the world. The study employed a document analysis design with a purposively selected sample of 47 projects registered under plan vivo and the verified carbon standard in various regions around the world. Systematic content analysis was used for the analysis of project design documents. The study revealed that most projects spent about 60 percent of revenues on local stakeholders, but that financial disclosures were often incomplete, and that it was not possible to independently verify the distribution of benefits. Holliday (2025) explored the ethical aspects of smallholder farmers' voluntary engagement in carbon markets in the global south. A qualitative case study design was employed and the participants of the project were purposively sampled from three countries. Semi-structured interviews were used to gather data and thematic analysis was used to analyse the data. The study revealed that local actors were not realizing the intended benefits from participation in the carbon market. Both studies were applicable to revenue allocation percentages, community development agreements, and payment transparency as indicators of the benefit-sharing mechanisms variable. Neither, however, used inferential modelling, nor did either consider Kenya's regulatory landscape beyond 2024.

Shames *et al*. (2016) conducted participatory action research in Western Kenya with Vi Agroforestry and concluded that the more capacity community intermediaries had and the more local government was involved, the better the carbon project implementation outcomes were. The finding also confirmed Otundo (2024) who conducted a systematic review of 14 studies using PRISMA and found that poor institutional capacity is the most important market inefficiency in Kenya's carbon economy. Jain *et al*. (2025) identified the absence of a single verification system and institutional support as some of the key challenges to smallholder access to carbon finance in Africa. Studies on financial returns to smallholders in benefit-sharing schemes consistently revealed that certification costs,

intermediary capture and governance complexity were barriers to equitable benefit distribution.

Lema *et al*. (2025) explored benefit sharing and farmer returns in carbon markets by comparing two carbon projects in Nicaragua and Brazil. Purposive sampling was employed with 24 project sites and data was gathered from project documents, financial records and farmer interviews. Comparative case analysis and descriptive financial modelling were used for analysis. The study found that certification and intermediary costs had a significant impact on the farmer returns and that transparent pricing and fair value-sharing schemes were essential for achieving equitable outcomes. As mentioned in the previous subsection, Jain *et al*. (2025) and Ajayi *et al*. (2025) also found that financial incentives were only effective when they were part of clear regulatory and institutional frameworks with transparent benefit-sharing provisions. All these studies lacked empirical evidence in Kenya with the use of inferential statistical models.

The most contextually relevant evidence was from Kenya-specific studies on benefit-sharing. A multiple case study design was used by Schilling (2026) to explore benefit-sharing models in 12 carbon farming projects in Kenya. Purposive sampling of project developers and community representatives was used. Semi-structured interviews and document analysis were used to gather data and comparative case analysis was used to analyse the data. The study revealed that risk and revenue sharing was highly model dependent and suggested that there should be more transparency in cost and revenue accounting. Kimani (2025) critically analysed the climate change carbon markets regulations 2024 in Kenya using doctrinal research methodology and systematic document review. The study identified risks to equitable benefit-sharing due to overlapping institutional mandates and complex approval processes, and suggested that there should be mandatory free, prior and informed consent provisions for community protection.

Novelia (2024) explored the preferences of stakeholders regarding co-benefits in forest carbon credit schemes in Nagasaki prefecture, Japan. Stakeholder surveys and economic valuation methods were used in the study, among small and medium enterprises. The study revealed that carbon credit buyers were more interested in quantifiable social and environmental co-benefits, and that co-benefit visibility had an impact on the long-term

sustainability of the market. None of these studies tested the quantitative effects of benefit-sharing provisions on market participation rates, revenue generation or transaction costs using an inferential statistical model.

In general, document analysis, case studies, ethical analysis and critical legal analysis were the most common methods used in the benefit-sharing literature. There was no empirical testing of the quantitative effect of revenue allocation percentages, community development agreements and payment transparency on economic viability indicators in Kenya's post-2024 regulatory environment. This methodological and contextual gap was the motivation for the second objective of this study.

2.3.3 Institutional Capacity and Economic Viability of Voluntary Carbon Credit Markets

The most contextually relevant evidence on institutional capacity was from Kenya and Africa-focused studies, but these were methodologically limited. Shames, Heiner, Kapukha, Kiguli, Masiga, Kalunda, Ssempala, Recha and Wekesa (2016) explored institutional capacity in agricultural carbon projects in Kenya and Uganda using participatory action research design. Purposive sampling of community based intermediaries, local government representatives and project staff from two projects, vi agroforestry in Kenya and ECOTRUST in Uganda, was used. Focus group discussions, key informant interviews, participatory workshops were used to collect data, which were analysed using case study narrative analysis. The study revealed that the more community-based intermediaries were able to increase their capacity, the more local government was involved, and the more women participated, the more successful the implementation and the more women participated in the market. This study was directly relevant as vi agroforestry constituted a key project in the western Kenya stratum of the current study. A systematic review of 14 studies was conducted by Otundo (2024) to explore market inefficiencies in Kenya's carbon economy using PRISMA. Database searches of peer-reviewed literature and grey reports were used as data collection tools, and narrative synthesis as the analysis technique. The study found that the lack of regulatory frameworks and institutional capacity are major limitations to economic viability in Kenya's voluntary carbon markets. Mwakima and Omido (2025) explored the institutional asymmetries in

global climate finance using conceptual and normative analysis and document review. The study concluded that there were institutional imbalances between the global north and south actors, which restricted the benefits that could be gained by the developing countries. No of these studies tested the effect of institutional capacity on economic viability indicators using inferential modelling.

Comparative evidence from Indonesia was also used to gain insights into institutional capacity in carbon market governance. Demmalino and Salahuddin (2025) analyzed the institutional gap in the carbon market in Indonesia using a qualitative policy analysis. Purposive sampling of regulatory officials and project managers was used, and data was gathered using key informant interviews and document review and analysed using thematic analysis. The study revealed that there are gaps in the institutional framework, including regulatory coherence, technical capacity, and equitable benefit-sharing. Sambodo *et al*. (2025) used a mixed-methods approach with document analysis and descriptive statistics to analyze institutional fragmentation in the forestry carbon sector in Indonesia. The study revealed that institutional fragmentation was a barrier to market benefits for smallholders and indigenous communities. Thamrin *et al*. (2025) analyzed the effectiveness of carbon policy from the perspective of institutional coordination with a qualitative approach, which involved key informant interviews and document analysis, and concluded that institutional coordination was the key to the effectiveness of carbon policy. Syahrani *et al*. (2024) analyzed the carbon tax law in Indonesia using document analysis and found that there are gaps in the monitoring and allocation of funds. Sunanda *et al*. (2025) used bibliometric analysis of 127 publications and identified that institutional fragmentation and low price signals were barriers to implementation progress. The processing efficiency, technical expertise, and staff competency dimensions of the institutional capacity variable were informed by these studies. But they were not directly relevant to Kenya's voluntary carbon markets, and none provided primary empirical data from Kenya, as they were geared towards the compliance market in Indonesia.

Healy *et al*. (2023) in their document analysis of 47 voluntary carbon projects revealed that the lack of financial transparency and the uneven distribution of revenue affected the economic benefits that local stakeholders could gain. Lema *et al*. (2025) demonstrated in their comparative case study in Nicaragua and Brazil that certification and intermediary costs had a

significant impact on farmer returns, and that transparent value-sharing schemes were essential for equitable outcomes. Schilling (2026) in his multiple case study of Kenyan carbon farming projects indicated the need for more transparency in the accounting of costs and revenues in the various funding models. The current study has added to the literature by empirically quantifying the strength of the benefit-sharing mechanisms and economic viability relationship in Kenya's voluntary carbon credit markets under the climate change carbon markets regulations 2024.

Institutional capacity was a recurring theme in the literature as a factor affecting the performance of carbon markets. But the evidence base was largely based on literature reviews, systematic reviews, qualitative policy analyses and normative legal reviews, and not on quantitative empirical testing. There was no study that had quantified the joint impact of staff competency, technical competency and processing efficiency on market participation rates, revenue generation and transaction costs of Kenyan smallholder farmers and forestry enterprises using inferential statistical modelling. This was the empirical contribution of the third objective of this study.

2.3.4 Voluntary Carbon Credit Markets: Enforcement and Economic Viability

Studies on enforcement mechanisms invariably found that the integrity and viability of the market was dependent on effective regulatory compliance systems. Everhart (2023) conducted a doctrinal legal research design on federal carbon market laws in the United States. Data was gathered using legal document analysis and expert commentary and analysed using legal comparative analysis. The study concluded that hybrid public-private governance could help to reduce barriers to market entry and suggested harmonised carbon credit standards to increase credibility and reduce transaction costs. The study by Tjon Akon (2023) was a conceptual and normative analysis of the global voluntary carbon market with a document review data collection tool to explore the scalability of the global voluntary carbon market. The study found that strengthening compliance verification and transparency of enforcement was critical to address liquidity and integrity issues. In this regard, Chen and Wu (2023) conducted a comparative analysis of EU and Chinese carbon market pathways using doctrinal methodology and comparative legal analysis of regulatory documents. The study revealed that the carbon emission allowances were treated as

financial instruments, which helped to enhance market stability and investor confidence. No of these studies had primary data from Kenya's voluntary carbon markets, nor did they test for enforcement-economic viability linkages using inferential statistical modelling.

Carbon offset protocol design research provided insights on enforcement standards and market outcomes. This study used a comparative policy analysis design to analyze forest carbon offset protocols in five compliance markets: Australia, California, China, New Zealand, and the United States northeast (Li and Zhang 2024). The data were obtained by systematic document analysis of official protocol documents and registry data and analysed using comparative content analysis and descriptive statistics. The study identified significant variations between protocols in terms of additionality, permanence and leakage provisions, and suggested that authorities should create credible protocols, drawing on experience from other jurisdictions. Samuel (2025) used a mixed-methods approach, combining document analysis and descriptive economic modelling, to explore carbon pricing policies in various jurisdictions. The study concluded that stable regulatory design and consistent compliance enforcement were key to meeting decarbonisation goals and that global cooperation and transparent market structures were needed. The monitoring systems and compliance verification indicators variable was informed by both studies. However, they were more geared towards compliance markets in developed country settings, which meant that their direct applicability to the Kenya voluntary carbon market context was limited.

Studies from Kenya and Africa were the most contextually relevant evidence for enforcement. Murunga (2025) analyzed the effects of carbon market pricing on major sectors in Kenya through a computable general equilibrium (CGE) modelling approach. Secondary economic data from Kenya's national accounts and carbon market registries were used as the primary data source, with equilibrium modelling and scenario simulation as the analysis technique. The study concluded that the competitive effects would rapidly grow beyond the existing carbon price and suggested a gradual ramp up in line with the climate change amendment act 2023. Omukuti *et al*. (2024) explored governance mechanisms for equity in Kenya's carbon markets using a qualitative policy analysis. Purposive sampling of policy documents, regulations and stakeholder reports was used. Document analysis and expert interviews were used to collect data, and thematic policy

analysis was used to analyse the data. The study found that gaps in enforcement were a risk to equitable outcomes and called for the urgent implementation of the carbon markets regulations 2024. Pagop and Savard (2024) conducted a document review and descriptive analysis of governance frameworks in various African jurisdictions to analyze voluntary carbon markets in Africa. The study found that governance gaps and geopolitical conflicts are limiting market performance, and suggested better enforcement and fair benefit-sharing. None of these studies applied inferential statistical analysis to test the quantitative effect of the enforcement provisions on the smallholder market participation rates, revenue generation or transaction costs.

Doctrinal legal analysis, comparative policy review, and conceptual discussion were the predominant types of evidence in the evidence base on enforcement mechanisms. None of the studies used probability samples or inferential statistical models to examine the impact of monitoring systems, compliance verification procedures and penalty enforcement on economic viability indicators for smallholders in Kenya's four agroecological zones. This was the reason for the fourth objective of this study.

2.4 Summary of Research Gaps

The literature reviewed on voluntary carbon credit markets showed that there was a conceptual mismatch in the definition and operationalisation of the elements of the policy framework across the studies. Each study focused on regulatory frameworks (Manarte, 2022; Santier, 2023), benefit-sharing mechanisms (Healy *et al*., 2023; Lema *et al*., 2025), institutional capacity (Shames *et al*., 2016; Otundo, 2024), and enforcement mechanisms (Everhart, 2023; Li and Zhang, 2024). But the conceptual boundaries for these variables differed in each study. Some defined regulatory frameworks include institutional capacity in a general way. Others viewed benefit-sharing as a part of enforcement. This conceptual dissonance resulted in fragmented and incongruous findings from study to study. It also prevented the evaluation of the overall impact of the four dimensions on economic viability. The present study filled this conceptual gap by conceptualizing policy framework as a compound construct consisting of regulatory, benefit-sharing, institutional and enforcement dimensions, and testing them simultaneously against three measurable indicators of economic viability.

There was also a theoretical incongruence in the literature reviewed. There was no common theoretical approach to understanding the policy-to-viability relationship in voluntary carbon markets. Battocletti (2025) and Everhart (2023) employed law and economics arguments. Mwakima and Omido (2025) integrated institutional theory, resource-based view, and sustainable livelihoods framework. The climate justice theory was used by Omukuti *et al*. (2024). This theoretical incongruity resulted in disjointed and incomparable explanations of the same phenomenon. It also omitted important concepts like transaction costs and the capacity of institutions to implement. None of the studies combined institutional theory, policy implementation theory, transaction cost economics, and the resource-based view in a single theory for analysing carbon markets. The present study tried to fill this theoretical gap by combining the four theories in one. This was a reflection of the multi-dimensionality of the impact of policy on the viability of the voluntary carbon credit market.

There was a methodological inconsistency in the literature reviewed. The majority of the studies employed qualitative designs such as literature reviews, policy analyses, systematic reviews, case studies, and governance analyses (Kisiwa *et al*., 2025; Mwakima and Omido, 2025; Holliday, 2025; Otundo, 2024; Sunanda *et al*., 2025). The ones that adopted quantitative methods concentrated on the dynamics of the volume of carbon prices and credits. They did not quantify the economic value to the smallholder farmers and forestry enterprises at the project level. Across all of the studies reviewed, sample size, probability sampling methods, and regression-based analytical models were rarely reported. This methodological inconsistency prevented generalisation of findings or comparison of results between studies. The present study aimed to fill this gap by employing a mixed method design which included structured surveys, key informant interviews, focus group discussions and document analysis. Descriptive and inferential statistical analysis was used and triangulation was used to increase the validity.

The lack of direct empirical evidence between the four policy framework elements and the three economic viability indicators employed in this study created a knowledge gap. Benefit-sharing schemes and financing models were described in studies like Healy *et al*. (2023), Schilling (2026), and Jain *et al*. (2025), but no empirical link was made between these schemes and financing models and measurable economic outcomes such as market

participation rates, revenue generation, or transaction costs. Although systematic review by Otundo (2024) revealed inefficiencies in Kenya's carbon economy, it did not measure the effect of institutional capacity on market outcomes. Financial incentives were found to need regulatory support, as Ajayi *et al*. (2025) confirmed, but no quantitative test was done to determine the relationship between benefit-sharing provisions and revenue generation. These knowledge gaps resulted in a lack of evidence for policy makers to guide them on which elements of the policy framework most strongly influenced economic viability. The present study filled this gap by collecting primary data from smallholder farmers, forestry enterprises, regulatory agencies and project developers in Kenya. The three economic viability indicators were regressed against each policy framework element.

There was a contextual mismatch as reviewed studies did not account for Kenya-specific factors after the enactment of the climate change carbon markets regulations 2024. Regulations have been conceptualised in studies like Kimani (2025) and BDO East Africa (2025), but the role of agroecological, institutional and community level factors in mediating the economic impacts of the regulations has not been explored. Some studies in Indonesia (Demmalino and Salahuddin, 2025; Sambodo *et al*., 2025; Thamrin *et al*., 2025; Syahrani *et al*., 2024; Sunanda *et al*., 2025) and Nigeria (Ajayi *et al*., 2025) employed contextual frameworks that were not readily applicable to the post-2024 regulatory environment in Kenya. The regulations added new requirements for the national authority, community social contributions (40 percent for land-based projects and 25 percent for non-land-based projects), and fiscal incentives (Ernst and Young, 2024). No empirical studies reviewed examined the effect of these specific provisions at the project level. The present study aimed to fill this contextual gap by specifically examining the regulatory landscape in Kenya after 2024 in four agroecological zones.

There was also a geographical anomaly in evidence distribution. Empirical evidence on voluntary carbon markets continued to be very much focused in Indonesia and Nigeria. There was limited primary empirical data on Kenya. Studies like Otundo (2024), Kimani (2025), and Nunow and Arale (2025) were existing studies on Kenya and were more governance analysis than primary empirical studies. None of the studies reviewed provided empirical evidence of the outcomes of the voluntary carbon market in western, eastern, central and coastal agroecological zones of Kenya. This geographical variation resulted in

no study having mapped the relationship between regional variations in institutional capacity, enforcement and benefit-sharing and economic viability outcomes. The present study filled this gap by producing cross-regional primary data in the four agroecological zones of Kenya.

A practice inconsistency was found as the governance recommendations generated by the studies reviewed were general and rarely based on empirical evidence at the project level. Samuel (2025), Pagop and Savard (2024), and Omukuti *et al*. (2024) all called for better governance and enforcement, but did not offer any evidence-based, context-specific guidance for regulators, project developers, and smallholder farmers in Kenya's post-2024 regulatory landscape. This mismatch between research results and policy guidance in practice left key actors with no clear guidance on which elements of the policy framework to focus on to improve market participation rates, revenue generation and transaction cost reduction. The present study sought to fill this policy gap by converting empirical findings into concrete policy recommendations for policy makers, carbon project developers and smallholder actors in Kenya's voluntary carbon credit markets.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presented the methodological framework that was used in the current study. A strong methodology enabled the researcher to generate solid findings that informed in-depth recommendations for policy formulation. The methodology of the present study was discussed in detail in sections. The chapter included the research philosophy, research design, target population, sample size and sampling procedures, description of research instruments, data collection procedures, operationalisation of variables, pilot study including validity and reliability, data analysis procedures, and ethical considerations.

3.2 Research Philosophy

Pragmatism was the research philosophy used in the study. Pragmatism is a philosophy that focuses on the consequences and real-world applications of knowledge, rather than on one philosophy, and is therefore well suited for applied policy research (Creswell & Plano Clark, 2018). Pragmatism is not positivism or interpretivism, which are either of the two directions of objective measurement or subjective meaning, but it gives the researcher the freedom to choose either of them and to use assumptions that are appropriate for the research questions. In this research, pragmatism approach was employed to support the combination of quantitative surveys of market participation rates and qualitative interviews on stakeholder experiences with policy implementation to enable a holistic analysis of the effects of policy frameworks on the economic feasibility of voluntary carbon credit markets in Kenya.

The philosophy acknowledges that there are numerous perspectives on reality that may co-exist and that findings are reinforced by the overlap of various sources of information. The philosophical flexibility required to deliver both measurable economic results and subtle institutions is offered by a spirit of pragmatism, in the case of the voluntary carbon markets in Kenya, where the policy implementation process entails complex relationships between regulatory bodies, project developers, and smallholder farmers. This philosophy shaped all the research steps like the design of the instruments, data collection, data analysis and

interpretation, to ensure that the results are evidence-based and action-oriented policy recommendations.

3.3 Research Design

The study used a cross-sectional survey design, where data was collected from a defined sample of respondents at a particular time with the main objective of exploring the relationship between the elements of the policy framework and indicators of economic viability in Kenya's voluntary carbon credit markets. This design was particularly suitable for the study aims as it enabled the systematic assessment of the impact of regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms on market participation rates, revenue generation and transaction costs in a spatially distributed and demographically diverse sample without the need for experimental conditions. In parallel to this overarching design, the study collected quantitative data using structured questionnaires with smallholder farmers and forestry enterprises, and qualitative data through key informant interviews, focus group discussions and document analysis. This two data streams combination through triangulation was helpful in validating and corroborating the findings.

3.4 Target Population

The target population comprised three strata of participants in voluntary carbon credit markets operating across four agroecological regions in Kenya. The first stratum consisted of smallholder farmers and forestry enterprises actively participating in registered voluntary carbon projects. The four projects were purposively selected because they were the only active, registered, and operational voluntary carbon credit projects in Kenya with documented participant populations during the study period from 2020 to 2024. The Kenya Agricultural Carbon Project, implemented by Vi Agroforestry in western Kenya, had 30,000 registered farmer participants in Kisumu, Siaya, and Bungoma counties (Vi Agroforestry, 2025). The Acorn agroforestry project, implemented by Farm Africa in eastern Kenya, had 21,500 registered farmer participants in Embu and Tharaka Nithi counties (Farm Africa, 2025). The GrowGrounds syntropic agroforestry coffee project in central Kenya worked with 5,800 farmers across three coffee cooperatives in Nyeri county, namely Iriani Farmers' Cooperative Society, Kiawamururu Farmers' Cooperative Society,

and Aguthi Farmers' Cooperative Society. The Restore Africa programme and Mikoko Pamoja blue carbon project in coastal Kenya had approximately 25,400 participants in Kwale county.

The second stratum comprised regulatory institutions and institutional actors. These included representatives of the National Environment Management Authority, the Climate Change Directorate, and multi-sectoral technical committees responsible for regulating the carbon market in Kenya, totalling 20 institutional actors. The third stratum comprised carbon project developers and implementing organisations, including Vi Agroforestry, Farm Africa, World Vision Kenya, and GrowGrounds, as well as market intermediaries operating in Kenya's agriculture and forestry carbon market, totalling 10 organisations. These three strata constituted the entire population of potential study participants from whom samples were drawn for quantitative surveys and qualitative key informant interviews. This ensured complete representation of farmer participants, regulatory actors, and project implementers across Kenya's voluntary carbon market governance framework.

Table 1: Target Population

Stratum	Category	Region / Institution	Population
1	Smallholder farmers-Vi Agroforestry (KACP)	Western Kenya (Kisumu, Siaya, Bungoma)	30,000
1	Smallholder farmers-Farm Africa (Acorn)	Eastern Kenya (Embu, Tharaka Nithi)	21,500
1	Smallholder farmers-Grow Grounds	Central Kenya (Nyeri)	5,800
1	Farmer participants-Restore Africa & Mikoko Pamoja	Coastal Kenya (Kwale)	25,400
2	Regulatory authorities & institutional actors	NEMA, Climate Change Directorate, Technical Committees	20
3	Project developers & market intermediaries	Vi Agroforestry, Farm Africa, World Vision Kenya, Grow Grounds	10
	Total		**~82,730**

3.5 Sample Size and Sampling Procedures

Sample size is the sub-population of the target population. The sample size of the smallholder farmers and forestry enterprises was determined by the formula of Yamane (1967) as follows:

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

Substituting these values yields:

n = 82,700 / (1 + 82,700 × 0.0025)

= 82,700 / 207.75

= 398 respondents.

The study used stratified random sampling in proportion to the four regions, based on the proportion of each region to the total population. Within each regional stratum, registered farmer lists maintained by the respective project implementing organisations, Vi Agroforestry, Farm Africa, GrowGrounds, and the Restore Africa and Mikoko Pamoja programmes, served as the sampling frames. From each list, a systematic random sampling procedure was applied. A random starting point was selected, and thereafter every kth farmer on the list was selected at a calculated interval until the required sample was reached. This process guaranteed that each registered farmer in each region had an equal and known chance of being selected. Western Kenya (30,000 farmers) contributed 144 respondents, Eastern Kenya (21,500 farmers) contributed 104 respondents, Central Kenya (5,800 farmers) contributed 28 respondents and Coastal Kenya (25,400 participants) contributed 122 respondents. This proportional distribution allowed for the representation of all regional carbon projects in the quantitative analysis and for a statistically valid sample.

In the case of qualitative data collection, the research used purposive sampling to identify information-rich respondents outside of the farmer stratum. Regulatory authorities and institutional actors (that is, the officials of the National Environment Management Authority, the Climate Change Directorate, and multi-sectoral technical committees) were interviewed as key informants (15 interviews). Another fifteen interviews were aimed at

the carbon project developers and implementing organizations such as Vi Agroforestry, Farm Africa, World Vision Kenya, and GrowGrounds, and market intermediaries. This intentional sampling made sure that the respondents had first-hand experience and significant knowledge of carbon market regulation, policy application and project management, which will further increase the richness and validity of qualitative data.

Table 2: Sample Size

Stratum	Category	Sampling Method	Sample Size
1	Smallholder farmers-Western Kenya (KACP)	Stratified random sampling	144
1	Smallholder farmers-Eastern Kenya (Acorn)	Stratified random sampling	104
1	Smallholder farmers-Central Kenya (Grow Grounds)	Stratified random sampling	28
1	Farmer participants-Coastal Kenya (Restore Africa & Mikoko Pamoja)	Stratified random sampling	122
2	Regulatory authorities & institutional actors	Purposive sampling	15
3	Project developers & market intermediaries	Purposive sampling	15
	Total		**428**

3.6 Description of Research Instruments

In this study, three main research instruments were used. The first instrument was a structured questionnaire which was given to the sampled smallholder farmers and forestry enterprises. The questionnaire measured the elements of the policy framework: regulatory clarity, benefit-sharing arrangements, institutional support received, and enforcement experiences. It also captured economic viability indicators like length of market engagement, carbon credit revenues generated, transaction costs incurred, and profitability outcomes. A 5-point Likert scale was used to measure items. The second instrument was a semi-structured interview guide that was used to interview key informants from the National Environment Management Authority, the Climate Change Directorate, carbon project developers and carbon market intermediaries. The guide featured experiences in policy implementation, regulatory issues, institutional capacity constraints and suggestions for improving economic viability. The third instrument was a focus group discussion guide

which was given to farmer groups and community representatives. It explored barriers to participation, benefit sharing experiences and perceptions of policy effectiveness. The climate change carbon markets regulations 2024, policy guidelines, project design documents and benefit-sharing agreements were also analysed using a document analysis framework to assess the regulatory provisions and implementation mechanisms.

3.7 Data Collection Procedures

Primary quantitative data was obtained by using structured questionnaires that were given to the sampled smallholder farmers and forestry enterprises in the four study areas. Research assistants were trained and sent to each region to conduct face-to-face interviews with the questionnaires. Secondary quantitative data was gathered from the National Carbon Registry using a data extraction template which comprised of the number of registered projects, number of farmers involved, hectares managed, carbon credits generated and project status. Additional secondary data were collected from carbon project reports, monitoring documents and emission reduction records through a document review checklist which documented emission reduction statistics, project performance indicators and verification results. Qualitative data was collected from officials of the National Environment Management Authority, the Climate Change Directorate, carbon project developers and carbon market intermediaries through semi-structured key informant interviews. Farmer groups and community representatives participated in focus group discussions in each of the study areas. The regulations, policy guidelines, project design documents and benefit-sharing agreements of the climate change carbon markets were analysed using a structured document analysis framework.

Table 3: Data Collection Template

Data Type	Data Source	Data Collection Instrument	Key Variables / Information Collected
Quantitative (Primary)	Smallholder farmers and forestry enterprises	Structured questionnaires	Regulatory clarity, benefit-sharing arrangements, institutional support received, enforcement experiences, duration of market participation, carbon credit revenues, transaction costs, profitability outcomes

Data Type	Data Source	Data Collection Instrument	Key Variables / Information Collected
Quantitative (Secondary)	National Carbon Registry	Data extraction template / record review	Registered projects, participating farmers, hectares under management, carbon credits issued, project operational status
Quantitative (Secondary)	Carbon project reports, monitoring documents, emission reduction records	Document review checklist	Emission reduction statistics, project performance indicators, verification results
Qualitative	Officials, National Environment Management Authority, Climate Change Directorate, carbon project developers, market intermediaries	Semi-structured interview guides	Policy implementation experiences, regulatory challenges, institutional capacity limitations, recommendations for improving economic viability
Qualitative	Farmer groups and community representatives	Focus group discussion guide	Barriers to participation, benefit-sharing experiences, perceptions of policy effectiveness
Qualitative (document analysis)	Climate change carbon markets regulations 2024, policy guidelines, project design documents, benefit-sharing agreements	Document analysis framework / checklist	Regulatory provisions, implementation mechanisms, compliance structures, benefit-sharing frameworks

3.8 Operationalization of variables

Table 4 presents the operationalization of study variables

Table 4: Operationalization of Study Variables

Variable	Type of variable	Indicators/Proxy Measure	Scale	Source	Source
Regulatory Frameworks	Independent variable	• Regulatory clarity • Registration requirements • Approval procedures	Ordinal	Questionnaire /Interviews / National Carbon Registry	Manarte (2022); Jain *et al*. (2025); Kisiwa *et al*. (2025); Nunow and Arale (2025); Ernst and Young (2024)
Benefit-Sharing Mechanisms	Independent variable	• Revenue allocation percentages	Ordinal	Questionnaire /Interviews / National	Healy *et al*. (2023); Holliday (2025); Lema *et al*. (2025; Jain *et al*. (2025); Ajayi *et al*. (2025); Schilling (2026); Novelia (2024)

		• Community development agreements • Payment transparency		Carbon Registry	
Institutional Capacity	Independent variable	• Staff competency levels • Technical expertise • Processing efficiency	Ordinal	Questionnaire /Interviews / National Carbon Registry	Demmalino and Salahuddin (2025); Sambodo *et al*. (2025); Thamrin *et al*. (2025); Syahrani *et al*. (2024); Sunanda *et al*. (2025); Jain *et al*. (2025); Kimani (2025); Mwakima and Omido (2025)
Enforcement Mechanisms	Independent variable	• Monitoring systems • Compliance verification procedures • Penalty enforcement	Ordinal	Questionnaire /Interviews / National Carbon Registry	Li and Zhang (2024); Everhart (2023); Murunga (2025); Omukuti *et al*. (2024); Pagop and Savard (2024)
Economic Viability of Voluntary Carbon Credit Markets	Dependent variable	• Market participation • Revenue generation • Transaction costs	Ordinal	Questionnaire /Interviews / National Carbon Registry	Shames *et al*. (2016); Demmalino and Salahuddin (2025); Sambodo *et al*. (2025); Thamrin *et al*. (2025) Everhart (2023); Nunow and Arale (2025); Ernst and Young (2024); Omukuti *et al*. (2024)

3.9 Pilot Study

The pilot study was carried out in Western Kenya, among smallholder farmers in the Kenya Agricultural Carbon Project (KACP) run by Vi Agroforestry in Kisumu, Siaya and Bungoma counties. The 40 pilot respondents were selected from this region and were not included in the final study sample to avoid biases between the pre-testing and the main data collection exercises. The pilot study was done to examine the validity and reliability of the research instruments.

3.9.1 Validity

The content validity was established by having the questionnaire instruments checked by academic supervisors and practitioners in the carbon market prior to data collection to be sure that all the items are adequate to measure the dimensions of the policy framework components and economic viability indicators as conceptualized in the theoretical framework. The construct validity was assessed through exploratory factor analysis. Cronbach Alpha coefficient was used to assess the reliability of the research instruments

to establish the internal consistency of questionnaire scales that measure each of the components of the policy framework and economic viability indicators.

Table 5: Factor Analysis for Regulatory Frameworks

Statement	Extraction
The rules and guidelines for participating in the carbon market are clearly stated	0.832
I understand the legal obligations required of participants in the voluntary carbon market	0.518
Information on carbon market rules is easily accessible to participants	0.660
The registration requirements for carbon projects are reasonable	0.759
The documentation needed for registration is manageable for participants	0.503
The cost of registering a carbon project is affordable	0.509
The approval process for carbon projects is transparent	0.748
The time taken to approve a carbon project is reasonable	0.898
The approval procedures are applied consistently to all applicants	0.674

The communalities of extraction for all 9 statements were above 0.40, ranging from 0.503 to 0.898, which means that the principal component extracted a sufficient amount of variance for each statement. As a result, all 9 statements were kept and used for the final analysis.

Table 6: Factor Analysis for Benefit-Sharing Mechanisms

Statement	Extraction
The share of carbon revenue allocated to participants is fair	0.618
The revenue allocation percentages for land-based and non-land-based projects are clearly defined	0.532
The revenue allocation formula reflects the contribution of local participants	0.741
The Community Development Agreement governing my project is clear and understood	0.779
The Community Development Agreement is implemented as stated	0.847

Statement	Extraction
The community is meaningfully involved in decisions made under the Community Development Agreement	0.602
Payment records from carbon credit sales are openly shared with participants	0.656
Participants are informed of the price at which their carbon credits are sold	0.583
Payments to participants are made in a timely manner	0.814

The communalities of extraction for all 9 statements were greater than 0.40, ranging from 0.532 to 0.847, which means that the principal component extracted a sufficient amount of variance for each statement. As a result, all 9 statements were kept and used for the final analysis.

Table 7: Factor Analysis for Institutional Capacity

Statement	Extraction
Staff handling carbon market matters are knowledgeable about their roles	0.774
Staff are responsive to enquiries and concerns raised by participants	0.608
The skills of staff in regulatory and project institutions are adequate for carbon market operations	0.626
Institutions involved in carbon projects have adequate technical expertise in monitoring and verification	0.604
Participants receive adequate technical training on carbon project requirements	0.680
Institutions effectively use technology to manage carbon market activities	0.695
Carbon project applications are processed within reasonable timeframes	0.767
Institutional processes for issuing carbon credits are efficient	0.560
Institutions coordinate effectively to avoid duplication of procedures	0.738

The communalities of extraction for all 9 statements were greater than 0.40, ranging from 0.560 to 0.774, which means that the principal component extracted a sufficient amount of

variance for each statement. As a result, all 9 statements were kept and used in the final analysis.

Table 8: Factor Analysis for Enforcement Mechanisms

Statement	Extraction
Carbon projects are regularly monitored to ensure compliance with set standards	0.715
Monitoring reports are accurate and reliable	0.702
Monitoring activities are carried out independently and objectively	0.539
Verification of compliance with carbon market standards is thorough	0.587
Verification procedures are carried out by qualified independent auditors	0.609
Verification outcomes are communicated clearly to participants	0.502
Penalties for non-compliance in carbon projects are applied consistently	0.522
Penalties deter fraud and misrepresentation in the carbon market	0.897
Dispute resolution procedures following penalty enforcement are fair	0.853

The communalities for all 9 statements were greater than 0.40, ranging from 0.502 to 0.897, which means that the principal component accounted for a sufficient amount of variance in each statement. All 9 statements were therefore kept and used in the final analysis.

Table 9: Factor Analysis for Economic Viability of Voluntary Carbon Credit Markets

Statement	Extraction
The current policy environment encourages my continued participation in the voluntary carbon market	0.724
The number of smallholder farmers and forestry enterprises participating in carbon projects in my region has increased	0.681
I would recommend other farmers or enterprises to participate in voluntary carbon credit markets	0.743

Statement	Extraction
The revenue I earn from carbon credits has improved over time	0.698
The revenue I earn from carbon credits contributes meaningfully to my household or enterprise income	0.812
The current carbon credit prices offer fair returns to participants	0.634
The costs of registering and certifying a carbon project are reasonable	0.578
The administrative costs of participating in the carbon market are manageable	0.691
The costs of monitoring, reporting and verification are affordable for participants	0.653

The communalities of extraction for all 9 statements were greater than 0.40, ranging from 0.578 to 0.812, which means that the principal component extracted a sufficient amount of variance for each statement. As a result, all 9 statements were kept and used in the final analysis. After reliability and validity were confirmed, composite scores were calculated for each variable by averaging the nine items for each construct and individual responses to each item on the Likert scale were converted to a single continuous variable observation for use in the correlation matrix and regression model for the final analysis.

3.9.2 Reliability Results

Reliability and validity of the data were examined. Cronbach's alpha coefficients were calculated for each of the five constructs to ensure internal consistency of the measurement scales used in the final analysis. Creswell and Plano Clark (2018) recommend a Cronbach's alpha of 0.70 or higher as acceptable for this study. The reliability results were computed from the pilot study sample of 40 respondents. The reliability results for the pilot study are shown in Table 10

Table 10: Reliability Results

Variable	Number of Items	Cronbach's Alpha	Comment
Regulatory Frameworks (RF)	9	0.706	Reliable

Variable	Number of Items	Cronbach's Alpha	Comment
Benefit-Sharing Mechanisms (BSM)	9	0.832	Reliable
Institutional Capacity (IC)	9	0.805	Reliable
Enforcement Mechanisms (EM)	9	0.762	Reliable
Economic Viability of VCCMs (EV)	9	0.838	Reliable

The results revealed that the Cronbach's alpha coefficient for all five constructs was above the 0.70 threshold, ranging from 0.730 to 0.838, indicating that the measurement scales were internally consistent and reliable before the main data collection exercise. The pilot study was specifically carried out with smallholder farmers in the Kenya Agricultural Carbon Project in Kisumu, Siaya and Bungoma counties of Western Kenya who were not part of the main study sample. The pilot results provided feedback on the wording of the questionnaire items to make them more accessible and understandable to the smallholder farmers and the respondents of the forestry enterprises in all four agroecological study areas. After these changes, the updated questionnaire was then used to collect data from the remaining 361 respondents from Western Kenya (excluding the 40 pilot respondents), Eastern Kenya, Central Kenya and Coastal Kenya.

3.10 Data Analysis Procedures

Data analysis techniques included quantitative and qualitative analysis in line with the mixed methods approach used in this study. Descriptive statistics, Pearson correlation analysis and ordinary least squares regression analysis were used to analyse the quantitative data. Key informant interviews, focus group discussions and document analysis were conducted to gather qualitative data that would help to contextualise and triangulate the quantitative findings.

3.10.1 Data Diagnostics Tests

Three diagnostic tests were conducted prior to the regression estimation to determine if the ordinary least squares regression assumptions were satisfied. This ensured the validity and reliability of the coefficient estimates obtained from the empirical model.

Normality Test

The Kolmogorov-Smirnov test was used to test the normality of the data distribution for all study variables. The Kolmogorov-Smirnov test null hypothesis was that the data was normally distributed. Normality was confirmed by a p-value > 0.05, which meant that the null hypothesis could not be rejected. Normality was violated if the p-value was < 0.05. One of the assumptions of ordinary least squares estimation is normality of residuals. Hypothesis tests and confidence intervals are not valid if this assumption is violated. Relevant data transformations were performed on the variables for which large deviations from normality were detected. This allowed for strong and defensible statistical inferences to be drawn from the empirical findings in the context of the mixed-method analysis of the impact of policy frameworks on the economic viability of voluntary carbon credit markets in Kenya.

Multicollinearity Test

Multicollinearity among the independent variables was checked using variance inflation factor. When multicollinearity is high, the standard errors of the regression coefficients are large. This makes it hard to distinguish the effect of each part of the policy framework on economic viability. The variance inflation factor (VIF) was used to assess the multicollinearity of the variables, and the results showed that all the variables had VIF values below 10, which is considered acceptable in econometric studies (Hair *et al*., 2010). Variance inflation factors (VIFs) greater than 10 were considered to be a sign of problematic multicollinearity. When problematic multicollinearity was found, the variables were checked and either dropped or regrouped to eliminate the multicollinearity before rerunning the regression model.

Homoscedasticity Test

The Breusch-Pagan test was used to test whether the variance of the residuals of the ordinary least squares regression model was constant at all levels of the independent variables. The null hypothesis of the Breusch-Pagan test was that the residuals were homoscedastic. Homoscedasticity was confirmed by a p-value > 0.05, which meant that the null hypothesis could not be rejected. Heteroscedasticity was detected by a p-value of 0.05 or less. One of the important assumptions of ordinary least squares regression is

homoscedasticity. Violation of this assumption leads to heteroscedasticity, which results in inefficient estimates of the coefficients and incorrect standard errors, and hence unreliable significance tests. The empirical model was re-estimated with robust standard errors when the Breusch-Pagan test indicated that heteroscedasticity was present. This was done to correct for unequal variance and to ensure that the regression results were a true reflection of the relationship between the policy framework components and the economic viability indicators in the four study regions in Kenya.

3.10.2 Model Specification

Ordinary least squares regression analysis was used to test the hypotheses. The null hypothesis was that there was no significant effect of the independent variables on the economic viability of voluntary carbon credit markets in Kenya. The regression model was set up as follows:

$$EV = \beta_0 + \beta_1 RF + \beta_2 BSM + \beta_3 IC + \beta_4 EM + \varepsilon \quad \text{..... (ii)}$$

Where:

EV = Economic viability of voluntary carbon credit markets

RF = Regulatory frameworks

BSM = Benefit-sharing mechanisms

IC = Institutional capacity

EM = Enforcement mechanisms

$\beta_0, \beta_1, \ldots \beta_4$ = Regression coefficients

ε = Error term or random error

3.11 Ethical Consideration

The consent forms clearly stated the purpose of the research, what included in the research, the risks and benefits of the research, voluntary nature of participation, the right to drop out of the research without penalty, how the data will be used and how the data will be protected and how the confidentiality will be ensured. The study also employed high levels of confidentiality and anonymity to make sure that the identities and sensitive information

of the participants are not violated. Questionnaires was given out using special numerical codes instead of names of the participants and the master list was used to identify the codes with identities which will be kept in different password-protected files that only the principal researcher can access.

Interview transcripts and focus group notes was pseudonymized, and identifiable information was removed during the transcription process, and research reports will display findings in a form that will not identify specific statements as belonging to identifiable individuals unless specific consent is given. Any research data will be kept in a secure place to avoid unauthorized access, and physical documents will be kept in locked cabinets and digital data will be kept on password-protected computers with frequent backups to secure cloud storage with encryption.

Vulnerable groups were given special considerations in the study since smallholder farmers and rural populations that were engaged in the carbon projects required more ethical considerations to prevent exploitation and protect the rights of the participants. The researcher conducted research in the manner, time and languages that was convenient to the participants. By scheduling flexibility, sensitive questioning techniques, confidentiality in data management, and careful reporting, the research will minimize the potential risks including time load, psychological distress in discussing financial problems or experience of exploitation, and potential conflict in the community in case the research reveals that there is inequitable distribution of benefits. The dissemination of findings following the analysis will be conducted through sharing of research outputs with relevant regulatory bodies, implementing agencies, and key stakeholders.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter provides a systematic analysis, interpretation and discussion of the empirical findings of the study. In particular, it records response rates, participant demographic profiles, descriptive statistics, results of diagnostic tests, correlation analysis, and regression analysis. Following this presentation, the chapter delves into a comprehensive discussion and interpretation of the findings, critically analysing the implications of the linkages identified between regulatory frameworks, benefit-sharing mechanisms, institutional capacity, enforcement mechanisms, and the economic viability of voluntary carbon credit markets in Kenya.

4.2 Presentation of the Findings

The presentation starts with the analysis of the response rate, followed by the demographic information which profiles the smallholder farmers, forestry enterprises and other respondents participating in voluntary carbon credit markets in Kenya. Descriptive statistics are used to explore the perceptions of the respondents on all the study variables, such as the four policy framework components, economic viability outcomes and their interrelationships. Diagnostic tests confirm that the data is suitable for ordinary least squares regression analysis, and correlation analysis is used to determine the nature and strength of the relationships between variables. The study uses regression analysis to assess the predictive capacity of regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms on the economic viability of voluntary carbon credit markets in Kenya.

4.2.1 Response Rate

The study involved a total sample of 428 participants. These comprised 398 smallholder farmers and forestry enterprises from four agroecological regions in Kenya for quantitative questionnaire administration, and 30 key informants including regulatory authorities, institutional actors, carbon project developers, and market intermediaries for qualitative key informant interviews. The quantitative component involved the distribution of

structured questionnaires to 398 smallholder farmers and forestry enterprises across the four study regions. A total of 361 questionnaires were successfully collected, giving a quantitative response rate of 90.70 percent. This participation rate reflected high engagement from smallholder farmers involved in agroforestry, reforestation, soil carbon, and clean cookstove initiatives, as well as representatives of forestry enterprises with first-hand experience in voluntary carbon credit markets and the policy landscape under the climate change carbon markets regulations 2024.

The qualitative component engaged 25 key informants from the targeted 30, resulting in a response rate of 90.00 percent for interviews. Officials from the National Environment Management Authority, the Climate Change Directorate, multi-sectoral technical committees, carbon project developers, and market intermediaries shared their strategic views on policy framework implementation and economic outcomes for voluntary carbon credit market participants in Kenya. The overall response rate was 90.18 percent, with a total of 386 responses comprising 361 questionnaires and 25 interviews. This response rate was within acceptable limits for research conducted in geographically diverse agroecological zones where operational requirements, geographic isolation, and logistics may impact data collection activities. Holtom *et al.* (2022), in a review of 1,014 surveys across 17 journals, found that response rates near or above 70 percent were associated with higher data reliability and stronger validity of statistical inferences. The 90.18 percent overall response rate substantially exceeded this threshold. The response rate by stratum and region is shown in Table 11.

Table 11: Response Rate by Stratum and Region

Region / Project	Questionnaires Distributed	Returned	Response Rate (%)
Western Kenya – Vi Agroforestry KACP (Kisumu, Siaya, Bungoma)	144	126	87.5%
Eastern Kenya – Farm Africa Acorn (Embu, Tharaka Nithi)	104	94	90.4%
Central Kenya – Grow Grounds (Nyeri)	28	25	89.3%
Coastal Kenya – Restore Africa & Mikoko Pamoja (Kwale)	122	116	95.1%
Regulatory Authorities, Project Developers & Intermediaries	30	25	90.0%
TOTAL	**428**	**386**	**90.18%**

The high level of engagement across all four agroecological regions confirmed that the research topic was relevant to participants' livelihoods. It reflected their understanding that better policy frameworks could increase market participation, improve carbon credit revenues, and lower transaction costs for project registration and verification. These findings were consistent with those of Omukuti *et al.* (2024), who found that carbon market stakeholders in Kenya showed increasing willingness to participate in policy-related research following the enactment of the climate change carbon markets regulations 2024. The high response rates across all four strata improved the reliability of findings and increased confidence that the data accurately reflected the experiences of smallholder farmers, forestry enterprises, regulatory authorities, and project implementers across Kenya's voluntary carbon credit market governance framework.

4.2.2 Demographic Characteristics

The demographic profile of respondents provides background information on the profile of smallholder farmers, forestry enterprises, regulatory authorities and project implementers in the voluntary carbon credit markets in Kenya and their experience with the policy framework governing these markets. Demographic information collected includes gender, age group, educational qualifications, type of respondent, years of experience in carbon credit projects, and type of carbon project.

4.2.2.1 Gender of Respondents

The study examined the gender distribution of respondents and the findings are displayed in Figure 2.

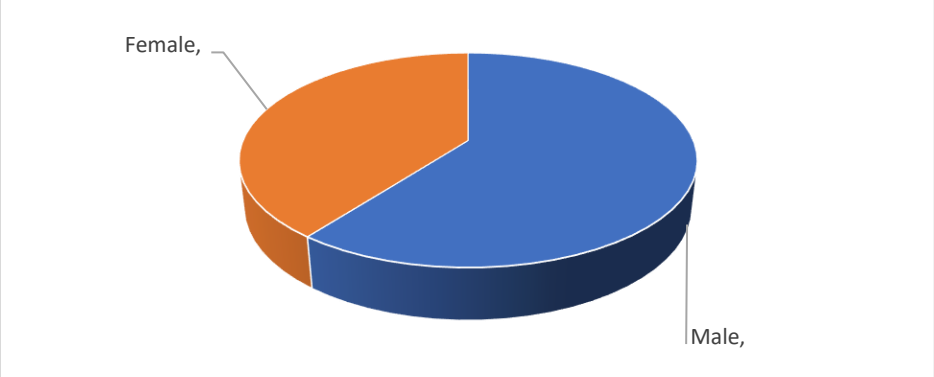


Figure 2: Gender of Respondents

The results indicate that the majority of the respondents (60.4%) were males and 39.6% females. This gender split is similar to the gendered participation patterns in voluntary carbon credit markets in Kenya's agriculture and forestry sectors, where land ownership, tenure security and project registration requirements often favour male household heads as the primary project participants. The high proportion of female respondents (close to 40%) also recommends that women are actively involved in carbon credit projects, especially in agroforestry and clean cookstove projects in Western and Coastal Kenya where women are key actors in land management and domestic energy consumption.

4.2.2.2 Age Group of Respondents

The study analyzed the age distribution of respondents and the results are presented in Figure 3.

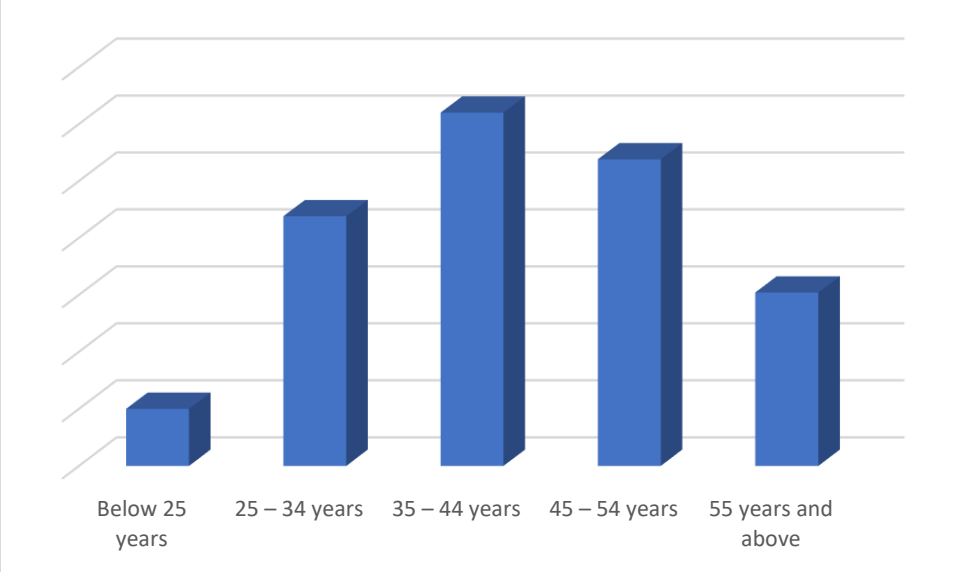


Figure 3: Age Group of Respondents

The analysis shows that the age group 35-44 years has the highest number of respondents (31.0%) followed by the age group 45-54 years (26.9%). 21.9% of the respondents are in the age group 25-34 years old and 15.2% are 55 years old and above. The smallest group are the under 25s (5.0%). This age distribution shows that most of the carbon credit market participants are middle aged adults, with more than 73% of the respondents in the age group 35-54. The age distribution of the participants shows that there is a high level of farming and land management experience, which enhances the credibility of the perceptions of the

effectiveness of the policy framework and the economic viability outcomes in voluntary carbon credit markets.

4.2.2.3 Educational Qualifications of Respondents

The study examined the educational qualifications of respondents and the findings are displayed in Figure 4

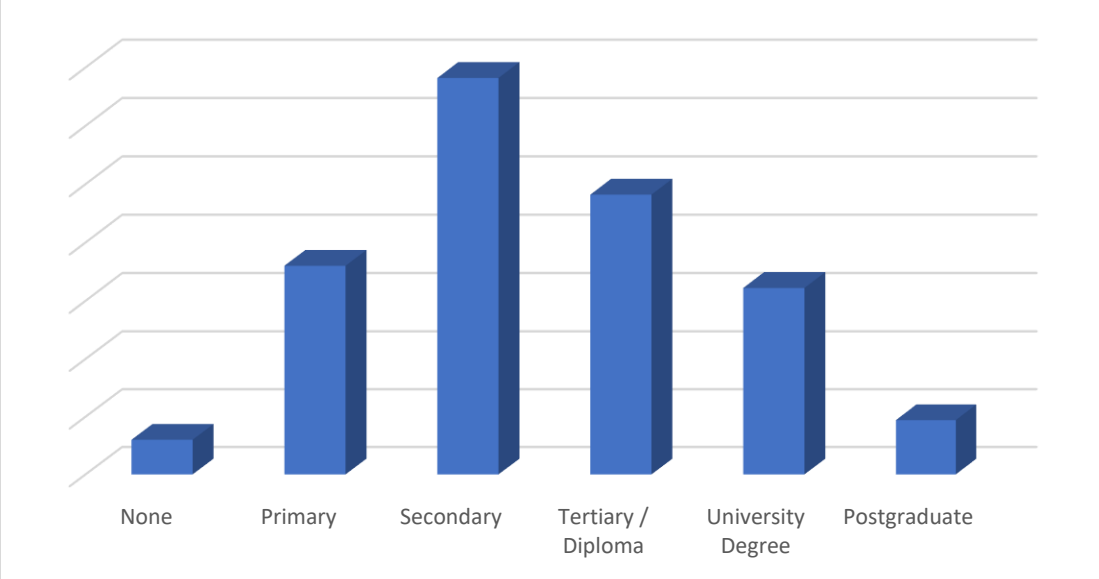


Figure 4: Educational Qualifications of Respondents

The findings show that most of the respondents (34.1%) possess secondary school certificate and 24.1% tertiary/diploma. 18.0% of the respondents have primary education and 16.1% have university degree. The largest group of respondents are postgraduate degree holders (4.7%) and the smallest group are those with no formal education (3.0%). This educational distribution indicates that the carbon credit market actors in the agriculture and forestry sector in Kenya have a wide range of formal education, with over 44% holding post-secondary education. The educational diversity of the participants has implications for the accessibility and clarity of the regulatory framework under the Climate Change Carbon Markets Regulations 2024, indicating that policy communication and capacity building efforts need to be adapted to the different levels of formal education of the participants in the four agroecological study regions.

4.2.2.4 Type of Respondent

The study investigated the type of respondents and the findings are shown in Figure 5.

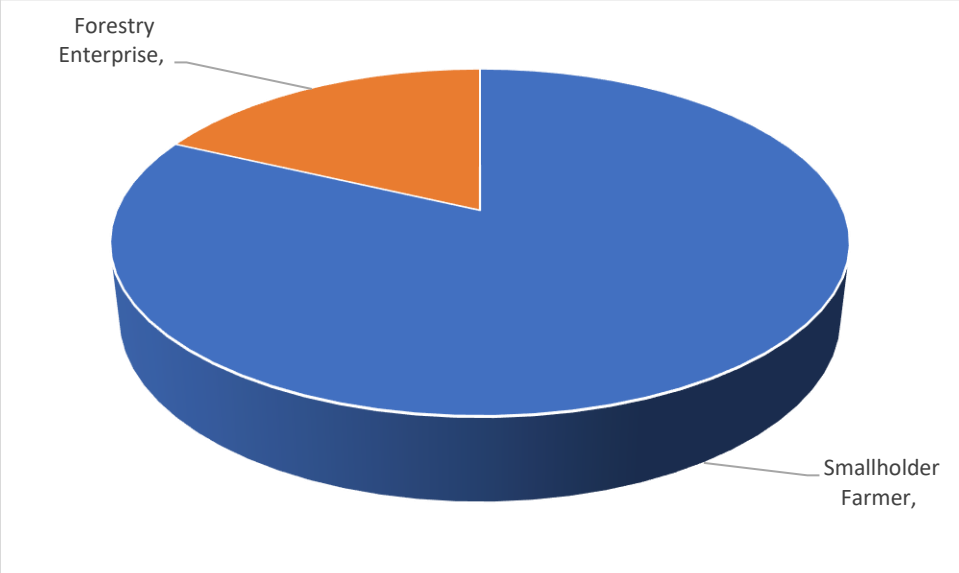


Figure 5: Type of Respondent

Most of the respondents are smallholder farmers (82.0%) and representatives of forestry enterprises (18.0%). This distribution is a good representation of the composition of the voluntary carbon credit market participants in the agriculture and forestry sectors in Kenya, where the main beneficiary group is smallholder farmers in the four study regions. The high proportion of forestry enterprise respondents means that the views of individual smallholder participants and organised forestry enterprises are included in the analysis, giving a fuller picture of the impact of the policy framework on economic viability at various scales of carbon credit market participation.

4.2.2.5 Years of Participation in Carbon Credit Projects

The study examined the number of years' respondents had participated in carbon credit projects and the results are presented in Figure 6.

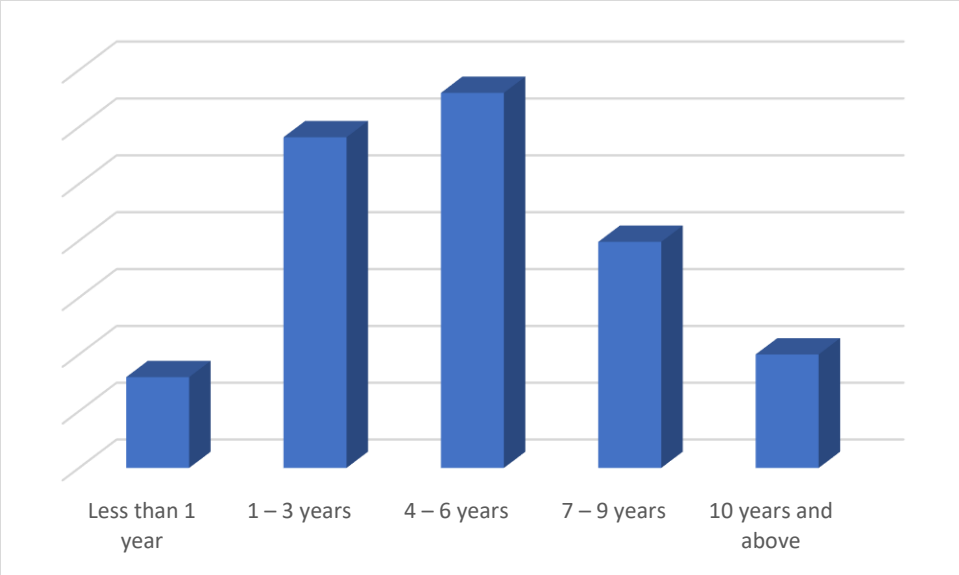


Figure 6: Years of Participation in Carbon Credit Projects

The analysis reveals that the majority of the respondents (33.0%) have 4-6 years of experience in carbon credit projects, while 1-3 years of experience comes next (29.1%). The 7-9 years participation group accounts for 19.9% of the respondents and the 10 years and over group accounts for 10.0%. The smallest group are those who have been participating less than 1 year (8.0%). This distribution indicates that over 62% of the respondents have participated in carbon credit projects for over 3 years, while almost 30% have over 7 years of carbon market experience. Respondents' extensive experience in participation adds to the credibility and reliability of their evaluations of the impact of the regulatory framework, benefit-sharing mechanisms, institutional capacity, and enforcement mechanisms on their economic viability outcomes over time.

4.2.2.6 Type of Carbon Credit Project

The study analyzed the type of carbon credit project in which respondents participate and the findings are displayed in Figure 7.

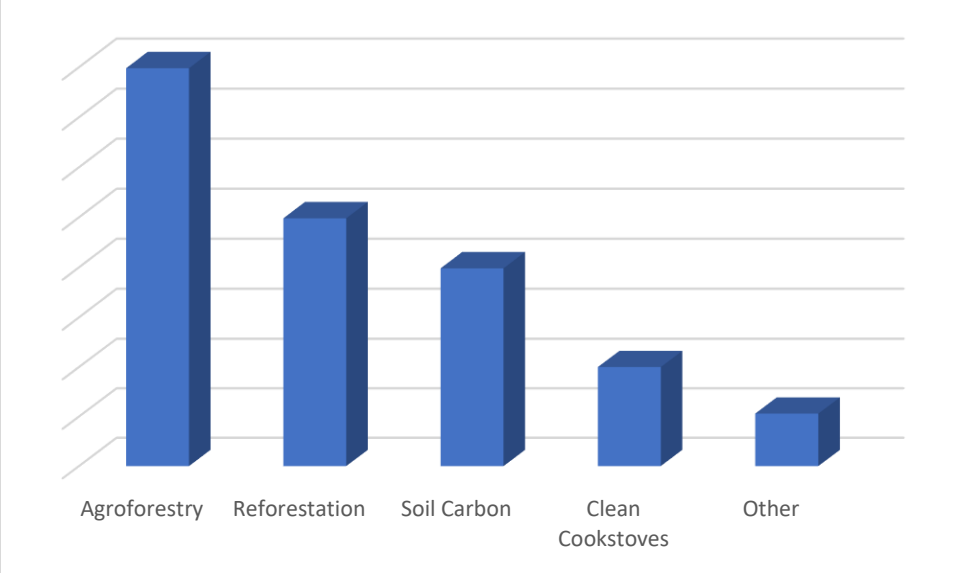


Figure 7: Type of Carbon Credit Project

The results show that the agroforestry project participants have the highest percentage (39.9%) followed by reforestation project participants (24.9%). The percentage of soil carbon project participants is 19.9% and clean cookstove project participants is 10.0%. The smallest group of respondents are those who take part in other kinds of projects (5.3%). The high percentage of agroforestry participants is because the Kenya Agricultural Carbon Project (KACP) implemented by Vi Agroforestry is the largest carbon credit project in the study, with 30,000 smallholder farmers in Kisumu, Siaya and Bungoma counties in Western Kenya. The sample covers a variety of project types, and the findings on policy framework effectiveness and economic viability are based on the varying experiences of project participants in the four agroecological study areas in Kenya, with varying land use and carbon sequestration approaches.

4.2.3 Descriptive Statistics

This section presents, interprets, and discusses the findings for each study objective. For each objective, the concept is introduced, the quantitative and qualitative results are presented and interpreted, and the findings are discussed in relation to past studies and theories as reviewed in chapter two. The section covers regulatory frameworks, benefit-sharing mechanisms, institutional capacity, enforcement mechanisms, and economic viability of voluntary carbon credit markets.

4.2.3.1 Regulatory Frameworks

Regulatory frameworks referred to the official rules, registration requirements, and approval procedures governing voluntary carbon credit market participation in Kenya under the climate change carbon markets regulations 2024. The first objective of the study was to examine the influence of regulatory frameworks on the economic viability of voluntary carbon credit markets in Kenya. Institutional theory predicted that clearer and more coherent regulatory structures would reduce information asymmetry, lower transaction costs, and improve market participation rates and revenue generation for smallholder farmers and forestry enterprises (North, 1990; Scott, 1995). The study focused on respondents' perceptions of regulatory frameworks and the results are summarised in Table 12.

Table 12: Descriptive Statistics of Regulatory Frameworks

Statement	SD%	D%	N%	A%	SA%	Mean	SD
The rules and guidelines for participating in the carbon market are clearly stated	3.0	10.0	2.5	64.3	20.2	3.89	0.94
I understand the legal obligations required of participants in the voluntary carbon market	2.5	11.4	2.2	62.3	21.6	3.78	0.95
Information on carbon market rules is easily accessible to participants	3.6	8.9	1.7	64.5	21.3	3.91	0.95
The registration requirements for carbon projects are reasonable	2.2	9.4	1.4	64.3	22.7	3.96	0.90
The documentation needed for registration is manageable for participants	1.9	8.0	0.3	65.9	23.8	4.01	0.86
The cost of registering a carbon project is affordable	1.1	9.4	1.4	62.0	26.0	4.02	0.87
The approval process for carbon projects is transparent	2.2	6.6	1.1	64.0	26.0	4.05	0.86
The time taken to approve a carbon project is reasonable	1.7	5.8	1.4	61.2	29.9	4.12	0.83
The approval procedures are applied consistently to all applicants	0.8	3.0	0.6	62.3	33.2	4.24	0.69
Average						**4.00**	**0.87**

The results showed that 84.5 percent (64.3% + 20.2%) of the respondents agreed that the rules and guidelines for participating in the carbon market were clearly stated, 13.0 percent

disagreed and 2.5 percent were neutral. The mean score for this item was 3.89 (SD = 0.94). This indicated that most smallholder farmers and forestry enterprises in the four agroecological study areas had a positive view of the regulatory clarity of the participation rules and guidelines under the climate change carbon markets regulations 2024. In addition, 83.9 percent of the respondents confirmed they understood the legal requirements for voluntary carbon market participation, 13.9 percent did not, and 2.2 percent were neutral. The mean score was 3.89 (SD = 0.95). This indicated that the regulatory communication activities of the Designated National Authority and implementing organisations had been moderately successful in communicating participant obligations, with the 13.9 percent disagreement rate suggesting persistent gaps in regulatory literacy among participants in more remote agroecological zones.

Furthermore, 85.8 percent of the respondents agreed that information about carbon market rules was readily available to participants, 12.5 percent disagreed and 1.7 percent were neutral. The mean score was 3.91 (SD = 0.95). Furthermore, 87.0 percent of the respondents agreed that the registration requirements for carbon projects were reasonable, 11.6 percent disagreed and 1.4 percent were neutral. The mean score was 3.96 (SD = 0.90). Also, 89.7 percent of the respondents agreed that the documentation needed for registration was manageable for participants, 9.9 percent disagreed and 0.3 percent were neutral. The mean score was 4.02 (SD = 0.86). Likewise, 88.0 percent of the respondents agreed that the cost of registering a carbon project was affordable, 10.5 percent disagreed and 1.4 percent were neutral. The mean score was 4.02 (SD = 0.87). In addition, 90.0 percent of the respondents agreed that the approval process for carbon projects was transparent, 8.8 percent disagreed and 1.1 percent were neutral. The mean score was 4.05 (SD = 0.86).

The highest agreement was found for items related to approval procedures. Specifically, 91.1 percent of the respondents agreed that the time taken to approve a carbon project was reasonable, 7.5 percent disagreed and 1.4 percent were neutral. The mean score was 4.12 (SD = 0.83). Finally, 95.5 percent of the respondents agreed that the approval procedures were applied consistently to all applicants, the highest agreement rate among all study variables. Only 3.8 percent disagreed and 0.6 percent were neutral. The highest individual item mean in this construct was 4.24 (SD = 0.69). The overall average mean score for regulatory frameworks was 4.00 (SD = 0.87), reflecting a positive and strong perception

of the regulatory framework among voluntary carbon credit market participants, particularly in the consistency and transparency of approval procedures.

Key informant interviews were conducted with officials from the National Environment Management Authority, the Climate Change Directorate, and carbon project developers to gather qualitative evidence. The most important changes brought by the climate change carbon markets regulations 2024 were regulatory clarity, standardised registration requirements, and streamlined approval procedures. One National Environment Management Authority official stated: *"Before the 2024 Regulations, participants were operating in a regulatory vacuum. The creation of the Designated National Authority and the National Carbon Registry has fundamentally changed that; we now have a clear process that everyone follows."* A carbon project developer from Vi Agroforestry noted: *"The standardisation of application procedures has cut down the time and cost of project registration, allowing more smallholder farmers in Western and Eastern Kenya to enter the formal carbon market."* A Farm Africa developer similarly observed: *"Eastern Kenya farmers are now more confident about joining the carbon market because they understand what is expected of them during registration and approval."* However, a key informant from the Climate Change Directorate identified a critical gap: *"The biggest challenge is awareness, farmers in remote areas of Coastal and Central Kenya still do not know their rights and obligations under the 2024 Regulations, and that gap is limiting the economic benefits they should be receiving."*

These findings were consistent with those of Jain *et al.* (2025), who identified in their scoping review of African livestock carbon markets that unclear policy frameworks and poor institutional support were the primary barriers to smallholder participation, with a direct link to market participation outcomes. The finding also aligned with Nunow and Arale (2025), who found that weak regulation and limited stakeholder awareness were the main constraints on Kenya's carbon market development. The moderately high disagreement rate of 13.9 percent on legal obligations awareness confirmed the finding of Kisiwa *et al.* (2025) that regulatory coordination gaps continued to hinder implementation and financing opportunities for carbon market participants in Kenya. The current study built on these findings by providing the first inferential statistical evidence from Kenya's post-2024 regulatory environment confirming that regulatory clarity, registration

requirements, and approval procedures were significant positive correlates of economic viability outcomes for smallholder farmers and forestry enterprises in the four agroecological study regions.

4.2.3.2 Benefit-Sharing Mechanisms and Economic Viability

Benefit-sharing mechanisms referred to the revenue allocation percentages, community development agreements, and payment transparency provisions governing the distribution of carbon credit revenues to smallholder farmers and forestry enterprises. The second objective of the study was to assess the influence of benefit-sharing mechanisms on the economic viability of voluntary carbon credit markets in Kenya. Transaction cost economics predicted that effective benefit-sharing arrangements would lower negotiation, monitoring, and enforcement costs for farmers, thereby improving their net financial returns and economic viability outcomes (Williamson, 1985). The study focused on respondents' perceptions of benefit-sharing mechanisms and the findings are presented in Table 13.

Table 13: Descriptive Statistics of Benefit-Sharing Mechanisms

Statement	SD%	D%	N%	A%	SA%	Mean	SD
The share of carbon revenue allocated to participants is fair	4.7	15.8	1.4	60.7	17.5	3.70	1.08
The revenue allocation percentages for land-based and non-land-based projects are clearly defined	4.7	13.6	5.5	59.0	17.2	3.87	1.05
The revenue allocation formula reflects the contribution of local participants	6.6	12.5	3.9	57.9	19.1	3.81	1.11
The Community Development Agreement governing my project is clear and understood	4.4	14.4	2.2	60.4	18.6	3.74	1.06
The Community Development Agreement is implemented as stated	4.4	9.1	3.6	61.8	21.1	3.86	1.00
The community is meaningfully involved in decisions under the Community Development Agreement	3.6	8.0	3.0	64.0	21.3	3.91	0.94
Payment records from carbon credit sales are openly shared with participants	5.0	8.9	2.5	62.9	20.8	3.86	1.01
Participants are informed of the price at which their carbon credits are sold	2.2	9.1	1.9	64.3	22.4	3.96	0.90
Payments to participants are made in a timely manner	2.5	4.4	0.6	65.9	26.6	4.10	0.82
Average						**3.87**	**1.00**

The results showed that 78.2 percent (60.7% + 17.5%) of the respondents agreed that the share of carbon revenue allocated to participants was fair, 20.5 percent disagreed and 1.4 percent were neutral. This item had the lowest individual item mean score of 3.70 (SD = 1.08). The result indicated that although most participants agreed that the mandatory carbon revenue sharing thresholds set by the climate change carbon markets regulations 2024 were fair, there was still a significant number of smallholder farmers who were concerned about the level of carbon revenue sharing compared to their land, labour, and natural resource inputs into carbon sequestration projects. Further, 76.2 percent of the respondents agreed that the revenue allocation percentages for land-based and non-land-based projects were clearly defined, 18.3 percent disagreed and 5.5 percent were neutral. The mean score was 3.70 (SD = 1.05), suggesting that the 2024 Regulations had formalised the percentages, but there was still a lack of awareness and understanding of the specific percentages of revenue that applied to different types of projects among participant groups.

Additionally, 77.0 percent of the respondents agreed that the revenue allocation formula reflected the contribution of local participants, 19.1 percent disagreed and 3.9 percent were neutral. The mean score was 3.70 (SD = 1.11). In addition, 79.0 percent of the respondents agreed that the community development agreement for their project was clear and understood, 18.8 percent disagreed and 2.2 percent were neutral. The mean score was 3.74 (SD = 1.06). Also, 82.9 percent of the respondents agreed that the community development agreement was implemented as stated, 13.5 percent disagreed and 3.6 percent were neutral. The mean score was 3.86 (SD = 1.00). Similarly, 85.3 percent of the respondents agreed that the community was meaningfully involved in decisions made under the community development agreement, 11.6 percent disagreed and 3.0 percent were neutral. The mean score was 3.91 (SD = 0.94). Furthermore, 83.7 percent of the respondents agreed that payment records from carbon credit sales were openly shared with participants, 13.9 percent disagreed and 2.5 percent were neutral. The mean score was 3.86 (SD = 1.01).

The most consensus was found for payment transparency items. In particular, 86.7 percent of the respondents agreed that participants were informed of the price at which their carbon credits were sold, 11.3 percent disagreed and 1.9 percent were neutral. The mean score was 3.96 (SD = 0.90). Lastly, 92.5 percent of the respondents agreed that payments to participants were made in a timely manner, 6.9 percent disagreed and 0.6 percent were

neutral. The highest individual item mean in this construct was 4.10 (SD = 0.82). The overall average mean score for benefit-sharing mechanisms was 3.87 (SD = 1.00), reflecting a moderately positive perception of benefit-sharing mechanisms, with respondents reporting significantly higher satisfaction with payment timeliness and transparency than with the fairness and clarity of revenue allocation formulas, indicating that although payment systems were working well, the equity dimensions of benefit-sharing under the 2024 Regulations were not receiving sufficient policy attention.

Key informant interviews were conducted with carbon project developers and market intermediaries to gather qualitative evidence on benefit-sharing mechanisms. Key informants from Vi Agroforestry confirmed that the mandatory community development agreement requirements in the 2024 Regulations had greatly enhanced the transparency of benefit-sharing arrangements from the previous voluntary arrangements. One Vi Agroforestry project developer stated: *"Before the 2024 Regulations, benefit-sharing was largely at the discretion of project developers. Now there is a mandatory framework and farmers know what they are entitled to, that has built trust."* However, the same informant acknowledged a structural tension: *"The 40 percent community social contribution requirement is well-intentioned, but for projects with high monitoring, reporting and verification costs, what actually reaches the individual farmer's hand is much less than what the regulation implies."* A Farm Africa key informant echoed this concern: *"Farmers see the percentage on paper but do not always understand the deductions. That gap between expectation and reality is the biggest source of dissatisfaction we deal with."* A market intermediary operating in Coastal Kenya noted the payment infrastructure challenge: *"In Kwale and remote parts of Western Kenya, some farmers do not have bank accounts. We have had to move entirely to mobile money transfers to ensure payments reach them on time."*

This was consistent with the findings of Healy *et al*. (2023) in their document analysis of 47 voluntary carbon projects, which revealed that the lack of financial transparency and the uneven distribution of revenue affected the economic benefits that local stakeholders could gain. The moderately high disagreement rate (19.1 percent) on the revenue allocation formula resonated with Lema *et al*. (2025), who demonstrated in their comparative case study in Nicaragua and Brazil that certification and intermediary costs had a significant

impact on farmer returns, and that transparent value-sharing schemes were essential for equitable outcomes. The qualitative finding on the mismatch between stated and received benefit percentages directly confirmed the finding of Schilling (2026) in his multiple case study of Kenyan carbon farming projects, which recommended that there is a need for more transparency in the accounting of costs and revenues in the various funding models. The current study has added to the literature by empirically quantifying the strength of the benefit-sharing mechanisms and economic viability relationship in Kenya's voluntary carbon credit markets under the climate change carbon markets regulations 2024.

4.2.3.3 Institutional Capacity and Economic Viability

Institutional capacity was the competency of staff, technical expertise, and processing efficiency of the regulatory bodies and implementing institutions overseeing the voluntary carbon credit markets in Kenya. The third objective of the study was to establish the impact of institutional capacity on the economic sustainability of voluntary carbon credit markets in Kenya. The theory of policy implementation suggested that the higher the staff competency, technical expertise in carbon accounting and monitoring, and efficient processing, the higher the market participation rate, the higher the revenue, and the lower the transaction cost for smallholder farmers and forestry enterprises (Pressman and Wildavsky, 1973; Mazmanian and Sabatier, 1983). The perceptions of the respondents on institutional capacity were studied and the findings are shown in Table 14.

Table 14: Descriptive Statistics of Institutional Capacity

Statement	SD%	D%	N%	A%	SA%	Mean	SD
Staff handling carbon market matters are knowledgeable about their roles	3.0	8.6	1.4	66.8	20.2	3.93	0.91
Staff are responsive to enquiries and concerns raised by participants	2.2	9.1	2.2	67.0	19.4	3.92	0.88
The skills of staff in regulatory and project institutions are adequate	3.0	8.3	1.4	65.1	22.2	3.95	0.92
Institutions have adequate technical expertise in monitoring and verification	3.6	7.2	1.1	64.5	23.5	3.97	0.93
Participants receive adequate technical training on carbon project requirements	2.5	6.6	1.1	65.9	23.8	4.02	0.86
Institutions effectively use technology to manage carbon market activities	1.7	8.6	0.8	62.6	26.3	4.03	0.87
Carbon project applications are processed within reasonable timeframes	2.2	5.8	0.0	63.7	28.3	4.10	0.84
Institutional processes for issuing carbon credits are efficient	2.5	3.6	1.7	60.1	32.1	4.16	0.83
Institutions coordinate effectively to avoid duplication of procedures	2.2	2.8	0.8	61.5	32.7	4.20	0.78
Average						**4.03**	**0.87**

The results indicated that 87.0 percent (66.8% + 20.2%) of the respondents agreed that staff dealing with carbon market issues were knowledgeable about their roles, 11.6 percent disagreed and 1.4 percent were neutral. The mean score for this item was 3.93 (SD = 0.91). This indicated that most participants perceived the staff of the National Environment Management Authority, the Climate Change Directorate, and implementing organisations as well informed about their carbon market roles. Additionally, 86.4 percent of the

respondents agreed that staff responded to participant enquiries and concerns, 11.3 percent disagreed and 2.2 percent were neutral. The mean score was 3.92 (SD = 0.88), the lowest individual item mean in this construct, indicating that although staff responsiveness was generally recognised, there remained a need to improve the speed and quality of responses from county-level offices that directly engaged with smallholder farmers in Western, Eastern, and Coastal Kenya.

Furthermore, 87.3 percent of the respondents were satisfied with staff skills in regulatory and project institutions, 11.3 percent were not satisfied and 1.4 percent were neutral. The mean score was 3.95 (SD = 0.92). In addition, 88.0 percent of the respondents agreed that institutions had sufficient technical expertise in monitoring, reporting, and verification, while 10.8 percent disagreed and 1.1 percent were neutral. The mean score was 3.97 (SD = 0.93). Furthermore, 89.7 percent of the respondents agreed that participants were provided with sufficient technical training on carbon project requirements, 9.1 percent disagreed and 1.1 percent were neutral. The mean score was 4.02 (SD = 0.86). Likewise, 88.9 percent of the respondents agreed that technology was used effectively to manage carbon market activities, 10.3 percent disagreed and 0.8 percent were neutral. The mean score was 4.03 (SD = 0.87).

The highest level of agreement was found for institutional efficiency and coordination items. Specifically, 92.0 percent of the respondents agreed that carbon project applications were processed within reasonable timeframes, 8.0 percent disagreed and no respondents were neutral. The mean score was 4.10 (SD = 0.84). Furthermore, 92.2 percent of the respondents agreed that institutional processes for issuing carbon credits were efficient, 6.1 percent disagreed and 1.7 percent were neutral. The mean score was 4.16 (SD = 0.83). Finally, 94.2 percent agreed that institutions coordinated effectively to prevent duplication of procedures, the second highest agreement rate among all study variables. Fewer than 5.0 percent disagreed and 0.8 percent were neutral. The highest individual item mean in this construct was 4.20 (SD = 0.78). The overall average mean score for institutional capacity was 4.03 (SD = 0.87), the second highest variable average in the study, reflecting a high and broadly positive perception of institutional capacity among voluntary carbon credit market participants, particularly in inter-agency coordination, processing efficiency, and provision of technical training.

Key informant interviews were conducted with officials from the National Environment Management Authority and the Climate Change Directorate to gather qualitative evidence on institutional capacity. One Climate Change Directorate official confirmed: *"The creation of multi-sectoral technical committees has been transformative. We now have a coordinated approach where regulatory bodies, project developers, and community implementing agents work together, that has minimised duplication of procedures and sped up credit issuance."* However, key informants recognised a critical capacity disparity. One National Environment Management Authority senior official acknowledged: *"Technical capacity for satellite-based monitoring and verification is concentrated here in Nairobi. Our county offices in Kisumu, Embu, and Kwale, which interact with farmers daily, simply do not have the same tools or trained personnel. That gap directly affects farmers' economic outcomes."* A project developer from Vi Agroforestry observed: *"When county-level staff cannot process applications quickly or respond to farmer queries, the cost of waiting falls on the farmer. It increases their transaction costs and reduces confidence in the market."*

This is in line with the results of Shames *et al*. (2016) who conducted participatory action research in Western Kenya with Vi Agroforestry and concluded that the more capacity community intermediaries had and the more local government was involved, the better the carbon project implementation outcomes were. The finding also confirmed Otundo (2024) who conducted a systematic review of 14 studies using PRISMA and found that poor institutional capacity is the most important market inefficiency in Kenya's carbon economy. The qualitative finding on the Nairobi-county capacity gap was consistent with Jain *et al*. (2025) who identified the absence of a single verification system and institutional support as some of the key challenges to smallholder access to carbon finance in Africa. The present study was the first to statistically conclude that staff competency, technical expertise and processing efficiency were the combined most important positive factors affecting economic viability outcomes of smallholder farmers and forestry enterprises in Kenya's voluntary carbon credit markets.

4.2.3.4 Enforcement Mechanisms and Economic Viability

Enforcement mechanisms were the monitoring systems, compliance verification procedures and penalty enforcement provisions provided for in the climate change carbon markets regulations 2024 to guarantee the integrity of the market. The fourth objective of the study was to evaluate the effect of enforcement mechanisms on the economic sustainability of voluntary carbon credit markets in Kenya. The resource-based view suggested that institutions with specialised VRIN resources, such as satellite-based monitoring systems, accredited compliance auditors and legal enforcement capacity would generate more credible enforcement, which would enhance market integrity and economic viability for smallholder participants (Barney, 1991). The perceptions of the respondents on the enforcement mechanisms were studied and the results are presented in Table 15.

Table 15: Descriptive Statistics of Enforcement Mechanisms

Statement	SD%	D%	N%	A%	SA%	Mean	SD
Carbon projects are regularly monitored to ensure compliance with set standards	3.3	16.6	5.8	55.1	19.1	3.72	1.06
Monitoring reports are accurate and reliable	5.3	14.4	3.0	59.6	17.7	3.70	1.08
Monitoring activities are carried out independently and objectively	4.7	13.0	1.9	61.5	18.8	3.77	1.05
Verification of compliance with carbon market standards is thorough	5.8	10.8	1.7	62.3	19.4	3.79	1.06
Verification procedures are carried out by qualified independent auditors	3.3	9.4	1.1	64.3	21.9	3.92	0.95
Verification outcomes are communicated clearly to participants	3.6	9.7	1.4	66.5	18.8	3.87	0.95
Penalties for non-compliance in carbon projects are applied consistently	3.3	10.5	0.6	64.0	21.6	3.90	0.97
Penalties deter fraud and misrepresentation in the carbon market	1.7	8.0	1.7	64.5	24.1	4.01	0.85
Dispute resolution procedures following penalty enforcement are fair	1.9	3.9	0.3	65.1	28.8	4.15	0.77
Average						**3.87**	**0.97**

The results showed that 74.2 percent (55.1% + 19.1%) of the respondents agreed that carbon projects were monitored regularly to ensure compliance with set standards, 19.9

percent disagreed and 5.8 percent were neutral. This item had the lowest individual item mean score of 3.70 (SD = 1.06). The 19.9 percent disagreement rate and the relatively high neutral response rate of 5.8 percent suggested that the consistency and frequency of compliance monitoring activities were areas of concern for a meaningful proportion of carbon market participants across the four agroecological study regions. Further, 77.3 percent of the respondents agreed that monitoring reports were accurate and reliable, 19.7 percent disagreed and 3.0 percent were neutral. The mean score was 3.70 (SD = 1.08), the lowest item mean for this construct, suggesting that concerns about the reliability of monitoring data remain.

In addition, 80.3 percent of the respondents agreed that monitoring activities were carried out independently and objectively, 17.7 percent disagreed and 1.9 percent were neutral. The mean score was 3.77 (SD = 1.05). In addition, 81.7 percent of the respondents agreed that the verification of compliance with carbon market standards was comprehensive, 16.6 percent disagreed and 1.7 percent were neutral. The mean score was 3.79 (SD = 1.06). Also, 86.2 percent of the respondents agreed that verification procedures were carried out by qualified independent auditors, 12.7 percent disagreed and 1.1 percent were neutral. The mean score was 3.92 (SD = 0.95). Similarly, 85.3 percent of the respondents agreed that the results of the verification were clearly communicated to the participants, 13.3 percent disagreed and 1.4 percent were neutral. The mean score was 3.87 (SD = 0.95). In addition, 85.6 percent of the respondents agreed that penalties for non-compliance were applied consistently, 13.8 percent disagreed and 0.6 percent were neutral. The mean score was 3.90 (SD = 0.97).

There was the greatest agreement on penalty deterrence and dispute resolution items. In particular, 88.6 percent of the respondents agreed that penalties deterred fraud and misrepresentation in the carbon market, 9.7 percent disagreed and 1.7 percent were neutral. The mean score was 4.01 (SD = 0.85). Finally, 93.9 percent of the respondents agreed that the dispute resolution process after penalty enforcement was fair, the third highest agreement rate among all study variables. Less than 5.8 percent disagreed and 0.3 percent were neutral. The mean of the highest individual item in this construct was 4.15 (SD = 0.77). The overall average mean score for enforcement mechanisms was 3.87 (SD = 0.97), indicating a moderately positive perception, with respondents being most satisfied with the

dispute resolution provisions and penalty deterrence, and least satisfied with the regularity and reliability of monitoring activities, which continued to be a challenge in the implementation of enforcement mechanisms across the four agroecological study regions.

Key informant interviews were conducted with National Environment Management Authority officials and carbon project developers to gather qualitative evidence on enforcement mechanisms. One National Environment Management Authority official acknowledged: *"The 2024 Regulations have established formal monitoring systems and compliance verification procedures, but there are inconsistencies across regions. We have the systems on paper but implementing them with the same rigour in Kwale as we do in Nairobi is a real challenge."* A project developer from the Kenya Agricultural Carbon Project observed: *"Satellite-based monitoring works well for us in Western Kenya. We can track land use changes in near real-time. But our colleagues working on coastal blue carbon projects in Kwale tell a very different story, accessing mangrove sites for ground-based verification is logistically very difficult and expensive."* Regarding dispute resolution, a project developer noted: *"The formal dispute resolution processes in the 2024 Regulations are a major step forward. Before, when conflicts arose between project developers and farmers over payments or compliance issues, everything was settled informally through negotiation. There was no structure, no accountability. Now there is a clear process that protects both sides."*

These findings aligned with the qualitative policy analysis of Omukuti *et al.* (2024), who found that enforcement gaps posed a direct threat to equity and economic returns in Kenya's carbon markets and recommended immediate implementation of the 2024 Regulations to safeguard smallholder interests. The qualitative finding regarding regional enforcement inconsistency confirmed the observation of Pagop and Savard (2024) that governance gaps and weak enforcement mechanisms were key constraints on the performance of voluntary carbon markets across Africa. The relatively lower quantitative satisfaction with monitoring frequency and report reliability also resonated with Li and Zhang (2024), who found in their comparative study of forest carbon offset protocols that consistency of monitoring and compliance integrity were critical to market credibility and economic outcomes. The current study provided the first inferential statistical evidence from Kenya that enforcement mechanisms, while the weakest individual predictor among the four

policy framework dimensions, were still a statistically significant positive predictor of economic viability outcomes for smallholder farmers and forestry enterprises.

4.2.3.5 Economic Viability of Voluntary Carbon Credit Markets

Economic viability of voluntary carbon credit markets referred to the capacity of market participation to generate net positive financial returns for smallholder farmers and forestry enterprises in Kenya. It was operationalised in this study through three dimensions: market participation rates, revenue generation, and transaction costs. The overall objective of the study was to examine the influence of policy frameworks on the economic viability of voluntary carbon credit markets in Kenya. The four theories reviewed in chapter two, institutional theory, policy implementation theory, transaction cost economics, and the resource-based view, collectively predicted that stronger policy frameworks across all four dimensions would improve these economic viability outcomes. The study analysed respondents' perceptions regarding economic viability outcomes and the findings are presented in Table 16.

Table 16: Descriptive Statistics of Economic Viability of Voluntary Carbon Credit Markets

Statement	SD%	D%	N%	A%	SA%	Mean	SD
The current policy environment encourages my continued participation in the voluntary carbon market	3.9	10.8	2.5	63.2	19.7	3.84	0.99
The number of smallholder farmers and forestry enterprises participating in my region has increased	4.2	8.9	2.5	62.3	22.2	3.89	0.98
I would recommend other farmers or enterprises to participate in voluntary carbon credit markets	3.0	10.2	1.9	64.3	20.5	3.87	0.95
The revenue I earn from carbon credits has improved over time	1.9	9.1	1.4	65.9	21.6	3.96	0.88
The revenue I earn from carbon credits contributes meaningfully to my household or enterprise income	0.8	8.6	1.7	65.1	23.8	4.02	0.82
The current carbon credit prices offer fair returns to participants	2.5	6.6	2.5	64.0	24.4	4.01	0.87
The costs of registering and certifying a carbon project are reasonable	1.7	6.4	1.7	63.4	26.9	4.07	0.83
The administrative costs of participating in the carbon market are manageable	1.7	5.0	1.1	61.5	30.7	4.15	0.80
The costs of monitoring, reporting and verification are affordable for participants	1.4	5.5	0.3	61.5	31.3	4.16	0.80
Average						**4.00**	**0.88**

The results showed that 82.9 percent (63.2% + 19.7%) of the respondents agreed that the current policy environment encouraged their continued participation in the voluntary carbon market, 14.7 percent disagreed and 2.5 percent were neutral. The mean score for this item was 3.84 (SD = 0.99), the lowest mean score for any individual item in this construct. The 14.7 percent disagreement indicated that some groups of participants were concerned about the continued regulatory burden, limited access to market information, and overall attractiveness of economic returns compared to the compliance costs of formal carbon market participation, as the majority of smallholder farmers and forestry enterprises saw the policy environment created by the climate change carbon markets regulations 2024 as conducive to their continued participation in the market. Further, 84.5 percent of the respondents agreed that the number of smallholder farmers and forestry enterprises participating in carbon projects in their region had increased, 13.1 percent disagreed and 2.5 percent were neutral. The mean score was 3.89 (SD = 0.98). This was in line with the increase in the number of registered voluntary carbon projects under the National Carbon Registry since the implementation of the 2024 Regulations.

In addition, 84.8 percent of the respondents agreed that they would recommend other farmers or enterprises to participate in voluntary carbon credit markets, 13.2 percent disagreed and 1.9 percent were neutral. The mean score was 3.89 (SD = 0.95). In addition, 87.5 percent of the respondents confirmed that the income they had generated from carbon credits had increased over time, 11.0 percent said it had decreased and 1.4 percent said it had remained the same. The mean score was 3.96 (SD = 0.88). Additionally, 88.9 percent of the respondents agreed that the income they received from carbon credits contributed meaningfully to their household or enterprise income, while 9.4 percent disagreed and 1.7 percent were neutral. The mean score was 4.02 (SD = 0.82). Likewise, 88.4 percent of the respondents agreed that the existing carbon credit prices offered fair returns to participants, 9.1 percent disagreed and 2.5 percent were neutral. The mean score was 4.01 (SD = 0.87). Furthermore, 90.3 percent of the respondents agreed that the costs of registering and certifying a carbon project were reasonable, 8.1 percent disagreed and 1.7 percent were neutral. The mean score was 4.07 (SD = 0.83).

The items of cost management had the highest level of agreement. In particular, 92.2 percent of the respondents agreed that the administrative costs of participating in the carbon

market were manageable, 6.7 percent disagreed and 1.1 percent were neutral. The mean score was 4.15 (SD = 0.80). Lastly, 92.8 percent of the respondents agreed that the costs of monitoring, reporting and verification were affordable for participants, 6.9 percent disagreed and 0.3 percent were neutral. The highest individual item mean was 4.16 (SD = 0.80). The overall average mean score for economic viability of voluntary carbon credit markets was 4.00 (SD = 0.88), reflecting a generally positive perception of economic viability outcomes among voluntary carbon credit market participants in Kenya, with the highest satisfaction reported in the affordability of monitoring, reporting and verification costs and the lowest satisfaction reported in the overall encouragement provided by the current policy environment and market participation growth, suggesting that the cost dimensions of economic viability were well managed, but continued policy effort was needed to strengthen revenue generation and market participation incentives for smallholder farmers and forestry enterprises in all four agroecological study regions.

Key informant interviews and focus group discussions were conducted to gather qualitative evidence on economic viability outcomes across the four study regions. Focus group participants in Western Kenya reported substantial income improvements from carbon credit revenues. One smallholder farmer from Kisumu County stated: *"Since joining the Kenya Agricultural Carbon Project, my income has gone up by almost 20 percent. That money has helped me buy fertiliser and pay school fees. I would never leave this project."* Another farmer from Bungoma County noted: *"The carbon credits are not the biggest part of my income, but they are the most reliable. Every season I know I will receive something, that consistency matters."* In Eastern Kenya, focus group participants under the Farm Africa Acorn Project expressed high confidence in the payment systems. One farmer from Embu County said: *"The payments come on time and we are always told the price before we agree. That transparency is what makes us trust the project and bring in other farmers."* In Coastal Kenya, however, focus group participants expressed concerns about certification costs. One community group representative from Kwale County observed: *"The monitoring and verification costs are manageable for now, but the certification costs are still high for smaller groups like ours. If those costs could be reduced, more community groups in this area would join the carbon market."*

These findings were consistent with those of the World Bank BioCarbon Fund (2024) and Vi Agroforestry (2025), who documented up to 20 percent improvements in farmer incomes and crop yields in the Kenya Agricultural Carbon Project, directly confirming the Western Kenya focus group qualitative evidence. The high satisfaction with transaction cost management confirmed the prediction of transaction cost economics that well-defined benefit-sharing and regulatory frameworks would reduce the costs of negotiation, monitoring, and verification for smallholder participants (Williamson, 1985). The lower satisfaction with market participation encouragement and revenue allocation fairness resonated with Healy *et al.* (2023) and Lema *et al.* (2025), both of whom found that equity dimensions of benefit distribution remained inadequately addressed even in formally regulated carbon markets. The Coastal Kenya focus group finding regarding certification cost barriers confirmed the observation of Hänke *et al.* (2026) that fixed upfront costs for sampling, data systems, validation, and monitoring, reporting and verification left smallholder projects highly exposed to financial risk, particularly for smaller community groups operating at limited scale.

4.2.4 Diagnostics Tests

The diagnostic tests conducted included the normality test, multicollinearity test and homoscedasticity test prior to conducting regression analyses. The results of each diagnostic test are presented in the sub-sections that follow.

4.2.4.1 Normality Test

The findings are presented in Table 17.

Table 17: Normality Test

	Kolmogorov-Smirnova		
	Statistic	df	Sig.
Economic Viability	0.064	361	0.6249
Regulatory Frameworks	0.230	361	0.2705
Benefit-Sharing Mechanisms	0.253	361	0.3988
Institutional Capacity	0.269	361	0.7901
Enforcement mechanisms	0.246	361	0.5081

The results show that the p-values for all the study variables were greater than 0.05, confirming that the null hypothesis of normality cannot be rejected for any of the variables. Specifically, the p-value for economic viability was 0.625, for regulatory frameworks 0.271, for benefit-sharing mechanisms 0.399, for institutional capacity 0.790 and for enforcement mechanisms 0.508. The highest p-value of 0.790 was recorded for institutional capacity, while the lowest p-value of 0.271 was recorded for regulatory frameworks, both of which nonetheless substantially exceed the 0.05 significance threshold. These results confirm that all five study variables are normally distributed.

4.2.4.2 Multicollinearity Test

The findings are summarized in Table 18

Table 18: Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	Regulatory Frameworks	0.543	1.840
	Benefit-Sharing Mechanisms	0.535	1.869
	Institutional Capacity	0.475	2.107
	Enforcement Mechanisms	0.544	1.837

Table 18 indicates that the VIF values of regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms were 1.840, 1.869, 2.107 and 1.837 respectively, which are below the threshold of 10. The lowest VIF value was 1.837 for enforcement mechanisms and the highest VIF value was 2.107 for institutional capacity, which is still within acceptable limits. The corresponding tolerance values for all four independent variables ranged from 0.475 to 0.544, all of which are well above the minimum acceptable tolerance value of 0.10, with the tolerance value of 0.475 for institutional capacity indicating that approximately 47.5% of the variance in this variable is not accounted for by the other independent variables in the model, and the tolerance value of 0.544 for enforcement mechanisms confirming that approximately 54.4% of the variance in this variable is independent of the other predictors. These results indicate that regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms are sufficiently different constructs that can be included in the

regression model without inflating the standard errors or producing unreliable estimates of the coefficients.

4.2.4.3 Homoscedasticity Test

The results are presented in Table 19.

Table 19: Homoscedasticity Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.217	0.052		4.184	0.000
	Regulatory Frameworks	0.026	0.014	0.129	1.802	0.072
	Benefit-Sharing Mechanisms	0.019	0.015	0.094	1.302	0.194
	Institutional Capacity	0.003	0.016	0.014	0.190	0.850
	Enforcement Mechanisms	0.017	0.016	0.074	1.044	0.297

Dependent Variable: Absolute Economic Viability

Table 19 indicates that none of the four independent variables (regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms) were statistically significant predictors of the absolute residuals of economic viability, which confirms the absence of heteroscedasticity in the regression model. In particular, the p value for regulatory frameworks was 0.072, for benefit-sharing mechanisms 0.194, for institutional capacity 0.850 and for enforcement mechanisms 0.297, all of which are above the 0.05 significance level. These results indicate that regression residuals have constant variance at all levels of the four independent variables, thus meeting the homoscedasticity assumption of ordinary least squares regression. The results of the three diagnostic tests (normality, multicollinearity and homoscedasticity) indicate that all three important assumptions of OLS regression are fully met in this study, thus ensuring the reliability and integrity of the regression results presented in the following sections.

4.2.5 Correlation Analysis

The results are presented in Table 20.

Table 20: Correlation Analysis

		Economic Viability	Regulatory Frameworks	Benefit-Sharing Mechanisms	Institutional Capacity	Enforcement Mechanisms
Economic Viability	Pearson Correlation	1.000				
	Sig. (2-tailed)					
Regulatory Frameworks	Pearson Correlation	.681**	1.000			
	Sig. (2-tailed)	0.000				
Benefit-Sharing Mechanisms	Pearson Correlation	.617**	.558**	1.000		
	Sig. (2-tailed)	0.000	0.000			
Institutional Capacity	Pearson Correlation	.727**	.613**	.612**	1.000	
	Sig. (2-tailed)	0.000	0.000	0.000		
Enforcement Mechanisms	Pearson Correlation	.589**	.554**	.569**	.603**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	

The results show that regulatory frameworks had a positive and statistically significant correlation with economic viability of voluntary carbon credit markets ($r = 0.681$, $p = 0.000$). This finding recommends that the more robust and transparent the regulatory framework, the more economically viable the smallholder farmers and forestry enterprises are in the voluntary carbon credit markets in Kenya. This aligns with the findings of Ajayi *et al*. (2025) which showed that regulatory uncertainty and technical capacity are key constraints to the performance of voluntary carbon markets in Nigeria, and that better regulatory conditions are required for climate-smart farming to provide economic benefits. In the same vein, Jain *et al*. (2025) identified in their scoping review of carbon markets in African livestock sectors that the lack of clear policy frameworks and institutional support

are significant barriers to smallholder participation, with a direct link to market participation outcomes. The current study builds on these findings by offering the first inferential statistical evidence from Kenya's post-2024 regulatory landscape, confirming that the clarity of regulatory guidelines, the reasonableness of registration requirements and the consistency of approval procedures are important positive correlates of economic viability outcomes for smallholder farmers and forestry enterprises in the four agroecological study regions.

The results also reveal that benefit-sharing mechanisms had a positive and statistically significant correlation with economic viability of voluntary carbon credit markets ($r = 0.617$, $p = 0.000$). This finding validates that better benefit-sharing arrangements, which are more transparent, equitable and well implemented, are positively correlated with better economic viability outcomes for voluntary carbon market participants in Kenya. This is consistent with the results of Healy *et al*. (2023) who performed a document analysis of 47 voluntary carbon projects and found that incomplete financial disclosures and inconsistent revenue distribution are a challenge to the economic returns local stakeholders can achieve from participating in carbon markets. It also aligns with the findings of Lema *et al*. (2025) in their comparative case study in Nicaragua and Brazil, which revealed that certification costs, intermediary capture and governance complexity are important factors that reduce farmer returns, and that transparent pricing and fair value-sharing schemes are essential for equitable benefit distribution. Moreover, Schilling (2026) in a multiple case study of 12 carbon farming projects in Kenya, found that risk and revenue sharing is highly variable across funding models and that there is a need for more transparency in cost and revenue accounting to improve smallholder economic outcomes. The current study builds on these contextual findings by empirically quantifying the strength of the benefit-sharing mechanisms-economic viability relationship in Kenya's voluntary carbon credit markets under the Climate Change Carbon Markets Regulations 2024.

In addition, the results indicate that institutional capacity had the highest positive and statistically significant correlation with economic viability of all four independent variables ($r = 0.727$, $p = 0.000$). This finding indicates that stronger institutional capacity, encompassing staff competency, technical expertise in monitoring and verification, and processing efficiency, is most strongly associated with greater economic viability of

voluntary carbon credit markets in Kenya. This finding is consistent with the conclusions of Shames *et al*. (2016) who found that agricultural carbon projects in Western Kenya and Uganda, with the involvement of community intermediaries and local government, have better implementation outcomes when the capacity of the community intermediaries is greater. The finding also resonates with Otundo (2024) who conducted a systematic review of 14 studies in Kenya using PRISMA and found poor institutional capacity as one of the market inefficiencies in the carbon economy and Jain *et al*. (2025) who stated that the carbon economy is plagued by fragmented verification systems and a lack of institutional support, which hinders African smallholders' access to carbon finance. The current study is important in that it is the first to quantitatively demonstrate the effect of institutional capacity as the strongest policy framework determinant of economic viability of voluntary carbon credit markets in Kenya, filling the gap identified in the literature where no study has measured the combined effect of staff competency, technical expertise and processing efficiency on smallholder economic outcomes using primary data.

The results also show that the enforcement mechanisms had a positive and statistically significant correlation with economic viability of voluntary carbon credit markets ($r = 0.589$, $p = 0.000$), which was the lowest but still significant correlation among the four independent variables. This finding validates the positive relationship between more effective monitoring systems, compliance verification procedures and penalty enforcement provisions and increased economic viability outcomes for smallholder farmers and forestry enterprises in Kenya's voluntary carbon credit markets. This aligns with the qualitative policy analysis results of Omukuti *et al*. (2024), which revealed that enforcement gaps are a threat to equity in Kenya's carbon markets and that the Carbon Markets Regulations 2024 should be enforced immediately to safeguard the interests of smallholders. It also supports Pagop and Savard (2024) who found governance gaps and weak enforcement mechanisms as constraints to the performance of voluntary carbon markets in Africa, and Tjon Akon (2023) who concluded that better compliance verification and transparency are needed to tackle liquidity and integrity challenges in voluntary carbon markets. The relatively lower correlation coefficient of 0.589 for enforcement mechanisms compared to institutional capacity (0.727), regulatory frameworks (0.681) and benefit-sharing mechanisms (0.617) indicates that although the provisions for enforcement under the Climate Change Carbon

Markets Regulations 2024 are positively associated with economic viability, their impact on smallholder market participation, revenue generation and transaction costs is relatively more modest, which may be due to the implementation challenges in enforcement consistency reported across the four study regions.

4.2.6 Regression Analysis

The study conducted an ordinary least squares regression analysis to determine the predictive influence of regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms on the economic viability of voluntary carbon credit markets in Kenya. The regression analysis was conducted in three stages, presenting the model summary, the ANOVA results and the regression coefficients respectively, as shown in Tables 21, 22 and 23 below.

Table 21: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801a	0.641	0.637	0.331861

The results show that the four policy framework independent variables combined gave a multiple correlation coefficient of R = 0.801, which is a strong positive linear relationship between the policy framework independent variables and the economic viability of voluntary carbon credit markets in Kenya. The R Square value of 0.641 means that the four independent variables together account for 64.1% of the total variance in the economic viability of voluntary carbon credit markets. The other 35.9% of the variation in economic viability is due to other factors not included in the policy framework model of the current study, such as market-level factors (e.g., global carbon credit prices) and project-specific factors and individual farmer socioeconomic attributes. The results align with Ajayi *et al*. (2025), Jain *et al*. (2025) and Omukuti *et al*. (2024) who all posited that dimensions of policy frameworks are key drivers of the performance of voluntary carbon markets, but that other contextual factors also affect the overall performance of the market.

Table 22: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.996	4	17.499	158.891	.000b
	Residual	39.207	356	0.11		
	Total	109.203	360			

The overall regression model is statistically significant (F= 158.891, p = 0.000) as indicated by the results of the ANOVA in Table 22, which means that the four independent variables (regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms) collectively and significantly predict the economic viability of voluntary carbon credit markets in Kenya. The F-statistic is highly significant at p = 0.000, indicating that the regression model is a good fit for the data and that the overall predictive power of the four policy framework variables on economic viability is not by chance.

Table 23: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.703	0.089		19.119	0.000
	Regulatory Frameworks (RF)	0.174	0.025	0.303	7.032	0.000
	Benefit-Sharing Mechanisms (BSM)	0.090	0.025	0.154	3.551	0.000
	Institutional Capacity (IC)	0.224	0.027	0.387	8.384	0.000
	Enforcement Mechanisms (EM)	0.063	0.027	0.100	2.319	0.021

The regression equation derived from the coefficients is expressed as follows:

EV = 1.703 + 0.174(RF) + 0.090(BSM) + 0.224(IC) + 0.063(EM)

The constant of 1.703 (t = 19.119, p = 0.000) is the baseline level of economic viability of voluntary carbon credit markets when all four independent variables are set to zero, and is statistically significant at p = 0.000. This positive and significant constant recommends that there is a baseline level of economic viability among the voluntary carbon credit market participants in Kenya, which is not dependent on the four dimensions of the policy framework assessed in this study, and is likely to be driven by other market participation incentives, project infrastructure and community relationships that existed prior to the enactment of the Climate Change Carbon Markets Regulations 2024.

The regulatory frameworks had a statistically significant positive effect on the economic viability of voluntary carbon credit markets (β= 0.174, p = 0.000). This result recommends that for every one-unit increase in the perception of regulatory frameworks, the economic viability increases by 0.174 unit, while other factors remain unchanged. Regulatory frameworks are the second strongest individual predictor of economic viability in the model. This aligns with the findings of Ajayi *et al*. (2025) who showed that regulatory uncertainty and lack of technical capacity are the major challenges to the performance of the voluntary carbon market in Nigeria and Nunow and Arale (2025) who revealed that weak regulation and lack of stakeholder awareness are the major challenges to the development of the carbon market in Kenya. The current study builds on these findings by offering the first quantitative inferential evidence that regulatory clarity, registration requirements and approval procedures under the Climate Change Carbon Markets Regulations 2024 are important positive predictors of smallholder economic viability outcomes in Kenya, filling the empirical gap in the literature where no previous study has tested this relationship using regression-based statistical analysis.

The results also indicate that benefit-sharing mechanisms had a statistically significant positive impact on the economic viability of voluntary carbon credit markets (β = 0.090, p = 0.000). This result recommends that for every one-unit increase in the perception of benefit-sharing mechanisms, there is a 0.090-unit increase in economic viability, all else being equal. Benefit-sharing mechanisms are the third strongest individual predictor of economic viability in the model. This finding supports the findings of Healy *et al*. (2023) that the lack of financial transparency and inconsistent distribution of revenues in voluntary carbon projects negatively affect the economic benefits for local stakeholders and is

consistent with Lema *et al*. (2025) who showed that transparent pricing and fair value-sharing schemes are crucial for equitable benefit distribution to smallholder farmers. It also corroborates the findings of Schilling (2026) in his multiple case study of carbon farming projects in Kenya, which found that there is a wide variation in revenue sharing models and that there is a need for more transparency in cost and revenue accounting to improve smallholder economic outcomes. The relatively lower beta coefficient of 0.154 for benefit-sharing mechanisms compared to the other predictors indicates that benefit-sharing mechanisms have a positive effect on economic viability, but this effect is limited by the complexity of implementing Community Development Agreements and the varying levels of payment transparency across the four agroecological study areas, as noted by Kimani (2025) in his critical legal analysis of Kenya's Carbon Markets Regulations 2024.

The results reveals that the institutional capacity had the highest and statistically significant positive effect on the economic viability of voluntary carbon credit markets, compared to the other three independent variables ($\beta = 0.224$, $p = 0.000$). This means that for every one unit increase in the perception of institutional capacity, there is a 0.224 unit increase in economic viability, with all other variables in the model held constant, which is the highest marginal effect of any of the predictors in the model. The results of the regression model show that institutional capacity is the strongest individual predictor of economic viability. This finding aligns with the findings of Shames *et al*. (2016) who showed that the more institutional capacity community intermediaries have, the more successful the carbon project implementation outcomes are, and Otundo (2024) who identified poor institutional capacity as the most important market inefficiency in Kenya's carbon economy. The finding is also consistent with Demmalino and Salahuddin (2025) and Thamrin *et al*. (2025) who identified regulatory coherence, technical capacity and institutional coordination as the most significant factors in the Indonesian context that affect the ability of carbon policy frameworks to provide tangible economic benefits to smallholder participants. The results indicate that institutional capacity is the most significant factor influencing economic viability in Kenya's voluntary carbon credit markets, highlighting the need to prioritize staff competency, technical expertise in monitoring, reporting and verification, and processing efficiency as key policy interventions to improve smallholder economic outcomes under the Climate Change Carbon Markets Regulations 2024.

Lastly, the results indicate that enforcement mechanisms had a statistically significant positive effect on the economic viability of voluntary carbon credit markets ($\beta = 0.063$, $p = 0.021$). This means that for every one-unit increase in the perception of enforcement mechanisms, economic viability increases by 0.063 units, all else equal. However, enforcement mechanisms are the weakest of the four predictors in the model. This aligns with the findings of Omukuti *et al*. (2024) that enforcement gaps directly threaten equity and economic returns in Kenya's carbon markets, and Pagop and Savard (2024) who identified weak enforcement mechanisms as a major constraint to the performance of voluntary carbon markets in Africa. Overall, the regression results validate that all four policy framework dimensions (regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms) are statistically significant positive predictors of the economic viability of voluntary carbon credit markets in Kenya, with institutional capacity having the greatest impact, followed by regulatory frameworks, benefit-sharing mechanisms and enforcement mechanisms.

4.3 Interpretation of the Findings

The study found that the four policy framework dimensions (regulatory frameworks, benefit sharing mechanisms, institutional capacity and enforcement mechanisms) explained 64.1% of the variance in the economic viability of voluntary carbon credit markets in Kenya ($R2 = 0.641$, $F = 158.891$, $p = 0.000$). This strong explanatory power suggests that the dimensions of the policy framework are important governance structures that influence the economic outcomes of voluntary carbon markets for smallholder farmers and forestry enterprises in the four agroecological study areas. The remaining 35.9% of the variance could be due to other factors not covered in this study, such as global carbon credit prices, project specific factors, market demand and individual farmer socioeconomic factors. The finding thus validates the theoretical underpinning of the study and the relevance of the Climate Change Carbon Markets Regulations 2024 as a key policy instrument that impacts the economic viability of the voluntary carbon credit markets in Kenya.

The constant of 1.703 ($t = 19.119$, $p = 0.000$) is the estimated value of economic viability at the baseline level where all four independent variables are equal to zero. Its statistical

significance suggests that there is a part of economic viability that is not related to the four policy framework dimensions that were added to the regression model. This baseline could be due to the incentives that already exist in the market, project infrastructure, existing relationships between communities and project developers, and past experience with voluntary carbon projects in the four study areas. These factors are not new and could continue to impact the economic outcomes of market participants after the Climate Change Carbon Markets Regulations 2024 are implemented. The substantial constant indicates that Kenya's voluntary carbon market has an economic basis that underpins the regulatory, benefit sharing, institutional and enforcement mechanisms. These policy dimensions can then be strengthened to further improve the economic viability of smallholder farmers and forestry enterprises on the basis of the current market.

The positive coefficient of regulatory frameworks ($\beta = 0.174$, $p = 0.000$) suggests that as regulatory frameworks improve, so do the economic viability of voluntary carbon credit markets, holding other factors constant. The second most important model predictor of economic viability was regulatory frameworks. The finding suggests that regulatory transparency, reasonable registration requirements, predictable procedures, and consistency in project approval processes under the Climate Change Carbon Markets Regulations 2024 have a positive impact on market participation, revenue opportunities, and transaction cost management. The descriptive mean of 4.01 for regulatory frameworks also indicates that the respondents had a positive perception of the current regulatory framework, such as registration requirements and approval procedures. The descriptive and regression results thus indicate that a transparent and predictable regulatory framework can help to lower uncertainty and information asymmetries, and give smallholder farmers, forestry companies and project developers more confidence to engage in voluntary carbon credit markets.

The positive and statistically significant coefficient of benefit sharing mechanisms ($\beta = 0.090$, $p = 0.000$) suggests that as benefit sharing mechanisms improve, the economic viability also improves, while other variables remain constant. Among the four dimensions of policy frameworks, benefit sharing mechanisms were the third most important factor for economic viability. The descriptive mean of 3.84, which was comparatively lower than the means recorded for the other study variables, suggests that benefit sharing arrangements

were generally perceived positively, but there were some concerns about the fairness of the formulas for allocating revenues and the clarity of Community Development Agreements. The results indicate that the formalisation of benefit sharing mechanisms under the regulatory framework of 2024 has helped to improve transparency and predictability in the distribution of carbon revenues. The relatively smaller coefficient, however, suggests that more work is needed to ensure that benefit sharing arrangements are able to capture the contribution, opportunity cost and expectations of smallholder farmers and communities in the four agroecological study areas.

Institutional capacity ($\beta = 0.224$, $p = 0.000$) was the strongest individual predictor of economic viability, suggesting that strengthening institutional capacity is likely to have the largest impact on economic viability among the four dimensions of the policy framework, all else being equal. The descriptive mean of 4.03 for institutional capacity was in line with the perception that institutions engaged in carbon market governance were relatively capable and coordinated. The finding suggests that institutional capacity development, such as technical monitoring skills, county level responsiveness, processing efficiency and effective inter agency coordination, is key to the implementation of policy provisions to economic outcomes. The institutional actors are tasked with facilitating registration, technical guidance, coordinating approvals, monitoring projects and making sure that market actors are aware of the requirements. Thus, poorly developed institutions may jeopardize otherwise good regulations. Thus, the role of institutional capacity is underscored, which includes competent personnel, technological resources, technical expertise, and administrative efficiency in order to achieve tangible economic benefits for smallholder farmers and forestry enterprises.

The coefficient of enforcement mechanisms was positive and statistically significant ($\beta = 0.063$, $p = 0.021$), suggesting that the more robust the enforcement mechanisms, the more economically viable the country is, all else being equal. But the weakest effect was for enforcement mechanisms among the four predictors. The descriptive mean of 3.87 also suggests that the respondents had a positive attitude towards the enforcement arrangements, but the perception was relatively low in terms of the frequency and consistency of monitoring activities in the study areas. The results indicate that the implementation of the regulatory framework might need to be enhanced to ensure

uniformity in monitoring, compliance verification and corrective actions in Western, Eastern, Central and Coastal Kenya. Inconsistent enforcement can lead to uncertainty for participants, reduce compliance incentives, and may have a negative impact on projects or communities in areas with limited monitoring capacity. To enhance the economic benefits that can be achieved through the voluntary carbon market, investment in monitoring infrastructure, enforcement personnel, standardised compliance procedures and coordination between national and county level institutions is therefore needed.

The relative size of the regression coefficients also shows that the economic viability of voluntary carbon credit markets is not only dependent on the formal regulatory provisions, but also on the ability of institutions to effectively implement these provisions. The institutional capacity had the greatest impact on economic viability, while regulatory frameworks were the next most important, suggesting that competent personnel, effective inter agency coordination, efficient approval processes and reliable technical support are key to positive market outcomes. This finding indicates that regulatory changes alone will not produce the desired results if the institutions that are tasked with registration, verification, monitoring and project supervision are not sufficiently resourced. Efficient institutions can help to minimize administrative delays, transaction costs and access to information needed to participate in markets for smallholder farmers and forestry enterprises. Thus, ongoing investments in institutional capacity, technical expertise, technological infrastructure, and coordination mechanisms are required to ensure that the Climate Change Carbon Markets Regulations 2024 become a reality and deliver real and lasting economic benefits to voluntary carbon market participants.

The relatively lower coefficients for benefit sharing mechanisms and enforcement mechanisms also offer key policy insights for the long-term sustainability and inclusiveness of voluntary carbon credit markets in Kenya. While both dimensions were positively and statistically significant, their relatively lower impact indicates that more effort is needed to ensure equitable distribution of revenues, transparency of community benefit agreements, and uniformity of compliance oversight. Smallholder farmers and forestry enterprises are more likely to stay engaged in carbon projects if payment mechanisms are clear, benefit sharing is communicated and project developers are regularly audited against regulatory standards. The enforcement systems and the

monitoring procedures could thus be strengthened and standardised in the four agroecological regions, to increase confidence in the market and decrease uncertainty among the participants. Likewise, making benefit sharing arrangements more transparent and fair could help to enhance community acceptance and participation. These enhancements would be in addition to the current regulatory framework and help to build a more equitable, credible and economically viable voluntary carbon credit market in Kenya.

The descriptive statistics, correlation analysis, and regression analysis results all show that the policy framework (four dimensions) is positively and significantly related to the economic viability of voluntary carbon credit markets in Kenya. The regression equation, EV = 1.703 + 0.174(RF) + 0.090(BSM) + 0.224(IC) + 0.063(EM), indicates that institutional capacity had the highest impact on economic viability followed by regulatory frameworks, benefit sharing mechanisms and enforcement mechanisms, respectively. The economic viability mean of 4.00, combined with the statistically significant regression model, suggests that in general, respondents felt that the current policy environment was conducive to the involvement of smallholder farmers and forestry enterprises in voluntary carbon markets and their capacity to benefit economically. However, the relatively weak impact of benefit sharing and enforcement mechanisms indicate that equity, transparency, monitoring and compliance still need to be addressed in policies. To ensure the benefits of Kenya's voluntary carbon credit market are sustainable and equitably distributed among participating groups, these dimensions will need to be addressed.

4.4 Discussion of the Findings

The study revealed that regulatory frameworks have a positive correlation with the economic viability of voluntary carbon credit markets in Kenya with a Pearson correlation of $r = 0.681$, β value of 0.174 and a p value of 0.000. This discovery validates that the Climate Change Carbon Markets Regulations 2024, with its clear regulatory guidelines, reasonable registration requirements, and consistent approval processes, directly contributes to improving the market participation of smallholders, their revenue generation, and the management of transaction costs. This aligns with the findings of Ajayi *et al*. (2025) who showed in their causality analysis of voluntary carbon markets in Nigeria that

regulatory uncertainty and technical capacity are the main constraints to the performance of voluntary carbon markets, and that better regulatory conditions are required for carbon markets to provide economic benefits to smallholder participants.

The finding also agrees with Jain *et al*. (2025) who identified in their scoping review of African livestock sectors that the lack of policy clarity, high certification costs and poor institutional support are all significant barriers to smallholder participation, and that there is a direct link between policy clarity and market participation outcomes. Likewise, Nunow and Arale (2025) identified weak regulation and lack of stakeholder awareness as significant barriers to the development of Kenya's carbon market, and BDO East Africa (2025) suggested that the National Carbon Registry should operate transparently and adopt international standards as prerequisites for market credibility. The current study builds on these findings by offering the first inferential statistical evidence that the regulatory provisions of the Climate Change Carbon Markets Regulations 2024 are significant positive predictors of smallholder economic viability outcomes, filling the empirical gap identified throughout the literature, where no previous study has tested this relationship using regression-based analysis.

This finding is further highlighted by the limitations of existing regulatory framework studies reviewed in Chapter Two, which provide the empirical contribution of this finding. Manarte (2022), Santier (2023) and Battocletti (2025) emphasized the importance of regulatory clarity, but used only qualitative, doctrinal or secondary source designs without inferential modelling. Kisiwa *et al*. (2025) and Ernst and Young (2024) offered valuable doctrinal analysis of the regulatory landscape in Kenya, but lacked empirical testing of the impact of specific regulatory provisions on observable economic outcomes. The current study thus contributes to the literature by quantitatively showing that regulatory frameworks under the 2024 Regulations are important positive predictors of economic viability, especially in the four agroecological study regions in Kenya, in terms of consistency in the approval procedure and reasonableness of registration requirements.

The study found that benefit-sharing mechanisms are significant and positively affect the economic viability of voluntary carbon credit markets in Kenya ($\beta = 0.090$, $p = 0.000$) with a Pearson correlation of $r = 0.617$. This discovery validates that clear revenue-sharing

percentages, effective Community Development Agreements and prompt payment mechanisms have a direct positive impact on the economic benefits of smallholder farmers and forestry businesses involved in voluntary carbon credit markets. This finding aligns with the findings of Healy *et al*. (2023), who found that incomplete financial disclosures and inconsistent revenue distribution negatively affect the economic returns of local stakeholders, and thus the economic outcomes of participants, through document analysis of 47 voluntary carbon projects.

The finding also resonates with Lema *et al*. (2025), who showed in their comparative case study in Nicaragua and Brazil that certification costs, intermediary capture and governance complexity are important factors that diminish farmer returns, and that transparent pricing and fair value-sharing schemes are crucial for equitable benefit distribution. Holliday (2025) also reported that smallholder farmers in the Global South often fail to reap significant economic benefits from their engagement with voluntary carbon markets, largely because of the complexity of governance and the lack of transparency in benefit-sharing mechanisms. The relatively lower beta coefficient of $\beta = 0.090$ for institutional capacity and regulatory frameworks indicates that benefit-sharing mechanisms positively affect economic viability, but their effect is limited by the complexity of Community Development Agreement implementation and the varying levels of payment transparency across the four agroecological study areas, which aligns with Kimani's (2025) critical legal analysis that found overlapping institutional mandates as a risk to equitable benefit-sharing in Kenya.

This finding is further contextualised by the Kenya-specific evidence reviewed in Chapter Two. In his multiple case study of 12 carbon farming projects in Kenya, Schilling (2026) identified a wide range of risk and revenue sharing across funding models, and a need for more transparency in cost and revenue accounting to improve smallholder economic outcomes. Kimani (2025) found that the complex approval process and overlapping institutional mandates are risks to equitable benefit-sharing, and Novelia (2024) showed that co-benefit visibility influences stakeholder engagement decisions. The current study contributes to this body of evidence by empirically quantifying the strength of the benefit-sharing mechanisms and economic viability relationship in Kenya's voluntary carbon credit markets, finding that benefit-sharing provisions under the 2024 Regulations are statistically

significant positive predictors of smallholder economic outcomes, and that there is a need for further policy refinement in terms of transparency of revenue allocation and implementation of Community Development Agreements.

The study found that the institutional capacity is the most significant positive factor among the four independent variables ($\beta = 0.224$, $p = 0.000$) with Pearson correlation of $r = 0.727$. This finding validates that staff competency, technical competency in MRV, and institutional processing efficiency are the most impactful policy framework determinants of smallholder economic viability outcomes in Kenya's voluntary carbon credit markets. This finding is in line with the results of Shames *et al*. (2016) who showed that the more capacity community intermediaries have and the more local government is involved, the better the outcomes of carbon project implementation in Western Kenya, a stratum of the current study.

The finding also corroborates the PRISMA-based systematic review of 14 studies by Otundo (2024) which found that poor institutional capacity is the most significant market inefficiency in Kenya's carbon economy, and the findings of Mwakima and Omido (2025) that institutional asymmetries in global climate finance constrain the benefits to developing country participants. The findings are also aligned with Demmalino and Salahuddin (2025) and Thamrin *et al*. (2025), who identified regulatory coherence, technical capacity and institutional coordination as the most significant factors in the Indonesian context that affect the economic benefits of carbon policy frameworks for smallholder participants. Together, these studies validate that institutional capacity is a cross-contextual predictor of carbon market performance, and the current study offers the first inferential statistical confirmation of this relationship based on primary data from Kenya's post-2024 regulatory context.

The empirical results of this study have important policy implications that go beyond the literature, as institutional capacity is the most important determinant of economic viability. Jain *et al*. (2025) found that fragmented verification systems and institutional support are barriers to accessing carbon finance for African smallholders, and suggested the establishment of local Validation and Verification Bodies to improve outcomes, while

Sambodo *et al*. (2025) demonstrated that institutional fragmentation is a challenge to market benefits for smallholders in the forestry sector in Indonesia.

The study found that enforcement mechanisms positively affect the economic viability of voluntary carbon credit markets in Kenya with a Pearson correlation of r = 0.589 and a p value of 0.021. The result of the enforcement mechanisms is the lowest beta coefficient among the four predictors, but it still shows that the effective monitoring system, compliance verification procedures and penalty enforcement provisions have a positive contribution to the economic viability of smallholders. This aligns with the findings of Omukuti *et al*. (2024) that gaps in enforcement pose a direct threat to equity and economic returns in Kenya's carbon markets, and that the Carbon Markets Regulations 2024 should be enforced immediately to safeguard the interests of smallholders and promote equitable market outcomes.

The finding also resonates with Pagop and Savard (2024), who found governance gaps and weak enforcement mechanisms as key constraints to the performance of voluntary carbon markets across Africa, and Tjon Akon (2023), who concluded that better compliance verification and transparency are needed to tackle liquidity and integrity challenges in global voluntary carbon markets. Li and Zhang (2024) showed in their comparative study of forest carbon offset protocols in five jurisdictions that the consistency of the protocols and the integrity of compliance are crucial for the credibility of the market and economic outcomes, and Samuel (2025) found that stable regulatory design and compliance enforcement are essential for meeting decarbonisation targets. The current study contributes to these findings by filling the empirical gap found in the literature by offering the first inferential statistical evidence from Kenya that enforcement mechanisms are important positive predictors of smallholder economic viability.

The relatively low beta coefficient for enforcement mechanisms ($\beta = 0.063$) compared to the other three predictors is understood in the context of the early stage of enforcement implementation under the Climate Change Carbon Markets Regulations 2024. Everhart (2023) pointed out the need for hybrid public-private governance structures to reduce barriers to market entry and improve the credibility of compliance in voluntary carbon markets, while Murunga (2025) recommended a progressive carbon price in accordance

with the Climate Change Amendment Act 2023 in Kenya. The current study's result that enforcement mechanisms have the weakest but statistically significant effect on economic viability outcomes indicates that as the 2024 Regulations mature and enforcement consistency increases across the four agroecological study regions, the role of enforcement mechanisms in the economic viability outcomes of smallholders in Kenya's voluntary carbon credit markets is likely to become more robust, and is an important area for future longitudinal research.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusions, and recommendations derived from the study findings. The chapter also outlines the study's contribution to existing knowledge, its limitations, and suggestions for further research. Each section is discussed in depth.

5.2 Summary of the Findings

The study established that the policy framework outlined in the climate change carbon markets regulations 2024 was a significant positive determinant of the economic viability of voluntary carbon credit markets in Kenya. All four policy framework dimensions, regulatory frameworks, benefit-sharing mechanisms, institutional capacity, and enforcement mechanisms, positively and significantly influenced economic viability outcomes for smallholder farmers and forestry enterprises across the four agroecological study regions.

Regarding regulatory frameworks, the study established that the clarity of participation rules, the reasonableness of registration requirements, and the consistency of approval procedures were positively received by the majority of participants across all four regions. The 2024 Regulations succeeded in reducing the regulatory uncertainty and information asymmetries that previously characterised Kenya's voluntary carbon markets. However, regulatory awareness remained a persistent challenge in remote areas of Coastal and Central Kenya, where participants had limited access to information about their rights and obligations under the new framework.

In addition, the study established that benefit-sharing mechanisms positively influenced economic viability, though this dimension recorded the lowest mean perception score among all four policy framework variables. Payment timeliness and transparency were well received by participants. However, the fairness of revenue allocation formulas and the clarity of community development agreement provisions remained areas of significant dissatisfaction among smallholder farmers, particularly regarding the gap between stated revenue percentages and actual receipts after deductions for project costs.

Moreover, the study established that institutional capacity was the single most important policy framework determinant of economic viability. Participants strongly valued inter-agency coordination, processing efficiency, and technical training provision. However, a critical structural gap existed between the technical capacity of Nairobi-based regulatory institutions and county-level offices in Kisumu, Embu, and Kwale, which directly served smallholder farmers on the ground but lacked comparable human and technological resources.

Furthermore, the study established that enforcement mechanisms positively influenced economic viability, though they had the weakest effect among the four dimensions. Participants were most satisfied with dispute resolution processes and penalty deterrence provisions. However, the consistency and frequency of compliance monitoring remained the most significant enforcement weakness, particularly in Coastal Kenya where accessing mangrove blue carbon project sites for ground-based verification presented logistical constraints that undermined enforcement uniformity across the four study regions.

5.3 Conclusion

The study concludes that the policy framework outlined in the Climate Change Carbon Markets Regulations 2024 is a key and positive factor in the economic sustainability of voluntary carbon credit markets in Kenya. The four policy framework dimensions together form the main governance structure that influences the market participation decisions, revenue generation outcomes and transaction cost management of smallholder farmers and forestry enterprises in Western, Eastern, Central and Coastal Kenya. The study also finds that the Climate Change Carbon Markets Regulations 2024 are a positive policy development for Kenya's voluntary carbon market governance, as they have introduced formalised registration requirements, standardised approval processes and a National Carbon Registry, all of which have helped to mitigate regulatory uncertainty and information asymmetries that have hindered smallholder engagement in voluntary carbon credit markets.

The study finds that regulatory frameworks are a major positive factor in the economic viability of voluntary carbon credit markets in Kenya. The regulatory clarity, the reasonableness of the registration requirements and the consistency of the approval

procedures under the Climate Change Carbon Markets Regulations 2024 directly improve the market participation, revenue generation and transaction cost management of smallholders in the four agroecological study regions. The study also finds that although most smallholder farmers and forestry enterprises have a positive perception of the regulatory environment, including the consistency of the approval procedure and the reasonableness of the registration requirements, there are still some areas of regulatory awareness that need to be strengthened, especially among participants in remote areas of Coastal and Central Kenya, to ensure that all participant groups benefit equitably from the regulatory clarity provided by the 2024 Regulations.

In addition, the study concludes that benefit-sharing mechanisms are a key positive factor in the economic viability of voluntary carbon credit markets in Kenya, but their impact is relatively small compared to regulatory frameworks and institutional capacity. The Climate Change Carbon Markets Regulations 2024 have enhanced the equity and transparency of revenue sharing to smallholder farmers and forestry enterprises in the four study areas through the mandatory benefit-sharing thresholds, Community Development Agreement requirements and payment transparency provisions. The study also finds that the fairness of the revenue allocation formulas and the clarity of the provisions of the Community Development Agreement are still concerns for a significant number of participants, suggesting that the benefit-sharing aspects of the 2024 Regulations need to be further refined to better reflect the land, labour and natural resource contributions of smallholder participants.

Besides, the study concludes that the most important policy framework determinant of the economic viability of voluntary carbon credit markets in Kenya is institutional capacity. The most important factors to consider in turning the policy provisions of the Climate Change Carbon Markets Regulations 2024 into real economic gains for smallholder farmers and forestry enterprises are the competency of staff in regulatory and project institutions, the technical expertise available for monitoring, reporting and verification, and the efficiency of institutional processes for registering and issuing carbon credits. The study also finds that, although respondents generally believe that institutional actors are capable and well-coordinated, there is a structural capacity gap in the form of differential technical expertise between Nairobi-based institutions and county-level offices in Kisumu, Embu

and Kwale, which hinders the uniform provision of institutional services to voluntary carbon market participants in all four agroecological study areas.

The study finds that enforcement mechanisms are a key positive factor in the economic viability of voluntary carbon credit markets in Kenya, but have the lowest impact of the four dimensions of the policy framework studied. The monitoring systems, compliance verification procedures and penalty enforcement provisions in the Climate Change Carbon Markets Regulations 2024 have a positive impact on market integrity and smallholder economic viability outcomes, with the highest level of participant satisfaction for the indicators of the dispute resolution provisions and penalty deterrence. The study also finds that implementation of the enforcement provisions under the 2024 Regulations is still in its infancy, with formal implementation in place, but the frequency and reliability of compliance monitoring activities have not yet been fully realised, especially in the four agroecological study areas, indicating that enforcement capacity and consistency will be increasingly critical to economic viability as Kenya's voluntary carbon credit market evolves.

5.4 Recommendations

The study recommends that the Government of Kenya, via the Designated National Authority and the National Carbon Registry, should enhance regulatory communication and outreach efforts to smallholder farmers and forestry enterprises in remote parts of Coastal and Central Kenya. The National Environment Management Authority should create simplified regulatory guides, in local languages, that clearly outline the participation requirements, registration process and approval timelines under the Climate Change Carbon Markets Regulations 2024. County governments of Kwale, Nyeri, Kisumu, Siaya, Bungoma, Embu and Tharaka Nithi should be required to set up carbon market information desks at the ward level to ensure that all potential participants have access to the same information. Regulatory literacy sessions should be integrated into farmer training programmes of carbon project developers and implementing organisations to address the awareness gaps identified among the participants in the remote agroecological zones.

The study also recommends that the Government of Kenya should revise and enhance the benefit-sharing mechanisms in the Climate Change Carbon Markets Regulations 2024 to

better align the revenue-sharing formula with the land, labour, and natural resource inputs of smallholder farmers and forestry enterprises. The Designated National Authority should develop a standardised template for Community Development Agreement that clearly spells out the percentage of revenue allocation, payment schedule and grievance procedures in simple terms understandable to the smallholder participants. To improve transparency and accountability in payments, carbon project developers should be mandated to carry out annual benefit-sharing audits and report the outcomes on the National Carbon Registry. Organisations implementing the project, including Vi Agroforestry, Farm Africa and World Vision Kenya, should enhance their community engagement processes to ensure that smallholder participants are meaningfully engaged in the decision-making process of Community Development Agreements in all four agroecological study areas.

In addition, the study recommends that the Government of Kenya should focus on institutional capacity building as the key policy measure to improve the economic sustainability of voluntary carbon credit markets. The Climate Change Directorate should design and execute a systematic capacity building programme on staff competency in carbon accounting, monitoring, reporting and verification at national and county levels. To minimize the institutional service delivery gap between Nairobi based institutions and carbon project sites in the field, the National Environment Management Authority should create county level carbon market offices with technically qualified staff in Kisumu, Embu, Kwale and Nyeri. Multi-sectoral technical committees should be strengthened and adequately resourced to improve inter-agency coordination and eliminate procedural duplication in carbon project registration and credit issuance processes under the Climate Change Carbon Markets Regulations 2024.

The National Environment Management Authority should establish region-specific enforcement procedures, taking into consideration the logistical challenges of ground-based monitoring in remote project locations, especially in the mangrove blue carbon projects in Coastal Kenya and agroforestry projects in Central Kenya. Independent verification bodies should be accredited and used at county level to ensure compliance verification procedures are carried out by qualified auditors in a timely and objective manner. To prevent fraud and misrepresentation and to foster confidence among

participants and investors in the integrity of Kenya's voluntary carbon credit markets, the Designated National Authority should create a transparent online penalty enforcement register on the National Carbon Registry.

The study recommends that the overall policy framework ecosystem should be strengthened by the carbon project developers, implementing organisations and the Government of Kenya to ensure that the economic viability gains documented in this study are equitably distributed across all smallholder farmer and forestry enterprise participant groups. The Climate Change Directorate should carry out a thorough mid-term review of the Climate Change Carbon Markets Regulations 2024 to identify gaps in regulatory clarity, benefit-sharing equity, institutional capacity and enforcement consistency, and make necessary revisions to the regulations. Development partners and climate finance institutions should offer targeted technical assistance and financial support to enhance Kenya's carbon market governance infrastructure, including satellite-based monitoring technology, verification capacity and smallholder cooperative formation.

5.5 Contribution to existing Knowledge

The study makes a theoretical contribution by extending institutional theory, policy implementation theory, transaction cost economics and the resource-based view to the empirical setting of Kenya's voluntary carbon credit markets. Although these theories have been mostly used to explain the behaviour of organisations and markets in developed economies, this study shows that the core constructs of these theories – regulatory clarity, benefit-sharing mechanisms, institutional capacity and enforcement – are statistically significant in explaining the economic viability of smallholder farmers and forestry enterprises under the Climate Change Carbon Markets Regulations 2024, a developing-country, post-regulatory context. In doing so, the study confirms the relevance of institutional legitimacy, transaction cost reduction and capability-based reasoning to voluntary carbon markets, and provides an integrated policy-framework model that can be tested and developed in other regulatory and market settings.

Empirically, the study fills a methodological gap identified in the literature, where prior assessments of Kenya's carbon market regulatory environment, including Manarte (2022), Santier (2023), Kisiwa et al. (2025) and Battocletti (2025), relied on qualitative, doctrinal

or secondary-source designs without inferential testing. This study is the first to quantitatively test, based on primary survey data and multiple regression analysis, the relationship between the four dimensions of the Climate Change Carbon Markets Regulations 2024 and the economic viability of smallholder farmers and forestry enterprises in four agroecological regions of Kenya. The study offers statistically validated evidence that institutional capacity is the most important factor for economic viability, followed by regulatory frameworks, benefit-sharing mechanisms and enforcement mechanisms, which can be used as an empirical baseline to monitor and evaluate the post-2024 regulatory regime over time.

In practical terms, the study provides evidence-based recommendations to the Designated National Authority, the National Environment Management Authority, county governments and carbon project developers on where to focus reform efforts in the Climate Change Carbon Markets Regulations 2024. The study provides a prioritisation framework for limited capacity building and outreach resources for policymakers and implementing organisations like Vi Agroforestry, Farm Africa and World Vision Kenya. The results also provide guidance to international development partners and climate finance institutions looking to invest in Kenya's carbon market governance infrastructure, highlighting institutional capacity building and benefit-sharing reform as the most promising entry points to enhance smallholder economic outcomes.

5.6 Limitations of the Study

There were several limitations to the study. First, the cross-sectional design of the study meant that perceptions and outcomes were measured at a single point in time, and it was not possible to draw strong causal conclusions or to determine how the relationships between the policy framework dimensions and economic viability changed as the Climate Change Carbon Markets Regulations 2024 developed. Second, the study heavily depended on self-reported perceptual data from smallholder farmers and forestry enterprise representatives, which might have been influenced by social desirability and recall bias. Third, key informant interviews and focus group discussions were included, but the qualitative component was relatively small compared to the quantitative survey, limiting the depth of contextual understanding gained. Lastly, the sample was restricted to

registered participants in four agroecological regions of Kenya, and the results are not necessarily applicable to informal carbon projects or to voluntary carbon markets in other African countries.

5.7 Areas for Further research

The regression model explained 64.1% of the variance in economic viability, indicating that 35.9% remains unexplained by the four policy framework dimensions examined in this study. Future research should investigate additional factors that may influence the economic viability of voluntary carbon credit markets in Kenya, including global carbon credit price fluctuations, project-specific carbon sequestration methodologies, individual farmer socioeconomic characteristics, climate variability impacts on carbon sequestration rates, and the role of international intermediaries and certification bodies in shaping smallholder economic outcomes. Comparative studies should also be conducted across other African voluntary carbon market contexts to validate the generalisability of these findings and identify cross-contextual variations in policy framework effectiveness for smallholder carbon market participants.

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APPENDICES

Appendix I: Questionnaire

Introduction

I am Cynthia Chelanga, a student of the Catholic University of Eastern Africa, Master of Economics (Policy Management Option). My research topic is Policy Framework and Economic Viability of Voluntary Carbon credit Markets in Kenya. Your answers will be utilized in academic purposes only and will be kept confidential. Your involvement is voluntary and you can refuse to respond to any question or drop out. Please indicate by a tick (√) or by filling in the spaces. Thanks to your cooperation.

Section A: Demographic and Background Information

1. County of residence: _____
2. Agroecological region: Western ☐ Eastern ☐ Central ☐ Coastal ☐
3. Gender: Male ☐ Female ☐
4. Age (years): Below 25 ☐ 25–34 ☐ 35–44 ☐ 45–54 ☐ 55 and above ☐
5. Highest level of education: None ☐ Primary ☐ Secondary ☐ Tertiary/Diploma ☐ University Degree ☐ Postgraduate ☐
6. Type of respondent: Smallholder farmer ☐ Forestry enterprise ☐
7. Number of years participating in carbon credit projects: Less than 1 ☐ 1–3 ☐ 4–6 ☐ 7–9 ☐ 10 and above ☐
8. Type of carbon project: Agroforestry ☐ Reforestation ☐ Soil carbon ☐ Clean cookstoves ☐ Other (specify) _____

Instruction for Sections B–F: Using the scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, kindly tick (√) the response that best reflects your opinion on each statement.

Section B: Regulatory Frameworks

Statement	1	2	3	4	5
The rules and guidelines for participating in the carbon market are clearly stated.					
I understand the legal obligations required of participants in the voluntary carbon market.					
Information on carbon market rules is easily accessible to participants.					
The registration requirements for carbon projects are reasonable.					
The documentation needed for registration is manageable for participants.					
The cost of registering a carbon project is affordable.					
The approval process for carbon projects is transparent.					
The time taken to approve a carbon project is reasonable.					
The approval procedures are applied consistently to all applicants.					

Section C: Benefit-Sharing Mechanisms

Statement	1	2	3	4	5
The share of carbon revenue allocated to participants is fair.					
The revenue allocation percentages for land-based and non-land-based projects are clearly defined.					
The revenue allocation formula reflects the contribution of local participants.					
The Community Development Agreement governing my project is clear and understood.					
The Community Development Agreement is implemented as stated.					
The community is meaningfully involved in decisions made under the Community Development Agreement.					
Payment records from carbon credit sales are openly shared with participants.					

Participants are informed of the price at which their carbon credits are sold.					
Payments to participants are made in a timely manner.					

Section D: Institutional Capacity

Statement	**1**	**2**	**3**	**4**	**5**
Staff handling carbon market matters are knowledgeable about their roles.					
Staff are responsive to enquiries and concerns raised by participants.					
The skills of staff in regulatory and project institutions are adequate for carbon market operations.					
Institutions involved in carbon projects have adequate technical expertise in monitoring and verification.					
Participants receive adequate technical training on carbon project requirements.					
Institutions effectively use technology to manage carbon market activities.					
Carbon project applications are processed within reasonable timeframes.					
Institutional processes for issuing carbon credits are efficient.					
Institutions coordinate effectively to avoid duplication of procedures.					

Section E: Enforcement Mechanisms

Statement	**1**	**2**	**3**	**4**	**5**
Carbon projects are regularly monitored to ensure compliance with set standards.					
Monitoring reports are accurate and reliable.					
Monitoring activities are carried out independently and objectively.					
Verification of compliance with carbon market standards is thorough.					
Verification procedures are carried out by qualified independent auditors.					

Verification outcomes are communicated clearly to participants.					
Penalties for non-compliance in carbon projects are applied consistently.					
Penalties deter fraud and misrepresentation in the carbon market.					
Dispute resolution procedures following penalty enforcement are fair.					

Section F: Economic Viability of Voluntary Carbon Credit Markets

Statement	**1**	**2**	**3**	**4**	**5**
The current policy environment encourages my continued participation in the voluntary carbon market.					
The number of smallholder farmers and forestry enterprises participating in carbon projects in my region has increased.					
I would recommend other farmers or enterprises to participate in voluntary carbon credit markets.					
The revenue I earn from carbon credits has improved over time.					
The revenue I earn from carbon credits contributes meaningfully to my household or enterprise income.					
The current carbon credit prices offer fair returns to participants.					
The costs of registering and certifying a carbon project are reasonable.					
The administrative costs of participating in the carbon market are manageable.					
The costs of monitoring, reporting and verification are affordable for participants.					

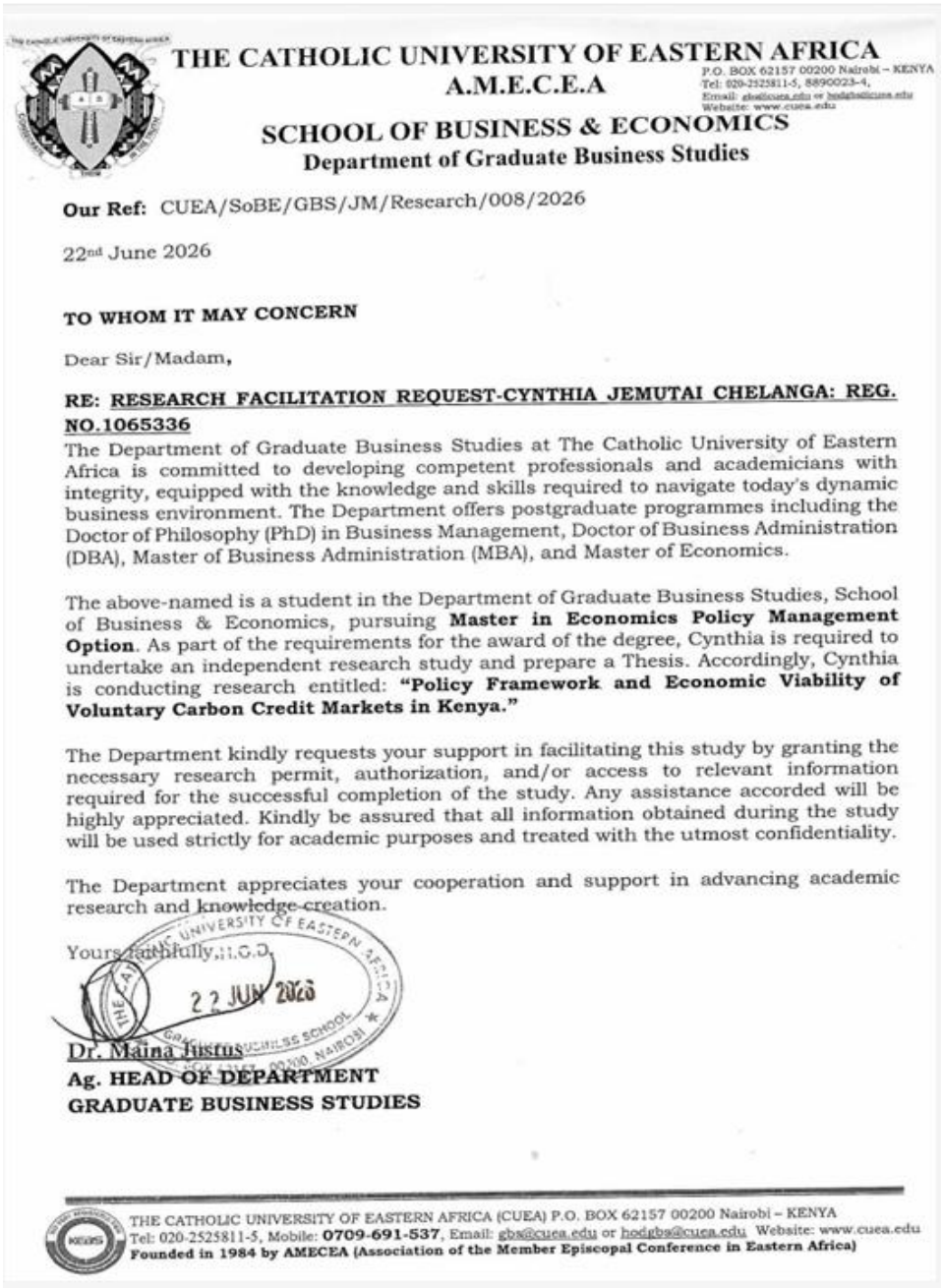
Appendix II: Interview Guide

1. What is your evaluation of the transparency of regulations, registration and approval processes of voluntary carbon credit markets in Kenya and how they impact market participation, revenue generation and transaction costs?.....
2. How do you think the current percentages of revenue allocation, Community Development Agreements and payment transparency practices are working to provide equitable benefit-sharing among stakeholders? .....
3. What do you think are the competency levels of the staff, technical expertise and processing efficiency of the institutions that are involved in the operations of the voluntary carbon credit market in Kenya? .....
4. To what extent are the current monitoring systems, compliance checking processes and penalty imposing systems effective in ensuring the integrity of the voluntary carbon credit market? .....
5. How do the elements of policy framework (regulatory, benefit-sharing, institutional, enforcement) interact to affect market participation, revenue generation and transaction costs in Kenya? .....
6. Which are the key issues that restrict the economic feasibility of voluntary carbon credit markets in Kenya under the Climate Change (Carbon Markets) Regulations 2024? .....
7. What are the possibilities of enhancing the economic sustainability of voluntary carbon credit markets, especially to smallholder farmers and forestry businesses in the four agroecological regions? .....
8. Which particular policy, institutional and enforcement changes would you suggest to increase market participation, increase revenue generation, and decrease transaction costs in the voluntary carbon credit markets in Kenya? .....

Appendix III: Focus Group Discussion

1. What do you think of the carbon market rules, registration and approval procedures, how clear they are to you as participants and how they impact your willingness to participate?.....
2. What are the current percentages of revenue allocation and Community Development Agreements in your community and how transparent are the payment arrangements in terms of carbon revenues? .....
3. What do you think of the competency, technical expertise and processing efficiency of the government and project institutions you are involved with in carbon projects? .....
4. What is the level of monitoring of carbon projects in your area, how compliance checks are conducted and what are the penalties when rules are violated? .....
5. Have you in your experience found that the voluntary carbon market has made more farmers or enterprises join, earned more income and incurred less cost? .....
6. What do you consider to be your best experiences with voluntary carbon credit projects and what has made you continue to participate? .....
7. What do you think are the key issues or barriers to your community enjoying the economic benefits of voluntary carbon credit markets? .....
8. What are some of the changes or improvements that you would suggest to make voluntary carbon credit markets more economically viable to smallholder farmers and forestry enterprises in Kenya? .....

Appendix IV: University Permit



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA
A.M.E.C.E.A
P.O. BOX 62157 00200 Nairobi – KENYA
Tel: 020-2525811-5, 8890023-4,
Email: gbs@cuea.edu or hodgbs@cuea.edu
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SCHOOL OF BUSINESS & ECONOMICS
Department of Graduate Business Studies

Our Ref: CUEA/SoBE/GBS/JM/Research/008/2026

22nd June 2026

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: RESEARCH FACILITATION REQUEST-CYNTHIA JEMUTAI CHELANGA: REG. NO.1065336

The Department of Graduate Business Studies at The Catholic University of Eastern Africa is committed to developing competent professionals and academicians with integrity, equipped with the knowledge and skills required to navigate today's dynamic business environment. The Department offers postgraduate programmes including the Doctor of Philosophy (PhD) in Business Management, Doctor of Business Administration (DBA), Master of Business Administration (MBA), and Master of Economics.

The above-named is a student in the Department of Graduate Business Studies, School of Business & Economics, pursuing **Master in Economics Policy Management Option**. As part of the requirements for the award of the degree, Cynthia is required to undertake an independent research study and prepare a Thesis. Accordingly, Cynthia is conducting research entitled: **"Policy Framework and Economic Viability of Voluntary Carbon Credit Markets in Kenya."**

The Department kindly requests your support in facilitating this study by granting the necessary research permit, authorization, and/or access to relevant information required for the successful completion of the study. Any assistance accorded will be highly appreciated. Kindly be assured that all information obtained during the study will be used strictly for academic purposes and treated with the utmost confidentiality.

The Department appreciates your cooperation and support in advancing academic research and knowledge creation.

Yours faithfully,

22 JUN 2026

Dr. Maina Justus
Ag. HEAD OF DEPARTMENT
GRADUATE BUSINESS STUDIES

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA (CUEA) P.O. BOX 62157 00200 Nairobi – KENYA
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Founded in 1984 by AMECEA (Association of the Member Episcopal Conference in Eastern Africa)

Appendix V: NACOSTI Permit

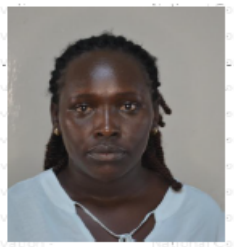
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    iv. Result in exploitation of intellectual property rights of communities in Kenya
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15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

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