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Abstract

Kenya's agriculture and forestry sectors present significant opportunities for climate change mitigation and rural income generation through voluntary carbon credit markets. However, these markets remain economically unviable for many smallholder farmers and forestry enterprises because average carbon prices of USD 10 per ton remain far below the USD 100 per ton threshold required for land-based projects to generate positive financial returns. The study determined the influence of institutional capacity on the economic viability of voluntary carbon credit markets in Kenya. It was anchored in Policy Implementation Theory and guided by a pragmatist research philosophy. A cross-sectional mixed-methods survey was conducted across four agroecological regions: Western, Eastern, Central and Coastal Kenya. Stratified random sampling yielded 361 valid questionnaire responses from smallholder farmers and forestry enterprise representatives, while 25 key informants from the National Environment Management Authority, the Climate Change Directorate and carbon project developers were purposively sampled for interviews. Data were analysed using descriptive statistics, Pearson correlation and ordinary least squares regression. Institutional capacity had a positive and statistically significant correlation with economic viability ($r = 0.727$, $p < 0.001$) and was a statistically significant positive predictor of economic viability ($B = 0.224$, $\beta = 0.387$, $t = 8.384$, $p < 0.001$). Thus, a one-unit increase in institutional capacity was associated with a 0.224-unit increase in economic viability. The study concludes that institutional capacity is a critical determinant of economic viability in Kenya's voluntary carbon credit markets. It recommends that the Government of Kenya prioritise institutional capacity building, particularly satellite-based monitoring, reporting and verification and county-level staffing, as a high-return policy intervention for improving smallholder economic outcomes under the Climate Change Carbon Markets Regulations 2024.

Keywords: *Institutional capacity, economic viability, smallholder farmers, Kenya, Climate Change Carbon Markets Regulations 2024*

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1.0 Background to the Study

Voluntary carbon credit markets have become an important mechanism for climate change mitigation and rural income generation globally, with their economic success largely determined by the robustness of the institutional frameworks within which they operate. Nations with strong institutional capacity, well-coordinated regulatory bodies, adequate technical expertise and efficient processing systems have demonstrated greater economic viability in carbon markets than those with fragmented or weak institutional arrangements (North, 1990; UNCTAD, 2024). In October 2023, the European Union implemented the Carbon Border Adjustment Mechanism, whose effectiveness depended substantially on the institutional capacity of implementing bodies to enforce standardised approval procedures and reduce transaction costs for market participants (European Parliament, 2023). In the same year, Australia's amendment of its Carbon Credits Act demonstrated that even well-designed regulatory provisions may fail to deliver economic viability when institutional capacity to enforce compliance and verify carbon credits is inadequate (Center for Strategic and International Studies, 2024).

At the regional level, voluntary carbon markets in Africa have underperformed primarily because of weak institutional coordination and limited technical capacity among implementing bodies. Only 2 percent of land-based mitigation potential was realised across least developed African countries between 2020 and 2023, a situation attributed to limited institutional capacity, regulatory ambiguity and inequitable benefit-sharing arrangements that constrained communities' access to carbon revenues (UNCTAD, 2024; Pagop & Savard, 2024). In Kenya, the country emerged as Africa's second-largest carbon credit issuer with 11 million credits in 2022, yet voluntary carbon markets contributed only 3 percent of external financial flows in 2023, equivalent to approximately USD 136 million. These figures indicate that institutional capacity gaps continue to constrain the translation of market activity into broad economic benefits for smallholder farmers and forestry enterprises (Atwood, 2024; Allied Offsets, 2025).

Institutional capacity within voluntary carbon credit market governance bodies encompasses the organisational resources, technical expertise, staff competency and processing efficiency of regulatory and implementing institutions. These dimensions determine whether policy provisions translate into tangible economic outcomes for market participants. In Kenya, the Climate Change Carbon Markets Regulations 2024 established a governance structure coordinated by the National Environment Management Authority, the Climate Change Directorate and multi-sectoral technical committees. These institutions are mandated to register projects, verify carbon credits, enforce benefit-sharing provisions and process applications through the Designated National Authority and National Carbon Registry (Government of Kenya, 2024). Before these regulations, however, carbon markets operated in a legal vacuum in which weak institutional frameworks exposed participants to uncertainty and exploitation, thereby undermining economic viability (British Institute of International and Comparative Law, 2024).

The economic viability of voluntary carbon credit markets is operationalised in this study through three measurable dimensions: market participation rates, revenue generation and transaction costs. Average carbon prices of USD 10 per ton recorded between 2020 and 2023 remain far below the USD 100 per ton threshold required for land-based projects to generate positive financial returns. This gap reflects not only market-level pricing challenges but also the inability of implementing institutions to create conditions that reduce transaction costs and enable smallholder participation

at scale (UNCTAD, 2024). In 2023, voluntary carbon markets provided least developed countries with only USD 403 million, equivalent to 1 percent of bilateral development aid. This outcome reinforces concerns that weak institutional capacity among implementing bodies constrains economic viability for smallholder farmers and forestry enterprises in developing-country contexts (UNCTAD, 2024).

Despite Kenya's active market position, isolated project successes have not translated into broad economic viability, largely because of uneven institutional capacity across implementing bodies. The Kenya Agricultural Carbon Project enabled 30,000 smallholder farmers to increase crop yields by up to 20 percent and earn carbon credit revenues, while the Farm Africa agroforestry project in Embu and Tharaka Nithi enabled 21,500 farmers to earn income, with 80 percent of revenues going directly to participants (World Bank BioCarbon Fund, 2024; Farm Africa, 2025). These successes, however, were achieved under externally supported projects with strong institutional infrastructure. This raises critical questions about whether Kenya's domestic institutional capacity, particularly at county-level offices in Kisumu, Embu and Kwale, is sufficient to replicate these outcomes at scale among ordinary smallholder farmers and forestry enterprises across the four agroecological study regions.

The current study therefore focuses on determining the influence of institutional capacity on the economic viability of voluntary carbon credit markets in Kenya. Institutional capacity is measured through staff competency, technical expertise in monitoring, reporting and verification, and processing efficiency across regulatory and implementing institutions operating under the Climate Change Carbon Markets Regulations 2024. Although Kenya has made significant advances in establishing a formal institutional governance framework, empirical evidence remains limited on whether these institutional capacity dimensions improve market participation rates, revenue generation and transaction costs for ordinary smallholder farmers and forestry enterprises. This constitutes the central gap addressed by the study.

1.1 Statement of the Problem

Voluntary carbon credit markets in Kenya lack demonstrated economic viability for smallholder farmers and forestry enterprises despite the country's ranking as Africa's second-largest carbon credit issuer, with 11 million credits issued in 2022 (Atwood, 2024). The voluntary carbon market contributed only 3 percent of Kenya's external financial flows in 2023, equivalent to approximately USD 136 million. Moreover, average carbon prices of USD 10 per ton between 2020 and 2023 remain far below the USD 100 per ton threshold required for land-based projects to generate positive financial returns. Consequently, project costs may exceed revenues, while only 2 percent of land-based mitigation potential has been realised in developing countries (Allied Offsets, 2025; UNCTAD, 2024).

Smallholder farmers face numerous institutional and structural challenges that undermine economic viability, including inadequate technical expertise, high transaction costs, land tenure insecurity and volatile carbon credit prices that make revenue forecasting difficult (Lee, 2017; Fonacier & Nordbotten, 2024). Before the Climate Change Carbon Markets Regulations 2024, carbon markets operated in a legal vacuum characterised by exploitation, biased benefit-sharing arrangements and false reporting that eroded farmers' economic returns. Resource inequalities,

weak institutional capacity and poor stakeholder coordination have continued to jeopardise equitable outcomes even after the regulations were enacted (British Institute of International and Comparative Law, 2024; Omukuti et al., 2024).

Although isolated project successes demonstrate market potential, these outcomes were achieved under externally supported institutional frameworks that are not readily available to ordinary smallholder farmers. For example, the Kenya Agricultural Carbon Project enabled 30,000 farmers to increase production by one-fifth, while the Farm Africa project enabled 21,500 farmers to earn carbon credit income (World Bank BioCarbon Fund, 2024; Farm Africa, 2025). The 2024 Regulations introduced mandatory benefit-sharing thresholds and a National Carbon Registry to address systemic governance failures. However, it remains empirically unverified whether the institutional capacity of implementing bodies, reflected in staff competency, technical expertise in monitoring, reporting and verification, and processing efficiency, translates into measurable improvements in market participation, revenue generation and transaction costs across Kenya's four agroecological regions. This constitutes the central problem investigated by the study.

1.2 Objective of the Study

To determine the influence of institutional capacity on the economic viability of voluntary carbon credit markets in Kenya.

1.3 Hypothesis

H₀: Institutional capacity does not significantly influence the economic viability of voluntary carbon credit markets in Kenya.

1.4 Conceptual Framework

Figure 1 presents the relationship between the study variables. The independent variable is institutional capacity, while the dependent variable is the economic viability of voluntary carbon credit markets, proxied by revenue generation.

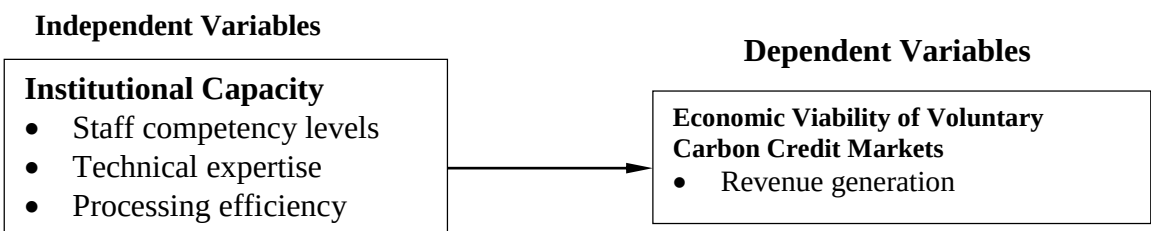


Figure 1: Conceptual Framework

2.0 Literature Review

This chapter presents the theoretical and empirical literature relevant to the study. The theoretical review discusses Policy Implementation Theory, while the empirical review examines the relationship between institutional capacity and the economic viability of voluntary carbon credit markets.

2.1 Theoretical Review

Policy Implementation Theory explains how policy outcomes are shaped by policy design, institutional capacity and enforcement mechanisms. Pressman and Wildavsky (1973) laid the groundwork by demonstrating that the quality of implementing agencies and the implementation process are key determinants of the relationship between policy intentions and policy outcomes. The theory recognises clear goals, sufficient financial and human resources, effective stakeholder coordination and competent implementing agencies as essential prerequisites for successful policy implementation. Mazmanian and Sabatier (1983) further developed this perspective by showing that the characteristics of implementing organisations, including inter-agency relationships, capacity and mandate, are central to understanding whether regulatory provisions translate into intended social and economic outcomes at the point of delivery.

In the context of voluntary carbon credit markets, Policy Implementation Theory posits that economic viability depends on the ability of implementing institutions to create functioning markets. Kenya's carbon market governance structure comprises institutions such as the National Environment Management Authority, the Climate Change Directorate and multi-sectoral technical committees, all of which are mandated to implement the Climate Change Carbon Markets Regulations 2024. However, policy implementation ultimately occurs through interactions between public officials and citizens, making the capacity and responsiveness of frontline institutional actors central to implementation outcomes, as noted by Lipsky (1980). Even where regulatory provisions are formally established, they may not lower transaction costs or increase market participation when implementation capacity is fragmented, technically weak or administratively slow, as observed in Kenya's complex multi-actor carbon governance framework.

This study uses Policy Implementation Theory as the theoretical framework supporting institutional capacity. The three measures of institutional capacity—staff competency, processing efficiency and technical expertise—correspond directly with the implementation-capacity constructs identified by Pressman and Wildavsky (1973) and Mazmanian and Sabatier (1983) as critical to successful policy implementation. The theory suggests that institutions with strong technical capacity for carbon accounting and monitoring, competent staff and efficient processes are more likely to support higher market participation, increased revenues and lower transaction costs for smallholder farmers and forestry enterprises under the Climate Change Carbon Markets Regulations 2024. Hill and Hupe (2002), however, maintain that weak implementation capacity is a major source of policy failure, implying that even a well-designed carbon market regulatory framework may remain economically ineffective when implementing institutions lack adequate capacity.

2.2 Empirical Review

The most contextually relevant evidence comes from studies of institutional capacity in Kenya and Africa, although much of this evidence is methodologically limited. Shames et al. (2016) examined institutional capacity in agricultural carbon projects in Kenya and Uganda using participatory action research with Vi Agroforestry and ECOTRUST. They found that stronger community-intermediary capacity, local government engagement and women's participation led to better implementation outcomes. The study is directly relevant because Vi Agroforestry constitutes a key

project in the Western Kenya stratum of the current study. In Kenya, Otundo (2024), through a PRISMA-based systematic review of 14 studies, identified weak regulatory frameworks and institutional capacity as important sources of market inefficiency in the carbon economy. Mwakima and Omido (2025) similarly noted that institutional asymmetries in global climate finance constrain benefits for developing countries. Although these studies identify institutional capacity as a key factor, none uses inferential modelling to test its effect on specific economic viability indicators.

A substantial body of Indonesian literature examines institutional capacity in carbon market governance and provides useful comparative insights for this study. Demmalino and Salahuddin (2025) identified regulatory coherence, technical capacity and equitable benefit-sharing as key institutional gaps in Indonesia's carbon market, while Sambodo et al. (2025) showed that institutional fragmentation constrains market benefits for smallholders and Indigenous communities in the forestry sector. Thamrin et al. (2025) found institutional coordination to be a key determinant of carbon policy effectiveness, whereas Syahrani et al. (2024) identified gaps in monitoring and fund allocation under Indonesia's carbon tax law. Through a bibliometric analysis, Sunanda et al. (2025) further noted that institutional fragmentation and weak price signals limit implementation progress. Collectively, these studies inform the institutional capacity dimensions of processing efficiency, technical expertise and staff competency. Their focus on Indonesia's compliance market, however, limits direct applicability to Kenya, and none provides primary empirical evidence from Kenya's voluntary carbon markets.

The institutional capacity discourse is also reflected in several related studies. Jain et al. (2025) found that fragmented verification systems and limited institutional support hindered African smallholders' access to carbon finance and argued that local Validation and Verification Bodies are needed to improve outcomes. Kimani (2025) critically examined Kenya's carbon trading system and identified overlapping institutional mandates and complex approval processes as constraints to effective governance, while Healy et al. (2023) showed that weak governance systems reduce project trust and efficiency among carbon market actors. These studies are relevant because they consistently link staff competency, technical expertise and processing efficiency to the extent to which regulatory provisions generate economic benefits for smallholder farmers. Their methodological limitations, including qualitative designs, limited primary data from Kenya and the absence of inferential modelling, underscore the empirical contribution of the current study.

The literature reviewed consistently identifies institutional capacity as a key factor in carbon market performance. However, the evidence base consists largely of literature reviews, systematic reviews, qualitative policy analyses and normative legal reviews rather than quantitative empirical analyses. Kenya-focused studies, including Shames et al. (2016), Otundo (2024) and Mwakima and Omido (2025), rely primarily on case-study, systematic-review or theoretical approaches without inferential statistical modelling. Studies from Indonesia provide useful comparative institutional insights but do not examine how institutional capacity affects economic viability indicators in voluntary carbon market contexts. The empirical gap addressed by this study is therefore the absence of research measuring the combined effect of staff competency, technical expertise and processing efficiency on market participation, revenue generation and transaction costs among Kenyan smallholder farmers and forestry enterprises.

3.0 Research Methodology

The study adopted a pragmatist research philosophy that supported the integration of quantitative and qualitative approaches. A cross-sectional survey design was used to examine the relationship between institutional capacity and the economic viability of voluntary carbon credit markets in Kenya. The target population comprised approximately 82,730 participants across three strata drawn from Western, Eastern, Central and Coastal Kenya. The Yamane (1967) formula was used to determine a sample of 398 smallholder farmers and forestry enterprises, who were selected through proportionate stratified random sampling, alongside 30 purposively sampled key informants from regulatory authorities and carbon project developers. Data were collected using structured questionnaires, semi-structured key informant interview guides, focus group discussion guides and document analysis frameworks. Ethical safeguards relating to informed consent, confidentiality, anonymity, data security and the protection of vulnerable rural participants were observed to ensure the integrity of the research process under the Climate Change Carbon Markets Regulations 2024.

4.0 Presentation of the Findings

The findings are presented in the following sections.

4.1 Response Rate

The study targeted 428 participants, comprising 398 smallholder farmers and forestry enterprises from four agroecological regions for the quantitative survey and 30 key informants for qualitative interviews. The key informants included representatives of regulatory authorities, institutional actors, carbon project developers and market intermediaries. The quantitative component yielded 361 completed questionnaires, representing a 90.70% response rate, while 25 of the targeted 30 key informants participated in the interviews, representing a reported interview response rate of 90.00%. Overall, 386 responses were obtained, corresponding to a reported response rate of 90.18%. This level of participation was considered adequate for research conducted across geographically diverse agroecological zones, where geographic isolation and logistical requirements may affect data collection. The high engagement across the study strata strengthened the reliability of the findings and ensured that the data reflected the experiences of smallholder farmers, forestry enterprises, regulatory authorities and project implementers within Kenya's evolving voluntary carbon credit market governance framework under the Climate Change Carbon Markets Regulations 2024.

4.2 Demographic Characteristics

The demographic characteristics provide important contextual information on smallholder farmers, forestry enterprises, regulatory authorities and project implementers participating in Kenya's voluntary carbon credit markets. Data were collected on gender, age group, educational qualifications, respondent type, years of involvement in carbon credit projects and type of carbon credit project. These characteristics provide a contextual basis for interpreting how different participant groups perceive the influence of regulatory frameworks, benefit-sharing mechanisms, institutional capacity and enforcement mechanisms on the economic viability of voluntary carbon credit markets across the four agroecological study regions under the Climate Change Carbon Markets Regulations 2024.

The results indicate that 60.4% of respondents were male and 39.6% were female, consistent with gendered participation trends in Kenya's agriculture and forestry sectors, where land ownership and registration requirements tend to favour male household heads. The 35–44-year age group constituted the largest proportion of respondents (31.0%), followed by those aged 45–54 years (26.9%). More than 73% of respondents were aged between 35 and 54 years, reflecting a concentration of experienced middle-aged farmers whose farming and land-management backgrounds strengthen the credibility of their assessments of policy effectiveness and economic viability across the four agroecological study regions. Regarding educational qualifications, 34.1% held secondary school certificates, 24.1% held tertiary or diploma qualifications, 18.0% had primary education and 16.1% held university degrees, with the study reporting that more than 44% of participants had post-secondary qualifications. Smallholder farmers constituted 82.0% of respondents, while forestry enterprise representatives accounted for 18.0%. In addition, 33.0% reported four to six years of carbon credit project experience, and more than 62% had participated for over three years. Agroforestry was the most common project type (39.9%), followed by reforestation (24.9%), soil carbon (19.9%) and clean cookstove projects (10.0%), indicating a diverse and experienced sample across Western, Eastern, Central and Coastal Kenya.

4.3 Descriptive Statistics

The descriptive statistics provide a detailed account of respondents' perceptions of the major dimensions of institutional capacity and their relationship with the economic viability of voluntary carbon credit markets in Kenya. The study sought to establish the influence of institutional capacity on economic viability. Respondents' perceptions of institutional capacity are presented in Table 1.

Table 1: 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 indicate that 87.0% (66.8% + 20.2%) of respondents agreed that staff handling carbon market matters were knowledgeable about their roles, 11.6% disagreed and 1.4% were neutral. The mean score for this item was 3.93 (SD = 0.91). This finding indicates that most participants perceived staff from the National Environment Management Authority, the Climate Change Directorate and implementing organisations as well informed about their carbon market responsibilities. In addition, 86.4% of respondents agreed that staff were responsive to participant enquiries and concerns, 11.3% disagreed and 2.2% were neutral. The mean score was 3.92 (SD = 0.88), the lowest individual item mean within the construct. Although staff responsiveness was generally rated positively, the result suggests a continuing need to improve the speed and quality of responses from county-level offices that directly engage smallholder farmers in Western, Eastern and Coastal Kenya.

Furthermore, 87.3% of respondents agreed that the skills of staff in regulatory and project institutions were adequate, 11.3% disagreed and 1.4% were neutral. The mean score was 3.95 (SD = 0.92). In addition, 88.0% agreed that institutions possessed sufficient technical expertise in monitoring, reporting and verification, while 10.8% disagreed and 1.1% were neutral. The mean score was 3.97 (SD = 0.93). Similarly, 89.7% agreed that participants received sufficient technical training on carbon project requirements, 9.1% disagreed and 1.1% were neutral, yielding a mean of 4.02 (SD = 0.86). Finally, 88.9% stated that institutions used technology effectively to manage carbon market activities, 10.3% disagreed and 0.8% were neutral. The mean score for this item was 4.03 (SD = 0.87).

The highest levels of agreement concerned institutional efficiency and coordination. Specifically, 92.0% of respondents agreed that carbon project applications were processed within reasonable timeframes, 8.0% disagreed and none were neutral, producing a mean of 4.10 (SD = 0.84). Furthermore, 92.2% agreed that institutional processes for issuing carbon credits were efficient, 6.1% disagreed and 1.7% were neutral, with a mean of 4.16 (SD = 0.83). Finally, 94.2% agreed that institutions coordinated effectively to prevent duplication of procedures, representing the second-highest agreement rate among the study variables. Fewer than 5.0% disagreed and 0.8% were neutral. This item recorded the highest mean within the construct at 4.20 (SD = 0.78). The overall mean for institutional capacity was 4.03 (SD = 0.87), indicating a broadly positive perception of institutional capacity, particularly in inter-agency coordination, processing efficiency and the provision of technical training.

Key informant interviews were also conducted to obtain detailed insights from officials of the National Environment Management Authority and the Climate Change Directorate. The institutional capacity dimensions identified as having the most direct influence on the economic viability of voluntary carbon credit markets were staff competency, technical expertise in carbon accounting and monitoring, and inter-agency coordination. Officials from the Climate Change Directorate noted that the establishment of multi-sectoral technical committees had improved coordination among regulatory bodies, project developers and community implementing agents, thereby reducing procedural duplication and expediting credit issuance. Key informants, however, recognised that technical capacity for satellite-based monitoring and verification was unevenly distributed, with stronger capacity in Nairobi-based institutions than in county offices in Kisumu, Embu and Kwale that directly serve smallholder farmers and forestry enterprises. Respondents' perceptions of economic viability outcomes are presented in Table 2.

Table 2: 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 show that 82.9% (63.2% + 19.7%) of respondents agreed that the current policy environment encouraged their continued participation in the voluntary carbon market, 14.7% disagreed and 2.5% were neutral. The mean score was 3.84 (SD = 0.99), the lowest individual item mean within the construct. The 14.7% disagreement suggests that some participants remained concerned about regulatory burdens, limited access to market information and the attractiveness of economic returns relative to the compliance costs of formal carbon market participation. Nevertheless, most smallholder farmers and forestry enterprises perceived the policy environment created by the Climate Change Carbon Markets Regulations 2024 as conducive to continued participation. Furthermore, 84.5% agreed that the number of smallholder farmers and forestry enterprises participating in carbon projects in their region had increased, 13.1% disagreed and 2.5% were neutral. The mean score was 3.89 (SD = 0.98). This pattern was consistent with the

reported increase in registered voluntary carbon projects under the National Carbon Registry following implementation of the 2024 Regulations.

In addition, 84.8% of respondents agreed that they would recommend voluntary carbon credit market participation to other farmers or enterprises, 13.2% disagreed and 1.9% were neutral. The mean score was 3.89 (SD = 0.95). Regarding income trends, 87.5% reported that income generated from carbon credits had increased over time, 11.0% reported a decrease and 1.4% reported no change. The mean score was 3.96 (SD = 0.88). Moreover, 88.9% indicated that carbon credit income contributed meaningfully to household or enterprise income, while 9.4% disagreed and 1.7% were neutral, yielding a mean of 4.02 (SD = 0.82). Similarly, 88.4% considered existing carbon credit prices to provide fair returns, 9.1% disagreed and 2.5% were neutral. The mean score was 4.01 (SD = 0.87). Finally, 90.3% agreed that the costs of registering and certifying a carbon project were reasonable, 8.1% disagreed and 1.7% were neutral, with a mean of 4.07 (SD = 0.83).

Cost-management items recorded the highest levels of agreement. In particular, 92.2% of respondents agreed that the administrative costs of participating in the carbon market were manageable, 6.7% disagreed and 1.1% were neutral. The mean score was 4.15 (SD = 0.80). Similarly, 92.8% agreed that monitoring, reporting and verification costs were affordable for participants, while 6.9% disagreed and 0.3% were neutral. This item recorded the highest mean of 4.16 (SD = 0.80). The overall mean for the economic viability of voluntary carbon credit markets was 4.00 (SD = 0.88), indicating a generally positive perception of economic viability among participants in Kenya. Satisfaction was highest for the affordability of monitoring, reporting and verification costs and lowest for the extent to which the policy environment encouraged continued participation. These findings suggest that cost dimensions were perceived as comparatively well managed, while continued policy effort is required to strengthen revenue generation and market participation incentives for smallholder farmers and forestry enterprises across the four agroecological study regions.

Key informant interviews and focus group discussions were also conducted to obtain in-depth insights from smallholder farmers, forestry enterprise representatives and project developers. Focus group discussions in Western Kenya indicated that the Kenya Agricultural Carbon Project provided participants with a stable source of supplementary income through carbon credit revenues, with some farmers reporting income increases of 15% to 25% after joining the project. Farmers in Eastern Kenya under the Farm Africa Acorn Project reported that clear payment mechanisms and timely payments had strengthened their confidence in the carbon market and their willingness to encourage other farmers to participate. Participants in Coastal Kenya, however, indicated that although monitoring, reporting and verification costs were perceived as relatively low, certification costs should be reduced further to improve the economic viability of participation for smaller community groups in Kwale County.

4.4 Correlation Analysis

Table 3 presents the Pearson correlation results for the relationship between institutional capacity and the economic viability of voluntary carbon credit markets in Kenya.

Table 3: Correlation Analysis

		Economic Viability	Institutional Capacity
Economic Viability	Pearson Correlation	1.000	
	Sig. (2-tailed)		
Institutional Capacity	Pearson Correlation	.727**	1.000
	Sig. (2-tailed)	0.000	

Institutional capacity recorded a positive and statistically significant correlation with economic viability ($r = 0.727$, $p < 0.001$). This indicates that stronger institutional capacity, encompassing staff competency, technical expertise in monitoring, reporting and verification, and inter-agency processing efficiency, was strongly associated with better economic viability outcomes for smallholder farmers and forestry enterprises participating in Kenya's voluntary carbon credit markets under the Climate Change Carbon Markets Regulations 2024. The finding aligns with Shames et al. (2016), who demonstrated that stronger capacity among community intermediaries in Western Kenya's agricultural carbon projects was associated with better implementation outcomes, and with Otundo (2024), who identified weak institutional capacity as a major source of market inefficiency in Kenya's carbon economy through a PRISMA-based systematic review of 14 studies. The correlation coefficient of 0.727 indicates that institutional capacity had the strongest bivariate association with economic viability among the four policy framework dimensions examined in the study, providing inferential statistical evidence from Kenya's post-2024 regulatory context.

4.5 Regression Analysis

Table 4 presents the regression coefficients.

Table 4: Regression Coefficients

Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.703	0.089		19.119	0.000
Institutional Capacity (IC)	0.224	0.027	0.387	8.384	0.000

The regression results in Table 4 indicate that institutional capacity had a statistically significant positive effect on the economic viability of voluntary carbon credit markets in Kenya ($B = 0.224$, $\beta = 0.387$, $t = 8.384$, $p < 0.001$). Holding other predictors constant, a one-unit increase in institutional capacity was associated with a 0.224-unit increase in economic viability. The result represented the largest marginal effect among the predictors in the full policy framework model and led to rejection of the null hypothesis that institutional capacity does not significantly influence the economic viability of voluntary carbon credit markets in Kenya. The constant of 1.703 ($t = 19.119$, $p < 0.001$) represents the modelled baseline level of economic viability when institutional capacity is zero. The standardised beta coefficient of 0.387 further demonstrates the comparatively strong predictive contribution of institutional capacity. This finding is consistent with Otundo (2024) and Shames et al. (2016), who identified staff competency, technical expertise and

processing efficiency as important determinants of carbon market outcomes for smallholder farmers and forestry enterprises in Kenya.

5.0 Conclusion

The study concludes that institutional capacity is an important policy framework determinant of the economic viability of voluntary carbon credit markets in Kenya. Staff competency, technical expertise in monitoring, reporting and verification, and institutional processing efficiency are particularly important in translating the provisions of the Climate Change Carbon Markets Regulations 2024 into tangible economic gains for smallholder farmers and forestry enterprises across Western, Eastern, Central and Coastal Kenya. Although respondents generally perceived institutional actors as capable and well coordinated, a structural capacity gap remained between Nairobi-based institutions and county-level offices in Kisumu, Embu and Kwale. This gap may constrain the consistent delivery of institutional services to voluntary carbon market participants across the four agroecological study regions. The study further concludes that the Climate Change Carbon Markets Regulations 2024 represent a positive policy development by introducing formalised registration requirements, standardised approval processes and a National Carbon Registry to reduce regulatory uncertainty. Nevertheless, the benefit-sharing and enforcement dimensions of the framework require continued policy attention. Benefit-sharing mechanisms, although positively associated with economic viability, are constrained by concerns about the fairness of revenue-allocation formulas and the clarity of Community Development Agreements. Enforcement mechanisms remain the weakest predictor of economic viability, while the frequency and reliability of compliance monitoring activities have not yet been fully realised across the four agroecological study areas. Enforcement capacity and consistency will therefore become increasingly important as Kenya's voluntary carbon credit market continues to evolve.

6.0 Recommendations

The study recommends that the Government of Kenya, through the Climate Change Directorate and the National Environment Management Authority, prioritise institutional capacity building as a high-return policy intervention for improving the economic viability of voluntary carbon credit markets. A systematic programme should strengthen staff competency in carbon accounting, monitoring, reporting and verification at both national and county levels. The Government should also establish county-level carbon market offices with technically qualified staff in Kisumu, Embu, Kwale and Nyeri to address the institutional service-delivery gap. In addition, multi-sectoral technical committees should be strengthened to improve inter-agency coordination and reduce procedural duplication in carbon project registration and credit issuance under the Climate Change Carbon Markets Regulations 2024. The study further recommends that the Designated National Authority revise the benefit-sharing provisions of the Climate Change Carbon Markets Regulations 2024 to better align revenue-sharing formulas with the land, labour and natural-resource contributions of smallholder participants. It should also develop a standardised Community Development Agreement template with clear payment schedules and grievance procedures and mandate annual benefit-sharing audits by carbon project developers. In parallel, the National Environment Management Authority should establish region-specific enforcement procedures, accredit independent verification bodies at county level and create a transparent online penalty-enforcement register within the National Carbon Registry. These measures would strengthen market integrity and foster investor and participant confidence across Kenya's four agroecological study regions.

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