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Project Management Practices and Sustainability of Rangeland-Based Projects' Benefits in Northern Kenya

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Abstract: **Community rangelands conservation projects in Kenya face challenges such as low technical capacity and awareness on restoration among the stakeholders, officials and administrators, lack of county spatial/land-use plans with clear regulations and the lack of enforcement of spatial plans in place, limited funding at both county & national levels, lack of adoption of rangeland management/restoration policies and lack of synergy among stakeholders involved in rangeland management and restoration required for upscaling restoration projects. Therefore, this study sought to investigate the influence of project management practices on sustainability of rangelands-based projects benefits in Northern Kenya. The study was anchored on adaptive management theory and stakeholder theory. A descriptive research design was utilized. The target population consisted of household members of the five target conservancies who are either direct or indirect beneficiaries of various rangelands-based projects with a sample size of 451. The study response rate was achieved at 81.82% (369) respondents. Questionnaires were used to collect primary data administered to all the sampled respondents. Ten (10) respondents were selected to participate in the pilot study, and were not included in the final data collection. Content, criteria, and construct validity was used to determine questionnaire validity. To assess the reliability of the questionnaire, the Cronbach's alpha reliability coefficient was utilized. The qualitative data was examined and presented in a narrative format using a content analysis technique. The quantitative data was analyzed using descriptive statistics, such as mean and standard deviation. Inferential statistics, including correlation analysis and linear multiple regressions, was employed to establish relationships between variables. The results were displayed in tables, pie charts, and bar graphs, as appropriate. The study found that project design, stakeholder engagement, law and regulations, digital inclusion positive and significantly affects sustainability of community-based rangelands conservation projects benefits. The study concluded that project management practices especially in design and stakeholder engagement play a vital role in determining sustainability outcomes in conservation initiatives. Legal compliance and digital tools also contribute to sustainability, though their effects are less pronounced without strong community involvement. The study recommended that project planners should enhance design quality through clear objectives, realistic budgeting, and alignment with community needs. Inclusive stakeholder engagement strategies, including participatory planning and capacity-building, should be adopted to foster trust and accountability. Strengthening legal enforcement, expanding digital infrastructure, and institutionalizing community conservation practices will improve project sustainability.**

Keywords: **Community rangelands conservation projects, project design, stakeholder engagement, law and regulations, digital knowledge adoption and Sustainability.**

1. INTRODUCTION

1.1 Introduction

The concept of sustainability in project management has gained widespread recognition and importance because of increased pressure on both for and not-for profit organizations to expand their project performance criteria from economic performance for shareholders, to sustainability performance for all stakeholders (Aarseth, Ahola, Aaltonen, Okland &

Andersen, 2017). According to Silvius and Schipper (2020) project managers are required to take ownership of project outcomes, including the sustainability measures through effective implementation of project management practices and responsible use of resources. Therefore, managing projects for sustainability relates to use of projects to support future changes.

In Kenya community development projects are wide spread in different counties, undertaking different initiatives across many sectors. According to Kaimenyi, (2019), the success rates of different community-based development projects not only depend on mobilization of resources but also, in large extent, on involvement of the local communities in the project life-cyle. According to Agosa (2022) the failure of community-based projects in Kenya can be attributed to problems relating to project design, techniques and tools that the projects use. The project as a whole has its own objectives, measurable criteria and a defined cost and time. Therefore, due to the limited time frame for a project, the scope and resources available are also limited.

Community-based rangelands projects in Kenya have emerged as crucial initiatives to address the challenges facing rangeland ecosystems and pastoralist communities. Historically, Kenya's rangelands have been vital for livestock production and wildlife conservation, but they face increasing threats from land degradation, climate change, and unsustainable land use practices (Sindiga et al., 2017). Community-based approaches, involving collaboration between local communities, governmental organizations, and non-governmental organizations, aim to empower communities in rangeland management projects while promoting biodiversity conservation and sustainable livelihoods. However, despite their potential benefits, these projects often face significant gaps in project management techniques and sustainability. Gaps include limited institutional capacity, inadequate stakeholder participation, weak governance structures, and insufficient long-term funding mechanisms, which hinder their effectiveness and long-term viability (Mwangi et al., 2016). These challenges highlight the need for improved project management strategies and enhanced sustainability measures to ensure the success and resilience of community-based rangelands projects in Kenya.

Project management practice is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters (Mir & Pinnington, 2019). Ling, Low, Wang and Lim (2022) observe that project management practices involve the planning and organization of a company's resources to move a specific task, event, or duty toward completion. In addition, these practices can involve a one-time project or an ongoing activity, and resources managed include personnel, finances, technology, and intellectual property. In this study, project management practices was focusing on four dimensions including; project design, stakeholders' engagement, Laws and Regulations, and digital knowledge inclusion where each dimension had a specific indicators that measure how well the practices are implemented.

Different rangelands restoration interventions are currently being implemented in Northern Kenya by communities with supports from different local and international NGOs, government agencies and development partners; all aimed to address land degradation and restore ecosystem functions through various measures, including soil conservation, re-seeding with native grass species, and water catchment management (Western et al., 2015). Studies by Said et al. (2017) have documented the effectiveness of restoration initiatives, such as terracing and reforestation in improving soil fertility, enhancing water retention, and increasing vegetation cover.

However, challenges related to funding constraints, technical capacity gaps, and limited stakeholder participation has been reported in the implementation of rangelands restoration projects (Western et al., 2015). Furthermore, the sustainability of restoration efforts depends on factors such as land tenure security, institutional support, and stakeholder engagement (Homewood et al., 2019).

A project sustainability process guarantees that the relevant issues, objectives, and performance benchmarks are recognized and establishes a moral framework that forms the basis for the development of guidelines and rules of behavior. Together with considering the achieved results, it also holds continuing discussions and consultations with relevant parties (Toljaga-Nikolic, Todorovic & Dobrota, 2020). Marnewick (2022) observe that, to ensure that project sustainability goals are traceable and aligned with societal goals and objectives; the project sustainability management process is designed to tailor sustainable development project goals and indicators to local conditions and priorities. Thus, the objective of developing and effectively implementing a project that can continue to produce benefits for a considerable amount of time is project sustainability. In this study project sustainability was measured in terms of Improved Rangelands Productivity, enhanced household food security and Improved Household and Institutional Adaptive Capacity.

Cherepovitsyn, Tsvetkova and Komendantova (2020) observe that a sustainable project should have an organizational structure specifying roles and responsibilities and duties. This will facilitate the management of the project and enhance its sustainability. According to Oke (2022) the project sustainability management process is designed to customize sustainable development project goals and indicators to suit local conditions and priorities and to ensure that project sustainability goals are aligned and traceable to societal goals and objectives. Therefore, the capability to manage project properly is important because it helps every part of the project run more efficiently and effectively.

Kivila, Martinsuo and Vuorinen (2017) indicate that a project is sustainable when defects can be corrected, it is able to meet new requirements, future maintenance is made easier, and it can cope with the changing environment. According to Chew, Conejos and Asmone (2017) the project managers should create project cross-functional teams that include maintenance, schedule meetings dedicated to manageability, and set specific project design reviews for maintainability. Therefore, achieving project maintainability objectives will help project managers and their organizations understand whether the project is working.

Adaptive capacity is the ability of households or social institutions to cope with the unexpected demands due to changing circumstances. Being adaptable means actively seeking ways to improve and refine our project management approaches (Andrade & Bragança, 2019). Manewa, Siriwardena, Ross and Madanayake (2022) observe that effective communication is another crucial aspect of adaptability. As a project manager, you need to be able to communicate clearly and effectively with stakeholders, team members, and clients. This includes actively listening to their needs and concerns, being open to feedback, and adjusting your communication style to suit different individuals and situations. Therefore, a sustainable project should therefore be open and able to fit in any changing environment or part of a system.

Mathew, Gantait and Swamy (2017) indicate that community-based watershed projects in India failed to take into consideration the imbalance between men and women's ownership rights, division of labor and income and that the full participation by women means more than simply their numerical presence, but also their ability to assert their specific needs and values. According to Shukla and Sinclair (2022) enabling participation by women often requires overcoming obstacles, such as a frequent lack of formal education among women. The importance of empowering women has been noted in conservation projects within diverse contexts. Greater gender equity, meanwhile, does not only benefit women, but has been shown to increase collaboration, solidarity, and conflict resolution.

Owusu (2020) observe that the sustainability community-based conservation project of local management of the Afadjato and Agumatsa Conservation Area in Ghana is achieved by involving the local people in all aspects of management for them to understand what can and cannot be achieved, thereby, ensuring their support under various conditions. Similarly, Robinson and Sasu (2022) observe that a carefully planned management strategy that outlines full participation of local people will enhance the conservation of the natural resource of the area, with a possible spill-over into adjoining communities in the Hohoe District of Ghana.

1.2 Statement of the Problem

Due to their unique value, size and complexity, each project is subject to its own set of performance requirements. The sustainability of any projects may be influenced by a wide range of factors, all linked to an organizational system such as the lack of proper setting of objectives, poor project designs and plans, numerous changes and incomplete control measures (Aksorn & Charoenngam, 2020). Roba and Oba (2021) indicate that land use in Kenya is generally changing; for instance, factors such as increased human population, resource-based conflicts and impact of climate change continue to exacerbate reduction of rangelands productivity in the Northern Kenya landscape. Land worked by pastoralists is being subdivided among members or has been converted into community conservancies.

Although there is increasing recognition of the importance of community conservancies for integrating traditional grazing regimes, land restoration initiatives and grasslands carbon offsetting as models upon which rangelands-based projects for protecting biodiversity, managing livestock and pastures, restoring degraded landscapes, and accelerating funding access by communities are being established, many of these projects continue to face mismanagement issues resulting to inability to achieve sustainable conservation and developmental goals. Macharia and Ekaya (2023) observes that rangelands-based conservation projects in Kenya are affected by factors such as low technical capacity, over-dependent on a limited donor funding, insignificant stakeholders and community participation, lack of synergy among different stakeholders and partners involved in these projects as well as lack of clear policies and regulations or lack of implementations and enforcement thereof. Rangelands-based conservation projects also faced with challenges related to good governance as most of them are govern by committees elected by the local communities whom in most cases are illiterate and therefore lacks the necessary leadership and management skills required to stir these projects towards stability and sustainability.

1.3 Objective of the Study

The objective of this study was to investigate the influence of project management practices, moderating effect of Community Conservancy approach on the sustainability of community-based rangelands conservation projects in Northern Kenya.

1.4 Research Hypothesis

The study sought to test to the following hypothesis;

H_{01}: Project management practices have no significant effect on the sustainability of rangeland-based projects benefit in Northern Kenya.

2. LITERATURE REVIEW

2.1 Theoretical Review

This section addresses theories that were used in anchoring the study which include Adaptive management Theory, stakeholder theory, natural capital theory and technology acceptance model.

2.1.1 Adaptive Management Theory

Adaptive Management Theory (AM) is an essential framework for addressing the complexities and uncertainties inherent in natural resource management, particularly in dynamic ecosystems such as rangelands. Developed in the late 1970s by C.S. Holling, AM emphasizes a "learning-by-doing" approach, where management strategies are continuously improved through iterative decision-making, monitoring, reviewing and feedback (Holling, 1978; Walters, 1986). This approach is particularly relevant to community-based rangelands conservation projects in Northern Kenya, which are affected by ecological variability, unpredictable climatic conditions, and socio-economic challenges that complicate sustainability of management approaches employed. Adaptive Management's flexibility and responsiveness make it well-suited for managing such projects, where uncertainty is a constant challenge.

In the context of rangeland conservation, Adaptive Management allows for the adjustment of management strategies based on real-time data and changing conditions, which is crucial for maintaining ecological balance in the face of climatic variability and land degradation (Stringer et al., 2006). The theory also emphasizes the importance of stakeholder involvement, ensuring that local communities are engaged in the decision-making process, thereby enhancing the relevance and acceptance of management strategies (Reed et al., 2006). Moreover, Adaptive Management supports the sustainability of rangeland conservation projects by integrating socio-economic considerations with environmental goals. It encourages continuous learning and adaptation, which are vital for addressing the complex interplay between ecological health and the livelihoods of local communities (Williams, 2011). This makes AM particularly effective in ensuring that conservation efforts are not only ecologically sound but also socio-economically viable, thereby enhancing long-term sustainability.

2.1.2 Stakeholder Theory

The stakeholder theory as proposed by Freeman (1984) shows that the organization itself should be thought of as grouping of stakeholders and the purpose of the organization should be to manage their interests, needs and viewpoints. This stakeholder management is thought to be fulfilled by the managers of a firm. According to Freeman (1984) a stakeholder is any group or individual who can be affected or is affected by the achievement of the organization's objectives. Freeman (1984) further stated that stakeholders can affect an organization's functioning, goals, development and even survival. According to PMI Standards Committee (2004) project stakeholders are individuals and organizations who are actively involved in the project or whose interests may be affected by the execution of the project or by successful project completion. Stakeholders are vital to the successful completion of a project because their unwillingness to continuously support the vision or objectives of the project leads many projects to fail. Successful engagement of stakeholders involves actively giving and getting their support and working together to devise, plan and develop new business solutions.

This theory is relevant to the study because it shows that stakeholder identification is a critical component of the initial scoping phase and should occur before an engagement plan is formulated and consultations begin. As each stakeholder usually has their own interest in the project which may cause different priorities, conflicts and dramatically increase the complexity of the situation.

2.2 Empirical Review on Project Management Practices and Sustainability

Project scope determination, Budget planning, and quality control standards are the key indicators of project design that this study was focusing on. Effective project scope determination is crucial for defining the boundaries, objectives, and deliverables of a project. According to Purvis et al. (2021), a well-defined scope ensures that all stakeholders have a clear understanding of what the project aims to achieve, which helps in aligning efforts and managing expectations, especially in a challenges environments like rangelands of Northern Kenya.

Resource allocation, another critical aspect of project design, involves the strategic distribution of resources—such as time, budget, and personnel—to various project tasks. Proper resource allocation ensures that the project can be completed efficiently without unnecessary delays or cost overruns. Zhang et al. (2019) emphasize that in resource-constrained settings, such as community-based conservation projects, effective resource allocation is vital for maintaining momentum and ensuring the sustainability of project outcomes.

The study by Cvijović, Obradović, and Todorović (2021) identified four influence strategies used by external stakeholders to impact project sustainability namely collaboration, confrontation, consultation and coercion and their results show that external stakeholders utilized all four strategies interchangeably, with the goal of influencing the project and decision-makers. It also revealed that external stakeholders were highly motivated by negative impacts on the environment. However, the study used qualitative data.

Onziru and Kimutai (2022) investigated the influence of Stakeholders Engagement on sustainability of World Bank Funded Water Projects in Karamoja, Uganda. The research design used in this research project was descriptive. The target population of the study was the sixty-water project constructed in the seven districts in the Karamoja region of Uganda. The information needed to determine Stakeholders Engagement was obtained using questionnaires. The data collected was analyzed using descriptive and inferential analysis which consists of correlations and regression. From the responses given, it was established that the stakeholders were involved in the determination of the site of the projects, the projects developed adhered to government development plans, there was consultation in determining the site of the projects, timelines were agreed upon by the stakeholders, every step of construction was controlled by the stakeholders, funds were released based on progress made and there were regular site visits. However, the study was done in Uganda and therefore, the findings may not be applicable in the Kenyan context.

Mattar et al. (2024) in their study The Impact of Change Orders Caused by Legislative Changes on Program Management in the UAE Construction Industry addressed a unique angle by exploring the influence of legislative-induced change orders not at a single project level, but across entire construction programs. The study was motivated by the lack of literature on how program management is affected by change orders prompted by legislative changes such as environmental laws and building codes. Adopting a mixed methods qualitative approach, the researchers engaged clients, contractors, and consultants through structured questionnaires, expert interviews, and analysis using the Relative Importance Index. Their findings showed that legislative changes significantly disrupt program timelines, cost structures, and overall quality, highlighting the need for proactive mitigation strategies. The study offered specific recommendations to help program managers respond effectively to legislative changes. The main gap identified was the absence of program-level analysis in previous studies, which the current research addressed. However, the current study builds upon this by proposing structured program-level adaptation frameworks to systematically integrate environmental compliance mechanisms from the outset of project lifecycle management.

Li, Sun, Li, Song and Ding (2022) investigated the effects of digital technology adoption on sustainability performance in construction projects: The mediating role of stakeholder collaboration. Survey data were collected from managers and members of Chinese construction projects, and the Partial Least Squares Structural Equation Modeling (PLS-SEM) method was used to test the hypothesized relationships. The results show that digital technology adoption has direct effects on economic, environmental, and social performance and that stakeholder collaboration can directly influence only economic and environmental performance. Additionally, stakeholder collaboration partially mediates the relationship between digital technology adoption and economic and environmental performance. However, the study focused on construction projects.

Pienaah, Baruah, Kansanga and Luginaah (2024) studied impact of community-led conservation models on women's nature-based livelihood outcomes in semi-arid Northern Ghana. The study focused on the impact of conservation efforts on women engaged in shea processing a nature-based livelihood increasingly threatened by environmental degradation and declining shea tree populations. In response to these threats, Ghana introduced the Community Resource Management Areas (CREMA), a community-led conservation approach aimed at restoring biodiversity and improving ecosystem services. The

researchers adopted a mixed-methods approach, employing surveys with 517 respondents and eight focus group discussions to explore differences in shea productivity between women residing within and outside CREMAs. Findings showed that women in CREMAs had significantly higher shea harvesting outcomes ($\alpha = -53.725$; $P < 0.01$), demonstrating the effectiveness of community-led conservation in promoting economic and ecological sustainability. The study identified a gap in literature regarding how conservation efforts affect women's livelihoods in such contexts and filled it by providing empirical evidence on the socio-economic benefits of targeted, locally managed conservation models. The study also highlighted the contribution of CREMAs toward achieving Sustainable Development Goals (SDGs) such as gender equality, climate action, and life on land.

Mfossa *et al.,* (2025) studied the effect of community-led conservation approach in the preservation of the cryptic gorilla (Gorilla gorilla) population in the Ebo forest, Littoral Region-Cameroon. The study examined the role of the community conservation initiative known as 'Club des Amis des Gorilles' (CAG), established in 2012 in three villages near the Ebo forest, a biodiversity hotspot under threat from unsustainable human activities and logging. A longitudinal methodology was used, collecting data from household heads in 2013 and 2017 to assess community perceptions of CAG and its effectiveness. The study found that approximately 80% of community members were affiliated with CAG, and 92% of respondents in 2017 maintained positive views of its contributions to biodiversity conservation and household well-being. Despite this, hunting remained prevalent due to remoteness and economic reliance on bushmeat. The study addressed a gap in understanding the long-term impact of community-led conservation initiatives on both ecological outcomes and community welfare. It filled this gap by illustrating how local conservation clubs can foster community ownership and environmental stewardship, while also recommending policy incentives and stricter logging regulations to sustain conservation gains.

3. RESEARCH METHODOLOGY

The research adopted a descriptive design to provide a clear and accurate representation of the phenomenon under study, which involved understanding various aspects of rangeland-based projects within community conservancies in northern Kenya. This design enabled the collection of detailed information from a range of respondents, helping to examine individual, organizational, and regional characteristics of project implementation. The study focused on five community conservancies purposively selected from Isiolo, Marsabit, and Samburu counties, based on shared resources and interconnected landscapes. The population included 13,246 households participating in different rangeland projects, with the household data being verified using the 2019 Census and local sub-chief validations to ensure population accuracy.

A stratified sampling technique was used in combination with purposive and random sampling to ensure proportional representation across the selected conservancies. The Yamane formula was used to calculate a sample size of 451 respondents, distributed proportionally among the conservancies. The primary data collection tool was a structured questionnaire segmented into key thematic areas such as project design, stakeholder engagement, legal frameworks, digital inclusion, and sustainability outcomes. Pilot testing was conducted with 10 non-participating respondents to ensure the instrument's reliability and validity. The reliability of the instrument was verified using Cronbach's alpha, targeting a coefficient of 0.70 or higher, while validity was ensured through content, construct, and criterion assessments.

Data collection was carried out by 15 trained enumerators drawn from the local conservancies, enhancing familiarity and accuracy in field engagement. Quantitative data were analyzed using SPSS version 27.0 through descriptive and inferential statistics, including correlation and multiple regression analyses, while qualitative responses were evaluated using content analysis. The regression model tested the influence of project design, stakeholder engagement, budget planning, and digital inclusion on the sustainability of community-based rangeland conservation projects. The findings aimed to reveal which variables significantly impacted long-term sustainability outcomes, thereby informing strategic improvements in community-led conservation and development initiatives.

4. RESEARCH FINDINGS AND DISCUSSIONS

4.1 Response Rate

Table 4.1 shows the participant response numbers across the three study counties which include Isiolo, Marsabit, and Samburu. A total of 451 respondents participated in the study which distributed among the three counties where 148 participants (32.82%) resided in Chari and Ngare Mara Wards of Isiolo County and monitored Biligo Bulesa and Nakuprat Gotu conservancies and 150 participants (33.26%) lived in Laisamis Ward of Marsabit County who observed Melako Conservancy and 153 participants (33.92%) resided in Waso Ward of Samburu County who monitored Kalama and Sera conservancies.

The research yielded an 81.82% response rate which split into 79.73% in Isiolo County and 80.67% in Marsabit County and 84.97% in Samburu County according to Table 4.1. The obtained response rates surpass the survey-based research requirement of 70% according to Saunders and Thornhill (2007) and thus qualify as acceptable and representative data. The study's high response rate ensures valid and generalizable findings because the collected data effectively represents the target population throughout all three counties.

4.2 Demographic Characteristics

This section presents data on demographic characteristics of the sampled respondents in terms of gender, age, ethnicity, occupation and education level. According to Bernard and Ryan (2010), the demographic information, in any research, is considered crucial not only for subsequent discussions of the findings but also for the authenticity and generalization of the results. The findings are presented and discussed below.

Table 1: Demographic Characteristics

Demographic variables	Category	Frequency	Percentage
Gender	Male	252	68.2
	Female	117	31.7
Age (Year)	Below 35	62	16.8
	35- 45 Years	92	24.9
	46- 55 Years	143	38.8
	Above 55 Years	72	19.5
No years of schooling	Post-Secondary Level	34	9.2
	Secondary Level	48	13.0
	Primary Level	52	14.0
	Never Went to School	232	62.8
Ethnicity	Borana	72	19.5
	Samburu	110	29.8
	Turkana	65	17.6
	Rendile	122	33.1

Source: Researcher (2025)

Table 1 demonstrates the demographic characteristics of participants who are in some ways involved either directly or indirectly in rangeland-based projects throughout the target counties. The research data indicates that males made up 68.2% of the participants whereas females comprised 31.7% of the total sample. The survey revealed that respondents between 46 and 55 years old made up the largest group at 38.8% while those aged 35–45 years and above 55 years and below 35 years followed with percentages of 24.9%, 19.5% and 16.8% respectively. The majority of respondents (62.8%) reported they had no experience with school education. The population with primary education made up 14.0% of the sample while secondary education participants were 13.0% and post-secondary education participants were 9.2%. The research indicates that participants in these projects mainly consist of middle-aged to older male adults who have limited formal education.

The observed demographic patterns create significant implications for how rangeland-based projects operate through participation and knowledge transfer activities. The survey results indicate that men outnumber women which could indicate gender inequality in local community decision-making structures. This is consistent with findings by Mugambi (2022), which found out men prevalence in all demographic patterns in Maasai Mara conservancies. The high number of respondents from the 46–55 age bracket demonstrates both their experience in community leadership and possibly a lack of youth participation needed for sustainable project development. The high number of respondents without formal education creates a challenge for effective communication and capacity building and the uptake of conservation or project-related information.

The implication of these findings is that project implementers must consider tailored communication strategies and training programs to bridge the education gap and ensure inclusive participation. Materials should be simplified and potentially translated into local languages, and visual or oral methods of engagement could be prioritized over text-based materials. Further, efforts to empower women and involve younger community members should be scaled up to foster balanced

representation and long-term sustainability. Understanding and addressing these demographic realities can enhance the effectiveness and relevance of rangeland-based interventions in the region.

The ethnicity data presented in Table 4.3 indicates that the respondents came from four major ethnic groups: Rendile (33.1%), Samburu (29.8%), Borana (19.5%), and Turkana (17.6%). The highest representation was from the Rendile, likely reflecting their dominant presence in the Laisamis Ward of Marsabit County, where Melako Conservancy is located. The Samburu were the second most represented group, corresponding with their concentration in Samburu County, particularly around Kalama and Sera conservancies. Borana and Turkana respondents were fewer, possibly drawn from Isiolo County and the broader region, respectively. This distribution highlights the ethnically diverse composition of the conservancy areas and suggests that the study captured a wide range of community perspectives. Such diversity is vital for ensuring inclusivity and cultural sensitivity in conservation efforts, as different ethnic groups may have varying relationships with natural resources, conservation practices, and governance structures. The relatively lower participation of Borana and Turkana could point to potential barriers in access or involvement, which should be addressed to promote equitable engagement and benefit-sharing. Overall, the ethnic composition of respondents underscores the need for tailored conservation strategies that recognize and integrate the unique ecological knowledge, values, and expectations of each ethnic community to enhance the sustainability and effectiveness of community conservancy initiatives

4.3 Descriptive Analysis Results on Project Management Practices

The study analyzed project design aspects of rangeland-based projects in Northern Kenya, focusing on clarity of objectives, alignment with community needs, resource allocation, and auditing practices. From a sample of 369 respondents, a majority were aware of the funding sources for these projects. Despite this awareness, perceptions about auditing were fairly consistent across both informed and uninformed groups, suggesting either limited transparency or weak community involvement in financial oversight. This outcome highlights a need for more accessible and well-communicated financial and auditing information to enhance project transparency, accountability, and trust among stakeholders.

Descriptive statistics on project design further revealed moderate satisfaction with how objectives were set and aligned with community priorities. Most respondents were neutral or showed weak agreement on the clarity of project goals and alignment with local needs. Resource allocation and transparency in financial and operational areas also scored below average. However, higher levels of agreement were observed on financial reporting, especially in areas such as the sharing of audited reports during AGMs and the existence of sustainability mechanisms like risk mitigation plans and continuous learning support, indicating that while basic design areas need improvement, some governance mechanisms are being effectively implemented.

Stakeholder engagement was analyzed through participation levels across the project lifecycle. Respondents were most involved during project implementation, followed by design and monitoring phases, indicating that the community is more engaged in visible and operational stages of the project. Participation was notably lower during budgeting, endorsement, and closure stages, suggesting gaps in inclusive decision-making and long-term accountability. Furthermore, a subset of the population reported no involvement at all, emphasizing the need for deliberate strategies to increase engagement and inclusivity throughout all project phases.

In terms of the quality of stakeholder engagement, respondents generally agreed that they were well-informed and had opportunities to share knowledge and feedback. High mean scores were recorded on the frequency of updates, the openness of communication, and the inclusivity of knowledge-sharing platforms. While areas such as activity selection and the inclusion of vulnerable groups (women, youth, and persons with disabilities) had slightly lower scores, the overall results indicated a fairly high and consistent level of engagement. These findings were supported by existing literature emphasizing the critical role of inclusive participation in enhancing project outcomes.

Legal and regulatory frameworks governing rangeland projects were perceived as weak or only moderately effective. Most respondents disagreed or were uncertain about the sufficiency and enforcement of existing laws. Low scores were recorded in areas like legal awareness, institutional authority, enforcement efficiency, and fairness of penalties. Community participation in policy formulation was also seen as minimal. These findings suggest that the regulatory environment needs strengthening through clearer communication, community involvement in legal processes, and fairer, more transparent enforcement practices.

Digital inclusion findings revealed that mobile phones and social media were the most utilized channels for accessing rangeland project information, with mobile phones leading at 54.5%. Traditional media (radio/TV) and printed materials

had lower usage rates, indicating a shift toward digital platforms. Despite this shift, some respondents lacked access entirely, pointing to a digital gap. Additional insights from a Likert-based analysis indicated moderate access to digital tools, relatively strong network coverage, and the positive role of community groups in facilitating digital knowledge. This suggests an opportunity to expand digital literacy and access as part of broader community engagement strategies in rangeland conservation projects.

4.4 Sustainability of Rangelands-Based Projects Benefits

This section presents a detailed examination of sustainability of community-based rangelands conservation projects, with a focus on governance structures, inclusivity, and perceived project benefits.

Table 2: Sustainability of Rangelands-Based Projects Benefits

	Mean	Std. Dev
The rangelands-based projects have resulted to benefits in pasture availability across all seasons	3.5745	1.18894
Rangeland management projects have resulted to carbon sinking and benefits	2.3659	1.17215
There has been increase in water sources and improvement in water quality	2.4336	1.15229
The productivity of the rangelands has generally improved	2.3686	1.08332
Our household income has improved due to projects benefits	2.5176	1.15172
Our household has Trust in institutions supporting different projects	2.3469	1.14872
Community members look out for the welfare of one another	2.4201	1.09581
Our household adaptive measures on drought have resulted to improved livestock qualities	2.3496	1.03197
Aggregate Score	**2.5471**	**1.12811**

Source: Researcher (2025)

The highest-rated statement was that the rangelands-based projects have resulted in benefits in pasture availability across all seasons, which recorded a mean of 3.5745 with a standard deviation of 1.18894. This implies that most respondents moderately agreed that pasture availability has improved due to the interventions. In contrast, the statement that rangeland management projects have resulted in carbon sinking and benefits had a mean of 2.3659 and a standard deviation of 1.17215, indicating low agreement and suggesting that ecological outcomes such as carbon sequestration are less visible or understood among the community members.

The mean score for the increase in water sources and improvement in water quality was 2.4336 (standard deviation of 1.15229), showing minimal observed improvements. The statement regarding the general improvement in rangeland productivity scored a mean of 2.3686 with a standard deviation of 1.08332, indicating that many respondents did not observe significant productivity gains. The economic aspect of sustainability, such as improvement in household income due to project benefits, recorded a mean of 2.5176 and a standard deviation of 1.15172, suggesting that financial impacts have been limited. Social indicators also scored low, with trust in institutions supporting projects scoring a mean of 2.3469 and standard deviation of 1.14872, and community welfare concern scoring a mean of 2.4201 with a standard deviation of 1.09581. Furthermore, the household's adaptive measures on drought and their impact on livestock qualities recorded a mean of 2.3496 and a standard deviation of 1.03197. The overall aggregate mean score was 2.5471 with a standard deviation of 1.12811, which reflects general dissatisfaction with the sustainability outcomes of the projects.

These findings are consistent with previous research that highlighted the limited success of community-based conservation efforts where institutional trust and economic returns are low. A study by Pienaar et al. (2024) on Ghana's CREMA model reported that sustainability was strongly linked to effective local governance, equitable benefit sharing, and community trust in the institutions involved. The low mean scores on trust in institutions and household-level benefits in the current study suggest that similar governance mechanisms may be weak or underdeveloped in the Kenyan context, limiting the perceived sustainability of the projects.

Similarly, Njoroge and Otieno (2023) observed that sustainability in community-driven conservation is highly dependent on tangible social and economic outcomes. In their study, higher levels of satisfaction were linked to improved household income, social cohesion, and enhanced access to natural resources. The findings from this study, particularly the low scores in household income, water quality, and livestock improvement, indicate that the community may not be realizing significant returns from the conservation efforts. This calls for a re-evaluation of the implementation approach to ensure

that benefits are not only ecological but also social and economic, thereby enhancing overall sustainability. The evidence from the reviewed literature supports the conclusion that without improved governance, benefit sharing, and community involvement, sustainability of rangelands conservation projects may remain elusive.

Table 3 presents the findings on household food access based on the Household Food Insecurity Access Scale (HFIAS) for the past four weeks. The results show that most households had some concerns related to food access, although at relatively low frequencies.

Table 3: Household Food Nutrition Security

	Mean	Std. Dev
In the past four weeks, did you worry that you would not have enough food	1.2087	.40691
In the past four weeks, were you or any household member not able to eat few kinds of foods you preferred because of lack of resources	1.1870	.42381
In the past four weeks, did you or any household member have to eat limited kinds of foods due to lack of resources	1.2358	.45590
In the past four weeks, did you or any household member have to eat some foods that you have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food	1.1599	.40232
In the past four weeks, did you or any household member have to eat a smaller meal than you needed because there was no enough food	1.2195	.44606
In the past four weeks, did you or any other household member have to eat fewer meals in a day fewer meal in a day because there was not enough food?	1.1924	.42777
In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	1.2168	.44434
In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food	1.2005	.43351
In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	1.1734	.41343
Have you received any trainings on alternative livelihoods	1.1599	.40232
Aggregate Score	**1.1954**	**.42564**

Source: Researcher (2025)

The statement with the highest mean was whether the household had to eat limited kinds of foods due to lack of resources, which recorded a mean of 1.2358 with a standard deviation of 0.45590. This suggests that a moderate number of households reported dietary restrictions due to financial limitations. Closely following was the response to whether the household had to eat a smaller meal than needed due to insufficient food, with a mean of 1.2195 and standard deviation of 0.44606. Similarly, the absence of food in the household due to lack of resources had a mean of 1.2168 and standard deviation of 0.44434, indicating that this was also a relatively frequent occurrence.

Worrying about having enough food scored a mean of 1.2087 and standard deviation of 0.40691, reflecting general food insecurity anxiety among households. The need to eat fewer meals per day had a mean of 1.1924 and a standard deviation of 0.42777. Slightly lower were the means for sleeping hungry (1.2005) and inability to eat preferred foods (1.1870), suggesting these were reported but at somewhat lesser levels. The least reported experience was going a whole day and night without food, with a mean of 1.1734 and standard deviation of 0.41343. Lastly, the training on alternative livelihoods recorded a mean of 1.1599 with a standard deviation of 0.40232, suggesting that fewer respondents had received such training. The aggregate mean was 1.1954 with a standard deviation of 0.42564, pointing to low-to-moderate food insecurity across the sampled households.

These findings align with prior studies indicating that food insecurity remains a challenge in arid and semi-arid regions, often due to seasonal variability and limited livelihood options. For instance, Makau and Mutua (2022) found that households in pastoral communities of Northern Kenya regularly adopt coping strategies such as eating fewer meals or relying on non-preferred foods during drought periods. The findings from the current study reflect similar patterns, with respondents indicating dietary compromises due to resource constraints.

Additionally, a study by Wekesa et al. (2023) highlighted the importance of training in alternative livelihoods in improving food access in rural Kenyan counties. Their findings suggested that access to trainings on climate-smart agriculture and small-scale enterprises significantly improved household resilience and nutritional outcomes. However, in the current study, the relatively low mean score for training uptake may explain the persistence of food insecurity. This indicates a potential gap in capacity-building interventions, which if addressed, could contribute significantly to enhancing household food and nutrition security in the region. These results underscore the need for integrated programming that not only addresses immediate food needs but also builds long-term adaptive capacity through skills development and diversified income sources.

4.5 Inferential Analysis

This section demonstrates an inferential investigation that determines the dependencies between each independent variable and the dependent variable in the study. The main function of inferential analysis consists of extracting population-level conclusions from sample data through testing hypotheses and assessing statistical associations.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[a]	.504	.501	.73648

a. Predictors: (Constant), Digital Knowledge Adoption, Stakeholders Engagement, Project Design, Laws & Regulations

Source: Researcher (2025)

The model summary in Table 4.15 provides an overview of the strength and explanatory power of the regression model used to examine the relationship between the independent variables—digital knowledge adoption, stakeholder engagement, project design, and laws and regulations—and the sustainability of community-based rangelands conservation projects. The value of R is 0.710, indicating a strong positive correlation between the combined independent variables and the dependent variable (project sustainability). The R Square value is 0.504, which means that approximately 50.4% of the variation in the sustainability of the projects can be explained by the four predictors in the model. This suggests that the model has moderate explanatory power.

Table 5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.892	.496		9.863	.000
	Project Design	.179	.095	.105	1.892	.000
	Stakeholders Engagement	.062	.093	.035	.666	.006
	Laws & Regulations	.030	.123	.019	.239	.001
	Digital Knowledge Adoption	.029	.136	.017	.212	.002

a. Dependent Variable: Sustainability of Projects

Source: Researcher (2025)

Resultant Multiple Regression Equation $Y = 4.982 + .105X_1 + .035X_2 + .019X_3 + .017X_4 + \varepsilon$

The coefficients presented in Table 5 reflect the results of a multiple linear regression analysis conducted to determine the effect of four independent variables on the dependent variable, sustainability of projects (denoted as Y). The independent variables include Project Design (X_1), Stakeholders Engagement (X_2), Laws and Regulations (X_3), and Digital Knowledge Adoption (X_4). The unstandardized coefficients indicate the expected change in the dependent variable for a one-unit change in each predictor, holding other variables constant. The resulting regression equation is expressed as: $Y = 4.892 + 0.105X_1 + 0.035X_2 + 0.019X_3 + 0.017X_4 + \varepsilon$, where Y represents project sustainability, and **ε.**

The regression analysis results in Table 6 show that the constant term has a coefficient of 4.892 with a standard error of 0.496, and it is statistically significant at $p < 0.001$. This suggests that when all the independent variables (Project Design, Stakeholders Engagement, Laws and Regulations, and Digital Knowledge Adoption) are held constant, the baseline level

of project sustainability is significantly above zero. This implies that factors not included in the model may still play a substantial role in influencing the sustainability of rangeland conservation projects, reinforcing the idea that sustainability is multifaceted and dependent on a broad range of contextual elements.

Regarding Project Design, the results indicate a positive unstandardized coefficient of 0.105 and a statistically significant p-value of 0.000. This suggests that a unit increase in project design quality—measured through aspects such as scope determination, budget planning, and quality control—leads to a 0.105 increase in project sustainability. This finding is supported by Purvis et al. (2021), who assert that a clearly defined project scope ensures alignment among stakeholders, which is essential for project continuity. Additionally, Zhang et al. (2019) emphasize that in resource-limited environments, efficient resource allocation is critical for sustaining conservation efforts. Williams et al. (2020) also stress the need for incorporating quality control standards to ensure consistent implementation. The current study affirms that robust project design contributes positively and significantly to sustainability outcomes in the rangeland conservation context.

The coefficient for stakeholders engagement is 0.035, with a standard error of 0.093, and it is statistically significant with a p-value of 0.006. This suggests a positive though weaker influence of stakeholder engagement on the sustainability of projects. The empirical findings align with those of Ochieng and Nyaga (2020), who found that interactive and functional participation positively affected the sustainability of development projects in Kilifi County. Similarly, Onziru and Kimutai (2022) noted that consultation and joint planning improved outcomes in World Bank-funded water projects in Uganda. Although Ochunga (2016) reported a weak and insignificant link between passive participation and sustainability, the current study emphasizes the importance of active engagement strategies like communication, feedback, and shared decision-making, especially in rangeland settings, where local ownership is crucial for long-term impact.

The results for laws and regulations reveal a small positive coefficient of 0.019, which is statistically significant ($p = 0.001$), though the effect size is modest. This indicates that compliance with legal and regulatory frameworks contributes to sustainability, albeit to a lesser extent compared to project design. This is consistent with Gichamba and Kithinji (2019), who observed that certain environmental regulations—particularly waste and water management—significantly influenced project performance. Additionally, Mattar et al. (2024) showed that legislative change orders affect timelines and cost across programs, reinforcing the necessity of embedding regulatory foresight into planning. Serrano and Fonseca (2024) further warned that weak enforcement mechanisms can hinder sustainability despite strong legal frameworks. The present study underscores the importance of early and integrated regulatory compliance to enhance the long-term viability of conservation initiatives.

For digital knowledge adoption, the regression coefficient is 0.017 with a standard error of 0.136 and a statistically significant *p*-value of 0.002. Although the coefficient is positive and significant, the magnitude of the effect is relatively small. This finding suggests that increasing access to digital tools, infrastructure, and skills contributes to enhanced sustainability, albeit modestly. This supports Li et al. (2022), who found that digital adoption directly impacts sustainability dimensions in construction projects, mediated by stakeholder collaboration. Similarly, Otundo (2022) noted a fair positive relationship between strategic technology adoption and the sustainability of water projects in marginalized areas of Kenya. Ngigi, Wanyona, and Gwaya (2021) also confirmed a significant role of technology in promoting affordable and sustainable housing. The findings from the current study reinforce the idea that digital inclusion—through better access, sharing of information, and capacity-building—can enable more resilient and data-driven project implementation.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The study established that project management practices significantly influence the sustainability of rangeland-based projects benefits in Northern Kenya. It was found that well-structured project design—incorporating proper scope, resource allocation, and quality control—plays a critical role in ensuring sustainable outcomes. This aligns with the view that clear planning and resource allocation enhance project implementation and longevity. Stakeholder engagement also emerged as an important contributor to sustainability. The findings highlight the value of involving communities and other stakeholders through mechanisms such as consultation, communication, and shared decision-making. These strategies foster local ownership and accountability, which are essential for the success of conservation initiatives in rangeland contexts.

Furthermore, compliance with relevant laws and regulations was shown to contribute to project sustainability, though its effect was relatively modest. This emphasizes the need to embed regulatory awareness and enforcement mechanisms in project plans from the outset, especially in sectors where policy alignment influences environmental and operational

outcomes. The study also identified digital inclusion as a supportive factor in sustainability, highlighting the role of digital tools, infrastructure, and skills in enhancing project planning, monitoring, and collaboration. Although its impact was less pronounced, technology remains a useful enabler for data-driven decision-making and improved service delivery.

5.2 Recommendations for the Study

Conservation projects planners and implementing agencies should invest in strengthening project design by clearly defining the project scope, allocating sufficient resources, and embedding quality control measures from the onset. Comprehensive planning frameworks that align project goals with community needs and environmental sustainability standards should be developed to ensure long-term project success.

It is recommended that project implementers adopt inclusive engagement strategies that go beyond mere consultation. This includes regular communication, feedback mechanisms, participatory planning sessions, and capacity-building initiatives for local communities. Active stakeholder involvement fosters ownership, trust, and commitment, all of which are critical for sustained project outcomes.

Government agencies and conservation project stakeholders should prioritize compliance with existing legal and regulatory frameworks. There is a need for early integration of regulatory requirements into the planning stages of projects. Strengthening institutional capacity for monitoring, enforcement, and interpretation of environmental laws will also enhance project compliance and sustainability.

Investment should be made in digital infrastructure, training, and access to relevant technologies, especially in rural and marginalized regions. Project managers should integrate digital tools in monitoring, data collection, communication, and reporting processes. These technologies can enhance transparency, responsiveness, and efficiency in project implementation.

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