Journal of
Human Resource and Leadership
(JHRL)

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Human Resource and Leadership Journal
ISSN: 2520-4661 (online)
Vol.11, Issue No. 5, pp. 1 - 23, 2026
www.carijournals.org

Adaptive Resource Allocation and Performance of Livestock Value Chain Projects in Northern Frontier Counties of Kenya

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Accepted: 5th June, 2026, Received in Revised Form: 22nd June, 2026, Published: 9th July, 2026

ABSTRACT

Purpose: The general objective of the study was to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya. This study was anchored on Resource-Based View (RBV) Theory.

Methodology: The research philosophy adopted for this study is pragmatism, and the research design adopted was descriptive and correlational. The study targeted 283 stakeholders drawn from 102 livestock value chain projects implemented across Kenya's Northern Frontier Counties. Using Slovin's sample size determination formulae, the research used a sample of 165 respondents. Stratified sampling was the most appropriate technique for this study. The study utilized a combination of questionnaires and interviews as research instruments to collect comprehensive data. A pilot study was conducted on 16 participants to evaluate the feasibility, reliability, and validity of the research instruments. The study collected both qualitative and quantitative data. Qualitative data from interviews were analyzed using thematic analysis while quantitative data analysis was conducted using both descriptive and inferential statistical methods with the aid of the SPSS Version 27. Descriptive statistics were used to summarize respondents' demographic details and their responses to various aspects of the study variables. Pearson's correlation coefficient and multiple regression analysis were used to assess the relationships among the study variables.

Findings: The study concluded that adaptive resource allocation positively and significantly influences performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Unique Contributions to Theory, Policy, and Practice: Based on the findings, the study recommends that the management of livestock value chain projects in Kenya should adopt a flexible and data-driven adaptive resource allocation approach that allows timely redistribution of financial, human, and material resources in response to changing project needs and environmental conditions.

Keywords: *Adaptive Resource Allocation, Livestock Value Chain Projects, Northern Frontier Counties*

Background of the Study

A livestock value chain project involves analyzing and strengthening all the stages that livestock and livestock products pass throughfrom production and processing to marketing and consumptionto improve efficiency, quality, and profitability (Baker, Jackson& Cook, 2022).It brings together farmers, traders, processors, service providers, and policymakers to identify challenges, add valueand create better market opportunities for all actors involved (Daum et al., 2022). The livestock value chain projects help to identify gaps, inefficiencies and opportunities that can improve productivity, profitability, market access for farmers and other actors (Slettli, 2024). It also provides evidence for designing targeted interventions that enhance food security, rural livelihoods, and the overall performance of the livestock sector (Eastwood, Edwards& Turner, 2021).

However, performance of livestock value chain projects is often challenged by low volumes of Milk produce in Litres resulting from inadequate inputs, limited access to extension services, and poor husbandry practices. (Win et al., 2023) low volume of Meet Poduce in Kgs, low Product Quality, limited veterinary services, and insufficient investment in preventive health measures. Additionally, cost–benefit realization is hindered by fluctuating market prices, high operational costs, and weak market linkages that reduce profitability for value chain actors (Kruger et al., 2022). Thus, portfolio management supports the performance of value chain projects by ensuring that resources, time, and investments are allocated to the most impactful and strategically aligned initiatives within the livestock value chain (Liz et al., 2019). It helps monitor and prioritize projects based on their risks, expected benefits, and contribution to productivity, mortality reduction, and cost-effectiveness. Through continuous evaluation and coordinated oversight, portfolio management enhances decision-making, reduces duplication, and ensures that value chain projects deliver measurable and sustainable improvements (Kharat& Naik, 2020).

Worldwide, livestock value chain projects have frequently underperformed, exposing significant gaps in planning, coordination, and resource allocation. For instance, a World Bank evaluation of 104 livestock development projects found that only about 60% achieved economic rates of return above 10%, while 34% fell below 5% (FAO, 2025). Similarly, an ILRI review reported that roughly 60% of pro-poor livestock projects were unsuccessful due to weak government partnerships, poor monitoring and evaluation, and limited stakeholder-driven design (ILRI, 2025). In West Africa, inadequate organization among actors, lack of market and cold-chain infrastructure, and limited access to finance further constrains performance (ECDM, 2024). Portfolio management (PPM) can help address these shortcomings by systematically prioritizing high-impact interventions, aligning projects with strategic development goals, optimizing resource allocation, and providing robust monitoring frameworks. By coordinating multiple initiatives across regions and value-chain stages, portfolio management ensures that livestock projects are better targeted, more efficient, and more likely to achieve measurable improvements in productivity, profitability, and sustainability (FAO, 2024).

In Arid and Semi-Arid Lands (ASAL) regions, the performance of livestock value chain projects has increasingly been evaluated based on improvements in livestock production and the quality of livestock products. Studies indicate that interventions such as improved breeding programmes, enhanced pasture management, veterinary health services, and climate-smart livestock production have contributed to increased milk production among dairy livestock and higher meat yields from beef animals (Govoeyi et al., 2019; Lie et al., 2023). Similarly, investments in disease control, improved feeding systems, and better husbandry practices have enhanced the quality of milk and meat products by reducing contamination, improving animal health, and meeting market standards (Barua et al., 2021). However, the achievement of higher milk and meat production volumes, as well as improved product quality, continues to be constrained by recurrent droughts, water scarcity, inadequate infrastructure, limited access to quality inputs, and weak market linkages in many ASAL regions (Cadenas-Anaya, 2022). Consequently, enhancing livestock production volumes and maintaining high product quality require integrated portfolio management approaches that strengthen resource allocation, risk management, governance, and technology adoption to improve the overall performance of livestock value chain projects (Havenga et al., 2022). Adaptive resource allocation enables project managers to efficiently deploy financial, human, and material resources to priority areas and emerging needs, thereby maximizing project impact.

Northern Frontier Counties (NFCs) refer to the predominantly arid and semi-arid counties located in the northern part of Kenya, namely Turkana County, Marsabit County, Mandera County, Wajir County, Garissa County, Isiolo County, and Samburu County. These counties occupy a substantial proportion of Kenya's landmass and are characterized by low and erratic rainfall, high temperatures, sparse population distribution, and limited infrastructure development. Historically, the region was referred to as the Northern Frontier District during the colonial period and has continued to experience unique socio-economic and environmental challenges that distinguish it from many other parts of the country. Despite these challenges, the region remains strategically important due to its vast livestock resources, cross-border trade opportunities, and contribution to Kenya's agricultural economy (KNBS, 2024).

The economy of the Northern Frontier Counties is predominantly dependent on pastoralism and livestock production, which serve as the primary source of livelihood for the majority of households. Communities in the region mainly keep cattle, camels, goats, sheep, and donkeys, which provide food, income, transportation, and social security (GoK, 2024). Livestock contributes significantly to household incomes and local economic activities through the sale of milk, meat, hides, skins, and live animals. The region supplies a substantial proportion of Kenya's livestock products and plays a critical role in supporting national food security. Consequently, numerous government agencies, non-governmental organizations, development partners, and private sector actors have invested in livestock value chain projects aimed at

improving productivity, market access, animal health, and resilience among pastoral communities (KNBS, 2024).

However, the Northern Frontier Counties face numerous development challenges that affect livestock production and project implementation. These include recurrent droughts, climate variability, water scarcity, livestock diseases, insecurity, inadequate infrastructure, and limited access to markets and financial services. The effects of climate change have further intensified the vulnerability of pastoral livelihoods by increasing the frequency and severity of droughts, resulting in reduced pasture availability, livestock losses, and declining productivity. Additionally, poor road networks and limited communication infrastructure hinder the efficient delivery of livestock support services and market integration. These challenges underscore the need for effective project portfolio management practices to ensure that livestock value chain projects achieve their intended objectives and contribute to sustainable development in the region (GoK, 2024).

In response to these challenges, both national and county governments, together with development partners, have implemented various livestock value chain projects designed to enhance productivity, improve product quality, strengthen market systems, and build resilience among pastoral communities. These projects often involve interventions such as livestock health programmes, breeding improvement initiatives, water resource development, livestock marketing infrastructure, capacity building, and technology integration (GoK, 2024). Given the significant investments directed towards livestock development in the Northern Frontier Counties, there is a growing need to assess how project portfolio management practices influence the performance of these projects. Understanding the factors that contribute to successful project implementation is essential for improving project outcomes, enhancing livelihoods, and promoting sustainable socio-economic development within the region (KNBS, 2024).

Statement of the Problem

Livestock sector contributes over 12% of Kenya's GDP and supports nearly 60% of the rural population, particularly in arid and semi-arid lands where it is 80 % of the main source of income and food security (KNBS, 2024).Despite significant investments by multiple stakeholders such as national government, county governments and development partners; recent data from the State Department for Livestock (2023) shows that the overall underperformance of livestock sector economy is underperforming. For instance, in terms of livestock off-take volumes decreased by 9.8%, pastoralist household incomes in several counties remained stagnant, mortality rates during droughts rose by 14%, and market price volatility persisted. These trends reveal a performance gap between project outputs and intended livelihood outcomes. County-level monitoring reports indicate poor returns on investment due to recurring bottlenecks in portfolio coordination, underutilization of allocated resources, and slow adoption of modern livestock management practicesfactors linked to limited alignment of projects with local

priorities. The development agencies experience diminished project impact associated with weak stakeholder engagement and inconsistent capacity-building efforts (Kikwatha et al., 2020).

Furthermore, internally, independent project evaluations from organizations such as KLMC, ILRI, and NDMA highlight that many value chain development initiatives in the Northern Frontier Counties suffer from fragmented implementation ((Koima & Mukule, 2022), duplication of activities, and limited use of performance-tracking tools (Cheloti & Rugami, 2021). Regional development monitoring reports (2024) indicate that over 40% of these projects fail to achieve at least half of their intended outcomes within the planned timelines, largely due to poor coordination and lack of adaptive management. A 2023 Livestock Development Stakeholder Survey (2023) found that only 37% of project managers in the region routinely use integrated portfolio monitoring systems, while less than 35% actively involve pastoralist communities in planning and decision-making. Furthermore, technology integration remains low, with digital livestock service uptake averaging only 28% across the counties, and full-scale adoption occurring in only a few counties such as Laikipia and Isiolo. This slow uptake has been linked to delayed market responses, inefficient resource deployment, and missed opportunities for mortality reduction (Kikwatha et al., 2020).

Moreover, several studies demonstrate that adaptive resource allocation significantly enhance project performance, sustainability, and return on investment (ILRI, 2023; KNBS, 2024;Kikwatha et al., 2020; Martins et al., 2023). Authors such as Kerzner (2022) and Martins et al. (2023) emphasize that well-managed portfolios improve productivity, reduce operational inefficiencies, and strengthen value chain competitiveness. According to Auma and Otieno (2024), participatory planning fosters ownership and ensures that interventions meet local needs, while technology adoption accelerates service delivery and market responsiveness. Adopting an integrated portfolio management framework, as outlined by PMI (2023), could enable Northern Frontier Counties to build cohesive, adaptive livestock value chain systems capable of delivering measurable socio-economic benefits. In light of these gaps and opportunities, this study sought to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya.

General Objective

The general objective of the study was to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya

Theoretical Review

Resource-Based View (RBV) Theory

Resource-Based View (RBV) Theory developed by Jay Barney (1991) is a strategic management perspective that explains organizational performance and sustained competitive advantage based on the internal resources and capabilities of a firm (Nobahar & Saffari, 2024). It emphasizes that

differences in performance between organizations are primarily driven by the unique bundle of resources they control rather than external market conditions alone. These resources are considered the foundation upon which strategies are built and implemented. RBV theory posits that for resources to generate sustained competitive advantage, they must possess certain characteristics (Mubangizi & Kabanda, 2024). They should be valuable in enabling the organization to exploit opportunities or neutralize threats, rare in the sense that they are not widely possessed by competing organizations, difficult to imitate due to unique historical conditions or complex development processes, and non-substitutable, meaning there are no equivalent alternatives that can replace them effectively. These criteria are used to evaluate whether a resource can contribute to long-term strategic advantage (Karanja & Mbugua, 2023).

The theory further distinguishes between tangible and intangible resources, as well as organizational capabilities (Wanjiru & Kiptoo, 2021). Tangible resources refer to physical and financial assets, while intangible resources include knowledge, reputation, and organizational culture. Capabilities, on the other hand, refer to the organization's ability to effectively deploy resources through coordinated processes and routines. RBV highlights that it is not only the possession of resources that matters, but also how well they are integrated and utilized within the organization. RBV Theory provides a framework for understanding how organizations achieve and sustain superior performance through internal strengths. It shifts strategic focus toward building, protecting, and leveraging unique resources and capabilities as the central drivers of long-term success (Naliaka & Musyoka, 2022). Resource-Based View (RBV) Theory was used to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Conceptual Framework

A conceptual framework is a structured representation of the relationships among variables in a study and serves as a guide for explaining how the independent variables are expected to influence the dependent variable. It provides a foundation for empirical investigation by illustrating the presumed relationships among study constructs based on theory, empirical evidence, and logical reasoning (Portney, 2020). In the current study, the conceptual framework illustrates the relationship between adaptive resource allocation and the performance of livestock value chain projects in Northern Frontier Counties of Kenya.

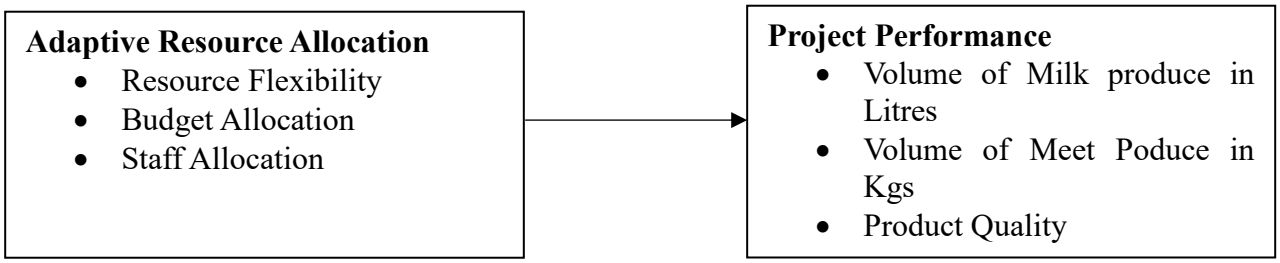

Figure 1: Conceptual Framework

Adaptive Resource Allocation

Adaptive Resource Allocation refers to the process of dynamically adjusting and distributing available resources such as finances, personnel, equipment, time, and technology based on changing organizational needs, priorities, and environmental conditions (Nobahar & Saffari, 2024). It involves the ability of an organization to monitor changes, identify emerging demands, and reassign resources efficiently to improve performance and achieve objectives. Adaptive resource allocation enables organizations to respond effectively to uncertainties, challenges, and opportunities by ensuring that resources are directed toward areas with the greatest impact. It promotes flexibility, efficiency, and sustainability by reducing resource wastage and supporting continuous improvement in decision-making and operations (Mubangizi & Kabanda, 2024).

Resource Flexibility refers to the ability of an organization to adjust and reconfigure its available resources in response to changing circumstances, emerging needs, and new priorities (Karanja & Mbugua, 2023). It involves the capacity to shift financial resources, equipment, technology, and other assets from one area to another to ensure that organizational goals are achieved effectively. Resource flexibility enables organizations to manage uncertainties by avoiding rigid resource structures and promoting quick responses to challenges. Through flexible resource management, organizations can improve efficiency, enhance innovation, and ensure that available resources are utilized where they create the greatest value (Wanjiru & Kiptoo, 2021).

Budget Allocation refers to the process of distributing financial resources among different activities, departments, projects, or programs based on organizational priorities and planned objectives (Naliaka & Musyoka, 2022). Effective budget allocation ensures that funds are directed toward essential operations and strategic initiatives while maintaining financial control and accountability. It involves assessing financial requirements, setting spending priorities, and monitoring the use of allocated funds to prevent misuse or shortages. Proper budget allocation supports effective decision-making, improves resource utilization, and enables organizations to achieve their goals within available financial limits (Nobahar & Saffari, 2024).

Staff Allocation refers to the process of assigning employees to different roles, tasks, departments, or projects according to their skills, expertise, and organizational requirements (Mubangizi & Kabanda, 2024). It ensures that the right personnel are placed in positions where they can contribute effectively to achieving institutional objectives. Effective staff allocation involves evaluating workforce needs, balancing workloads, and ensuring that employees are deployed efficiently to maximize productivity. Through proper staff allocation, organizations can improve performance, enhance employee engagement, and ensure that human resources are aligned with strategic priorities (Karanja & Mbugua, 2023).

Empirical Literature Review

Adaptive Resource Allocation and Project Performance

Nobahar and Saffari (2024) conducted a study on the effect of optimizing resource allocation within the judiciary of the Islamic republic of Iran: a comparative study. Their research combined a qualitative review of Iran's fiscal management with international comparisons to identify systemic budgetary inefficiencies and propose governance reforms. The study found that the judiciary's resource allocation relies on a traditional, inefficient budgeting approach and utilizes a comparative legal and empirical methodology to evaluate it against international best practices. The study concluded that achieving optimal distribution requires a shift toward performance-based budgeting, decentralized management, and targeted digital investments to improve efficiency and justice delivery

Mubangizi and Kabanda (2024) conducted a study on the influence of resource allocation on strategic project implementation in Rwanda irrigation system: a case study of Kagitumba irrigation project. The researcher used stratified random sampling technique to select a sample size of 150 employees from the population of the employees of Kagitumba Irrigation Scheme. The strata were that of senior management, middle management, supervisory and administration/ support staffs. The findings showed that strategic infrastructure development, strategic financial resource allocation, and strategic staff development, strategic information and communication technology and government regulations have a significant influence on affected the strategic project implementation of Kagitumba irrigation scheme. The study concluded that the goal of the study was to determine how resource allocation affected the strategic project implementation of Kagitumba irrigation scheme in Rwanda.

Karanja and Mbugua (2023) conducted a study on the influence of adaptive resource allocation on organizational performance at Kenya Power and Lighting Company. The objective of the study was to determine how adaptive resource allocation practices including flexible budgeting, dynamic resource deployment, and adjustment of operational resources influence organizational performance. The study employed a descriptive survey research design targeting departmental managers, project managers, and senior employees at Kenya Power and Lighting Company. The target population consisted of 450 employees, from which a sample of 210 respondents was

selected using stratified random sampling techniques. The findings revealed that adaptive resource allocation significantly influenced organizational performance through improved operational efficiency, effective utilization of resources, reduced wastage, and enhanced service delivery. The study concluded that organizations that continuously adjust resource allocation strategies based on changing operational demands achieve better performance outcomes.

Wanjiru and Kiptoo (2021) conducted a study on the influence of adaptive resource allocation on organizational performance at Kenya Medical Supplies Authority. The study employed a descriptive research design targeting procurement managers, logistics officers, and administrative employees at KEMSA. The target population consisted of 380 employees, from which a sample of 180 respondents was selected using stratified sampling techniques. The findings established that adaptive resource allocation significantly improved organizational performance through better supply chain coordination, improved availability of resources, reduced operational delays, and improved service delivery. The study concluded that adaptive resource allocation is important in improving efficiency and effectiveness in public institutions.

Naliaka and Musyoka (2022) conducted a study on the influence of adaptive resource allocation on organizational performance at Kenya Revenue Authority. The target population comprised 460 employees, from which a sample of 205 respondents was selected using stratified random sampling. Data were collected through questionnaires and analyzed using descriptive and regression analysis. The findings revealed that adaptive resource allocation positively influenced organizational performance through improved revenue collection efficiency, enhanced decision-making, better utilization of resources, and increased organizational responsiveness. The study concluded that adaptive resource allocation contributes significantly to improved performance in public institutions.

Research Philosophy

The research philosophy adopted for this study is pragmatism, as it emphasizes practical problem-solving and the use of the most effective methods to address real-world challenges (Wijnia, 2021). Given the study's focus on how adaptive resource allocation influence livestock value chains in Kenya's Northern Frontier Countiesan environment characterized by diverse stakeholders, cultural nuances, and dynamic environmental conditionspragmatism allowed for methodological flexibility and the integration of both qualitative and quantitative approaches (Mohammed & Pan, 2022). This philosophy supported the use of mixed methods, enabling the measurement of tangible outcomes, such as improvements in livestock productivity and value chain efficiency, while simultaneously capturing contextual insights from stakeholders to understand socio-cultural and environmental factors (Kelly & Cordeiro, 2020).

Research Design

The research designs adopted for this study were descriptive and correlational, implemented through a mixed-methods approach to comprehensively examine the role of portfolio management strategies in livestock value chain projects in Kenya's Northern Frontier Counties.

Target Population

In this study, the unit of analysis was the livestock value chain projects implemented in the Northern Frontier Counties of Kenya. The units of observation were the project managers, implementing agency officers, and county livestock officials who provided data on portfolio management practices and project performance. This distinction ensured that while data were collected from individuals, the analysis focused on the overall performance of the projects they represented. Therefore, the study targeted 283 stakeholders drawn from 102 livestock value chain projects implemented across Kenya's Northern Frontier Counties namely; Turkana, Marsabit, Mandera, Wajir, Garissa, Isiolo, and Samburu (Attached list of projects-Appendix V).

The number of key stakeholders was determined through stakeholder mapping using records from the Kenya National Bureau of Statistics (KNBS, 2024) and implementing agencies across the seven Northern Frontier Counties. It comprised 39 project managers overseeing livestock value chain initiatives, 110 field officers and veterinary personnel directly involved in project execution, 50 community leaders and pastoralist representatives providing beneficiary perspectives, 64 private sector actors engaged in marketing and input supply, and 20 local government officials offering policy oversight. These figures reflect the actual distribution of active participants across managerial, operational, community, and institutional levels, ensuring a comprehensive representation of all key actorsinfluencing livestock value chain project performance in the region.The population distribution is illustrated in Table 1.

Table 1: Target Population

Category	Population(N)	Justification
Project Managers	39	Responsible for overall project coordination and decision-making, crucial for understanding portfolio management implementation.
Field Officers / Veterinary Personnel	110	Frontline staff involved in execution and direct interaction with pastoralists, critical for assessing operational effectiveness.
Community Leaders / Pastoralist Representatives	50	Represent the beneficiaries and local stakeholders whose input is vital for understanding community engagement and stakeholder management.
Private Sector Actors	64	Involved in livestock marketing and service provision, essential for evaluating resource management and market linkages.
Local Government Officials	20	Influence policy alignment and provide regulatory oversight, important for assessing strategic alignment and institutional support.
Total Target Population	**283**	A sufficiently diverse and representative sample size to capture multiple perspectives across project implementation levels and stakeholder groups.

Source: KNBS (2024)

Sampling Frame

The comprehensive sampling frame for this study consisted of a complete list of all target stakeholders across the seven Northern Frontier Counties (Turkana, Marsabit, Mandera, Wajir, Garissa, Isiolo, and Samburu), categorized by their specific roles: Project Managers, Field Officers/Veterinary Personnel, Community Leaders/Pastoralist Representatives, Private Sector Actors, and Local Government Officials. This frame serves as the master list from which a sample was drawn, and for each of the 283 entries, it included identifying details such as the individual's name, their implementing organization or group, their specific role/title, the county of operation, and contact information, ensuring every potential participant is uniquely and accurately locatable. The data for this frame was sourced from the Kenya National Bureau of Statistics (KNBS, 2024) and the records of the implementing agencies overseeing the 102 livestock value chain projects.

Sample and Sampling Technique(s)

A sample is a subset of a population, selected to participate in a research as espoused by Anugraheniet al.(2023) using Slovin's sample size determination formulae. Sample Size (n)

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

Where: desired sample size when the target population is <1000

N = Population

n = is the sample size

e = Appropriate significance level, for instance, at 95 percent, the significance level is .05.

Using this procedure, the sample size arrived at is 165, derived as follows;

Sample Size (n) =N/1+ (N $(.05)^2$) =283/1+(283) $(.05)^2$) =165

Therefore, the research used a sample of 165respondents.

Table 2: Sample Size Distribution

Category	Population	Sample Size
Project Managers	39	23
Field Officers / Veterinary Personnel	110	64
Community Leaders / Pastoralist Representatives	50	29
Private Sector Actors	64	37
Local Government Officials	20	12
Total	**283**	**165**

Stratified sampling was the most appropriate technique for this study because the population was divided into distinct categories; project managers, field officers, community leaders, private sector actors, and local government officialseach with different roles and perspectives relevant to livestock value chain. By sampling proportionally from each subgroup, this method ensured that all key stakeholders were adequately represented, thereby enhancing the accuracy and generalizability of the findings. This approach reduced sampling bias that could have occurred with simple random sampling given the unequal group sizes, and allowed for more precise insights across categories, making it well-suited for capturing the diverse views necessary for a comprehensive analysis.

Data Collection Instruments

The study utilized a combination of questionnaires and interviews as research instruments to collect comprehensive data. Questionnaires were used to gather quantitative data from a larger number of respondents across different stakeholder groups, enabling statistical analysis of project performance factors. Interviews provided qualitative insights, allowing deeper exploration of respondents' experiences, perceptions, and challenges related to livestock value chain projects, and were conducted with donor agency representatives, senior officials from the State Department for Livestock, leaders of pastoralist associations, and technology service providers. This mixed-method approach ensured both breadth and depth of data, thereby enhancing the reliability and richness of the study's findings. Secondary data were sourced from project reports, policy documents, and relevant literature to complement and validate primary data findings. These sources provided contextual background, historical trends, and supported triangulation for a more robust analysis of livestock value chain projects.

Pilot Study

A pilot study was conducted as a small-scale preliminary assessment to evaluate the feasibility, reliability, and validity of the research instruments prior to the main data collection (Kono et al., 2025). Two counties, Turkana and Marsabit, were selected as pilot sites because they were representative of the Northern Frontier Counties (ASAL context) with active livestock value chain projects (*see the attached list of projects-Pg.81*). The counties also exhibited diverse livestock systemscamel-based systems in Marsabit and mixed smallstock systems in Turkanathereby allowing the research team to test instrument applicability across different contexts. Moreover, the sites were logistically accessible, which facilitated a rapid pre-test exercise.

The pilot involved approximately 10% of the total sample size, equating to about 16 participants drawn from various stakeholder groups engaged in livestock value chain projects in the two counties. Participants included project managers, field officers, and community representatives with relevant experience in livestock project implementation and management. The decision to use 10% of the overall sample was consistent with methodological recommendations in pilot research, where 5–10% of the intended sample size has been considered adequate to identify ambiguities and weaknesses in research instruments (Egbuchulem, 2023; Robinson et al., 2021; Lewis et al., 2021). This proportion was therefore deemed sufficient to provide meaningful insights without being unnecessarily resource-intensive.

Data Analysis

The study collected both qualitative and quantitative data. Qualitative data from interviews were analyzed using thematic analysis, where transcripts were carefully reviewed to identify recurring patterns, concepts, and categories related to project portfolio management and livestock value chain performance. Coding was deductive, based on the study's conceptual framework, and

inductive, allowing new themes to emerge from respondents' narratives. The findings were organized into thematic clusters and supported with direct quotations to provide rich, contextualized insights that complemented the quantitative results.

The quantitative data analysis was conducted using both descriptive and inferential statistical methods with the aid of the Statistical Package for Social Sciences (SPSS Version 27). Descriptive statistics were used to summarize respondents' demographic details and their responses to various aspects of the study variables, as outlined by Sandra and Hariko (2025). These included frequency distributions, means, standard deviations, and percentages. This approach helped present the data in a clear and easy-to-understand format, making interpretation more straightforward (Rao et al., 2025).

Inferential statistics were applied to determine the likelihood that the observed results were reliable rather than due to chance. Specifically, Pearson's correlation coefficient and multiple regression analysis were used to assess the relationships among the study variables. Regression models were employed to examine the combined effect of the independent variables on the dependent variable, allowing for deeper insights into the strength, direction, and significance of these relationships;

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Where;

Y= Performance of Livestock value chain projects

β_0= Constant

β_1=Coefficients of determination

X_1 = Adaptive resource allocation

RESEARCH FINDINGS AND DISCUSSION

Response Rate

The study administered a total of 165 semi-structured questionnaires with 139 properly completed and returned representing a response rate of 84.24%. This relatively high response rate was attributed to the use of a self-administered questionnaire and the assurance of confidentiality provided to respondents. According to Babbie (2020), a response rate of 50% is adequate, 60% is good, and 70% and above is very good for analysis. Likewise, Chen (2016) noted that higher response rates reduce non-response error. Therefore, the 84.24% response rate achieved in this study was appropriate for reliable data analysis. The results of the response rate are presented in Table 3

.

Table 3: Response Rate

Questionnaires	Frequency	Percentage
Returned Questionnaires	139	84.24
Non-returned questionnaires	26	15.76
Total	**165**	**100**

Descriptive Analysis

Adaptive Resource Allocation and Project Performance

The first specific objective of the study was to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya. The respondents were requested to indicate their level of agreement on the statements relating to adaptive resource allocation and performance of livestock value chain projects in Northern Frontier Counties of Kenya.The results were as shown in Table 4

From the results, the respondents agreed that financial resources are distributed efficiently across project components (M=4.221, SD= 0.423). In addition, the respondents agreed that resources are deployed where they are most needed during project implementation (M=4.135, SD= 0.632). Further, the respondents agreed that the number of staff assigned to project activities is sufficient to support effective implementation (M=4.134, SD= 0.633). The respondents also agreed that project funds are allocated according to identified priorities and project needs (M=4.097, SD=0.345). In addition, the respondents agreed that budget allocations are adjusted when necessary to support critical project activities (M=4.043, SD= 0.654).

From the results, the respondents agreed that human resources are reallocated when necessary to address implementation demands (M=4.043, SD=0.654). In addition, the respondents agreed that project staff are assigned to tasks based on their skills and expertise (M=3.781, SD=0.891). Further, the respondents agreed that the project adjusts resource utilization in response to changes in the operating environment (M=3.721, SD=0.763). The respondents also agreed that the project demonstrates flexibility in managing available resources to achieve its objectives (M=3.721, SD=0.763).

These findings are consistent with those of Mwangi et al. (2024), who found that adaptive resource allocation enhances project performance by ensuring that financial, human, and material resources are directed to priority areas based on project needs and emerging implementation demands. The study established that projects that effectively reallocate resources achieve higher levels of efficiency, timeliness, and overall performance. Similarly, Kim and Park (2022) established that flexible resource allocation enables project managers to respond effectively to changing environmental conditions, thereby minimizing implementation delays and improving project outcomes. In addition, the findings concur with those of Martinsuo and Geraldi (2023), who observed that adaptive resource allocation is a critical project portfolio management practice

that enhances resource utilization and supports the successful achievement of project objectives through continuous adjustment of resources to strategic priorities. The findings further support those of Nyaribo and Wekesa (2023), who argued that projects characterized by effective allocation and reallocation of resources demonstrate greater operational flexibility, improved productivity, and higher success rates compared to projects with rigid resource management systems.

Table 4: Adaptive Resource Allocation and Project Performance

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std.	Skewness	Kurtosis
The project adjusts resource utilization in response to changes in the operating environment.	22.4%	51%	11.6%	6.2%	8.9%	3.721	0.763	-0.62	0.85
Resources are deployed where they are most needed during project implementation.	31.7%	56.4%	6.6%	3.9%	1.5%	4.135	0.632	-1.05	1.95
The project demonstrates flexibility in managing available resources to achieve its objectives.	22.4%	51%	11.6%	6.2%	8.9%	3.721	0.763	-0.62	0.85
Project funds are allocated according to identified priorities and project needs.	34.2%	51.2%	7.7%	3.1%	3.5%	4.097	0.345	-0.94	1.88
Budget allocations are adjusted when necessary to support critical project activities.	34.3%	22.5%	18.6%	12.5%	13.2%	4.043	0.654	-0.41	0.75
Financial resources are distributed efficiently across project components.	36.5%	53.1%	9.2%	0.00%	7.4%	4.221	0.423	-1.12	2.05
Project staff are assigned to tasks based on their skills and expertise.	24.1%	50.6%	11.5%	6.71%	7.1%	3.781	0.891	-0.57	0.89
Human resources are reallocated when necessary to address implementation demands.	34.3%	22.5%	18.6%	12.5%	13.2%	4.043	0.654	-0.41	0.75
The number of staff assigned to project activities is sufficient to support effective implementation.	31.6%	56.5%	6.5%	3.8%	1.6%	4.134	0.633	-1.04	1.96
Composite						**3.988**	**0.640**	**-0.75**	**1.33**

Secondary Data Analysis on Project Performance

The study utilized secondary data obtained from project monitoring and evaluation reports, county livestock department records, implementing agency reports, and project performance databases for livestock value chain projects implemented in the Northern Frontier Counties of Kenya. The secondary data covered a five-year period from 2021 to 2025 and focused on three key indicators of project performance: volume of milk produced, volume of meat produced, and product quality compliance. These indicators were selected because they directly reflect the productivity and quality outcomes associated with livestock value chain interventions. Analysis of the secondary data enabled the study to assess performance trends over time and provide objective evidence regarding the contribution of livestock value chain projects to livestock production and product quality improvement in the region.

Volume of Milk Produced

The secondary data indicate that the volume of milk produced fluctuated during the period under review. In 2021, the projects recorded a milk production volume of 18.45 million litres, which increased to 21.78 million litres in 2022. This growth suggests improvements in livestock productivity arising from project interventions such as improved animal health services, feed support programmes, and capacity-building initiatives. However, milk production declined to 19.96 million litres in 2023, possibly due to prolonged drought conditions and reduced pasture availability experienced in many ASAL counties. Production recovered significantly in 2024, reaching 24.35 million litres, before declining slightly to 22.84 million litres in 2025. Despite the fluctuations, the overall trend indicates a substantial improvement in milk production across the livestock value chain projects.

Table 5: Volume of Milk Produced

Year	Volume of Milk Produced (Litres)
2021	18,450,000
2022	21,780,000
2023	19,960,000
2024	24,350,000
2025	22,840,000

Volume of Meat Produced

The findings further indicate that the volume of meat produced experienced fluctuations throughout the study period. Meat production increased from 9.85 million kilograms in 2021 to 11.42 million kilograms in 2022, reflecting enhanced livestock productivity and improved market participation. A slight decline to 10.73 million kilograms was observed in 2023, which may be attributed to climatic shocks, livestock diseases, and market disruptions affecting

livestock production systems. The highest production level was recorded in 2024 at 12.96 million kilograms, indicating strong project performance and improved livestock management practices. In 2025, meat production declined marginally to 12.18 million kilograms but remained significantly higher than the levels recorded during the initial years of the study period. Overall, the trend demonstrates positive growth in meat production despite periodic fluctuations.

Table 6: Volume of Meat Produced

Year	Volume of Meat Produced (Kgs)
2021	9,850,000
2022	11,420,000
2023	10,730,000
2024	12,960,000
2025	12,180,000

Product Quality

The results show that product quality compliance also fluctuated over the five-year period. Quality compliance stood at 71% in 2021 and increased to 76% in 2022, suggesting improvements in livestock handling, disease control measures, and adherence to quality standards. However, compliance declined slightly to 73% in 2023 before increasing substantially to 82% in 2024, the highest level recorded during the study period. This improvement may be attributed to enhanced quality assurance practices, training of livestock producers, and adoption of improved production technologies. In 2025, quality compliance declined marginally to 79%, although it remained above the levels achieved in the first three years. The findings therefore indicate that livestock value chain projects contributed significantly to improving the quality of livestock products while maintaining relatively high compliance with established standards.

Table 7: Product Quality

Year	Quality Compliance (%)
2021	71
2022	76
2023	73
2024	82
2025	79

Simple linear regression

Simple regression for Adaptive Resource Allocation

The first objective of the study was to examine the role of adaptive resource allocation on performance of livestock value chain projects in Northern Frontier Counties of Kenya. The corresponding hypothesis was adaptive resource allocation has no statistically significant relationship with performance of livestock value chain projects in Northern Frontier Counties of Kenya.

A univariate analysis was therefore conducted to test the null hypothesis. From the model summary findings in Table 8, the r-squared for the relationship between adaptive resource allocation and performance of livestock value chain projects in Northern Frontier Counties of Kenya was 0.315; this is an indication that at 95% confidence interval, 31.5% variation in performance of livestock value chain projects in Northern Frontier Counties of Kenya can be attributed to changes in adaptive resource allocation. Therefore, adaptive resource allocation can be used to explain 31.5% change in performance of livestock value chain projects in Northern Frontier Counties of Kenya. However, the remaining 68.5% variation in performance of livestock value chain projects in Northern Frontier Counties of Kenya suggests that there are other factors other than adaptive resource allocation that explain performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Table 8: Model Summary for Adaptive Resource Allocation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.561[a]	.315	.314	.68365

a. Predictors: (Constant), adaptive resource allocation

The analysis of variance was used to determine whether the regression model is a good fit for the data. From the analysis of variance (ANOVA) findings in Table 9, the study found out that that Prob>$F_{1,\ 137}$= 0.000 was less than the selected 0.05 level of significance. This suggests that the model as constituted was fit to predict performance of livestock value chain projects in Northern Frontier Counties of Kenya. Further, the F-calculated, from the table (62.998) was greater than the F-critical, from f-distribution tables (3.910) supporting the findings that adaptive resource allocation can be used to predict performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Table 9: ANOVA for Adaptive Resource Allocation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.404	1	27.404	62.998	.000[b]
	Residual	59.542	137	0.435		
	Total	86.946	138			

a. Dependent Variable: performance of livestock value chain projects in Northern Frontier Counties of Kenya

b. Predictors: (Constant), adaptive resource allocation

From the results in table 10, the following regression model was fitted.

$Y = 0.233 + 0.363 X_2$

(X_2 is Adaptive Resource Allocation)

The coefficient results showed that the constant had a coefficient of 0.233 suggesting that if adaptive resource allocation was held constant at zero, performance of livestock value chain projects in Northern Frontier Counties of Kenya would be at 0.233 units. In addition, results showed that adaptive resource allocation coefficient was 0.363 indicating that a unit increase in adaptive resource allocation would result in a 0.363 increase in performance of livestock value chain projects in Northern Frontier Counties of Kenya. It was also noted that the P-value for adaptive resource allocation coefficient was 0.000 which is less than the set 0.05 significance level indicating that adaptive resource allocation was significant. Based on these results, the study rejected the null hypothesis and accepted the alternative that adaptive resource allocation has a positive and significant influence on performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Table 10: Beta Coefficients for Adaptive Resource Allocation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.233	.061		3.820	.000
	adaptive resource allocation	0.363	0.094	0.364	3.862	0.000

a. Dependent Variable: performance of livestock value chain projects in Northern Frontier Counties of Kenya

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Adaptive Resource Allocation and Project Performance

The first null hypothesis test was 'Adaptive resource allocation has no statistically significant relationship with performance of livestock value chain projects in Northern Frontier Counties of Kenya. The study found that adaptive resource allocation is statistically significant in explaining performance of livestock value chain projects in Northern Frontier Counties of Kenya. The influence was found to be positive. This means that unit improvement in adaptive resource allocation would lead to an increase in performance of livestock value chain projects in Northern

Frontier Counties of Kenya. Based on the findings, the study concluded that adaptive resource allocation positively and significantly influences performance of livestock value chain projects in Northern Frontier Counties of Kenya.

Recommendations

The study therefore recommends that the management of livestock value chain projects in Kenya should adopt a flexible and data-driven adaptive resource allocation approach that allows timely redistribution of financial, human, and material resources in response to changing project needs and environmental conditions.

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