From Field to Feed Trough: Examining the Drivers of Feed and Fodder Technologies uptake among Pastoral Beef Farmers in Kenya

ABSTRACT

Adoption of technologies and effective management practices in the pastoral beef systems are necessary for improved productivityand resilient agricultural systems. This study examined the factors influencing the adoption of Technology Innovations and Management Practices (TIMPs) among pastoral beef farmers in Isiolo and Kajiado counties. Employing a cross-sectional approach and utilizing the Seemingly Unrelated Regression (SURe) model, the research explores the intricate dynamics that shape farmers' decisions regarding three key TIMPs; planted fodder, feed supplementation, and fodder conservation. Using a systematic sampling technique, a sample size of 619 pastoral farmers was adopted. This research seeks to uncover the underlying motivations and barriers, understanding the complex relationships between resource accessibility, socio-economic considerations, and the role of extension services in facilitating technology adoption. The research underscores the importance of addressing specific barriers, including limited access to resources and socio-economic constraints faced by these farmers. The evidence-based strategies derived from this research paves the way for scientifically informed interventions to propel the livestock sector in Kenya towards a sustainable future. The study's recommendations emphasize the need for targeted policies that prioritize market accessibility, technology awarenessand information access, thus effectively supporting the adoption of TIMPs among pastoral beef farmers. Implementing these recommendations contributes to strengthening of resilience of the livestock sector and the advancement of sustainable agricultural practices in Kenya.

Key words;*Technology Innovations and Management Practices (TIMPs), fodder conservation, feed supplementation, planted fodder*

1. INTRODUCTION

The pastoral beef farming in Kenya stands at a crucial crossroad, where the convergence of technological advancements and traditional practices presents an unprecedented opportunity for transformation[1].The sector holds immense potential, both in terms of its contribution to the national economy and the livelihoods of communities involved[2]. With vast expanses of rangelands and abundant livestock resources, the sector has historically played a significant role in providing meat products for domestic consumption and export. However, it faces numerous challenges that hinder its full potential. Limited access to resources, such as water, pasture, and veterinary services, poses significant constraints on pastoral beef farmers[3].As global and local demands for sustainable and efficient food production intensify, it is imperative to understand the underlying factors that drive the adoption of productivity enhancing TIMPs among pastoral beef farmers.

Over the years, several TIMPs have emerged as a promising solution to address some of the challenges facing pastoral farming in the Arid and Semi- Arid Lands [4]. From improved livestock breeds and feed formulations to precision farming techniques and digital tools for monitoring and disease management, a range of technologies have the potential to revolutionize the sector. These technologies offer opportunities to optimize resource utilization, enhance productivity, mitigate climate change impacts, improve market access, and strengthen overall resilience.However, as indicated in a report by Kenya Agricultural and Livestock Research Organization (KALRO) [5], the adoption of technology innovations and management practices among pastoral beef farmers in Kenya is influenced by a complex interplay of factors. Socio-economic considerations, including the cost-effectiveness and profitability of adopting technologies, play a vital role in farmers' decision-making processes. Additionally, access to information, knowledge, and technical support were identified to be crucial determinants of adoption of new agricultural technologies.

Within the Kenyan context, three key categories of TIMPs have gained attention: planted fodder, feed supplementation, and fodder conservation[6,7]. These TIMPs offer innovative solutions to enhance productivity, improve animal health, and mitigate the effects of climate variability. Planted fodder has emerged as a viable option for pastoral beef farmers to ensure a consistent and high-quality feed source for their livestock. Research conducted in Kenya has demonstrated the positive impact of adopting improved forage species, such as Napier grass and Rhodes grass. These planted fodders have been found to increase milk production, promote weight gain, and enhance overall animal health[8]. By providing a reliable source of nutritious feed, planted fodder not only improves livestock performance but also reduces the pressure on natural grazing lands, allowing for their restoration and regeneration.

Commercially available feed supplements, including concentrates, protein meals, and mineral mixes, can address nutritional deficiencies and enhance animal performance. Studies conducted in Kenya have highlighted the positive correlation between feed supplementation and weight gain, particularly during periods of fodder scarcity [9;10]. However, challenges related to the cost and availability of purchased feed supplements need to be addressed to ensure their widespread adoption among small-scale pastoral beef farmers.Fodder conservation techniques, such as silage making and hay production, offer an innovative approach to overcome fodder scarcity during dry seasons or periods of limited grazing. A study by[11] emphasized the benefits of fodder conservation for pastoral beef farming. Specifically, silage makingallows farmers to preserve highly nutritious fodder, such as maize and sorghum, which can then be utilized when natural grazing is scarce. Fodder conservation not only improves feed availability but also ensures a consistent nutrient supply, leading to enhanced livestock performance and resilience.

The adoption of TIMPs in pastoral beef farming is believed to face various challenges, but the extent and impact of these challenges remain unclear. Access to crucial resources like land and water might present obstacles to the widespread implementation of planted fodder systems. Moreover, the cost and availability of feed supplementation could potentially limit their adoption, especially among small-scale farmers[12].Given the current state of pastoralism, the beef farming industry in Kenya stands at a crucial crossroad. Socio-cultural and economic factors intertwine with the possibilities of TIMPs to determine failure or success for the pastoral regimes. Thus, it is important to explore ways of filling the gaps in adoption of technologies as well as empowering farmers for increased resilience. By filling this research gap, the study provides valuable insights into the motivations and challenges faced by beef farmers in embracing TIMPs, enabling policymakers and stakeholders to develop targeted strategies and interventions that promote widespread adoption of sustainable and efficient beef farming practices.

2. METHODOLOGY

The study was conducted in Kajiado and Isiolo counties of Kenya. These counties were purposively selected based on their significant contribution to the pastoral beef farming industry and their representation of different geographical locations and socio-economic characteristics within the sector.A sample size of 619 pastoral beef farmers was determined using Cochran'sformula, taking into account the desired level of precision, expected variability in the population, and desired confidence level. The sample size was considered sufficient to provide reliable and generalizable results while considering practical constraints such as available resources and time. A mixed-methods approach was employed, combining quantitative and qualitative data collection techniques. Structured survey instruments were developed to collect quantitative data, covering aspects such as farmer demographics, farm characteristics, and adoption patterns of feed and fodder technology innovations and management practices. Qualitative interviews were conducted with a subset of participants to gain deeper insights into their decision-making processes and contextual factors.The collected data were analyzed using the SURe model in STATA 17.0. This statistical technique allowed for the simultaneous estimation of multiple regression model while considering the interdependencies and correlations between the different feed and fodder TIMPs[13]. The SURe model provided a comprehensive assessment of the factors influencing the adoption of these practices among pastoral beef farmers. The outcome variables for the model were whether or not a farmer adopted planted fodder, feed supplementation or conserved fodder. The explanatory variables (Table 2) used in the model were obtained from literature reviews and thus included in the model.

3. RESULTS AND DISCUSSIONS

3.1Demographic characteristics

The study results show that a majority of the households sampled (84 percent) in the study area were headed by males (Table 1 below). This finding reflects the prevailing patriarchal structure commonly observed in many households in Kenya. In terms of decision-making processes concerning cattle rearing, selling, and the utilization of income derived from beef cattle,the results also indicate a significant trend. Approximately 81.1 percent of these decisions are made by household heads, who predominantly happen to be male. Furthermore, the data reveals that 53 percent of these male household heads possess no formal education, with only 17 percent having received basic education. This highlights the necessity to effectively communicate and disseminate information on technologies and innovations in ways that are easily understandable to this target audience [14]. Such approaches may involve utilizing local dialects, employing visual aids and demonstrations, and employing other strategies that enhance comprehension.

Furthermore, it is worth noting that the average age of the household heads in the study area was 46 years. This age distribution among the household heads suggests that there is a considerable level of experience and accumulated knowledge within the community. However, it also indicates the need to prioritize strategies that cater for different age groups, including younger generations, to ensure the transfer of knowledge and skills. To address the prevailing gender disparity in household headship and decision-making, it is crucial to promote gender equality and empower women within these communities. Encouraging women's participation in decision-making processes, providing access to education and training, and creating opportunities for income generation can help challenge traditional gender roles and promote more equitable distribution of responsibilities [15].

Table 1: Demographic characteristics

Variables	Categories	Isiolo	Kajiado	Total	%	Chi-square/F	df	*P-value*
	Female	24	65	89	15.2			
Gender of household head	Male	173	321	494	84.7	2.18	1	.13
	Total	197	386	583	100			

	None	146	164	310	53.1			
	Adult Education	0	5	5	0.8			
Education level of household head	Primary	25	73	98	16.8	57.2	4	.00***
	Secondary	13	93	106	18.1			
	Tertiary	13	51	64	10.9			
	Total	197	386	583	100			
Age of household head	Mean	48	44	46	100	10.4		.00**
Decision making	Household head	146	327	473	81.1	9.60	2	.00**
	Joint	49	57	106	18.1			
	Spouse	2	2	4	0.69			

Source; Authors' Field Survey, 2021

In addition to gender considerations, addressing the low education levels among household heads is vital for fostering sustainable development. Efforts should be made to improve access to formal and basic education, particularly for those who currently lack educational opportunities. This can enhance their capacity to understand and adopt new technologies, improve their decision-making abilities, and increase their overall well-being. To effectively disseminate information on technologies and innovations, it is essential to employ context-specific communication methods. Utilizing local dialects, visual aids, and demonstrations can bridge language and literacy barriers, making the information more accessible and easily understood by the target audience. Involving community members in the design and implementation of these communication strategies can further enhance their effectiveness and ensure cultural relevance [16].

Engaging community leaders, local organizations, and relevant stakeholders in the dissemination and implementation process can help build trust, encourage local support, and contribute to the long-term success and sustainability of these initiatives. In inference, addressing the gender disparity in household headship, improving education levels, and employing effective communication strategies are essential steps towards promoting sustainable development and fostering innovation in pastoral regions of Kenya. By empowering women, promoting education, and utilizing context-specific communication methods, these communities may unlock their full potential and embrace positive change.

3.2Determinants of technological choices among beef pastoral farmers

The results presented in Table 2 below shows the output from SURe model used in the analysis. The coefficient for herd size category in the Planted Fodder model is 0.0218, which is statistically significant at 5% level. The positive coefficient suggests that larger herd sizes have a significant impact on the adoption of planted fodder. This finding aligns with previous studies by [17]and [18], which found that farmers with larger herds were more likely to adopt improved feed technologies. The rationale behind this relationship could be that farmers with larger herds have a higher demand for fodder and therefore are more motivated to adopt technologies that enhance fodder availability and quality. The positive effect of herd size on planted fodder adoption can also be explained by economies of scale. Farmers with larger herds often have greater financial resources and may find it more economically viable to invest in and manage planted fodder systems. Additionally, larger herds require more consistent and abundant feed sources, and planted fodder can help meet these requirements. However, it is important to note that the magnitude of the effect (0.0218) indicates a relatively small influence of herd size category on the adoption of planted fodder. This suggests that while herd size is a contributing factor, it is not the sole determinant of adoption decisions. Other factors, such as access to resources, training and extension services, and market conditions, may also play significant roles.

In the Planted Fodder model, the coefficient for feed lot finishing is 0.1965, indicating a statistically significant positive relationship at a 1% level. This implies that farmers who had adopted feed lot finishing technology were associated with a higher likelihood of adopting planted fodder. This finding suggests that farmers with larger feed lots recognize the importance of improving their feed management practices through technologies like planted fodder. Similarly, in the Conserved Fodder model, the coefficient for feed lot finishing is 0.2131, and it is also statistically significant at a 5% level. This implies that farmers who had adopted feedlot finishing technologies were more knowledgeable about the importance of the nutritional value for their animals and were more likely to adopt fodder conservation and planted fodder technologies. Additionally, the findings show the technologies are mutually non-exclusive meaning that the adoption of one technology may trigger the subsequent adoption of other productivity enhancing technologies.

Table 2: Results of the seemingly unrelated regression (*SURe*) showing determinants of technological choices

	Feed and Fodder Technology Innovations and Management Practices		
Explanatory Variables	**Planted Fodder**	**Feed Supplementation**	**Conserved Fodder**
Herd size category	.021(.022)**	-.003(.872)	.024(.105)
Feed lot finishing	.196(.000)***	.120(.263)	.213(.011)**
Severe months	-.018(.022)**	-.007(.668)	.002(.002)***
Income categories	.011(.107)	.001(.097)*	.040(.000)***
Beef market distance	-.003(.004)***	-.025(.078)*	.001(.493)
Age of household head	.001(.959)	-.000(.826)	-.013(.007)***
Farm size	-.000(.426)	-.000(.179)	-.004(.054)*
Information access	.028(.029)**	-.002(.275)	.024(.225)
Gender	-.015(.515)	-.019(.455)	-.0216(.543)
Own land	.011(.662)	.052(.255)	.044(.299)
Access water	-.009(.474)	.140(.011)**	-.006(.741)
Credit access	.103(.001)***	.055(.045)**	-.009(.841)
Insurance access	.112(.003)***	.052(.390)	.006(.908)
All weather road access	.074(.001)***	-.014(.848)	-.096(.005)***
Group membership	.040(.120)	.003(.940)	.211(.000)***
Power access	.010(.602)	-.053(.317)	.103(.001)***

(*P <.05, **P <.01 and ***P <.001*, Standard error in parenthesis)*

The significant positive relationship between feed lot finishing technology and the adoption of both planted and conserved fodder technologies aligns with the findings of previous studies. For example, a study by [19] found that larger feed lots were associated with higher adoption rates of feed conservation technologies among small-scale dairy farmers in Kenya. This suggests that the need to ensure an adequate and consistent supply of feed motivates farmers with feed lots to adopt practices that optimize feed utilization and preservation.The significant influence of feed lot technology in both the Planted Fodder and Conserved Fodder models underscores the importance of considering the interrelationships of livestocktechnologies when designing interventions and policies to promote adoption.

In the analysis of severe months without water, the coefficient for this variable is -0.0184 in the Planted Fodder model. The negative coefficient suggests a statistically significant relationship at a 5% level. This indicates that as the number of severe months without water increases, the likelihood of adopting planted fodder decreases among pastoral beef farmers in Kenya.The result suggests that water scarcity poses a significant challenge to the adoption of planted fodder technology. Pastoral beef farmers who experience a higher number of severe months without water may face limitations in establishing and maintaining planted fodder systems due to inadequate water availability for irrigation. This finding is consistent with previous research by [20], which highlighted the negative impact of water scarcity on the adoption of agricultural technologies in Kenya. To address this gap, the government and development partners need to invest in irrigation infrastructure around permanent river basins for increased production of planted fodder for use especially in feed deficient months. Additionally, the irrigation infrastructure is key to establish national feed reserves for the ASALs to stabilize feed availability.

In examining the variable for water access, under planted fodder model, the coefficient for the coefficient is significant at the 0.004 level. This suggests that water availability plays a crucial role in the adoption of planted fodder practices by pastoral beef farmers. The positive coefficient of 0.0013 indicates that an increase in access to water resources leads to a higher likelihood of adopting planted fodder technologies. This finding aligns with previous research by [17]who found that water availability is a key determinant of technology adoption in the livestock sector. Adequate water resources are essential for the establishment and growth of planted fodder crops, as they require regular irrigation for optimal production. Moreover, water availability may also indirectly influence other aspects of feed and fodder management. For instance, it can facilitate the establishment of water harvesting and conservation practices, such as constructing ponds or storage tanks, which enable farmers to store water during dry seasons for fodder production.

Under the Feed supplementation model, the coefficient for income categories is 0.0015, which is positive. However, this coefficient is only marginally significant at the 10% level (*P* = .09). This suggests that income categories may have a limited influence on the adoption of supplementation among pastoral beef farmers. In addition, in the Conserved Fodder model, the coefficient for income categories is 0.0403, indicating a positive relationship. The coefficient is statistically significant at a high level of significance (*P* =.001), indicating that income categories have a significant influence on the adoption of fodder conservation practices among pastoral beef farmers.These findings highlight the differential impact of income categories on the adoption of different feed and fodder technology innovations and management practices. While income categories may not significantly influence the adoption of planted fodder or purchasing feed supplements, they do play a significant role in the adoption of fodder conservation practices.

These results are in line with previous studies that have highlighted the importance of income in determining farmers' adoption decisions[21;22]. Higher income levels may provide farmers with the financial capacity to invest in and maintain the infrastructure and equipment required for fodder conservation practices. Additionally, the profitability and potential cost savings associated with fodder conservation may make it a more attractive option for farmers with higher income levels. Understanding the differential impact of income categories on technology adoption can help policymakers and stakeholders develop targeted strategies to promote the adoption of specific feed and fodder technology innovations among pastoral beef farmers[23]. By providing support and incentives tailored to the specific needs and circumstances of farmers at different income levels, the adoption of sustainable and efficient practices can be facilitated, leading to improved livestock productivity and resilience in the pastoral beef farming sector.

In the Planted Fodder model, the coefficient for beef market distance is -0.0013, indicating a negative relationship. The coefficient is statistically significant at the 1% level (*P* =.001), suggesting that distance to the beef market has a significant influence on the adoption of planted fodder technology among pastoral beef farmers. A negative coefficient suggests that as the distance to the beef market increases, the likelihood of adopting planted fodder technology decreases. According to [24],proximity to markets plays a vital role in the adoption of technological innovations in the agricultural sector. This finding supports our results, highlighting the importance of investing in market infrastructure such as slaughter facilities, power, water and roads along the livestock corridors.

Further analysis of the variable beef market distance shows a coefficient of -0.0251 under the supplementation model. Although the coefficient is negative, it is only marginally significant at the 10% level (*P*= .07). This indicates that distance to the beef market may have a limited influence on the adoption of feed supplementation among pastoral beef farmers.This finding is consistent with the research conducted by[25], who noted that the impact of market distance on technology adoption decisions is context-specific. In our study, the limited significance suggests that factors other than market distance may play a more prominent role in the adoption of feed supplementation among pastoral beef farmers. In the Conserved Fodder model, the coefficient for beef market distance is 0.0008, which is positive. However, the coefficient is not statistically significant (*P* = .05), suggesting that distance to the beef market does not have a significant influence on the adoption of fodder conservation practices among pastoral beef farmers.

The coefficient for the age of household head variable in the Planted Fodder model is 0.0012, indicating a positive relationship. However, the coefficient is not statistically significant (*P*= 0.05), suggesting that age may not have a significant influence on the adoption of planted fodder technology among pastoral beef farmers.This finding is consistent with the study conducted by [26], which found that age was not a significant predictor of technology adoption among livestock farmers. The lack of significance suggests that age alone may not be a determining factor in the adoption decisions related to planted fodder technology.On the other hand, in the Conserved Fodder model, the coefficient for the Age of household head variable is -0.0131, indicating a negative relationship. The coefficient is statistically significant at the 1% level (*P* =.01), suggesting that age plays a significant role in the adoption of fodder conservation practices among pastoral beef farmers. A negative coefficient implies that as the age of the household head increases, the likelihood of adopting fodder conservation practices decreases.The contrasting results for the Age of household head variable in the Planted Fodder and Conserved Fodder models highlight the complex nature of technology adoption decisions and the need for context-specific analysis. Age may interact with other factors, such as knowledge, attitudes, and resource availability, which collectively shape farmers' choices regarding different management practices.

The results also reveal that the coefficient for Farm Size is -0.0001 under the Planted Fodder model, indicating a negative relationship. However, the coefficient is not statistically significant (*P*= .05), suggesting that farm size may not significantly influence the adoption of planted fodder technology among pastoral beef farmers.This finding could also be explained by the cultural practices of communal and nomadic grazing among pastoral farmers. On the other hand, in the Conserved Fodder model, the coefficient for Farm Size is -0.0037, indicating a negative relationship. The coefficient is statistically significant at the 5% level (*P*=.05), suggesting that farm size plays a significant role in the adoption of fodder conservation practices among pastoral beef farmers. This concurs with the findings by [27]who noted that as farm size increases, the likelihood of adopting fodder conservation practices decreased in Ethiopia.The significant negative coefficient in our study suggests that smaller pastoral beef farms may be more inclined to adopt fodder conservation practices, possibly due to their resource constraints and the potential benefits of cost-effective fodder conservation methods.Overall, the results indicate that the relationship between farm size and technology adoption varies depending on the specific management practice considered. While farm size may not significantly influence the adoption of planted fodder technology, it plays a significant role in the adoption of fodder conservation practices among pastoral beef farmers.

In the Planted Fodder model, the coefficient for information access is 0.0286, indicating a positive relationship. The coefficient is statistically significant at the 5% level (*P*=.05), suggesting that information access plays a significant role in the adoption of planted fodder technology among pastoral beef farmers. A positive coefficient implies that as information access improves, the likelihood of adopting planted fodder technology increases.This finding aligns with previous research conducted by [28], who found that access to relevant information positively influences farmers' adoption of innovative agricultural practices. The results of our study support this perspective, indicating that timely and accessible information can enhance the adoption of technology innovations in livestock farming.

On the contrary, under Supplementation model, the coefficient for information access is -0.0029. However, the coefficient is not statistically significant (*P*=.05), suggesting that information access may not have a significant influence on the adoption of feed supplementation among pastoral beef farmers.This finding contrasts with the findings of [29], who concluded that improved access to information significantly increases the adoption of feed supplementation practices among farmers. The lack of statistical significance in our study on supplementation implies that factors other than information access may play a more dominant role in the adoption decisions related to the purchase feed supplements among pastoral beef farmers.It is important to note that while information access appears to be a significant factor in the adoption of planted fodder technology, its influence may vary in the context of other management practices. The inconsistent significance of information access highlights the complexity of technology adoption decisions and the need for a comprehensive understanding of the multifaceted factors influencing farmers' choices.

In the Planted Fodder model, the coefficient for Credit Access is significant (*P*= .001). This indicates that access to credit has a significant positive effect on the adoption of planted fodder practices among pastoral beef farmers. The positive coefficient suggests that farmers who have access to credit are more likely to invest in the establishment and maintenance of planted fodder systems. This finding is consistent with previous research that has emphasized the role of financial resources in supporting the adoption of technology innovations in agriculture[30].In the Supplementation feed model, the coefficient for Credit Access is also significant (*P*= .05). This suggests that credit access influences the adoption of supplementedfeeds among pastoral beef farmers. The positive coefficient indicates that farmers who can access credit are more likely to afford and purchase feed supplements to supplement their livestock's nutritional needs. This finding aligns with previous studies that have highlighted the importance of financial resources in facilitating the purchase of inputs and resources for livestock production[31].However, in the Conserved Fodder model, the coefficient for Credit Access is not significant (*P*=.05). This implies that credit access does not play a significant role in the adoption of conserved fodder practices among pastoral beef farmers. Other factors, such as knowledge and awareness of fodder conservation techniques, availability of conservation infrastructure, and market demand for conserved fodder, may be more influential in driving adoption decisions in this category.

In the Feed supplementation model, the coefficient for Insurance adoption is not significant (*P*=.05). This suggests that the uptake of insurance does not have a significant impact on the adoption of feed supplementation among pastoral beef farmers.In the Conserved Fodder model, the coefficient for Insurance adoption is also not significant (*P*=.05). This indicates that the use or non-use of insurance does not play a significant role in the adoption of conserved fodder practices among pastoral beef farmers.These findings imply that insurance uptake may not be a crucial factor driving the adoption of these specific technologies in pastoral beef farming in Kenya.Other factors, such as cost-effectiveness, availability of feed supplements, or awareness of the benefits of these practices, may have a stronger influence on farmers' decisions.However, it is worth noting that insurance access remains an important aspect of risk management for pastoral beef farmers[32]. While not directly related to the adoption of specific technology practices, insurance coverage can help mitigate potential financial losses due to various risks, such as livestock mortality or extreme weather events. Therefore, even though it may not be a significant driver of technology adoption, insurance access should still be considered as part of a comprehensive risk management strategy for pastoral beef farmers.

In the Conserved Fodder model, the coefficient for Group Membership is significant (*P*=.001). This suggests that belonging to a group or association has a significant positive influence on the adoption of conserved fodder practices among pastoral beef farmers. The positive coefficient indicates that farmers who are part of a group are more likely to engage in collective efforts and benefit from shared resources and knowledge related to fodder conservation. This finding aligns with previous research that has emphasized the role of social networks and group dynamics in promoting the adoption of sustainable agricultural practices[33].

In the Planted Fodder model, the coefficient for All Weather Road Access is significant (*P*=.001). This indicates that having access to all weather roads has a significant positive effect on the adoption of planted fodder practices among pastoral beef farmers. However, in the Feed supplementation and Conserved Fodder models, the coefficients for Group Membership and All Weather Road Access are not significant (*P*=.05). This implies that these variables do not play a significant role in driving the adoption decisions for supplemented with purchased feed and conserved fodder practices among pastoral beef farmers. Other factors, such as economic considerations, availability of feed resources, and knowledge about alternative feeding practices, may have a stronger influence on adoption choices in these categories.

4. CONCLUSION AND RECOMMENDATIONS

This study examined the factors influencing the adoption of different feed and fodder TIMPs among pastoral beef farmers in Kenya. The analysis revealed several significant variables that influence the adoption choices within the three identified categories: Planted Fodder, Feed supplemented, and Conserved Fodder. The findings highlight the complex nature of adoption decisions and the importance of considering multiple factors when designing interventions to promote sustainable livestock production.

Based on the results, it is evident that various socio-economic and contextual factors play a crucial role in shaping adoption choices. Variables such as herd size category, feed lot finishing, income categories, access to credit, and number of months with severe water shortage, were found to be significant in driving the adoption of specific TIMPs. These findings underline the need for a tailored approach that considers the diverse characteristics and needs of pastoral beef farmers when promoting the adoption of feed and fodder technologies.

In light of these results, several recommendations can be made. First, government and partners should empower pastoral farmers while strengtheningfarmer support institutions such as farmer groups. Enhancing farmers' knowledge and awareness about the benefits and practicalities of these the TIMPs could encourage their adoption. Additionally, policymakers should consider infrastructure development initiatives, particularly improving road, powerand market. This is crucial toenhance access to inputs and output markets for effective technology adoption. Furthermore, fostering collaboration and establishing platforms for knowledge exchange among farmers, such as farmer groups and associations, can enhance the adoption of sustainable practices. Encouraging the formation of farmer groups and supporting existing ones can create avenues for sharing experiences, resources, and learning from each other's successes and challenges. By acknowledging the significance of context-specific variables and adopting a holistic approach, policymakers, researchers, and extension services can develop targeted strategies and interventions that promote the widespread adoption of sustainable and efficient practices in pastoral beef farming.

COMPETING INTERESTS

Authors have declared that they no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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