

# **An Assessment of Integration of MSMEs and CSA into Livestock Red Meat Value Chain: A Case Study of Kajiado County, Kenya**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author MWT the research design, data collection and manuscript preparation. Authors BEK, HMM and JM managed the manuscript review and supervision. All authors read and approved the final manuscript.*

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## **ABSTRACT**

The livestock sector is a major contributor to food security, livelihoods, and is most affected by climate change, but is also a major contributor of GHGs. While climate-smart agriculture (CSA) has been adopted to mitigate the effects of climate change it has focused more on smallholder food crop producers with little attention to livestock production, and or entire food chains. MSMEs play a pivotal role in enhancing the ability of producers to engage with value chains, integrate women and marginalized groups, innovate, and are key drivers of community resilience, social adaptation, poverty reduction, and protection of livelihoods due to MSMEs' greater adaptability and flexibility. Linking CSA to MSMEs within the livestock red meat value chains will strengthen the chains, improve incomes, reduce climate risks and increase resilience for pastoralists in ASALs. This study reveals that the red meat value chains in ASALs are still underdeveloped and fragmented, have little application of modern technologies and practices, unsustainable, and largely nomadic. Further, there is low integration of MSMEs and CSA due to actors' low awareness

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of the concept of CSA, limited capacity building on CSA, incentives, and policy instruments to integrate MSMEs thus leaving the value chains weak, inefficient, vulnerable to climate risks, and unsustainable. Adaption of sustainable practices can only come after the integration of actors, therefore there is a need to invest in context-based integration approaches, such as awareness and knowledge, affordable relevant modern technologies and practices, relevant policy instruments, and incentives to realize the CSA triple wins, and develop climate-resilient red meat value chains.

*Keywords: MSMEs; integration; CSA; sustainability; TIMPs; contextualization, livestock value Chain.*

## 1. INTRODUCTION

Micro, small and medium sized enterprises' (MSMEs) role in supporting climate risk management is starting to receive enormous attention [1]. MSMEs consist of businesses whose staff establishment range from 1-99 employees. MSMEs span over many sectors in the Kenyan economy, operating both formally and/or informally [2]. Kajiado is among the top five counties with the greatest number of MSMEs in Kenya having a total of 46,100 licensed and 101,900 unlicensed MSMEs and whose 90% are micro enterprises, according to the MSME Establishments Basic Report 2016. MSMEs is a major employer in Kajiado, absorbing at least 36 percent of the 2018 projected population [3].

Red meat global production has been on rapid expansion in the last decades in response to growing demand largely driven by expanding populations and increasing incomes [4]. In Sub-Saharan Africa, the livestock sector is a major contributor to food security. Kenya is a developing country with approximately 85 percent of landmass being ASALs, about 9 million poor livestock farmers that make 28 percent of Kenya's rural population [5]. Pastoral production makes up 80-90% of Kenya's red meat market, with an estimated 80% of Kenya's livestock being found in the ASALs, and supports 38% of Kenya's population. Population growth, increased urbanization, and a ballooning middle class is set to drive the demand for meat products, in Kenya, upwards[6].

The red meat value chain begins with the primary producers of cattle, sheep, and goats (shoats) and ends with consumers, covering all stages from input suppliers, and 'pasture to plate. The suppliers' inputs into red meat production are animal health products including drugs and vaccines; feeds, nutritional supplements (conserved forages, concentrates, minerals, and vitamins), Pasture seeds, breeding animals (mostly males), and artificial insemination, fixed and mobile equipment and tools and Credit.

Kajiado County's beef value chain is predominantly made up of cattle extensively reared on communally and private-owned rangelands [7,8,6]. Producers overwhelmingly work in traditional systems as either small-scale mixed farmers, agro-pastoralists with a few heads of stock, or pastoralists with a greater number of animals, accounting for 86% of production, and depend heavily on livestock for their livelihoods and whose yields have been decreasing, forcing farmers to keep more and more herds on limited acreage, impacting on the ecosystems already strained by climate change effects and land degradation[9,10,11]. The MSMEs within the value chain are all affected by the fluctuation in the supply of cattle and shoats due to climate effects on livestock production.

Along major livestock routes, cattle are trekked or trucked by road from pastoral areas to primary and secondary markets such as Bisil and Kiserian, and then to terminal markets in Nairobi [8]. The animals are slaughtered in urban slaughterhouses where producers and traders slaughter based on the day's order. The middlemen, distributors, and retailers buy off all the slaughtered meat and sell it to butcheries, schools, restaurants, hotels. The process input in slaughterhouses consists of water, labor, and electricity. The pastoral livestock value chains are buyer-driven value chains with a lot of middlemen who drive up the value chain transaction costs, leading to high prices on the final product, and whose benefits do not trickle back to the producer.

### 1.1 Statement of the Problem

Climate change presents greater risks to individuals, businesses, infrastructure, and economic growth and development efforts globally[12]. Climate threats in ASALs are compounded by the already dry and fragile ecosystems, and most of the population is poor. Livestock production is a source of employment and poverty alleviation especially in ASALs where livestock is the traditional occupation and

offers nomadic and pastoral communities the most promising way towards sustainable economic development and improved household nutrition[13]. Moreover, livestock production is an emitter of GHGs, this includes carbon monoxide, methane, and nitrous oxide from livestock farming[14].

Therefore, there is a need for a focused and significant investment in the ASAL livestock sector to make them sustainable through adaptation and mitigation to climate risks. Climate-Smart Agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively

support the development and ensure food security in a changing climate. The role of MSMEs in driving local development, the ability to integrate women and other marginalized groups, innovate, have greater adaptability and flexibility can be important drivers in building community resilience, poverty reduction, social adaptation, and scaling CSA objectives[15]. The understanding of the interactions of various actors and variables, activities and feedback loops within the food chain and systems, governance institutions, and capacities of actors involved is key to optimizing and realizing sustainability for food chains and climate resilience [16,7,12].

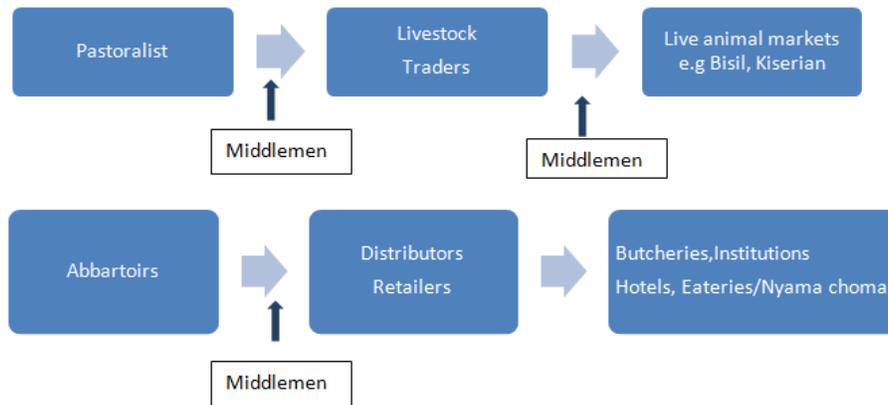


Fig. 1. Author’s extract of the pastoralist value chains

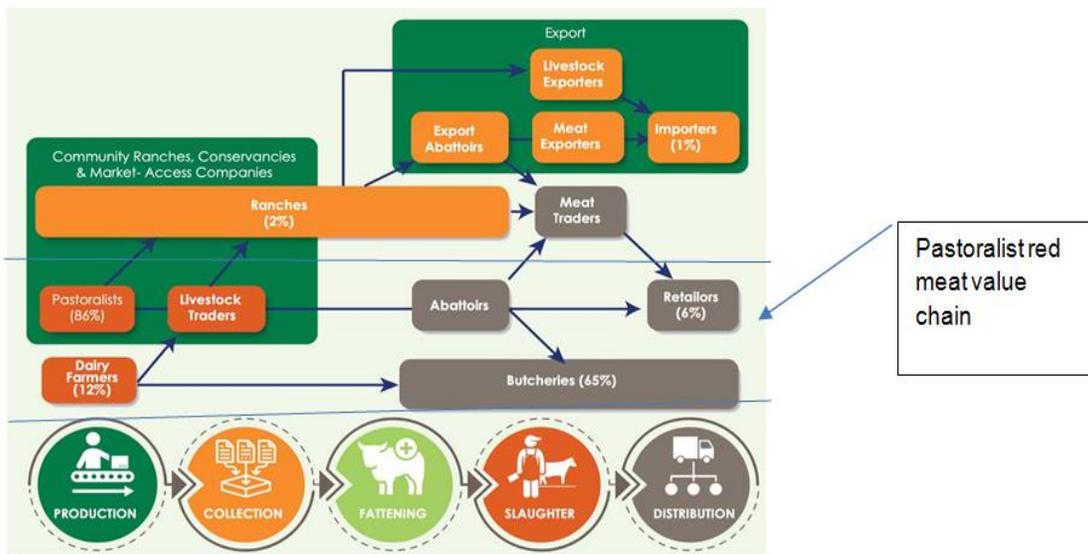


Fig. 2. Kenyan Livestock value chain, Adapted from Kenya market trust

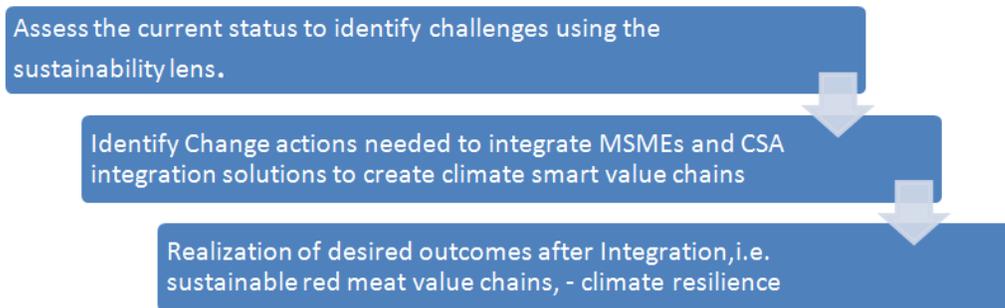
Linking CSA TIMPs to MSMEs within the livestock sector value chains will allow livestock farmers to improve their engagements with the red meat value chain, reducing climate risks and increasing farmers' resilience; it offers an opportunity to make the value chain sustainable, combining economic, social and environmental and equity objective[17].

### 1.2 Conceptual Framework

The concept of sustainability[18] and social learning theory on adaptation; useful in the integration of CSA and MSMEs into the sustainable food value chains and MSMEs significance in scaling the CSA objectives were employed in conducting this study. The sustainability concept is applied to the value

chain actors in integrating CSA and MSMEs to improve productivity, incomes, protect livelihoods, build resilience and reduce greenhouse gases. A sustainable system requires an analysis of the food systems from inputs, 'pasture to plate' including all actors, support services, and an enabling environment. The holistic approach towards sustainable livestock sector and red meat value chains required identification of environmental, social, economic and governance challenges and design of context-based integration approaches of MSMEs and CSA suited for ASALs and pastoralist production to lead to the actualization of the full benefits; economic, social and environmental impact while managing tensions, trade-offs, and synergies between these three dimensions[16].

### 1.3 Conceptual Model- 3Cs



Challenges (Current status)	Change actions for integration	CSA Benefit realization (Desired outcome)
<b>Environmental challenges</b> Climate change. ASALs-Low rainfall, diminishing Water & fodder supply, Overstocking, land degradation/soil erosion Encroachment of marginal lands & wetlands Agricultural/livestock footprint.	Enabling value chain actors Enablers- enabling Political, Economic and Social Environment. Strong vertical linkages and Governance. Access to markets and infrastructure. Sustainable social enterprise Models & Incentives for MSMEs.	Sustainable and climate-smart resilient red meat value chains. High sustainability and adaptive capacity of value chain actors.
<b>Social issues</b> Ballooning population Low development; high Poverty food insecurity, poor nutrition, Cultural beliefs, Gender & youth marginalization Low awareness of sustainability practices	Core value chain actors. Mainstreaming of context-based CSA technology, innovation, and management practices addressing unique needs of MSMEs/actors in the ASALs value chains.	<b>Social impact</b> Food security, Livelihood's protections Poverty alleviation. Youth and gender mainstreaming Sustainable CS livestock practices
<b>Economic issues</b> Poor Finance & Market access; Few or no MSMEs in the livestock value chains; poor	Awareness and knowledge of sustainability thinking and CSA among value chain actors.	<b>Economic impact</b> Effective, efficient & Profitable value chains, Strong value chain linkages High productivity Job creation ASALs Economic

<b>Challenges (Current status)</b>	<b>Change actions for integration</b>	<b>CSA Benefit realization (Desired outcome)</b>
infrastructure, Low productivity & profitability. <b>Governance issues.</b> Inefficient value chains. High transaction costs, Policy gaps; Buyer-driven captive value chains.	Extended value chain actors with specific Finance and Insurance services for MSMEs in ASALs, Financing; Risk management solutions. Early warning systems, and participation of CBOs.	development. <b>Environment impact.</b> Reduced stocking. Non-encroachment into marginal lands and wetlands Reduced land degradation. Reduced GHG emission

## 2. RESEARCH METHODOLOGY

### 2.1 Study Area

This study was conducted in four out of the six sub-counties in Kajiado County, Kenya by taking into consideration the culture of the inhabitants (Fig 3). The study area is situated between Longitudes 36° 5' and 37° 5' East and between Latitudes 1° 0' and 3° 0' South. The county covers an area of 21,900.9 square kilometers (Km<sup>2</sup>). The current Kajiado county integrated development plan[3] indicates pastoralism as a major economic activity in the county with major stocks being cattle, sheep, and goats (shoats). Livestock trade and products such as milk, beef and chevon, hides, and skins form the main part of household incomes[3].

### 2.2 Research Design

Both quantitative and qualitative data were collected. The data and information captured processes of production, distribution, and marketing. Informants included input suppliers, producers, traders, middlemen, processors,

transporters and distributors/retailers, consumer, and stakeholders in the extended and enabling value chains (extension officers, bankers, insurance agencies, and microcredits, central and county government, government agencies, and development partners) and from research institutions and universities. Following Mugenda and Mugenda et al. (2010) and Mutisya and Barker [19], a sample size of 459 respondents were sampled across the value chain. Context and thematic analysis were used for qualitative data analysis while the quantitative data was analyzed with the aid of Statistical Package for Social Sciences (SPSS) and reported in tables, frequencies, charts, and graphs. Statistical inferences were also made from regression, chi-square, and differences observed in various actors using the 95% confidence interval ( $P \leq 0.05$ ).

## 3. RESULTS

This study approached the assessment of the integration of MSMEs and CSA into the Livestock red meat value chains from a four perspectives framework, namely.

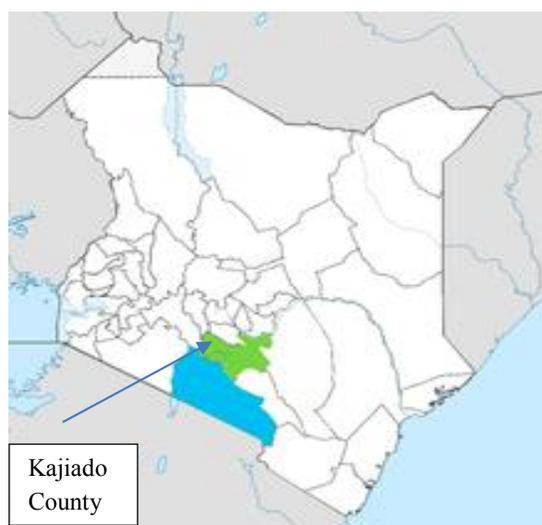


Fig. 3. Research area, Kajiado County in Kenya

Integration approach	Aspects within the approach
1. Capacity building driven integration	Provision and level of awareness, knowledge, skills to the value chain actors.
2. Process and technology-driven integration	Level of Technology, innovation, practices, sustainability efforts within the value chains.
3. Incentive driven integration	Availability of Grants, subsidies, interest-free loans, free capacity building and other financial and related incentives to drive integration.
4. Policy and institutional driven integration	Policy, governance, hard and soft institution - availability of policy and social support to enable integration including cultural practices and infrastructure support.

### 3.1 Capacity Building Driven Integration

In evaluating capacity-driven integration, the study assessed the awareness, knowledge, and attitudes of value chain actors in regards the to value chain and CSA concepts.

Table 1 shows that other than the actor's feeling that they do not have the support to effectively participate in the livestock value chain, all of them significantly felt not integrated into the livestock value chain in Kajiado ( $P \leq 0.05$ ) even though they are aware of the concept of the livestock value chain. The majority of the business surveyed had been in operation for at least 5 years (67.2%) years, had less than 10 employees (80.8%), hence most can be categorized as micro-enterprises. Most producers, processors, and consumers have been part of the value chain system in Kajiado for at least 10 years however actors (traders, aggregators, middlemen, transporters, slaughterhouses, butcheries and eateries) who are between producers and consumers had been in operation for between 1-6 years. The actors indicated that they open and close, or sell off their business outfits due to perennial financial challenges that accompany fluctuating seasons of drought and floods, hence the lack of consistent operations. Livestock production is the traditional occupation in ASALs, while most aggregators/middlemen have been part of the system for between 4-6 years, input suppliers were of two extremes mostly having been in business for between 1-3 years and a few for 10 years, and most distributors have been operating for between 1-3 years, showing different parts of the value chains were at different stages of formation with many being at the formative stages and many never breaking even due to the fluctuating nature of the pastoralist livestock production and weather variability.

This finding is not unique since due to poor incomes, low productivity and climate change risks of prolonged droughts, the value chain actors close or sell their businesses then other actors re-open when the environment or fortunes improves. In ASALs, following a drought period, it takes years for herd size to recover, affecting livelihoods, and in absence of financial resources to proactively re-stock through animal purchases, it can take decades hence affecting the continuity and productivity of the entire value chain. Equally, all factors that create an efficient value chain where every actor achieves maximum productivity may not be in place especially bearing in mind that the red meat value chain is underdeveloped and policy actions remain inadequate especially in the ASALs.

### 3.2 Awareness of Climate Change

The majority of the respondents were somehow aware of climate change, this implies that the actors had heard of the concept, climate change Fig. 4, shows that to most actors, climate change is associated with weather variability (50.4%), followed by extreme weather (26.5%) and frequent droughts (12.9%). This suggests that climate change to most actors is a weather index factor.

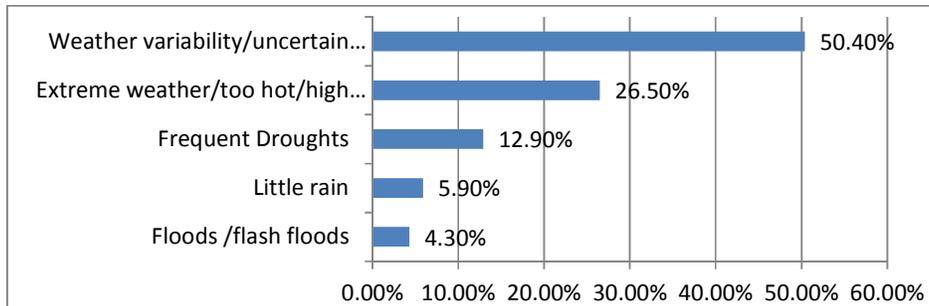
In testing the knowledge of actors on different concepts, results in Fig. 5 show that most actors have heard of building resilience (34.8%) and reducing poverty (31.1%), therefore close to 66% of the actors were knowledgeable on social concepts on poverty reduction and resilience building. The actors, on other remaining concepts, had awareness of less than 7%. Of interest, was the realization that actors' awareness of climate-smart agriculture and climate-smart animal/livestock agriculture was only at 5.3% and 6.1% respectively. This implies

that most actors may not be aware of climate-smart agriculture/livestock as a stand-alone concept and only 0.8% could appreciate the concept on adaption. This is not surprising especially since there has been minimal research and study on Climate change impacts on livestock systems and corresponding value chains and also given the fact that Kenya government, development partners, and NGOs efforts have been concentrated on poverty reduction strategy e.g. (PRSP) 2000, Economic Recovery Strategy (ERS) of 2003- 2007 and vision 2030 by GOK and livelihood protection efforts.

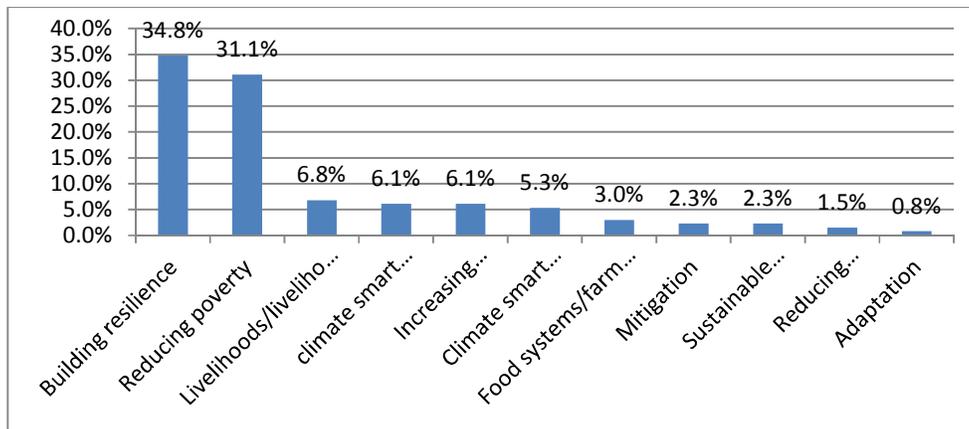
Cross-tabulation results indicated that actors had varied awareness of the various sustainability and climate change concepts with producers, middlemen/aggregators, distributors/retailers, and consumers being more aware of reducing poverty and building resilience, input suppliers being aware of increased productivity and building resilience as climate change-related concepts. As for the processors, they were relatively knowledgeable on the five constructs (climate-smart animal/livestock agriculture, increasing productivity, building resilience, livelihoods/livelihoods protection, and reducing poverty).

**Table 1. Actor awareness of the value Chain concept**

Parameter	Agree % (Positive)	Disagree % (Negative)
I believe I am part of the red meat business/value chain in Kajiado	5.5±.4 <sup>a</sup>	88±4.4 <sup>b</sup>
I have a market/someone to sell my product/services	16.7±.8 <sup>a</sup>	75.6±3.9 <sup>b</sup>
The red meat value chain contributes to my income	16.4±.8 <sup>a</sup>	76.2±3.8 <sup>b</sup>
I have access to the necessary information I need to participate effectively in the value chain	17.9±.9 <sup>a</sup>	64.3±3.2 <sup>b</sup>
I believe I have the skills and experience to effectively participate in the value chain	14.3±.7 <sup>a</sup>	71.6±3.6 <sup>b</sup>
I have the support/enablement to effectively participate in the value chain	57.5±2.9 <sup>a</sup>	22.9±1.1 <sup>b</sup>



**Fig. 4. Awareness of Climate Change**



**Fig. 5. Understanding of climate change-related concepts**

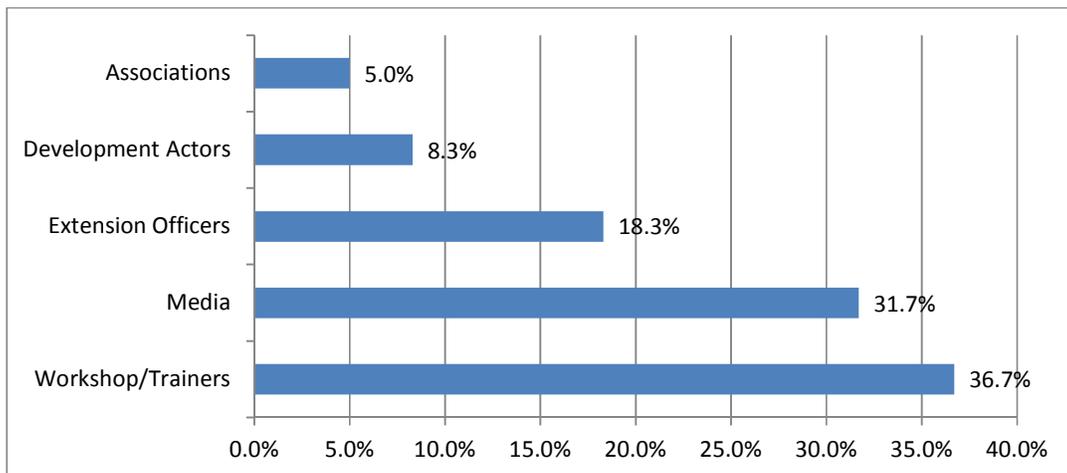
On sources of information on climate change-related concepts, results in Fig. 6 indicate that most actors received their capacity building from workshops and training courses (36.7%), media including mobile technology (31.7%), and extension and agriculture officers from the County government (18.3%), these channels accounted for 86.7% of capacity building driven integration and hence could be leveraged to improve integration of CSA and MSMEs into the red meat value chains. The other sources were development actors and NGOs and value chain actors' association, CBOs/chama. This implies that value chain actors use both formal and informal sources to acquire information necessary for their integration, and different value chain actors have different preferences when it comes to the source of information owing to the dynamics of engagement.

Table 2 presents results on the views of actors concerning the environment. As can be seen, a majority of the actors (61%) were aware that their business can impact the environment negatively. 71% of the actors believed that their business should be involved in protecting the environment. These findings are not surprising bearing in mind that the county government is driving initiatives of cleaning up the county urban areas and exercised penalties for dirty frontage and business premises even though the awareness did not translate to awareness of climate-smart agriculture/livestock practices with respect to their business activities. The activities in the value chain have both direct and indirect effects on the environment, moreover, the livestock sector is an emitter of GHGs, this includes

carbon monoxide, methane, and nitrous oxide from livestock farming, emissions from transportation of the livestock and other effects from red meat processing and waste, the water-intensive activities in the slaughterhouses, waste from retailers, butcheries, eateries, and meat roasting joints.

On assessing the three sustainability perspectives, i.e., environment, social and economic perspectives, Fig. 7 shows that most of the actors believed that their business can have an impact beyond the environment (42%), quality of life (22%), create jobs (20%) reduce poverty (16%). This awareness provides an entry to integrating sustainability knowledge and practices such as CSA TIMPs into the value chain, since the awareness and attitude of the actors are amenable to sustainability but there is a clear need to link cause and effect so that the actors can see how this translates into benefits for their businesses and livelihoods.

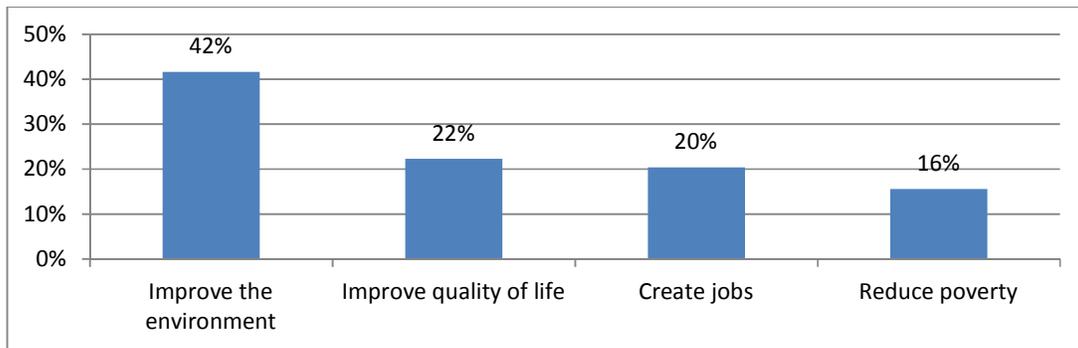
Most value chain actors especially the abattoirs were disposing of their liquid waste into a septic pit, the solid waste as manure is sold or given off to farmers, hides and skins are sold albeit at very low prices, due to lack of leather processing industries and cheap leather imports, hence leading to most hides and skins going to waste. Heads, and offal, are sold off to retailers and abattoir workers for traditional dishes, bones, and hooves are used for soaps and jewelry making. The findings show that there were no sustainable practices to ensure that abattoirs/ slaughterhouses production was optimal while at the same time safeguarding the environment.



**Fig. 6. Sources of Information on climate change-related concepts**

**Table 2. Effects of value chain activities on the environment**

		Frequency	Percent
Do you believe that businesses/ your activities/ have any negative impact on the environment?	NO	15	39.5
	Yes	23	60.5
	Total	38	100
Should your business/ your activities/actions be involved in the protection of the environment?	Yes	27	71.1
	No	4	10.5
	Not Applicable	7	18.4
Total		38	100



**Fig. 7. The positive social impacts the value chain activities can have on the community**

**3.2.1 Process and technology (Man, Machine, and Methods) driven integration approach**

In assessing climate-smart processes and technologies used by the value chain actors, the study included technologies/innovations, and management practices used along the red meat value chain. The value chain actors were found to be using various sustainable methods/practices along the chain, ranging from 8% to 12% which implies that adoption of technology and use of innovations in livestock value chains is significantly very low compared to crop value chains. This is not surprising because even though CSA technologies and innovations, in general, do exist, their diffusion is slow and limited, and where they exist the focus is mainly on crop farming and addresses producer level without necessarily permeating the entire value chain from input suppliers, producers, traders, middlemen, transporters, processors, distributors, to retailers and consumers.

Fig. 8 shows, that beyond producers, actors practices included having an emergency fund (13%), insuring businesses against weather effects (13%), having an awareness/knowledge on environmental protections practices among staff and stakeholders (11%), such as reuse or recycling of materials (10%) and having

environment days like cleaning or tree planting days (10%). This is not surprising because the practices adopted were mainly addressing the need to lower operating costs of the microenterprise, mitigate financial loss and comply with county environmental regulation for keeping clean frontage, drainage, and participating in county government clean-up days. But there was little appreciation of the direct link between MSMEs' Practices and technological innovation and response to the challenges faced by the value chain sustainability due to effects of climate change. Equally, the literature points to the very little or no 'modern' production among the pastoral livestock value chain actors and it is imperative that moving forward capacity building is geared towards modern-day technologies and methods to adapt to the changing technologies and systems with the changing dynamics of the value chain, ensure optimal operations while safeguarding the environment.

Further results on the integration of climate-smart technologies in respect to extended and enabling value chain actors such as financial institutions and actors' associations/cooperatives/chama show they adopted measures geared towards risk management from an economic perspective such as insuring of business, setting aside emergency funds, and Waste management, but

not from a social or environmental perspective or building of climate resilience.

### 3.2.2 Incentive driven integration approaches

When asked, 97% of value chain actors said they received no incentives at all to help in the adoption of sustainable practices. Results in Fig. 9 shows the incentives the actors would prioritize would be the provision of free extension/advisory services (25%), provision of subsidized inputs/technologies (18%), provision of free capacity building opportunities, information on market prices, training, awareness, free technology and general information on CSA (18%) and provision of affordable loans (14%) to the actors, showing that different actors require different incentives. Environmental schemes such as carbon credits/trading and payment of ecosystem services scored a measly 2% each,

pointing to a lack of awareness on ecosystem services/value and opportunities. Apart from extension services all the other incentives had a financial component to it and this accounted for 75% of the incentives requested for by actors.

Results in Fig. 10 below further explore CSA integration in relation to the financial aspects and shows that actors lacked access to inputs and technologies on CSA (17%) and financial support services that would enhance adoption (16%), 15% of the actors expressed that return on investments would inform their decision to adopt CSA, while 14% felt that CSA technologies were costly, customers would not be willing to pay more due to value chain integration of CSA (10%), and other pressing financial priorities (8%), this implies that at least 63% of the actors had a financial barrier to the integration of CSA.

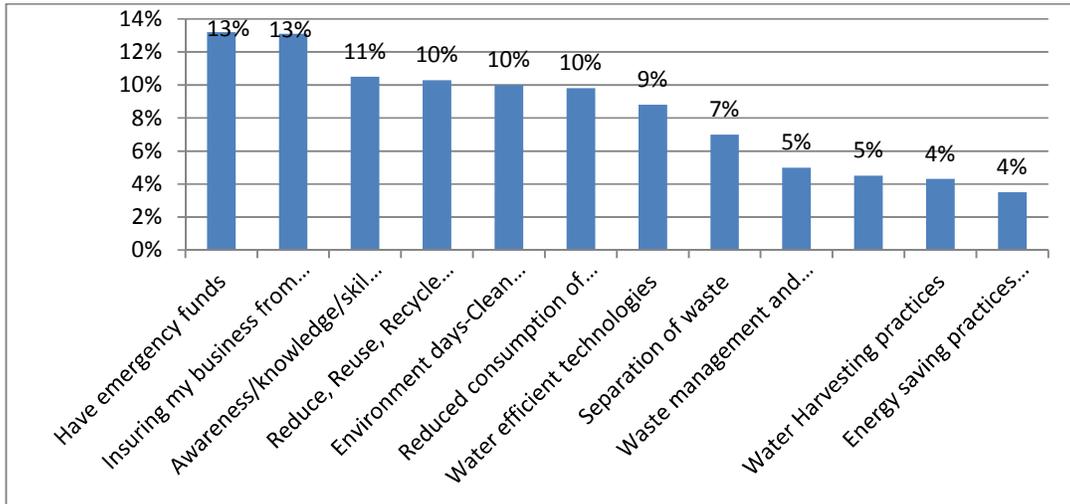


Fig. 8. Climate-Smart technologies in use by the core Value Chain Actors

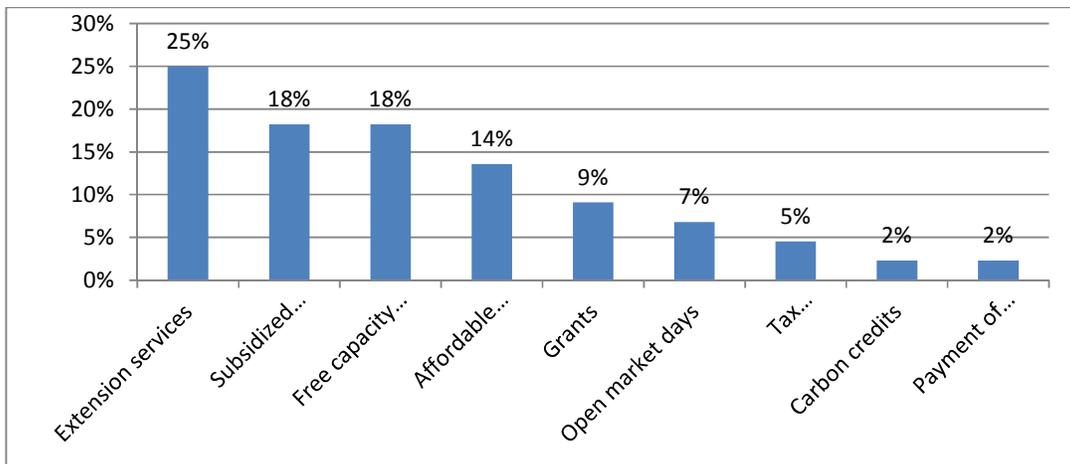
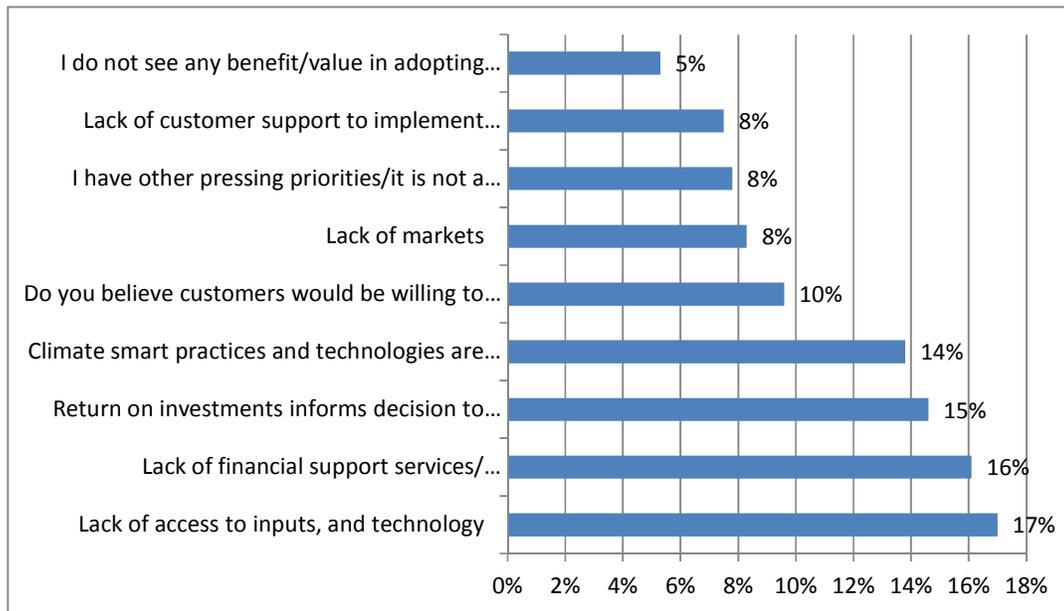


Fig. 9. Views of Actors on the value of Different Incentives for Adoption of CSA Practices



**Fig. 10. Barriers to adoption of CSA and sustainable practices**

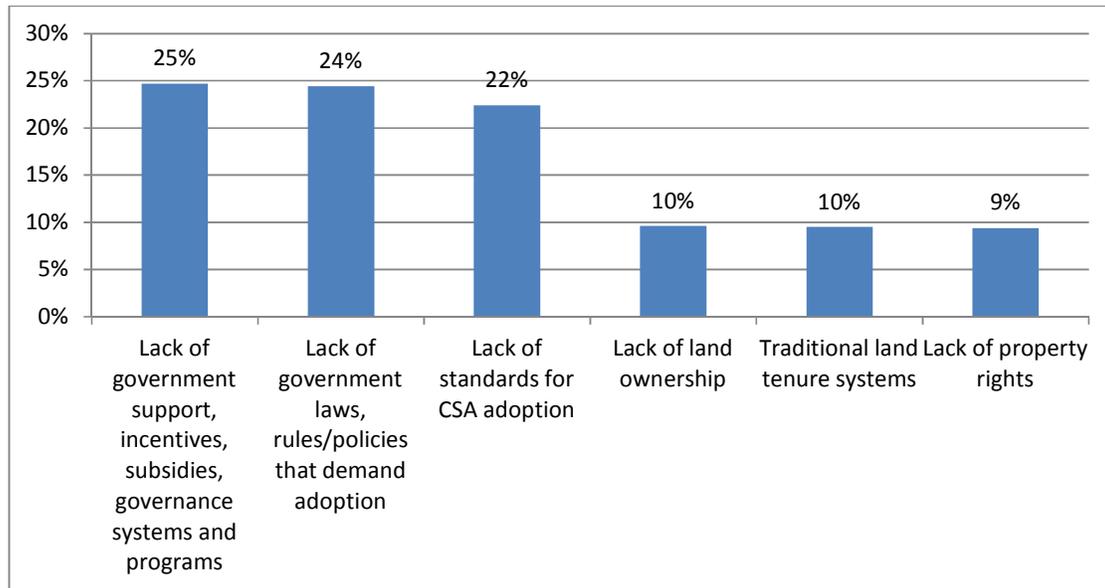
Interviews with key informants further showed that the majority of the incentives given to actors by the ministry of agriculture and development partners are currently geared towards awareness, better breeds, control of pest and diseases, and environmental cleanup but the sentiments of most actors and key informants indicated that to overcome financial barriers to integration of sustainable technologies such as CSA TIMPs, financial incentives (43%), i.e. soft loans (14%), grants (9%), tax rebates (2%), and subsidies (18%), is necessary. This implies that understanding the general and unique needs of various MSMEs within the chains can inform the kinds of incentives needed by each actor in integrating them and use of sustainable technologies and practices. Several integration approaches tend to assume that resources are evenly distributed across all actors and household irrespective of their position in the value chain, and economic abilities, and actors do not face substantial trade-offs when using resources and can assume higher risks when reinvesting capital and labor yet these assumptions rarely reflect the circumstances of the rural poor, especially those in ASALs.

### 3.2.3 Policy-driven integration approach

Fig. 11 presents the results on challenges associated with policy and creating an enabling environment. The majority of the value chain

actors (25%) cited lack of government support, incentives, subsidies, governance systems, and programs, while 24% cited lack of government laws, rules/policies that demand adoption of sustainable practices such as CSA and 22% cited lack of standards for CSA adoption, and challenges on land ownership (10%), land tenure system (10%) and property rights (9%).

Results on cross-tabulation between policy, laws, and regulations with value chain actors, on extended and enabling value chains, indicated similar challenges among the actors. These included lack of government support, incentives, subsidies, governance systems and programs, lack of government laws, rules/policies that demand adoption, and lack of standards for CSA adoption. Interviews with key informants also indicated challenges of poor infrastructure such as roads mostly affecting traders, aggregators, and transporters who transport or trek the animals to primary, secondary, and terminal live animal markets and distributors, while processors indicated reliability and cost of electricity and water that heavily impacts their overheads and lack of drainage and sewer systems for handling waste and processing water from slaughterhouses. All these challenges impede value chain economic efficiencies, the full integration of actors, environmental sustainability and the effective adoption of CSA TIMPs.



**Fig. 11. Policy Related Barriers that hinder adoption of CSA practices**

#### 4. DISCUSSIONS

This study shows that the red meat value chain MSMEs/actors were aware of the value chain concept even though they did not feel fully integrated into the value chains and had a low level of awareness of CSA concepts hence leading to the inability to directly link CSA TIMPs to the improvement of their productivity, incomes, livelihood protection, adaptation and climate mitigation. Most of them understand climate change as a weather index but could not effectively relate climate change, the CSA concept and their business activities however to some extent the producers could link climate change i.e. weather variability to the productivity of their livestock and hence their nomadic lifestyle in search of pastures[20,21,22]. Actors beyond the producers could not appreciate the concept of GHGs emissions and climate change, and how this affects their businesses even though they were aware that their businesses have an impact on the environment one way or another. This awareness was limited to the regulatory and compliance efforts driven by the county government such as the initiatives on cleaning up the county urban areas and penalties levied for dirty frontage and business premises. Even though this awareness did not translate to direct awareness on CSA TIMPS, but as proxy knowledge, it can be leveraged as an entry point to drive awareness of CSA and the link to the sustainability of their businesses while

simultaneously creating climate resilience [6,23]. The findings that the majority of the respondents believe that their business affects the environment is a good start to building sustainability mindsets, and norms among the livestock and red meat value chain actors.

The actors had varied awareness and adoption levels which can be explained by their level of education, access to information, interaction with other value chain actors, and location along the value chain. Abattoirs, retailers and consumers are mainly located in markets and urban areas where information is easily accessible through various means and they also interact with a host of actors from within and outside of the red meat value chain in urban centers. The pastoralist are isolated in the rural areas and nomadic, their source of information is mainly community social networks, local markets, some have mobile phones especially the youth who trek the animals to live animal markets and they also rely on extension officers who are rare and few. This points to the need to strengthen the extension services to enhance CSA knowledge however the nature of nomadic pastoralism creates a challenge of permanency, access and follow up on extension services. The choice of medium of communicating climate-smart technologies in the value chain plays an important role in the integration of MSMEs and CSA practices in the livestock red meat value chain; different value chain actors have different preferences when it

comes to the source of information owing to the dynamics of engagement and their position in the value chain. Awareness and knowledge of sustainability practices such as CSA and direct benefits to the actors in the value chains allow the actors to make informed choices in regards to improving their engagement with the value chains and adoption of sustainable practices such as climate-smart technologies, innovation, and practices [12,24,25] and hence the need to contextualize CSA. The varying levels of awareness can be leveraged for peer-to-peer education, transfer of sustainability and CSA knowledge but there would be the need to create peer education platforms. Community-based organizations (CBOs) can expand their scope to include peer learning, exchange of information, and engagement beyond just managing the market days, levying market fees, and animal transportation logistics.

The study shows that there are no incentives for MSMEs to invest in red meat value chains and in CSA adoption. When asked what incentive they considered as helpful and likely to enhance their engagement with the chain and adoption of sustainable practices such as CSA, most indicated provision of free extension/ advisory services, subsidized inputs/technologies, free capacity building opportunities, information on market prices, free technology, and general information on CSA and provision of affordable loans, in general, mainly financial support and related incentives. Training, awareness, and extension services on CSA are quick wins that can form a critical starting point. Without awareness and knowledge acting together with financial incentives, it's difficult to link CSA practices to outcomes, do a cost-benefit analysis on adoption of sustainable practices such as CSA because knowledge coupled with capacity support precedes adoption. Integration and CSA adoption require consultations with all relevant stakeholders to advise suitable interventions, incentives, and policy options [26,27,28]. Most actors may not have funds to invest and attend CSA training bearing in mind they are poor rural farmers and most actors are micro-enterprises with businesses that are mostly led by the youth and less than 5 years old, most may not have broken even and have no excess cash flow to invest in training and awareness, hence the need for free training and other incentive-driven integration approaches

Investing in modern technologies such as CSA TIMPs requires financial resources, which most

actors lack or have no access to, and even though they had access they would need to see the return on investment (ROI) almost immediately and bearing in mind that CSA impacts and benefits are realized in the long term compared to short term, this would discourage investment based on ROI, hence requiring some form of incentives to encourage early adopters of CSA TIMPs. In the livestock value chain, the actors would embrace climate-smart skills and practices that ensure maximum yields and profitability [29,30]. Incentives are important in enabling the adoption of sustainable practices especially where there are no immediate economic benefits in the short term, yet the adoption of sustainable practices is likely to support the building of more resilient and productive food systems and enable sustainable production in the red meat value chain [31].

Understanding the context, general and unique needs of actors and MSMEs is paramount in decision making in regards to the forms of policies, incentives, information, awareness and capacity building, and kinds of CSA TIMPs needed by each value chain actor in integrating them to climate-smart value chains [7,12]. Different actors require different incentives, yet integration approaches tend to assume that resources are evenly distributed across all actors and household irrespective of their position in the value chain, and economic abilities, and microenterprises do not face substantial trade-offs when using resources and can assume higher risks when reinvesting capital and labor yet these assumptions rarely reflect the circumstances of the rural poor, more so, climate vulnerable ASALs pastoralist communities [32]. There is therefore the need for context-based support and incentives that would address the needs of these communities collectively and specifically each actor along the chain.

Actors along the red meat value chain beyond the farmer level were found to be using various sustainable practices even though the adoption of the CSA TIMPs per se was low. This implies that value chain actors were aware and integrating a variety of obvious sustainable practices and technologies even though their motivations may have been financial i.e. to save costs, and ensuring environmental compliance with county government requirements but not necessarily to develop climate resilience. Climate-smart agriculture is part of the larger sustainable practices and it follows that even though actors may not be aware of climate-smart

livestock (5.3%) as a term they may be aware of practices that enhance productivity, save operating costs, while inadvertently protecting the environment and hence the concept of CSA may need expanding to explicitly address broader practices and entire value chains beyond farmer level. Additionally, the knowledge and practices already within the value chains can be leveraged to increase awareness, adoption, and integration of the expanded CSA TIMPS within the chains.

Results show that challenges towards integration of MSMEs and CSA include knowledge (only 5.3% were aware of CSA as a concept), access to markets, physical infrastructure, institutional and cultural challenges among others. Under incentive-driven integration results also showed that the majority of the actors 75% preferred financial and related incentives while 63% said they faced financial barriers to integration, hence clearly pointing to the need for policies related to financial incentives and removal of financial barriers facing the MSMEs integration and adoption of CSA, in ASALs red meat value chains.

## 5. CONCLUSION AND RECOMMENDATIONS

Most actors are not aware of climate-smart agriculture/livestock agriculture as a stand-alone concept and hence this affects the level of adoption and integration because the concept of Climate Smart Livestock Production and value chains is not well understood among the value chain actors. There is a need for integration of MSMEs and CSA through information, awareness, training, and extension services, as the first line of action to creating a climate-resilient red meat value chain.

The understanding of climate change in the livestock sector is still very low[33] as more emphasis has been laid on the crop while livestock value chains have been neglected and this is further compounded by the low understanding of the relationships between climate change, livestock production, and value chains sustainability. There is, therefore, a need to scale up research on the effect of climate change among pastoral livestock red meat value chains, adaptation, mitigation and sustainability.

It costs money to integrate into the value chains and to adopt CSA TIMPs and without enough

incentives, perceived immediate benefits, and economic empowerment that minimizes households resource allocation and tradeoffs, the actors may not see CSA adoption as a better option. There is a need to design responsive context-based incentives to enable integration into the value chains and adoption of CSA TIMPs, this would mitigate the risk and high cost of adoption and allow the actors sufficient time to experiment with the technologies without fear of losing money in experiments or impacting their profitability. A point to leverage in creating buy-in for sustainability practices such as CSA is the fact that the majority of the value chain actors are somewhat cognizant of the fact that their activities business impacts the environment.

The livestock sector is one of the major components of the agricultural sector. Over half of agricultural output globally and a third in developing countries is from livestock. Globally, the demand for livestock-derived foods (LDFs) is increasingly growing, and it's expected to double by 2050[34] and the livestock sector will need to expand over the years to meet the demand. In developing countries, the livestock sub-sector is one of the fastest-growing agricultural sectors, causing it to be dubbed, 'the livestock revolution'[33]. Its growth is linked to increases in the demand for meat and other livestock products due to population growth, urbanization, and increasing incomes in the developing world. FAO and African governments have launched the Africa sustainable livestock (ASL) initiative with two aims; 1. Anticipate and predict opportunities and challenges for the society that will emerge in the coming decades due to fast-changing African livestock systems. 2 Identify actions to be taken now to tap into future opportunities and deal with the emerging challenges associated with growing and changing livestock systems.

Therefore, there is a need for the Kenya government and Kajiado county since agriculture is now a devolved function to focus on incentives, policy, and support to create an enabling environment to encourage MSMEs to invest to take advantage of future opportunities in the red meat sector while at the same time achieving SDGs goals 1, 2, 3, 8, 9, 12 and 13, scaling CSA and making the value chains greener and sustainable.

## FURTHER RESEARCH AREA

The Kenya red meat value chain is inefficient, fragmented, and unorganized making it very

suboptimal with high transaction costs due to middlemen, poor infrastructural support and little use of modern technologies. This combined with the lack of targeted policies to effectively develop and manage the livestock sector and red meat value chains are undermining Kenya's competitiveness regionally in the meat sector. There is hence the need for further research specifically targeting ASALs, to make the sector economically efficient, and environmentally sustainable bearing in mind that 86% of Kenya's meat value chain is in ASALS.

The study also reveals that different actors require different incentives, yet integration approaches tend to assume that resources are evenly distributed across all actors and household irrespective of their position in the value chain, and economic abilities, and do not face substantial trade-offs when using resources and can assume higher risks when reinvesting capital and labor, these assumptions rarely reflect the circumstances of climate vulnerable ASALs pastoralist communities. There is a need for further research on context-based CSA support, incentives and financial products that would address the needs of these communities, collectively and specifically each actor, along the red meat chain.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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