Asian Journal of Agricultural Extension, Economics & Sociology

39(4): 134-148, 2021; Article no.AJAEES.68508
ISSN: 2320-7027

Evaluating Knowledge, Attitudes and Practices of Livestock Value Chain Actors on Climate Smart Agriculture/Livestock (CSA/L) in Kajiado County, Kenya

Mary W. Thongoh[1], H. M. Mutembei[2*], J. Mburu[3] and B. E. Kathambi[1]

[1]Wangari Maathai Institute for Peace and Environmental Studies (WMI), University of Nairobi, Kenya.
[2]Department of Clinical Studies, University of Nairobi, Kenya.
[3]Department of Agricultural Economics, University of Nairobi, Kenya.

Authors' contributions

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

Article Information

DOI: 10.9734/AJAEES/2021/v39i430568
Editor(s):
(1) Dr. Rajesh Kumar, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), India.
Reviewers:
(1) Waleed El Said El Sayed Mohamed Abou El Amaim, Egypt.
(2) I. Shakuntala Devi, Professor Jayashankar Telangana State Agricultural University,India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/68508

Original Research Article

Received 06 March 2021
Accepted 11 May 2021
Published 15 May 2021

ABSTRACT

The livestock sector is a major contributor to food security and is mainly practiced by the rural poor but faces climate related threats. While there are many natural occurrences impacting the average global temperature and consequently livestock production, human activities in the sector continue to be a main contributing factor to climate change as a result of greenhouse gas emissions. However there has been little attention paid to integration of climate smart initiatives into livestock production and beyond into the value chains especially in ASALs where 80% of livestock production is found. A mixed method approach was used to evaluate KAP (knowledge, attitudes and practices) of the Livestock value chain actors (MSMEs). Linking Climate Smart Agriculture (CSA) to MSMEs within the livestock sector value chains is imperative to producers' engagements within the livestock value chain, reducing climate risks and increasing resilience. The study revealed that actors relate climate change to weather variability, extreme weather conditions and drought and CSA/Livestock as a

**Corresponding author: E-mail: muiaceke@gmail.com;*

concept is not well understood; there is a general knowledge of climate change albeit with low understanding on its relationship with livestock, and concern among the value chain actors on the impacts of climate change on productivity and the willingness to take part in actions aimed at protecting the environment and mitigating climate change. There is need to provide context-based CSA technologies, innovation, and management practices (TIMPs) tailored to pastoral livestock production and ASALs value chains, strengthening of peer-to-peer learning and improving extension services to increase awareness, trainings and enhance adoption of CSA since most actors interact with extension officers, and with each other along the chains.

Keywords: Climate Smart Agriculture/Livestock (CSA/L); Technology, Innovations, and Management Practices (TIMPs); climate smart value chains; climate change; knowledge; practices; attitude; MSMEs.

1. INTRODUCTION

Livestock production impacts heavily on climate change by being the world's largest user of land directly through grazing and indirectly through consumption of fodder and feed grains while at the same time producing 14.5 percent of anthropogenic greenhouse gas emissions [1]. In Kenya livestock production is carried out mainly in the climate change sensitive rural arid and semi-arid (ASAL) villages that occupy over 85% of the land mass [2-4]. Kajiado county of Kenya is part of these ASAL areas where there are untapped opportunities for integrating climate smart within livestock value chain to achieve triple wins of improved productivity, enhanced resilience and reduction of greenhouse gas emissions [4].

The practice of livestock production in Kajiado has been pastoralism that is dependent on migrating large herds of cattle, sheep and goats(shoats) into open grasslands which have currently been threatened by ballooning human population and shifts of land use towards urban settlement [5,6]. Since livestock production is key to Kenyan economy and survival of many people living in ASAL communities, it is prudent that climate smart initiatives are integrated into its value chain for sustainability [1,7,8]. Value chain consist of range of activities necessary to transform raw materials into product or services in this case from livestock farms to red meat consumers, including all men, women and business that add value at each step. Value chains can boost productivity, rural incomes, reduce poverty, improve food security and address climate change challenges if well integrated and efficient [9].

CSA need to be integrated into production, marketing and processing sectors of the livestock in order to achieve sustainability [10,11,4]. In order to mitigate against negative effect on climate from keeping of large herds of livestock by farmers thereby leading to land degradation, and high methane GHG emissions, the aspect of knowledge, attitudes and practices amongst the livestock value chain actors need to be addressed [1,12,13].

Climate Smart Agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate through -coordinated actions among different actors in the value chain towards climate resilient pathways [14,15]. Agricultural value chains mainly consist of micro, small to medium enterprises (MSMEs) while in some ASALs there are only micro and small enterprises. However little has been done to pay attention on integration of climate smart initiatives into MSMEs within the livestock value chain [14,16,17].

Sustainability of climate smart initiatives are highly dependent upon knowledge, attitudes and practices of the actors on the same [18]. Studies have shown that these attributes influence the behaviour of the actors involved in such initiatives in the way they interphase and interact with regulating institutions [19]. Such attributes are built through experience, formal training and social cues. Personal attitude and psychological factors such as environmental identity and values [20] are also important. In livestock value chain for instance, the actors would embrace climate smart skills practices that ensure maximum yields and profitability [21,22].

This paper discusses the importance of understanding actors' knowledge, attitude and practices of the livestock value chain actors on climate smart initiatives in order to integrate the same in decisions of managing Micro, small and

medium enterprises (MSMEs) within the chain. Understanding and integrating such decisions into the value chain will lead to addressing climate change threats, impacts and resilience on livestock production in ASAL areas for sustainability [23].

2. THEORETICAL AND CONCEPTUAL BACKGROUND

The Livestock value chain in ASALs is composed of several actors of which majority are Micro, Small and Medium Enterprises (MSMEs) who play an important role in the whole value chain [14]. MSMEs consist of businesses whose staff establishment range from 1-99 employees, MSMEs span over many sectors of the Kenyan economy, they operate both formally and/or informally [4].

Previous authors have used social network and institutional theory to argue out a case of failed sustainability values in a society [24]. Institutional theory outlines a deeper and more adaptable aspects of social structure whereby the processes by which values are built by institutions that establish schemes, rules, norms, and routines, which then become accepted as authoritative guidelines for social behavior [24].

Social behavior is shaped by awareness, knowledge, and accepted and repeated practices in a social group. Sustainable climate smart practices can only result from social behavior that promotes environmental sustainability [25]. To effectively understand climate change in relations to livestock production, awareness/ education is an essential element of the global response to climate change [26]. Climate change education helps individuals comprehend and address the impact of global warming. Furthermore, it encourages changes in their attitudes and behavior and helps them adapt to the climate change-related trends as a strategy in building resilience for sustainable futures [27-29].

Fig. 2, shows that propagating sustainability values require building value chain actors' requisite skills (knowledge, attitude and practices) and desire for meaningful behavior change; in this case the farmer who rears the livestock, the traders and transporter who buys the livestock, the processor of the livestock, the distributor and retailer of the product (beef and shoats that make the red meat value chain). Actors hence acquire the pride behavior of integrating sustainability practices within the livestock value chain by integrating CSA TIMPs and obeying relevant laws. Such climate smart behavior would then take a shape of sustained actor decisions and actions (the mission and goals of the transformed value chain), which would then become institutionalized to realize desired benefits [30].

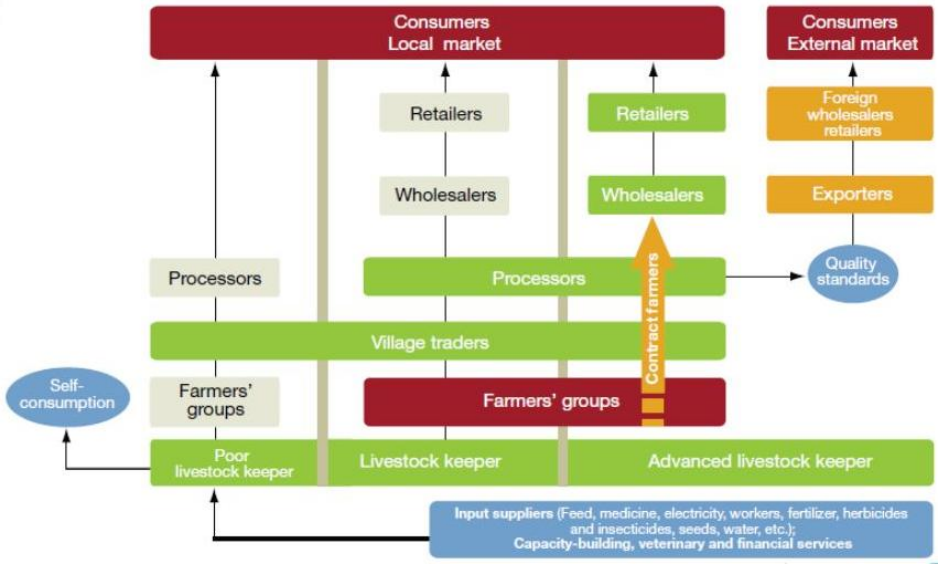

Fig. 1. The Livestock Value Chain system; Adapted from Daniel et al., 2018

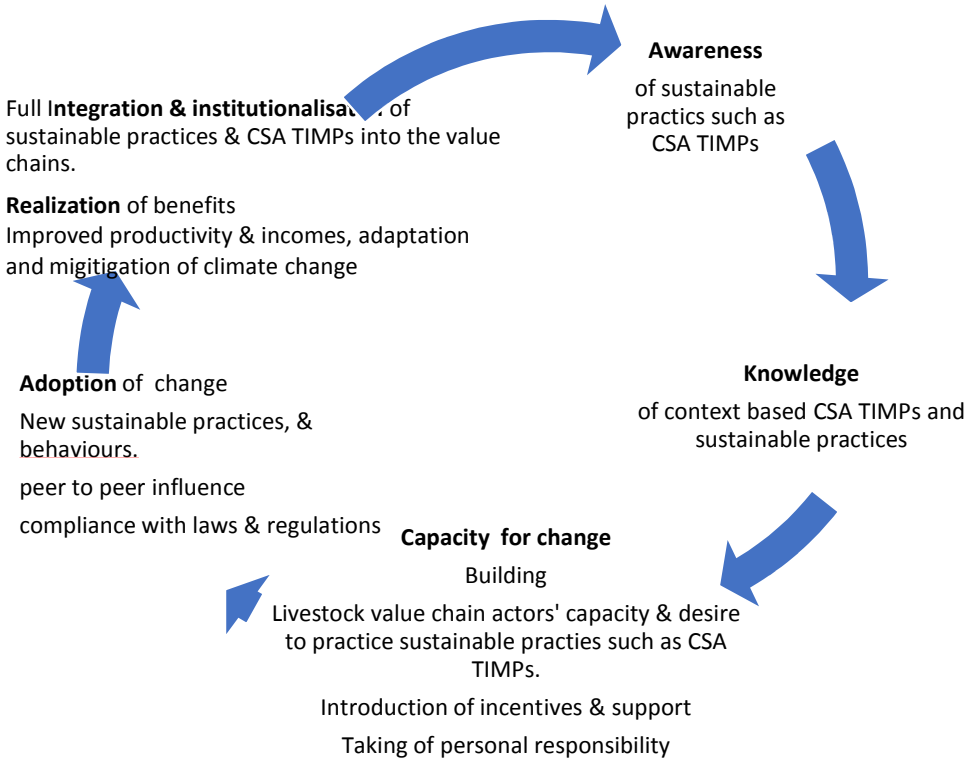

Fig. 2. AKCAIR conceptual model by the author

2. MATERIALS AND METHODS

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). It is situated between Longitudes 360 5' and 370 5' East and between Latitudes 10 0' and 30 0' South. The county covers an area of 21,900.9 square kilometres (Km2). The current Kajiado county integrated development plan [31] indicates pastoralism as a major economic activity in the county with major stocks being cattle, sheep and goats. Livestock trade, and products such as milk, beef and chevon, hides and skins form the main part of household incomes. The CIPD is focused on improving rural incomes and food security, through enhanced livestock productivity, value addition on agricultural and livestock produce. Kajiado being an ASAL is characterized by prolonged periods of abnormally low rainfall and shortage of water, negatively impacting the ecosystem and agriculture hence the local economy which is highly dependent on pastoralism. Some of the areas have been highly degraded by illegal tree felling, charcoal burning, over harvesting of sand, risking loss of bio-diversity, pollution and loss of aesthetic value. Flash floods are a common menace during long rains season mainly because of erosion and lack of vegetation cover [31].

2.2 Research Design

A cross-sectional survey was done [32] and use of questionnaire to carry out in depth interviews of actors (input suppliers, pasture and livestock producers, traders, processors, slaughter house workers, distributors and retailers of meat and consumers, and key informant interviews. Besides, personal observation during site visits to livestock keepers, livestock traders, market outlets and processors was carried out.

2.3 Data Collection and Analysis

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

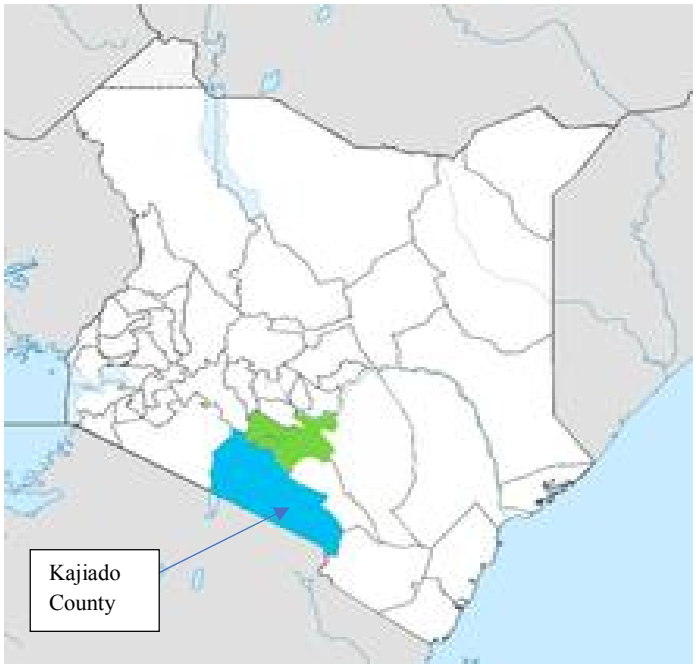

Fig. 3. The map of the study areas- map of Kenya showing Kajiado County

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 [33], 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=0.05).

3. RESULTS

3.1 Knowledge of the Value Chain Concept

Table 1 show 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= .04) even though they are aware that they are part of the livestock value chain in Kajiado. This is not unique since adoption precedes integration, all factors that create an efficient value chains where every actor achieves maximum productivity may not be in place especially bearing in mind that the red meat value chain is underdeveloped in Kenya and specifically in ASALs [34].

Most actors are in some way aware on the concept of value chain, this was supported by the aggregate score of the Likert items in Fig. 4 below which indicated an agreement level of 80.2% on value chain concept awareness. Creating more efficient value chain calls for involvement and knowledge of the value chain concept of many actors from livestock farmers, traders, transporters, processors, distributors and retailer and the input suppliers because engaging all the actors can improve value chain performance [9] and hence the incomes of the actors.

Retailers are the butcheries, eateries, kiosks, *Nyama choma* (meat roasting) joints while distributors are those who buy meat from processors (slaughter houses) and sell to butcheries and *nyama choma* joints, and the bulk of their business being to schools, hotels and institutions.

Table 1. Actor awareness of the livestock 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[a]	88±4.4[b]
I have a market/someone to sell my product/services	16.7±.8[a]	75.6±3.9[b]
The red meat value chain contributes to my income	16.4±.8[a]	76.2±3.8[b]
I have access to necessary information I need to participate effectively in the value chain	17.9±.9[a]	64.3±3.2[b]
I believe I have the skills and experience to effectively participate in the value chain	14.3±.7[a]	71.6±3.6[b]
I have the support/enablement to effectively participate in the value chain	57.5±2.9[a]	22.9±1.1[b]

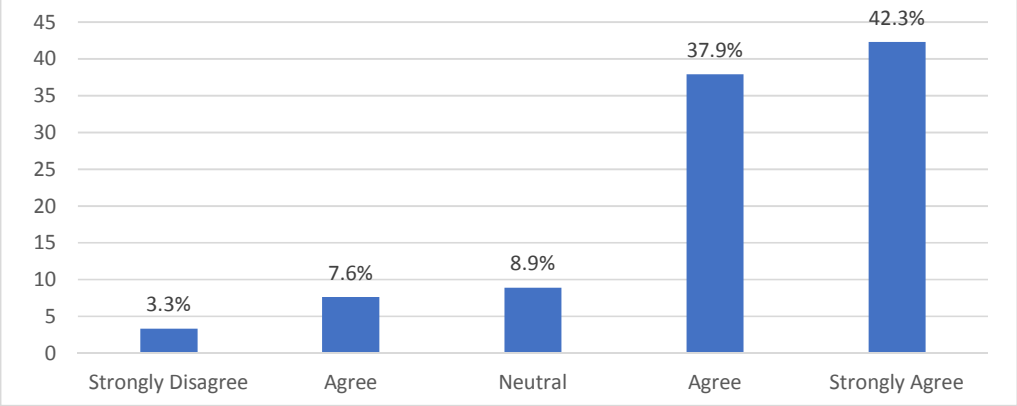

Fig. 4. Knowledge on the Value Chain Concept

Table 2. Regression Coefficients of Model Factors on Awareness of Value Chain Concept

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	Age of Respondents	0.25	0.129	3.788	1	0.052	1.284
	Level of Education	0.124	0.122	5.031	1	0.031	1.132
	Age of your business/activity (years)	-0.822	0.12	47.11	1	0	0.439
	Gender	0.76	0.278	4.499	1	0.046	0.468
	Constant	4.629	0.782	35.074	1	0	102.428

At least 80% believe in media as the main source of awareness and knowledge on the value. Regression results in Table 2 show that only three factors affect the awareness of Value Chain concept. These factors are level of education (*P*= .031), age of the business (*P*=.000) and gender (*P*= .046). Out of these factors level of education and gender (more males) is associated with increased knowledge on value chain while an increase in age of business is linked with diminished knowledge on value chain concept.

3.1.1 Understanding of climate change among the value chain actors

Majority of the respondents (76%) were aware of the climate change as shown in Fig. 5. This implies that the actors have heard of the concept of climate change. Climate change is associated with weather variability (50.4%), followed by extreme weather (26.5%) and frequent droughts (12.9%).

3.1.2 Knowledge on climate smart value chain concepts

In testing the knowledge of actors on different concepts, results in Fig. 6 show that most actors have heard of building resilience (34.8%) and reducing poverty (31.1%). The actors on other remaining concepts had awareness of less than 7%. Actors' awareness on climate smart agriculture and climate smart animal/livestock agriculture were only at 5.3% and 6.1%

respectively. This implies that most actors may not be aware about climate smart livestock/agriculture as a stand-alone concept even though they were aware of climate change. This observation might be unique and not worrying for counties like Kajiado where climate smart agriculture practices are rare within the livestock value chain. Based on the high number of development actors in rural Kenya tackling the subject of poverty it's possible the actors may have come across the concepts of resilience building and poverty reduction but since climate smart agriculture is still a new concept there may not be many organizations teaching on the same and especially in livestock/red meat value chains since most of the focus has been on food crop value chains [14,35].

A cross-tabulation results indicated that producer of the value chain was more aware on reducing poverty and building resilience. Similarly, middlemen/aggregators, distributors/retailers and consumers were equally aware on reducing poverty and building resilience as climate related concepts. On the other hand, input suppliers were aware about 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). This could be attributed to the fact that processors are located in urban towns within Kajiado county where they have access to information and they connect producers and traders to distributors and retailers, this makes them central to a lot of value chain information.

3.2 Attitude on the Climate Smart Livestock Value Chain Concept

Table *3*, presents results on the views of actors about negative effect of their business activity on the environment. As can be seen majority of the actors (61%) believed that their business can impact the environment negatively. About 71% of the actors also revealed that they believed that their business should be involved in protecting the environment. This is not surprising especially following the enactment of the environmental management act and the awareness campaign ran by the NEMA (National Environment Management Authority) and various NGOs, though the awareness is not specific to the livestock value chains.

Fig. 7 shows an overview of results on how actors' business activities can impact the community. It shows that most of the actors believed that their business can impact the environment more than other aspects (reduce poverty, quality of life, create jobs).

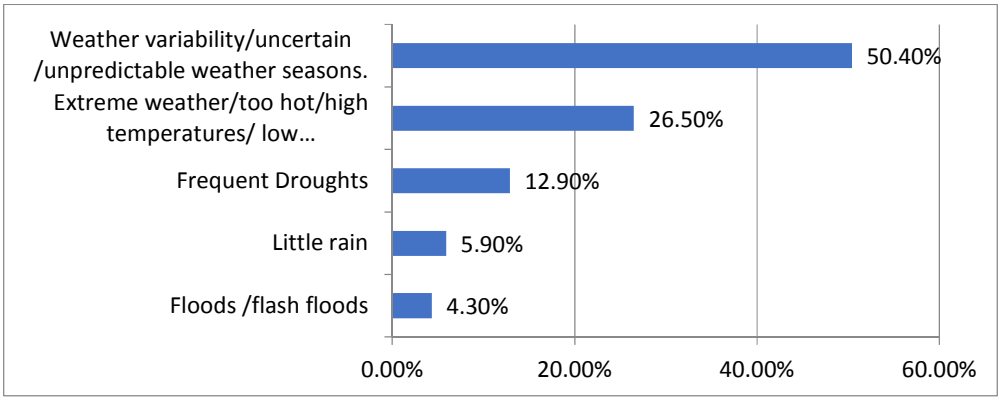

Fig. 5. Understanding of Climate change among value chain actors in Kajiado County

Table 3. Effects of value chain activities on the environment

Parameter	Yes (%)	No (%)
Do you believe that businesses/ your activities/ have any negative impact on the environment?	39.5±2[a]	60.5±3[b]
Should your business/ your activities/actions be involved in protection of environment?	71.1±3.6	28.9±1.4

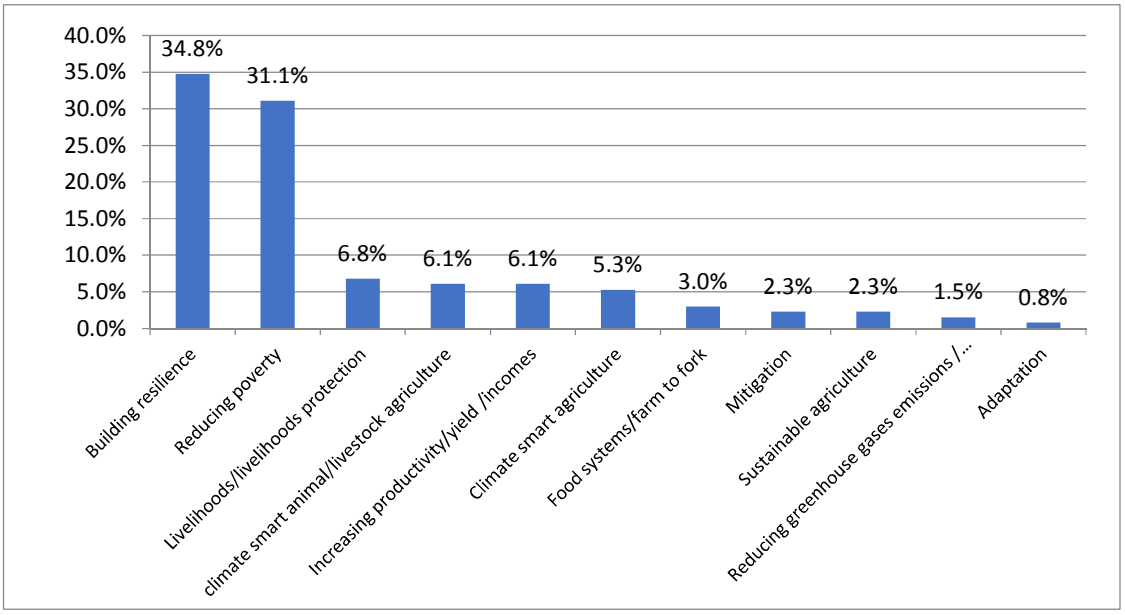

Fig. 6. Knowledge on climate Smart Value Chain concepts

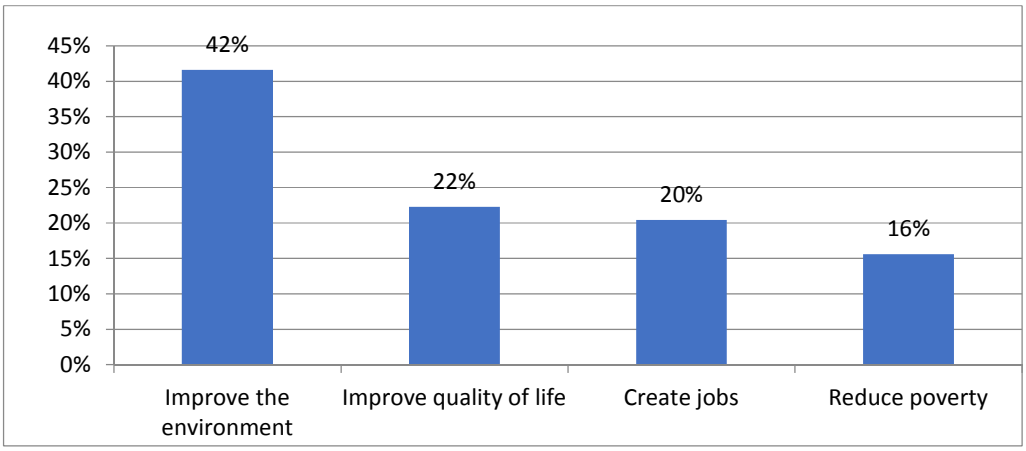

Fig. 7. The positive social impacts the value chain activities can have on the community

3.3 Existing MSME Practices in Climate Smart Agriculture and Livestock Value Chains in Kajiado County

The results in Table 4 shows actors used different sustainable practices and the usage of the different sustainable practices ranged between 8% and 12%.

Fig. 8 shows the technologies and practices employed by the value chain actors in their activities were having an emergency fund (13%), insuring businesses against weather effects (13%) having an awareness/knowledge on sustainable practices among staff and stakeholders (11%), reuse or recycling of materials (10%) and having environment days like cleaning or tree planting days (10%).

Cross-tabulation on the relationship between Technologies/Innovations and Extended Value Chain Actors revealed that financial institutions and associations/cooperatives adopted measures geared towards risk management such as insuring of business and setting aside emergency funds. And indicated that for enabling value chain, the County government adopted measures geared towards reducing risks while multi-lateral agencies adopted measure that

would enhance sustainability and mitigate against risks.

3.3.1 Use of cold storage facilities among value chain actors

Findings on use of cold storage facilities demonstrated that majority of retailers (57%) do not use cold storage facilities. 43% of those who use cold storage facilities, mainly used deep freezer/fridge as shown in Table *5.*

Amongst the retailers who do not use cold storage facilities, most reported that they did not need storage facilities (37.8%) and that it was expensive (21.8%). Non-importance of cold storage facilities was also supported by 14.5% who reported that all meat is sold before end of day and 12.6% who buy meat buy enough for consumption on a given day. Meat being an expensive food in Kenya, there is hardly any waste. Table 6 shows that meat waste was mainly used for dog food production.

Table 4. Sustainable practices, technologies or innovations used

Parameter	Practiced by (%)
Livestock insurance/emergency fund	12±.6[a]
Water harvesting for livestock	12±.6[a]
Crop and livestock mix	11±.55[a]
Adaptive breeds /animal breeding/appropriate breeds/animal genetic resources	11±.55[a]
Manure and composting	10±.5[a]
Keeping a variety of livestock	10±.5[a]
Reduce/reuse/recycling e.g., Biogas	9±.45[a]
Weather warning/agro- weather systems	9±.45[a]
Grassland management and restoration/Pasture management	8±.4[a]
Better feeds and feed supplements	8±.4[a]

Confidence Interval (CI) = 95%

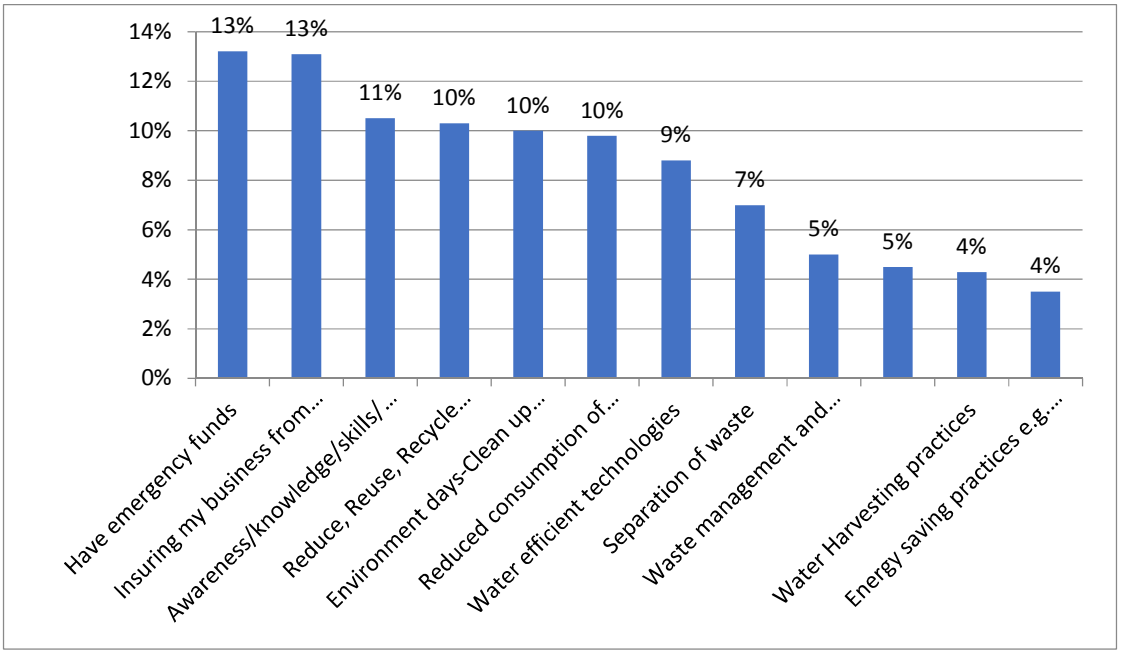

Fig. 8. Climate Smart technologies in use by the Value Chain Actors

Table 5. Type of storage facility

Cold storage facility	Frequency	Percent
Traditional cooler/Charcoal cooler	2	1
Deep freezer/Fridge	195	99
Total	197	100

Table 6. Meat waste disposal mechanism

Handling meat wastes	Frequency	Percent
Food to dogs/sold to dog owners as dog food	44	75%
Disposing off with other wastes	13	22%
Disposing for paid collection	1	2%
In making ornaments	1	2%
Total	**59**	**100%**

3.3.2 Meat Wastes handling mechanisms/Practices among the Value chain actors

Table 6 shows, about 75% of actors used meat waste as dog food while the hooves and horns are used in making ornaments, sold to those who sell traditional artefacts and jewelry. At abattoirs offal are given to workers, who sell them or use them for making traditional dishes popular with locals and what is not cooked is sold as dog food or disposed off with other waste.

4. DISCUSSIONS

The Livestock value chain in ASALs is composed of several actors who play an important role in the whole value chain [14]. Majority of the actors in this study had enterprises with less than 10 employees (80.8%), hence most of them can be categorized as micro enterprises and they operate both formally and/or informally [4].

Most of the actors in the study were aware of the value chains concept and its contributions to their livelihoods, they were conscious that they interact with other actors, exchanging and getting value within the livestock ecosystem. Majority of the respondents were aware of the climate change implying they have heard the term climate change. The actors mainly associated Climate change with three factors, namely; weather variability, extreme weather and frequent droughts. This suggests that climate change to most actors is a weather index factor but were not aware of climate smart agriculture (5.3%) as a concept [36]. The actors did not effectively understand climate change in relations to livestock value chain, implying that awareness is essential in responding to climate change [26]. The low understanding can be attributed to the fact that CSA as a concept is still at its nascent years having first been launched during the Hague Conference on Agriculture, Food Security and Climate Change in 2010 [1]. Equally knowledge of CSA in the livestock sector would be low because more emphasis have previously been placed on crops than livestock value chains, and there has also been a low understanding of the relationship between climate change and livestock production [26,13,25].

Awareness and knowledge can help the actors appreciate and address the impact of global warming on their activities. Knowledge of all the aspects of the value chain is key in adopting CSA (technologies, innovations and management practices) TIMPs [37], the concept of the value chain can act as an entry point to knowledge on climate change, related concepts, CSA and CSA TIMPS. Furthermore, knowledge encourages changes in attitudes and behavior and helps actors adapt to the climate change-related trends as a strategy in building resilience for sustainable futures [27-29].

The level of climate change awareness if linked to value chain productivity and livelihood protection can be used to effectively engage the actors/MSMEs to adopt CSA TIMPS within the value chain [13,38] as a means to develop climate smart value chains by mitigating the effects of climate change on productivity and incomes.

The transaction and agency theory, states that habits, norms and institutions play a significant role in directing human behavior (practices) and that individuals will only be willing to adopt a new practice or technology if they are able to perceive the benefit it comes with [39-41]. Hence increasing awareness of climate change and CSA is not enough the awareness/education efforts much also sell the benefit of CSA knowledge and its application and implications to the actors.

Collectively as a chain there is fair appreciation of climate change related concepts even though individually at the actor level there are noticeable gaps. The context and perceptions, attitude and knowledge of CSA and TIMPs along the value chains can determine various levels of understanding and adaptation to climate change [42] and hence actors/MSMEs can be leveraged

to disseminate information to each other based on their knowledge level.

Understanding how the social systems that includes level of education, age and gender affects awareness is critical in the application, adoption and scaling of CSA TIMPs among the value chain actors [43,38,44]. The three critical factors affecting the knowledge level on the value chain concept were; level of, age of the business, gender and education. Most of the respondents were youths (65.2%), and male, 72.3% suggesting that the livestock value chain is male dominated, this is because the livestock keeping and trading is culturally and by gender roles mainly a male role and livestock production requires economic capacity of which women are at a disadvantage especially in the pastoralist community [45].

Value chains and social networks do not only exchange products but also information and knowledge and due to their higher level of education and thus awareness, input suppliers, consumers and end customers can be leveraged as key source of information on CSA and CSA TIMPS to other actors within the value chain. Since training on related topics to climate smart agriculture can influence the actors' likelihood to adopt technologies, there is a possibility of leveraging existing knowledge on reducing poverty and building resilience to improve CSA awareness [46]. To effectively transfer CSA knowledge and information there is need to find innovative ways to tailor the CSA information and modes of transmission to the actors' level of literacy. Availability of extension officers is also very critical to promoting adoption and new innovation such as CSA TIMPs [47] and will effectively compliment sources such as media, workshop and training.

The activities in the value chain have both direct and indirect effects on the environment, moreover, Livestock sector is an emitter of GHGs, this includes carbon monoxide, methane and nitrous oxide from livestock farming [48]. It is therefore of critical importance that sustainable ways are put in place to ensure that production is maintained at an optimum level while the environment is safeguarded [49-51] and the findings that majority of the respondents believe that their business affects the environment and are consequently willing to be involved in the protection of the environment is a step forward in building sustainable and climate resilient livestock value chains [52,4].

The usage of different CSA practices among the value chain actors was very low which implies that adoption of technology and use of innovations in livestock production in Kajiado is still very low and this can be related to the findings on low awareness on CSA among the actors. Climate change education can encourage changes in attitudes and behavior and helps in adoption of climate change-related trends as a strategy in building resilience for sustainable futures [27,29].

The demand for meat in Kenya is driven by population growth, increasing economic welfare, a growing middle class and urbanization, in Nairobi alone, the demand for meat is expected to double by 2030 [53]. Consequently, more meat waste is likely to be generated from the sector across the value chains actors hence the need to strengthen proper waste management practices amongst the MSMEs [1, 14] as the red meat value chain develops [54].

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The concept of Climate Smart Agriculture/Livestock is not well understood among the value chain actors hence the difficulty in adoption of CSA TIMPS. This is attributed to the concepts being at a formative stage, lack of extension officers in the value chain alongside the nature of operations amongst the actors/MSMEs especially the producers who are pastoralists and nomads, and the fact that livestock value chains, especially in ASALs, are still very underdeveloped and fragmented. Equally previous research and efforts on CSA and CSA TIMPS was mainly focused on agriculture crop production and related value chains and neglecting livestock value chains hence there is limited TIMP specifically tailored to livestock production and specifically to the unique pastoral value chains.

On the positive, the value chain actors are concerned about the impacts of climate change on their activities and are consequently aware of the impacts their activities have on the environment hence willing to take part in initiatives aimed at ensuring environmental protection as well as curbing climate change risks and finally, the actors have incorporated various sustainability strategies but mainly for

cost reduction, mitigate against economic loss and compliance with county regulations not necessarily for environmental and social protection or as a result of personal responsibility.

Livestock sector will continue to grow at a faster rate hence the phrase, “Livestock revolution” and because of this expansion, there is an urgent need to embed sustainable practices such as CSA TIMPs into the livestock value chain to achieve food security, mitigate effects of climate change but also achieve sustainability.

5.2 Recommendations

The study recommends the following;

- Having reported low knowledge on CSA, there is need to enhance awareness on the Climate Smart Agriculture (CSA) through context-based CSA information, innovative channels of dissemination, like leveraging mobile technology and there is need for strengthening of extension officers in the sector.
- Resulting from the scarce CSA practices, there is need to enhance research and practices specific to Climate Smart Livestock (CSL) value chains and further inform the development of context based CSL TIMPs suited to unique challenges of ASALs and the Pastoralist livestock production.
- There is need to leverage actors across the value chain who have a higher awareness of climate change and related concepts such as the input suppliers, processors (slaughter houses) and consumers as climate smart peer educators and awareness advocates within the livestock value chain.
- It’s clear that agricultural production will need to expand by 60% by 2050 to meet increased food demand, and most of this cannot be met by increased land but from increased productivity. Hence there is need for further research on sustainable ways of transitioning from the nomadic pastoralist open land-based livestock production systems, to those that require less land.

ACKNOWLEDGEMENT

I would like to acknowledge the support of my family, the KCSAP and my supervisors without whom this research would not have been possible.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAO. Value chain analysis: A case study of mangoes in Kenya. Sugar and Beverages Group Raw Materials, Tropical and Horticultural Products Service Commodities and Trade Division Food and Agriculture Organization of the United Nations. 2013;11.
2. Mureithi, Stephen M, Verdoodt, Ann, Njoka, Jesse, Gachene, Charles, Meyerhoff, Elizabeth, Van Ranst, Eric. Benefits derived from rehabilitating a degraded semi-arid rangeland in communal enclosures, Kenya. Land Degradation & Development. 2014;27. DOI:10.1002/ldr.2341.
3. Wreford, Anita, Ignaciuk, Ada, Gruere, Guillaume. Overcoming Barriers to the Adoption of Climate-Friendly Practices in Agriculture; 2017. DOI:10.1787/97767de8-en.
4. Ministry of Agriculture, Livestock, F, I. Agricultural sector transformation and growth strategy: towards sustainable agricultural transformation and food security In Kenya. 2018;46.
5. Tánago, Itziar, Urquijo Reguera, Julia, Blauhut, Veit, Villarroya, Fermin, De Stefano, Lucia.. Learning from experience: A systematic review of assessments of vulnerability to drought. Natural Hazards. 2016;80. DOI:10.1007/s11069-015-2006-1.
6. World Bank. The World Bank Annual Report 2019: Ending Poverty, Investing in Opportunity. Washington, DC: World Bank. © World Bank; 2019. Available:https://openknowledge.worldbank.org/handle/10986/32333 License: CC BY-NC-ND 3.0 IGO
7. Stein C, Barron J. Mapping actors along value chains: integrating visual network research and participatory statistics into value chain analysis. Mapping Actors along Value Chains: Integrating Visual Network Research and Participatory Statistics into Value Chain Analysis; 2017. DOI:https://doi.org/10.5337/2017.216

8. Stoian D, Donovan J, Fisk J, Muldoon MF. Value chain development for rural poverty reduction: a reality check and a warning. Financial and Market Integration of Vulnerable People, September. 2015;71–86. DOI:https://doi.org/10.3362/9781780448879.006
9. World Bank. The World Bank Annual Report 2012 : Responding with Knowledge and Experience. World Bank Annual Report;. Washington, DC. © World Bank. 2012;2. Available:https://openknowledge.worldbank.org/handle/10986/11845 License: CC BY 3.0 IGO.
10. Ogutu JO, Piepho HP, Said MY, Ojwang GO, Njino LW, Kifugo SC, et al. Extreme Wildlife Declines and Concurrent Increase in Livestock Numbers in Kenya: What Are the Causes? PLoS ONE. 2016;11(9):e0163249. DOI:https://doi.org/10.1371/journal.pone.0163249
11. Mirzabaev A. Improving the resilience of central asian agriculture to weather variability and climate change. In Natural Resource Management and Policy. Springer. 2018;52:477–495. DOI:https://doi.org/10.1007/978-3-319-61194-5_19
12. Grossi, Giampiero, Goglio, Pietro, Vitali, Andrea, Williams, Adrian. Livestock and climate change: Impact of livestock on climate and mitigation strategies. Animal Frontiers. 2018;9. DOI:10.1093/af/vfy034.
13. Nations U. Climate change, Impacts, Adaptation, Ports, Seaports, Coastal transportation © 2019; 2019.
14. Sourcebook S. Climateesmart Agriculture; 2013. Available:www.fao.org/
15. Karami S, Shobeiri SM, Jafari H, Jafari H. Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. International Journal of Climate Change Strategies and Management. 2017b;9(3):402–415. DOI:https://doi.org/10.1108/IJCCSM-04-2016-0043
16. Meijer, Seline, Catacutan, Delia, Ajayi, Oluyede Olu, Sileshi, Gudeta, Nieuwenhuis, Maarten. The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. International Journal of Agricultural Sustainability. 2014;13. DOI:10.1080/14735903.2014.912493
17. Mwongera C, Nowak A, Notenbaert AMO, Grey S, Osiemo J, Kinyua I, Lizarazo M, Girvetz E. Climate-Smart Agricultural Value Chains: Risks and Perspectives. In The Climate-Smart Agriculture Papers. Springer International Publishing. 2019a;235–245. DOI:https://doi.org/10.1007/978-3-319-92798-5_20
18. Fielding, Kelly, Hornsey, Matthew. A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. Frontiers in Psychology. 2016;7. DOI:10.3389/fpsyg.2016.00121.
19. Raciti, Steve, Groffman, Peter, Jenkins, Jennifer, Pouyat, Richard, Fahey, Timothy, Pickett, STA, Cadenasso, Mary. Nitrate production and availability in residential soils. Ecological applications: a publication of the Ecological Society of America. 2011;21:2357-66. DOI:10.2307/41416663.
20. Fielding, Kelly, Hornsey, Matthew. A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. Frontiers in Psychology. 2016;7. DOI:10.3389/fpsyg.2016.00121.
21. Ali, Akhter, Erenstein Olaf. Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. Climate Risk Management. 2017;16:183-194. DOI:10.1016/j.crm.2016.12.001.
22. Williamson, Ian, Enemark, Stig, Rajabifard, Abbas. Land Administration for Sustainable Development; 2009.
23. Chandler CIR. Knowledge, attitudes, and practice surveys. the international encyclopedia of anthropology. 2018;1–2. DOI:https://doi.org/10.1002/9781118924396.wbiea1387
24. Scott W. Institutional theory: Contributing to a Theoretical Research Program; 2005.
25. UNFCCC. Climate change: Impacts, vulnerabilities and adaptation in developing countries; 2010.
26. Tasquier G, Pongiglione F, Levrini O. Climate change: An educational proposal integrating the physical and social sciences. Procedia - Social and Behavioral Sciences. 2014b;116:820–825. DOI:https://doi.org/10.1016/j.sbspro.2014.0

1.304
27. Wang et al.; 2015.
Retrieved August 21, 2020,
Available:https://www.researchgate.net/publication/281389709_Wang_et_al_2015
28. Heidari MR, Norouzadeh R. Nursing students' perspectives on clinical education. Journal of Advances in Medical Education & Professionalism. 2015; 3(1):39–43.
Available:http://www.ncbi.nlm.nih.gov/pubmed/25587554
29. Oversby J. Teachers' learning about climate change education. Procedia - Social and Behavioral Sciences. 2015;167:23–27.
DOI:https://doi.org/10.1016/j.sbspro.2014.12.637
30. Le QB, Nkonya E, Mirzabaev A. Biomass productivity-based mapping of global land degradation hotspots. In Economics of Land Degradation and Improvement - A Global Assessment for Sustainable Development. Springer International Publishing. 2015;55–84.
DOI:https://doi.org/10.1007/978-3-319-19168-3_4
31. Kajiado C. County Government of Kajiado Integrated Development Plan 2018-2022-Fostering Socio-Economic and political development for Sustainable Growth. 2018;15–114.
Available:https://cog.go.ke/downloads/category/106-county-integrated-development-plans-2018-2022
32. Ishtiaq M. Book Review Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage. English Language Teaching. 2019;12(5):40.
DOI:https://doi.org/10.5539/elt.v12n5p40
33. Budnick, Andrea, Kreutz R, Draeger D. Research methods: Qualitative and quantitative approaches. Innovation in Aging. 2017;1:231-232.
DOI:10.1093/geroni/igx004.861.
34. Karami S, Shobeiri SM, Jafari H, Jafari H. Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. International Journal of Climate Change Strategies and Management. 2017b;9(3):402–415.
DOI:https://doi.org/10.1108/IJCCSM-04-2016-0043
35. Mwongera C, Nowak A, Notenbaert AMO, Grey S, Osiemo J, Kinyua I, Lizarazo M, Girvetz E. Climate-Smart Agricultural Value Chains: Risks and Perspectives. In The Climate-Smart Agriculture Papers. Springer International Publishing. 2019a;235–245.
DOI:https://doi.org/10.1007/978-3-319-92798-5_20
36. Warhurst, Chris, Thompson, Paul. Mapping knowledge in work: Proxies or practices?. Work Employment and Society - WORK EMPLOY SOC. 2006;20:787-800.
DOI:10.1177/0950017006069815.
37. Mwongera C, Shikuku KM, Twyman J, Läderach, P., Ampaire E, Van Asten P, Twomlow S, Winowiecki LA. Climate smart agriculture rapid appraisal (CSA-RA): A tool for prioritizing context-specific climate smart agriculture technologies. Agricultural Systems. 2017;151:192–203.
DOI:https://doi.org/10.1016/j.agsy.2016.05.009
38. Ouédraogo M, Houessionon P, Zougmoré RB, Partey ST. Uptake of climate-smart agricultural technologies and practices: Actual and potential adoption rates in the climate-smart village site of Mali. Sustainability (Switzerland). 2019;11(17).
DOI:https://doi.org/10.3390/su11174710
39. Lang T. Institutional Theory, New. In The Blackwell Encyclopedia of Sociology. John Wiley & Sons, Ltd. 2018;1–3.
DOI:https://doi.org/10.1002/9781405165518.wbeosi050.pub2
40. Warhurst C, Thompson P. Mapping knowledge in work: proxies or practices? Work, Employment and Society. 2006;20(4):787–800.
DOI:https://doi.org/10.1177/0950017006069815
41. Poczta-Wajda, Agnieszka. Mechanisms and effects of agricultural subsidies – a theoretical depiction; 2015.
42. Makate Clifton, Makate Marshall, Mango Nelson. Smallholder farmers' perceptions on climate change and the use of sustainable agricultural practices in the Chinyanja Triangle, Southern Africa. Social Sciences. 2017;6:30.
DOI:10.3390/socsci6010030
43. Kuwornu, John, Al-Hassan, Ramatu, Etwire, Prince, Osei-Owusu, Yaw. Adaptation Strategies of smallholder farmers to climate change and variability: Evidence from Northern Ghana. 2013;5:233-239.

44. Mutisya SM, Barker M. Pupils' environmental awareness and knowledge: A springboard for action in primary schools in Kenya's Rift valley. In Science Education International. 2011;22(1).
45. IFAD. Livestock Thematic Paper, Women and Pastoralism; 2012.
46. Jeetendra Prakash Aryal, Dil Bahadur Rahut, Sofina Maharjan, Olaf Erenstein. Factors affecting the adoption of multiple climate-smart agricultural practices in the Indo-Gangetic Plains of India; 2018.
47. Chowdhury, Ataharul, Odame, Helen, Leeuwis C. Transforming the roles of a public extension agency to strengthen innovation: Lessons from the National Agricultural Extension Project in Bangladesh. The Journal of Agricultural Education and Extension. 2014;20. DOI:10.1080/1389224X.2013.803990.
48. Idersley A, Murray SJ, Corn SE. Science of the Total Environment Global an d regional an alysis of clim ate an d h um an drivers of w ild fi re. Science of the Total Environment. 2011; 409:3472–3481. DOI:https://doi.org/10.1016/j.scitoten
49. Dekens Julie, Dazé, Angie. Conducting gender analysis to inform national adaptation plan (NAP) Processes: Reflections from six African countries; 2019. DOI:10.13140/RG.2.2.12765.36321.
50. Carabine E, Simonet C. Value chain analysis for resilience in drylands (VC-ARID): identification of adaptation options in key sectors. 2018;76. Available:https://www.odi.org/sites/odi.org.uk/files/resource-documents/12286.pdf%0Ahttps://www.cabdirect.org/cabdirect/abstract/20183299617
51. Thornton P, Enahoro D, Njiru N, Wijk M. van, Ashley L. Program for climate-smart livestock systems. Country stocktake: Uganda; 2019. December. Available:https://cgspace.cgiar.org/handle/10568/106291
52. Krishnan A, Were A, Willem Te Velde D. Integrating Kenya's small firms into leather, Textiles and garments value chains: Creating jobs under Kenya's Big Four agenda. May 2019; 2019.
53. Alarcon, Pablo, Fèvre, Eric, Muinde, Patrick, Murungi, Maurice, Kiambi, Stella, Akoko, James, Rushton, Jonathan. Urban livestock keeping in the City of Nairobi: Diversity of Production Systems, Supply Chains, and Their Disease Management and Risks. Frontiers in Veterinary Science. 2017;4:171. DOI:10.3389/fvets.2017.00171.
54. Dietz M. Value Chain Governance that Benefits the Poor. 2011;1–15.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/68508