UNIVERSITY OF NAIROBI

# ANALYSIS OF INTEGRATION OF CLIMATE SMART INITIATIVES BY MICRO, SMALL AND MEDIUM ENTERPRISES IN BEEF VALUE CHAIN IN KAJIADO COUNTY

**A THESIS SUBMITTED TO THE UNIVERSITY OF NAIROBI IN PARTIAL FULFILLMENT OF THE DOCTOR OF PHILOSOPHY DEGREE IN ENVIRONMENTAL GOVERNANCE AND MANAGEMENT.**


**THONGOH-MUIA WACEKE MARY (B.Tech: Production Engineering (Moi University, MA: Environmental Planning and Management (UoN)**

**A82/53796/2018.**

**WANGARI MAATHAI INSTITUTE FOR PEACE AND ENVIRONMENTAL STUDIES**

**DEPARTMENT OF EARTH AND CLIMATE SCIENCES**

**FACULTY OF SCIENCE AND TECHNOLOGY,**

**UNIVERSITY OF NAIROBI**


**2021**

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This research Thesis is my original work and has not been submitted for the award of a degree in any other university.

**MARY WACEKE THONGOH-MUIA**

**Reg No A82/53796/2018**

Signature: Date: 24/3/2022

This Thesis has been submitted for examination with our approval as University Supervisors.

**PROF. MUTEMBEI MIKIUGU HENRY**

Signature: Date: 24/3/2022

Department of Clinical Studies/ Wangari Maathai Institute, University of Nairobi

**PROF. JOHN MBURU**

Signature: Date: 24/3/2022

Department of Agricultural Economics, University of Nairobi

**DR. B. E. KATHAMBI**

Signature: Date: 24/3/2022

Department of Earth and Climate Sciences

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University of Nairobi,

Faculty of Science and Technology

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|---|---|
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| **Registration Number:** | A82/53796/2018 |
| **Faculty:** | Science and Technology |
| **Department:** | Earth and Climate Sciences |
| **Course Name:** | Doctor of Philosophy in Environmental Governance and Management |
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# DEDICATION

I dedicate this work to all the people who care about our planet, who ascribe to the belief that we are stewards of self, others, and ultimately stewards of our planet.

I dedicate this work to the pastoral and nomadic communities in ASALs that continue to bear the brunt of climate change and whose livelihoods are heavily dependent on the beef value chain.

Finally, I dedicate this work to God, creator of the Universe who entrusted the planet to us as stewards.

"Coming together is a beginning, staying together is progress, and working together is success." – Henry Ford**.**

"None of us, including me, ever do great things. But we can all do small things, with great love, and together we can do something wonderful." – Mother Teresa

“We do not inherit the earth from our ancestors; we borrow it from our children”. - Unknown

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# ACRONYMS

| | |
|---|---|
| ACGN | Africa Corporate Governance Network. |
| ASAL | Arid and Semi-Arid Lands. |
| ASL 2050 | Africa Sustainable Livestock 2050. |
| ASGTS | Agriculture Sector Growth and Transformation Strategy. |
| CBD | Convention on Biodiversity. |
| CCAFS | Climate Change Agriculture and Food Security. |
| CDE | Centre for Development and Environment. |
| CGD | Centre for Global Development. |
| CIAT | International Center for Tropical Agriculture. |
| CGIAR | Consultative Group on International Agricultural Research. |
| CIDP | County Integrated Development Plan. |
| CSA | Climate-Smart Agriculture. |
| CSAA | Climate-Smart Animal Agriculture. |
| CSLVC | Climate Smart Livestock value chains. |
| EbA | Ecosystem based Adaptation. |
| FAO | Food and Agriculture Organization. |
| FIs | Financial Institutions. |
| GACSA | Global Alliance on Climate Smart Agriculture. |
| GDP | Gross Domestic Product. |
| GOK | Government of Kenya. |
| GPAF | Greenpeace Africa. |
| GPI | Greenpeace International. |
| GPS | Global Positioning System |
| GVC | Global Value Chains. |

| | |
|---|---|
| IFAD | International Fund for Agricultural Development. |
| IGAD | Intergovernmental Authority on Development. |
| IISD | International Institute of Sustainable Development. |
| ILO | International Labor Organization. |
| ILRI | International Livestock Research Institute. |
| IPBES | Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. |
| IPCC | Intergovernmental Panel on Climate Change. |
| KALRO | Kenya Agriculture and Livestock Research Organization. |
| KAPs | Knowledge, Attitudes, and Practices. |
| KCSAFP | Kenya climate smart agriculture framework program. |
| KEU | Kenya Economic Update. |
| KII | Key Informants Interviews. |
| KLMP | Kenya Livestock Master Plan |
| KMT | Kenya Market Trust. |
| KNBS | Kenya National Bureau of Statistics. |
| LDF | Livestock Derived Foods. |
| MOLD | Ministry of Livestock Development. |
| MOALFI | Ministry of Agriculture, Livestock, Fisheries, and Irrigation. |
| MSMEs | Micro Small and Medium Enterprises. |
| NAPs | National Adaptation Plans. |
| NDCs | National Determined Contributions. |
| NGOs | Non-Governmental Organizations. |
| ODK | Open Data Kit. |
| OECD | Organization for Economic Co-operation and Development. |

| | |
|---|---|
| PPP | Public-private partnerships. |
| PRISE | Pathways to Resilience in Semi-arid Economies. |
| SDGs | Sustainable Development Goals. |
| SEs | Social Enterprises. |
| SFVC | Sustainable Food Value Chains. |
| TIMPs | Technologies, Innovations, and Management Practices. |
| UN | United Nations. |
| UNCPD | UN Commission on Population and Development. |
| UNDP | United Nations Development Programme. |
| UNEP | United Nations Environmental Programme. |
| UNFCC | United Nations Framework Convention on Climate Change. |
| UNGA | United Nations General Assembly. |
| WASREB | Water Services Regulatory Board. |
| WB | World Bank. |
| WCED | World Commission on Environment and Development. |
| WHO | World Health Organization. |
| WWF | World Wide Fund for nature. |

# ABSTRACT

The beef value chain is a major part of the livestock sector in Kenya contributing to food security, livelihoods, and the economy. Beef production mainly takes place in the arid and semi-arid areas (ASALs) of the country, environmentally vulnerable ecological zone with socio-economic marginality and heavily impacted by climate change. The beef value chain is negatively impacted by climate change and is also a contributor to negative climate change through emitted greenhouse gases (GHGs) such as methane, nitrous oxide, and carbon dioxide from cattle rearing and, value chain activities, pasture to plate. The value chain is informal, fragmented, driven by micro, small and medium enterprises (MSMEs), and unsustainable. Climate adaptation research and climate risk management have largely ignored small businesses i.e. MSMEs and has had little recognition of the potential opportunities in climate change management that can be found in involving MSMEs. In the light of the aforementioned, as advocated through Sustainable Development Goal 12, sustainability of the beef value chain would only be assured through the integration of responsible production and consumption practices such as climate-smart agriculture (CSA) initiatives by the MSMEs in ASALs. Thus, establishing and analyzing the status of integration of CSA technologies, innovations, and management practices (TIMPs) by MSMEs was key. Prior to this study there existed scanty information on the status of integration of CSA TIMPs in the ASALs' beef value chain. In particular how the existing beef value chain governance and management practices interphase with the actors in terms of required skills, KAPs (knowledge, attitudes, and practices), creation of an enabling environment, and how the same influences the adoption of CSA TIMPs. The current study helped to unravel the existing status of CSA TIMPs integration by actors and, the root causes of any observed worrying practices to inform policy intervention and actions towards a climate smart beef value chain. Moreover, the study serves to inform future decisions to be made on Kenya's beef value chain in achieving the global Sustainable Development Goal

number 12, Kenya agriculture sector growth and transformation strategy, and Kenya Livestock Master Plan.

The study was guided by the overall objective that sought to analyze the status of integration of climate-smart initiatives by MSMEs in the beef value Chain in Kajiado County. The specific objectives were to (1) evaluate knowledge, attitudes, and practices of MSMEs on the integration of climate-smart initiatives, (2) determine enablers of climate-smart initiatives integration by MSMEs, and, (3) assess barriers of climate-smart initiatives integration by MSMEs in the beef value chain.

Sustainable integration of CSA TIMPs by MSMEs (dependent variable) is determined by factors such as actors' requisite skills, KAP (knowledge, attitude, and practices), and enablers and barriers of integration (independent variables) as modulated by existing governance and management practices and, regulatory frameworks (practices, laws, policies, and institutions) (moderating variables). Enablers and barriers of integration include prevailing political, social, economic, technological, legal, and environmental issues of the value chain. The theoretical frameworks used included those that advance arguments on technology adoption, which seeks to understand and explain constructs for enablers and barriers to actors' CSA TIMPs adoption. The theories also consider the perceived ease of use, benefits, and usefulness of the TIMPs, additional factors such as individual differences, innovativeness, concern for privacy and security, social influence, and peer pressure.

The study applied cross-sectional research that involved looking at KAP data from actors at one specific point and correlational research where non-experimental research methods were used to study the relationship between characteristics of MSME actors, adoption of CSA TIMPs, and sustainability of the value chain, with the help of statistical models. Data for KAP, enablers, and barriers was collected from value chain actors (N=459; farmers, traders, processors, marketers/distributors/retailers and consumers).

There was an observed poor understanding of the concept of CSA by the value chain actors, with less than six percent appreciating the concept. There was reported actors' recognition that the beef value chain could affect the environment with some being concerned about how their practices could cause negative climate change. There was actors' willingness to adopt CSA TIMPs that protected the environment as long as they had economic benefits. There were existing legal and institutional frameworks, though not tailored to CSA, that could be leveraged for actors' integration of CSA TIMPs, albeit poor actors' knowledge and compliance on the same. In addition, there were reported barriers to CSA TIMPs' integration and this study categorized them in six broad perspectives; (1) Knowledge and institutional, (2) Market and financial, (3) Policy and incentives, (4) Networks and engagement platforms, (5) Cultural and social, (6) Physical infrastructure barriers. Mainly, there were inadequate policy actions, and extension services, that impeded CSA awareness. The main interventions recommended by this study, were (a) initiation of capacity building programmes and strengthening of extension services, for better understanding of CSA, its usefulness and benefits while leveraging actors' recognition that the beef value chain is affected and has an impact on climate change and their willingness to take part in activities that protect the environment as long as they had socio-economic gains, (b) de-risking of the pastoral beef value chain through design of climate-sensitive financial policies, incentives, climate risk instruments and adequate physical infrastructure to attract innovators, investors and public-private partnerships (PPP) to beef value chain and encourage value chain actors' adoption of CSA TIMPs, (c) creating robust platforms for actors to self-organize, promote participatory learning and research, advocate/lobby and self-regulate towards a climate-smart beef value chain, and (d) leveraging, reviewing, contextualizing and creating awareness on legal and institutional frameworks to enhance not only compliance but sustainability mindsets, behavior change and adoption of CSA TIMPs.

# CHAPTER ONE

# 1.0 Introduction

## 1.1 Background Information

Food production will need to expand globally by 60% to meet increased food demand by 2050, and most of this cannot be met by increased land but from increased productivity through sustainable food systems (Lipper *et al*., 2014;  FAO, 2018). Beef production affects food security and has a vital role in the livelihoods of rural farmers and poverty alleviation (Mwongera *et al.,* 2019). While beef production is highly climate-sensitive, it is also a source of greenhouse gases (GHGs) (Breu *et al*., 2016; IPCC, 2019). Livestock contributes 14.5% of all agricultural GHGs, while beef contributes 60% of agricultural carbon dioxide emissions, i.e. 5.2–5.8 gigatonnes (Owino *et al*., 2020). The beef value chain contributes to GHGs through land use and land-use change, manure management, feed production, beef production, directly through enteric fermentation and indirectly through processing, marketing, transportation, consumption, and food waste, thus making beef a high carbon footprint food (Grossi *et al*., 2019a, 2019b). Manure management accounts for 25.9% of GHGs, it is the second-largest source after enteric fermentation accounting for 39.1% of GHGs in beef production (FAO, 2013; Owino *et al*., 2020).

The global meat protein consumption over the next decade is expected to continue on a growth path by 2030, at 14% growth, and specifically, beef consumption will increase at 5.9%, a higher trend than in the base period of 2018-2020 (OECD/FAO, 2021). The strongest beef growth rate will be in Sub-Saharan Africa at 15%, due to high population growth, urbanization, and increasing incomes, thereby doubling beef demand by 2050 (Alarcon, *et al.,* 2017a; Rojas-Downing *et al.,* 2017; OECD/FAO, 2021). Red meat makes up 80% of the Kenyan domestic meat consumption, with beef consumption likely to increase by over 0.81 million tons between 2010 and 2050 (KALRO, 2017-2018).

Livestock production in Kenya is practiced by approximately 7 million poor rural households and contributes 10 - 13% of Kenya's GDP as well as 40% of Agricultural GDP (KALRO, 2017-2018). Beef production in Kenya is mainly from arid and semi-arid areas (ASALs) (Njoka *et al.*, 2016). ASALs make up 85% of Kenya's land mass, hold 70% of the livestock, and are characterized as climate change hotspots, with high exposure and low adaptive capacity (Njoka *et al.*, 2016; Atela *et al.*, 2018). Therefore the effects of climate change threaten both food security and agriculture's focal role in ASALs, rural development, and incomes in Kenya, (Atela *et al*., 2018).

The population growth rate in sub-Saharan Africa is the highest in the world and is likely to double by 2050. Kenya's population continues to balloon and is expected to double by the year 2050 (Thornton *et al.*, 2018; FAO, 2018; World Bank, 2019). Population growth means the clearing of more land for crop and livestock production (Owino *et al*., 2020). It also means demand for more land for housing and due to rural-urban migration further expansion of urban areas into arable land previously used for food production (Gannon *et al.*, 2016; Jobbins *et al.*, 2016; Njoka *et al.*, 2016; Mwongera *et al*., 2017; Godde *et al*., 2018). In turn, pushing croplands into ASALs livestock production areas and in turn pushing livestock production into marginal lands, already threatened by harsh climate, little rain, livestock overstocking, and unsuitable soils, leading to further degradation and, reinforcing a negative feedback loop of climate change, livestock livelihoods, human conflict and poverty (Nkonya *et al*., 2016; Njoka *et al*., 2016; Atela *et al*., 2018). The answer to sustainable food security, poverty eradication, and improved livelihoods in ASALs lies in an integrated approach towards sustainable food systems, reinventing the systems to make them more resilient to climate change and by improving farmer's engagement with the value chains through stepping up micro, small and medium enterprises (MSMEs) integration and value-adding interactions (Njoka *et al*., 2016; Stein and Barron, 2017; FAO, 2018). Beef value chains present opportunities for rural poor to be producers, traders, processors, and retailers in food value chains by linking them with urban areas and other markets hence increasing their incomes, food, and nutrition security, and reducing poverty while contributing to sustainable food systems (Carabine *et al.*, 2017; Devaux *et al*., 2018a).

MSMEs in economies of developing countries form 90% of the private sector and play a major role in their GDPs (ILO 2015). MSMEs are essential to value chain development and in Kenya forms a critical part of the livestock sector and especially in ASALs, where MSMEs are mainly in livestock and, trade sectors (FAO, 2010; Kajiado CIDP, 2018-2022). A pastoralist-based beef production system includes MSMEs' activities like production, marketing, processing, and consumption (World Bank, 2012; GOK, 2018).

However, climate change presents both challenges and opportunities for MSMEs, especially in ASALs' rural areas, an ecological zone with socio-economic marginality, environmental vulnerability, and low adaptive capacities (Njoka *at el*., 2016; Nkonya *et al.*, 2016; Mwongera *et al.*, 2017). Yet MSMEs are the most poorly equipped to deal with the economic losses from climate change (Crick *et al*., 2016; Grossi, *et al*., 2019). The beef value chain is climate-sensitive, affected heavily by extreme weather such as droughts and floods (Grossi, *et al.*, 2019). During extreme weather occurrences, livestock actors (MSMEs) become vulnerable and incur heavy losses, from resultant animal deaths, increased pests and diseases, poor forage and foliage quality, reduced productivity and growth rates (Rojas-Downing *et al.*, 2017; Mwongera *et al.*, 2018; Grossi, *et al.*, 2019). The affected actors, smallholder farmers, and traders, in ASALs, are hardest hit because of a lack of existing climate-smart cushioning legal and institutional frameworks (World Bank, 2012; FAO, 2016; Mwongera *et al.*, 2017). Following a drought period, it takes years for herd size to recover, affecting the value chain actors' livelihoods, and in absence of financial resources to proactively re-stock through animal purchases it takes decades to recover, and many MSMEs actors abandon the value chain, migrate to urban areas in search of alternative means of livelihoods (Godde *et al*., 2018; Carabine *et al.,* 2017; Gannon *et al.,* 2018). Yet climate adaptation research and climate risk management has largely ignored small businesses like MSMEs and has had little recognition of the potential opportunities in climate risk management that can be found in involving the MSMEs (Crick *et al*., 2016; Dekens *et al*., 2019).

Further, ASALs ecosystems have low institutional quality and weak regulations to support the integration of MSMEs and their climate adaptation capacities (Njoka *at el*., 2016). Further, ASALs have low levels of trade and economic integration due to their inaccessibility and poor access to markets, low levels of human capital mostly due to cultural norms, poor physical infrastructure, low level of productivity due to lack of financing, and, uncompetitive markets leading to high levels of livelihoods vulnerability, that further worsens due to climate change vulnerabilities (Crick, *et al*., 2016; Gannon *et al.,* 2018; GOK, 2018).

The livestock population in ASALs is raised on rainwater-fed grasslands (Nkonya *et al.*, 2016). Although livestock farmers in ASALs are pastoralists who try to mitigate adverse weather conditions through migration, the dwindling water, land resources, and, grasslands conversion have greatly reduced pastures available for such migration in Kenya and fueled resource based conflicts (Nkonya *et al.,* 2016; Carabine *et al.,* 2017; Crick *et al.,* 2018). Africa is a major producer and consumer of beef despite her being the second driest continent where only 40% of her people with access to clean and adequate water resources (IPBES, 2019). Kenya is part of the African nations classified as water-scarce nations and her per capita availability of water resources is projected to fall to 250m$^3$ by the year 2025 (World Bank, 2017; FAO, 2020; WASREB, 2020). The fact that beef production and trading are highly dependent on large amounts of water and grasslands fed by rain water, with climate change, the dwindling renewal water resource will negatively impact the beef value chain (FAO, 2016, 2020; Rojas-Downing *et al.*, 2017). Meeting the increased beef demand will be dependent on the sustainability of the beef value chain which, in turn, depends on the ability to turn the chain around to withstand the effects of negative climate change (Rojas-Downing *et al.*, 2017; Crick *et al.,* 2018; Grossi, *et al.*, 2019). The actors' adaptation towards a climate-smart beef value chain that targets increased incomes, climate adaptation, and mitigation without compromising on her peoples' food and nutritional security would become a critical yin-yang balance for consideration by environmental scientists and policy makers (Cheung *et al.*, 2018; Crick *et al.*, 2016; Grossi, *et al.*, 2019).

Kenya's Climate-Smart Agriculture (KCSAP) initiative aims to transform and reorient agricultural production systems to ensure sustainable food security in a changing climate (FAO, 2013). The CSA initiative entails the incorporation of technologies, innovations, and management practices (TIMPs) that achieve triple wins of improved productivity/incomes, enhanced climate resilience, and reduced GHGs emissions (GoK, 2012; GoK, 2018). The initiative includes targeting the beef value chain by advocating for coordinated climate resilience actions among value chain actors (FAO, 2013; Karami *et al.*, 2017). The role of MSMEs in scaling CSA adoption has been considered in this study due to MSMEs' ability to provide pathways for producers and, rural actors to engage with food value chains, drive local development, integrate women, youth, and other marginalized groups, innovate through greater adaptability and flexibility which can be important drivers in building climate resilience, poverty reduction, social adaptation and scaling innovations such as CSA TIMPs within the food systems (Atela *et al.,* 2018).

CSA TIMPs such as breeding for more feed-efficient converting animals, climate-sensitive and high yield breeds, fodder conservation practices, keeping of fewer animals (right stocking rate), beef handling, health and safety management, value addition, mobile phone-based agro-weather and disaster management advisories, as well as fuel-efficient transportation trucks, slaughterhouse, retailers and distributors efficiencies in energy and water use, waste and by-products management practices would significantly contribute to climate resilience, reduced GHGs emissions and improved environmental integrity (Grossi, *et al.*, 2019).

Adoption of climate-smart agriculture (CSA) practices is estimated to have the potential to drastically reduce the GHGs e.g. 2861 $kgCO_{2e}$ $ha^{-1}$ $yr^{-1}$ ( SOC, $N_2O$, and $CH_4$ flux reductions of 2210, 611, 39 kg $CO_{2e}$ $ha^{-1}yr^{-1}$, respectively (Owino *et al*., 2020). While adoption of CSA TIMPs, such as improved breeds and herd efficiency are estimated to cut beef production GHGs by 25% (KCSAP, 2018; FAO, 2018; KALRO, 2017-2018; Mbae *et al.*, 2020). The resultant mitigation against climate risks such as reduced frequency and intensity of droughts and floods would be profitable for CSA integrated MSMEs (Njoka, 2016; Ogutu *et al.*, 2016; Fielding and Hornsey, 2016; FAO, 2013, 2018). Since MSMEs play key roles in the beef value chain in developing countries like Kenya (World Bank, 2017), they can be target levers for accelerating CSA TIMPs adoption (Kuruppu *et al.*, 2014; Dekens and Dazé, 2019; Girvetz *et al.*, 2019).

Adoption of CSA TIMPs is highly dependent upon MSMEs actors' knowledge, attitudes, and practices and the presence of an enabling environment (Fielding and Hornsey, 2016). Although numerous studies have been done on knowledge, attitude, and practices (KAPs) and how this affects the uptake of innovations in the last two decades, little has been studied on ASAL context and KAPs' effect on the adoption of CSA TIMPs by MSMEs in the beef value chain (Kgosikoma *et al.*, 2018; Waisman *et al*., 2019).

Appreciating the variables and dynamics which affect the diffusion of CSA TIMPs is an important factor in determining which policy actions and innovative solutions can successfully create a climate-smart beef value chain. Addressing barriers and challenges to CSA TIMPs adoption require consultations with all relevant stakeholders to advise suitable interventions and policy options (FAO, 2018). Understanding how the existing value chain governance interphase with the actors/stakeholders in terms of required skills, (KAP) and the presence of an enabling environment for the adoption of CSA TIMPs becomes key. Further appreciating whether existing legal and institutional frameworks are enabling or becoming barriers to CSA TIMPs integration and beef value chain sustainability is critical to arriving at responsive policy actions (Descheemaeker *et al*., 2016; Khatri-Chhetri *et al*., 2019).

## 1.2 Statement of the Problem

A sustainable beef value chain is vital to food security, livelihoods, and poverty alleviation for over 90% of the Kenyan ASAL population that is currently under threat from negative climate change ( Lamek *et al*., 2016; Banerjee *et al*., 2020). Beef production is negatively impacted by climate change and on the other hand is a key contributor to climate change through GHGs emissions (Cheung *et al.*, 2018; Crick *et al.*, 2016; Grossi, *et al.*, 2019). Climate change presents risks to individuals, businesses, infrastructure, economic growth, and development (Mwongera *et al.*, 2017). There is recognition by the National Drought Management Authority (NDMA) and Kenya agriculture sector transformation and growth strategy that the beef value chain would continue to be unsustainable unless the chain is re-oriented towards responsible production and consumption, through targeted initiatives such as climate-smart agriculture and whose objectives of improved productivity, enhanced climate resilience, and reduced GHGs emissions would reverse the unsustainable trend (GOK, 2018).

Negative climate disasters are more common in developing countries due to failed climate risk management, disaster, and risk mitigation plans (FAO, 2016; Godde *et al.*, 2018). Failed integration of climate adaptation, weather-related disaster, and risk mitigation through governance and management practices, legal and institutional frameworks have led to the undermining of economies and agricultural livelihoods in developing countries like Kenya (Carabine *et al.,* 2017; Gannon *et al.,* 2018). Although hazards mainly resulting from climate change are inevitable, the ability for communities, businesses, and value chains to recover from exposure to such hazards is directly linked to how well prepared, developed and robust their climate adaptation and mitigation systems and risk management practices are (Carabine *et al.*, 2017; Godde *et al.,* 2018). However, in spite of numerous occurrences of such disasters in developing countries like Kenya, little or no effort has been done to understand factors affecting institutionalization of climate adaptation and mitigation initiatives, such integration of CSA TIMPs, (Mutembei *et al.,* 2015).

Further, climate adaptation research and climate risk management have largely ignored small businesses like MSMEs and have had little recognition of the potential opportunities in climate risk management that can be found in involving the small businesses (Crick *et al*., 2016; Dekens *et al*., 2016). Specifically, scanty information existed on the status of integration of CSA TIMPs by MSMEs in the ASALs' beef value chain (Njoka *et al.*, 2016; Godde *et al.*, 2018). Further, there was insufficient information available prior to this study on how the existing beef value chain governance interphase with the actors/stakeholders in terms of their integration, required skills, KAP (knowledge, attitudes, and practices), and how this influence existing value chain practices. In addition, although numerous studies have been done on knowledge, attitude, and practices (KAPs) and how this affects the uptake of innovations in the last two decades, little has been studied on ASAL context and KAPs' effect on the adoption of CSA TIMPs by MSMEs in the beef value chain (Kgosikoma *et al.*, 2018; Waisman *et al*., 2019).

Therefore, there was a need to unravel the existing status of MSMEs' integration of climate-smart initiatives in order to inform policy and possible solutions on noted causes of the worrying state of the beef sector specifically in climate vulnerable ASAL ecological zone, while contributing to the achievement of the global Sustainable Development Goal number 12 on responsible consumption and production (UNEP, 2015; Dai *et al.*, 2018; Kgosikoma *et al.*, 2018).

## 1.3 Objectives

### 1.3.1 General Objective

To assess the integration of climate-smart initiatives by micro, small and medium enterprises in the beef value Chain in Kajiado County.

### 1.3.2 Specific Objectives

1. To evaluate knowledge, attitudes, and practices of micro, small and medium enterprises actors on the integration of climate-smart initiatives in the beef value chain in Kajiado.
2. To determine enablers of climate-smart initiatives integration by micro, small and medium enterprises in the beef value chain in Kajiado County.
3. To analyze barriers of climate-smart initiatives integration by micro, small and medium enterprises in the beef value chain in Kajiado County.

## 1.4 Justification of the Study

The data obtained from this study helps to identify sustainability and climate change challenges and their root causes in the pastoral beef value chain in ASALs areas and provides evidence-based information to guide critical actions and policies for their resolution. The study is a key contributor to informing the government of Kenya (GOK) decisions that help achieve the Global 2030 Agenda, Sustainable Development Goal number 12 and 13, on responsible consumption and production practices and climate action respectively and actions under NDCs (national determined contributions). Further, the study outcomes contribute to key GOK strategies such as the agriculture sector transformation and growth strategy (ASTGS 2019-

2029), Kenya climate-smart agriculture strategy (KCSAS 2017-2026), Kenya Livestock Master Plan (KLMP), and informs future climate-smart initiatives integration frameworks in the Kenya agriculture and livestock sectors.

## 1.5 Scope of the Study

This study focused on the subject of governance and management practices in relation to beef value chain practices, value chain governance, institutional and legal frameworks relevant to beef value chain, MSMEs and pastoral beef value chain. The study focused on sustainable practices but specific to climate smart agriculture. In CSA the study focused on CSA triple objectives of; (1) improved incomes/productivity, (2) climate resilience and (3) mitigation, in relation to the beef value chain. The study zeroed in on the integration of climate-smart initiatives (CSA TIMPs) by MSMEs in the beef value chain. Even though there are several beef production systems in Kenya, this study focused specifically on the pastoral beef production system. The study area focused on Kenya ASALs ecological zone that is categorized as environmentally vulnerable, climate change sensitive and suffer from socio-economic marginality. Specifically the study was conducted in Kajiado County, which is one of the 23 ASALs Counties out of the 47 Counties in Kenya. Further, the study was limited to three sub-counties namely; Kajiado North, East, and Central, out of the total five sub-counties found in Kajiado County, this was also considered as a sufficient scope and sample size for the study.

## 1.6 Assumptions of the Study

All respondents provided honest responses to the questions posed to them.

# CHAPTER TWO

## 2.0 Literature Review

### 2.1 History and Growth of Beef Livestock Production

Livestock production is practiced in numerous cultures as a community source of livelihood and a historical transition activity from hunting and gathering to meet nutritional needs (Hartung, 2013; Webster, 2013). Other than meeting nutritional needs, the beef value chain evolved to become useful also for economic gains such as modes of transportation, plowing and weeding services, manure provision, and trade in hide and skin (Webster, 2013). Based on such gains the farmers increased the size of their herds through the breeding of animals for desirable traits depending on available land resources (Silbergeld *et al.*, 2008).

Today, beef production system that complements our socio-cultural values, animal welfare, and sustainable utilization of natural resources through consideration of environmental integrity has become important (Rojas-Downing *et al.*, 2017b). In this context, climate-smart beef production is the current emphasis to address the negative effects of climate change such as droughts and floods to beef production while meeting the human needs on food security, livelihoods and socio-cultural value (Descheemaeker *et al.*, 2016). Since on the flipside, beef production contributes to GHGs emissions like methane, nitrous oxide, and carbon dioxide, there is an increased impetus to ensure sustainable beef consumption and production practices (Grossi *et al.*, 2019b). This calls for the integration of climate-smart initiatives by MSMEs in the beef value chain through requisite skills (knowledge, attitude, and practices), removal of barriers to sustainability and availability of enabling governance and management practices that support creation of a climate smart beef value chain (Mwongera *et al*., 2017).

## 2.2 Global Trends in Beef Value Chain

Global demand for beef has been the main driver for production practices (FAO, 2014, 2015, 2016; Thornton *et al.*, 2019; FAO 2019). As this demand increased with time, the production continued to respond accordingly placing more pressure on the grazing grasslands and the environment (Njoka *et al.*, 2016). This resulted in overstocking, overgrazing, grassland degradation, and negative climate from emitted GHGs (Nkonya *et al.*, 2016).

The alarm raised by increased production and related environmental challenges triggered the new thinking about the sustainability of the production systems (FAO, 2013; World Bank, 2020). The thinking needed to take into account the need for the low-income agriculture-dependent countries to continue producing the animals for livelihoods but in a climate-sensitive manner (FAO, 2016; FAO, 2018; KALRO, 2017-2018). This trend gave rise to the incorporation of such production systems into the Global Sustainable Development Goals as SDG number 12 that targets to promote sustainable consumption and production practices (UNEP, 2015). As developing countries in sub-Saharan Africa embark on demand-driven beef production (FAO, 2018), they must embrace the imperatives and implementation of SDG number 12 while combating climate change and its impact as envisioned in SDG goal 13 (UNEP, 2015; FAO, 2018; Thornton *et al.*, 2019)

Embracing the implementation of SDG number 12 in a climate-sensitive beef production system in developing countries would need a greater understanding of how MSMEs within the value chain would be properly involved, especially so because for them a shift must demonstrate maximum yields and profitability (FAO, 2013; Wreford *et al.*, 2017a, World Bank, 2019). Furthermore, such MSMEs actors in those countries where requisite skills (knowledge, attitudes, and practices) could be lacking, steps to first provide such skills would be necessary (World Bank, 2019). Therefore there is a need for differential treatment of countries based on their existing capacity for implementation of SDG 12 (FAO, 2018;

Mwongera *et al.*, 2019a). A status evaluation of such capacities is necessary among implementing countries. Such trends are even more complex in ASAL areas because beef production systems are inherently linked to local climatic conditions, traditions and cultures (Pantano *et al.*, 2012; Wilson, 2018; Thornton *et al.*, 2019).

Thus, in order for Africa to achieve her aspiration of a sustainable beef value chain, there is a need to link her production systems with prevailing global trends for sustainability through deliberate legal and institutional frameworks that also reflect local context (FAO, 2017; Kgosikoma *et al.*, 2018; Mwongera, *et al.*, 2019).

## 2.3 Nexus between Environmental integrity and Beef Value Chain

### 2.3.1 Overview

Livestock rearing, including beef production, is a high carbon footprint enterprise that heavily compromises environmental integrity (Alarcon *et al.*, 2017; Rojas-Downing *et al.*, 2017; Grossi, *et al.*, 2019). Thus, although production is key to meeting global food security, its expansion must be regulated to ensure environmental sustainability (Thornton *et al.*, 2019). The beef production revolutions and evolution need to place into account the delicate yin-yang balance on both production and environmental integrity (Ameen and Raza, 2018). Once this is done there will be responsible commercialization of the enterprise (Stokes *et al.*, 2014; Ameen and Raza, 2018; FAO, 2020). Despite the progress made in greening the beef value chain, an analysis still indicates a lot needs to be done to cushion it from weather-related shocks that increase the prevalence of pests/disease, low productivity and cases of animal deaths (Lipper *et al.*, 2014; FAO, 2015; World Bank, 2019). If not managed, increased demand for beef could trigger land degradation, soil erosion, negative climate, and eventual collapse of the production system itself (Thornton, 2010; Sumberg and Thompson, 2013; Rojas-Downing *et al.*, 2017; FAO, 2019; Grossi *et al.*, 2019).

The beef value chain is also highly water resource-dependent (Rojas-Downing *et al.*, 2017; FAO, 2019). The production is mainly through rain-fed grasslands that also serve as a home for other biodiversity (FAO, 2016; Rojas-Downing *et al.*, 2017). Therefore, negative climate resulting from overstocking would trigger a climate crisis that not only affects water resource itself but also fodder needed for cattle rearing and impact on biodiversity (Ometto *et al.*, 2011; Assunçao *et al.*, 2013; Stokes *et al.*, 2014).

There is increasing recognition that beef production needs to be climate-smart to reduce GHGs emissions (Cheung *et al.*, 2018; Crick *et al.*, 2016; Grossi, *et al.*, 2019). The methane produced by the biological processes such as enteric fermentation and the production of manure, nitrous oxide coming from used synthetic fertilizers for pasture improvement, and carbon dioxide produced from feed production, livestock rearing, meat processing, and meat combustion as well as emissions during transportation processes need to be reduced for enhanced resilience against negative climate (Davidson *et al.*, 2012; Butler *et al.*, 2013; Lipper *et al.*, 2014; Ameen and Raza, 2018).

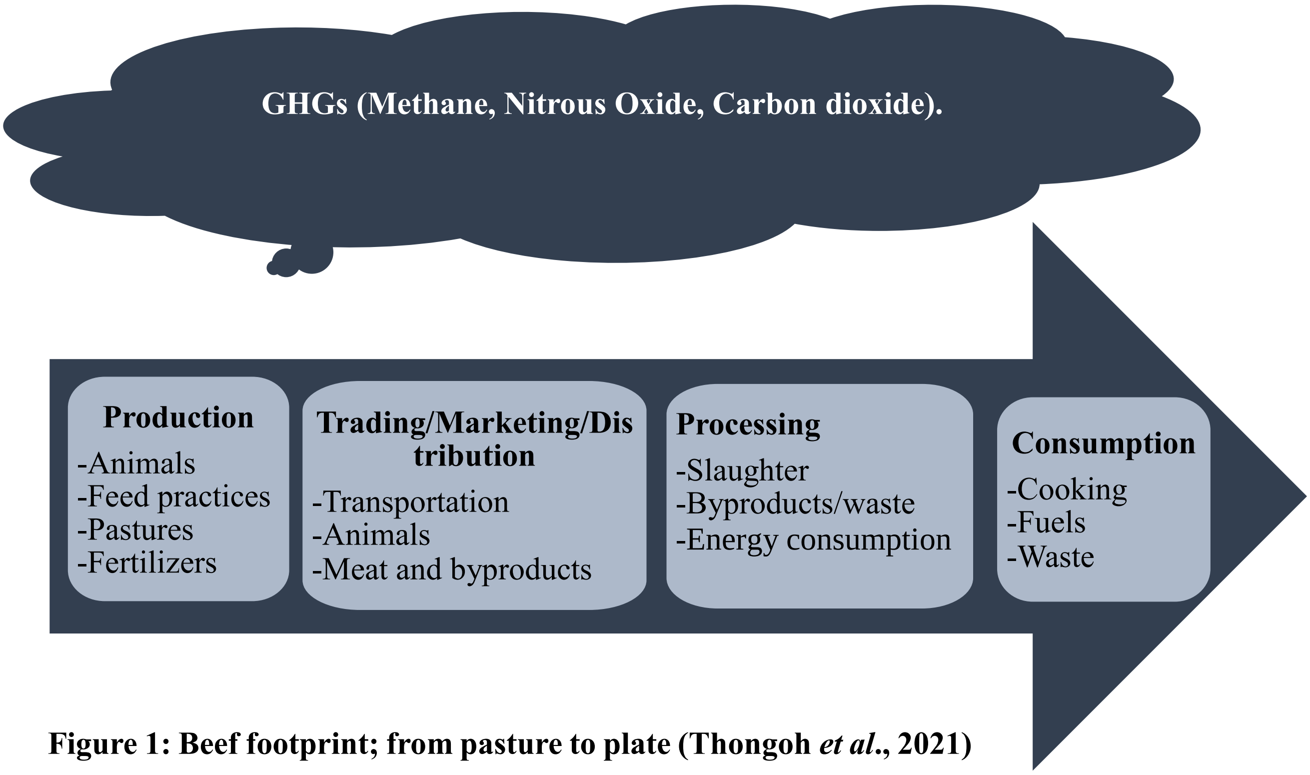


**Figure 1: Beef footprint; from pasture to plate (Thongoh *et al.*, 2021)**

It has been shown that up to 10–14% of global GHGs anthropogenic emissions in agriculture are from beef production, while 5.2–5.8 gigatonnes of $CO_2$ equivalent per year are from agricultural activities, with livestock contributing 60% of the agricultural carbon dioxide (Lipper *et al.,* 2014).

### 2.3.2 Status of Africa Beef production

The livestock sub-sector is among the fastest-growing agricultural sectors in Africa (Wreford *et al.*, 2017a; Nyariki and Amwata, 2019). The growth is driven by demand for meat protein and other livestock products in Africa and other developing countries like Yemen, with a rapidly growing middle-class population with higher incomes, and increased urbanization (Delgado *et al.,* 1999). According to the Africa Sustainable Livestock report 2050 by FAO (2017), this growth, is expected to continuously trigger the transformation of the sector in Africa as pushed by MSMEs and Africa's need to exploit it for her developmental opportunities albeit posing environmental challenges.

As the growth and transformation of the beef value chain continues to take place in the African continent, it is worth noting that most of the production takes place through traditional pastoralism set up where animals are raised in ASALs range grasslands threatened by climate change effects of unpredictable rain patterns, rising temperatures, increasing cycles of droughts and floods, rising prevalence of pest and diseases, degrading soils, and dwindling resources of land, water, and fodder (Mwongera, *et al.*, 2019).

In addition, Africa's livestock production systems are affected by a lack of supportive governance and management structures (institutionalized laws, policies, and regulation protocols) that guide procedures, customs, and socio-cultural norms of the actors in shaping prudent sector decisions for its growth and transformation in a sustainable manner (FAO, 2018; FAO, 2020). Therefore, the occurring growth and transformation may be driven by the urge of governments and MSMEs to exploit the sector for maximum yields and profitability rather than creating a sustainable growth based on sustainability initiatives such as CSA, i.e. practices that are supported by communities' changing cultures, norms, practices and ethics aligned to economic, social and environmental sustainability (UNEP, 2010; FAO, 2013).

It is also worth noting that the beef value chain in Africa is usually informal, fragmented, and mainly driven by MSMEs (Njoka *et al.,* 2016). Thus, there is a need to inculcate context-based CSA environmental governance and management practices at all levels of the value chain (producers to consumers, pasture to plate), including extended supporting actors such as banks, insurance, CBOs (community-based organizations), and development partners and enabling government institutions (UNEP, 2010; Gannon *et al.,* 2018). It is only through these governance and management structures that societal values and norms of creation, diffusion, adoption, and adaptation of climate-smart practices over space can happen with time to ensure a climate-smart beef value chain has been achieved (UNEP, 2010; FAO, 2019). Supportive governance and management frameworks could be the enabler for MSMEs to embrace CSA interventions through building requisite skills (knowledge, attitude, and practices) in order to acquire meaningful behavior and practices to sustainably manage the value chain by complying with the instituted laws, policies, and regulations and inculcating a sustainability mindset (UNEP, 2014). Once the value chain actors establish norms of transmitted sustainability culture of governing and managing the beef value chain, such norms would then become the means for shaping climate-smart decisions for current and future generations of beef value chain actors (Blankespoor *et al.*, 2010; UNEP, 2014).

### 2.3.3 Status of Kenyan Beef Production

Like in the African continent, the livestock sector and by extension the beef sub-sector is rapidly growing to meet the meat demand by expanding middle class and urbanization; Kenya's urban population growth rate is 4.3% (Alarcon *et al.,* 2017). The Kenyan middle-class treasure roasted meat ('nyama choma') mainly from beef, sheep, and goat that is traditionally made available at roadside eateries, clubs, and restaurants (Muhoro, 2014). It is estimated that by 2050 the demand for this meat could double albeit environmental and human health ( Muhoro, 2014; Girvetz *et al.*, 2019).

Going by the Kenya Markets Trust (2014) projection that the domestic beef supply in Kenya may not manage to achieve the growing per capita demand, the actors may exploit the projected domestic deficit to drive a non-sustainable enterprise and end up causing an environmental crisis. This may be further driven by an external demand for beef meat, a situation likely to drive cross border movement of live animals from Somalia, Tanzania, and Ethiopia, thereby complicating the crisis of the sector (Bergevoet and Van Engelen, 2014).

Kenya's diverse livestock is attributed to her wide range of climatic and geophysical variations, community cultural diversity, and livelihood economic activities (GoK, 2018). Beef production is predominantly done by communities living in ASALs that cover approximately 85% of Kenya's land mass and hold 70% of the livestock population (GoK, 2012; Katiku *et al.*, 2013). Kenya has an agricultural sector transformation and growth strategy (ASGTS), to guide the management of livestock rearing and marketing as per ASTGS 2012-2014 and ASTGS 2019-2029 priorities and Kenya Livestock Master Plan. Rearing of beef in Kenya serves to meet economic and cultural needs and it is done on available natural pastures (Katiku *et al.*, 2013). As the ASAL communities population increase rapidly and urban housing keep pushing into neighboring ASALs, there is a corresponding decrease in available pasture land leading to overstocking and environmental degradation (Njoka *et al.*, 2016).

### 2.4.2 Production Systems in Kenya

Beef production in Kenya is done through extensive and intensive systems (Njoka *et al.*, 2016). The extensive system involves the production of beef on rain-fed grassland pasture on large tracts of land (Njoka *et al.*, 2016). This system has two types of sub-production systems named as extensive-controlled (private beef ranches) and extensive-uncontrolled (communal farms). Private ranches specialize in the keeping of mainly pure Boran and other exotic fast-growing breeds while communal farms keep indigenous breeds and cross breeds (Njoka *et al.,* 2016).

The private ranches are predominant in formally colonial beef cultivated counties such as Laikipia and Taita Taveta counties while communal farms are spread out in other ASAL counties. Whereas private ranches target prime niche markets, communal farms produce beef for local markets (FAO, 2017; FAO, 2019). It was also observed that private ranches sell the bulk of their live animals to specific abattoirs with binding contracts, professional slaughtering practices, and access to market information, and adhered to export standards while communal farms lack these factors and standards of practice (FAO, 2019).

Intensive beef production system in Kenya is basically done as feedlots for fattening and/or accelerated growth where beef animals are either reared in zero-grazing units or allowed to graze outdoors but with intensive commercial feed supplementation (Bergevoet and Van Engelen 2014; Thornton *et al.,* 2019). Feedlot intensive systems are mainly for commercial purposes, done as capital and labor-intensive and target niche prime markets (FAO, 2019). This system, unlike for extensive, is done under irrigated pastures or in highland counties like Nakuru and Nyeri, where rainfall is adequate (FAO, 2019).

Another low-grade system of beef production taking place in Kenya is the integrated agro farming system where some beef animals are raised among dairy and mixed crop farming (FAO, 2019). In this setup, culled dairy animals and/or bulls are sold off for beef in local markets. This system is practiced mainly by all farmers practicing mixed farming and it is widespread in all the 47 counties of Kenya.

## 2.5. Beef Marketing in Kenya

### 2.5.1 Overview

Beef marketing is both informal and formal where the informal supply from non-contracted farmers meet beef demand for 80-90% of local consumers while the rest of 10-20% (mainly prime consumers and markets) are supplied by formal contracted private ranches and farmers for a niche market (FAO, 2019; Thornton *et al.*, 2019).

The proportionate beef supply income is at 45% from both communal extensive and semi-intensive grazing systems (mixed crop farming), 54% from semi-intensive feedlots (both grazed and supplemented farming and 1% from 100% zero-grazing feedlots (FAO, 2019). Pastoral extensive production system accounts for 80–90% of the 45% supplied meat from communal proportion while extensive private ranches take up 60% of the formal market with semi-intensive and intensive systems taking up the remaining portion of the markets for formal proportion ( FAO, 2016; Benton *et al.*, 2021).

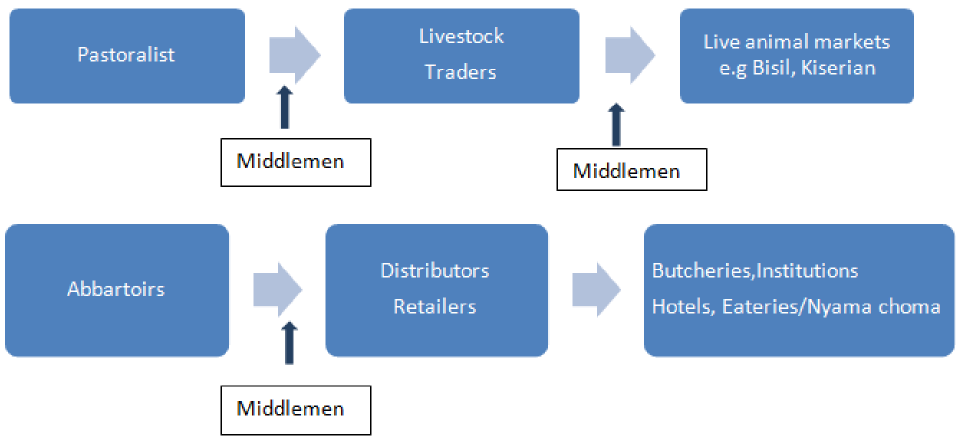


**Figure 2: Conceptualised Kenya's ASAL Pastoralist Beef Value Chain**

### 2.5.2 Primary and Secondary Beef Trading Markets

The main marketing channel for pastoral beef in Kenya is selling of live animals in designated live animal markets (Otieno *et al.*, 2012). These markets are known as the primary markets and through them, around 64% of the traded animals eventually find their way to abattoirs while the rest of the live animals become purchased in what is known as secondary markets whereby the purchased animals are bought to augment existing pastoral or feedlot herds (Otieno *et al.*, 2012; Jayne *et al.*, 2019). The trading is normally done by farmers, aggregators, middle men and abattoir owners. The producers usually transport their animals mainly by trekking them on foot to the primary markets where the bought animals are thereafter ferried through trucks to abattoirs for slaughter or to secondary, tertiary, and terminal markets in major urban centers (Katiku *et al.*, 2013; Jayne *et al.*, 2019). In Kajiado the live trading markets are in Bisil, Kiserian, Ngong and Namanga (Otieno *et al.*, 2012).

### 2.5.3 Beef Processing, Distribution, and Retailing Outlets

Purchased animals are slaughtered in abattoirs located in urban and semi-urban center slaughterhouses (Muhoro, 2014; Njoka *et al.*, 2016). Animal traders and middlemen deliver the animals to slaughterhouses where slaughtering is done at a fee per head (Muhoro, 2014; Njoka *et al.*, 2016). Based on demand and supply dynamics, owners of slaughtered animals and middlemen sell-off slaughtered beef to meat distributors, local butcheries, and eateries owners, for consumption in “Nyama Choma outlets”, supermarkets, institutions, restaurants, and hotels (Muhoro, 2014; Njoka *et al.*, 2016). There is an elaborate meat transportation regulation in Kenya based on the Meat Control Act, CAP 356 (Muhoro, 2014; Njoka *et al.*, 2016). However, there are still concerns in the handling of beef during processing, transport, distribution, and retailing in that although transportation mainly occurs in galvanized steel boxes carried by vehicles and motorbikes, handling of the same beef by personnel in slaughterhouses, butcheries, nyama choma joints, and eateries is yet to be through regulated standard operating procedures (Bergevoet and Van Engelen, 2014; Mutua *et al.*, 2017). It is worth noting that Kenyan meat consumers are increasingly making demands for high meat quality and safety standards, a trend likely to shift the value chain management practices and regulations towards improved beef handling standards (Muhoro, 2014; Njoka *et al.*, 2016).

## 2.6. The Needed Nexus for Driving Climate-Smart Beef Value Chain in Kenya

### 2.6.1 Climate-Smart Agriculture Objectives

Grassland-dependent beef production systems like those found in Kenya ASALs are mainly informal and practiced by rural poor (Njoka *et al.,* 2016). ASALs areas suffer from high environmental vulnerability and socio-economic marginality (Mwongera *et al.,* 2017). These rural poor livestock producers and beef value chain actors need cushioning from climate-related disasters (Bergevoet and Van Engelen, 2014; Thornton *et al.*, 2019). The frequent disasters of drought and floods experienced in Kenya affects the livelihoods of approximately 9 million poor livestock farmers living in ASAL areas and in turn affect the related value chains (García De Jalón *et al.*, 2014; Mbae *et al.*, 2020). The only sustainable solution to this scenario is making the beef production system and value chain climate-smart (Descheemaeker *et al.*, 2016).

The climate-smart agriculture seeks to achieve sustainable agriculture and livelihoods through three objectives namely; improved productivity, enhanced resilience, and reduced greenhouse gas emission (UNDP, 2015; Descheemaeker *et al.*, 2016; World Bank, 2018; FAO, 2019). Climate-smart beef value chain would sustainably protect the livelihoods of value chain actors while promoting environmental integrity (Mwongera *et al.,* 2019; World Bank, 2019).

### 2.6.2 Climate-Smart Beef Production System

Since Kenya's beef production is mostly done using rain-fed pastures in ASAL areas (Njoka *et al.,* 2016; Omollo *et al.,* 2018; World Bank, 2019), the systems can be made climate-smart through the use of CSA TIMPs that target to conserve soil, provide appropriately adapted breeds, introduce efficient feeds, better fodder and water management, energy efficiency, waste management and provide agro-weather advisories (FAO, 2019). Conserving soil degradation would entail TIMPs that preserve or prevent loss of biological or economic productivity of the same for enhanced yields and ecosystem services (UNCCD, 1994: Article 2). Simple TIMPs like paddocking pasture grasslands, rotational grazing, and ensuring correct stocking rates can prevent soil degradation (FAO 2017; FAO 2019).

Baling pastures such as hay and conserving some in form of in situ grass for use in drought seasons are some of the simple but practical TIMPs for fodder conservation in ASAL areas (Njoka *et al.*, 2016; Nkonya *et al.*, 2016). Breeding stock selection and targeted breeding TIMPs can ensure right and appropriate breeds suited for ASAL areas are kept by farmers (Njoka *et al.*, 2016; Nkonya *et al.*, 2016). Rain water harvesting through pans and earth dams TIMPs can be practiced to ensure water is preserved and conserved for beef production (FAO, 2019). Use of mobile-based agro weather advisory infrastructure can be utilized as TIMPs to provide resilience advisories to ensure farmers are well equipped with information for programs like livestock off-take during drought and flood disasters as well as restocking once the disasters have ended (Bobadoye *et al.*, 2016; Njoka *et al.*, 2016; World bank 2019).

### 2.6.3 Kajiado County Economic Activities and Livestock Production

Pastoralism and related economic activities in Kajiado consist mainly of cattle, sheep, and goats. Livestock trade and products such as milk, beef, and chevon, hides, and skins contribute to employment and is a major source of households' incomes in Kajiado. The size of the county and its proximity to Nairobi City makes it part of four counties identified as the Nairobi metropolis, this provides Kajiado with easy access to urban markets and business opportunities for the livestock, floriculture and horticulture value chains (Kajiado county CIPD 2018-2022). Other economic sectors include real estate development in major towns (Kitengela, Ngong, Ongata Rongai, Kiserian, and Isinya) and the extraction industry, leaving reduced pastoralist rangelands.

Pastoralism is a major source of livelihood among the rural community in Kajiado whereas crop farming and mixed farming are practiced on a small scale, mainly by women and for income diversification. Threats to County economic development have been identified within the current CIDP (County Integrated Development Plan of 2018-2022) as: (i) most of the land in the county is ASAL; (ii) dependency on livestock for household income; (iii) recurrent drought; (iv) erratic rains; (v) occurrence of floods; (vi) Human-wildlife conflict; (vii) high prevalence of pests and diseases affecting both livestock and crops; (viii) low capital base and high illiteracy level, all these creating severe challenges for beef production in the county.

### 2.6.4 Climate-Smart value chain

Frequently experienced weather-related disasters affect value chains through loss of investment and livelihoods (Kajiado County CIPD 2018-2022). Integration of climate-smart TIMPs by MSMEs with the beef value chain would ensure maximum yields and profitability for the actors while cushioning them from climate-related risks (Atela *et al.*, 2018). Such TIMPs could include trade pay-offs and incentives for the traders to embrace practices of only buying products from climate-sensitive production systems (UNEP, 2010). A holistic CSA trading would then push the producers and traders to engage in practices that encourage beef production that has embraced climate resilience infrastructure and processes all the way from pasture to plate (Mutembei *et al.*, 2015; Carabine and Simonet, 2017).

### 2.6.5 Climate-Smart Beef Transportation

Transportation of beef animals and their products in Kenya pastoral value chain is majorly by trekking and trucking of animals while for products is by use of small vehicles and motor bikes (Njoka *et al*., 2016; FAO, 2019). By so doing, there is emission of greenhouse gases as the animals move around through enteric waste as well as by vehicular exhaust (Rojas-Downing *et al*., 2017a; Cheung *et al*., 2018). Livestock and vehicular emissions could be addressed through the integration of CSA TIMPs for faster transportation of animals through appropriate animal welfare sensitive trucks and use of fuel-efficient vehicles for low GHG emissions (Gaughan and Cawdell-Smith, 2015; Grossi, *et al.*, 2019).

### 2.6.6 Climate-Smart Beef Processing

The slaughtering of beef animals is highly water-dependent while at the same time being a high greenhouse gas emission risk avenue (UNEP, 2010; FAO, 2018). Similarly, all other processing activities such as hide and skin tanning, meat roasting, cooking, disposal of by-products, and waste end up being avenues for GHG emissions (FAO, 2019). Greening of these processes via CSA TIMPs like water treatment and recycling, waste product digesters, and consumer-driven practices of purchasing only from climate-smart processors can help reduce greenhouse gas emission during processing (UNEP, 2010; FAO, 2019).

### 2.6.7 Climate-Smart Beef Consumption

The 21st century beef meat consumption revolution seeks to achieve a balance between sustainable production, processing, and transportation with a low carbon footprint (UNEP, 2010; FAO, 2019). The sustainability guiding principle for the long-term global meat value chain provides an array of value chain legal and institutional regulation frameworks that ensure environmental protection, social and economic development (FAO, 2018). Today there is increasing awareness to consume what leaves little or no carbon footprint to protect the environment (UNDP, 2015; FAO 2018). Practices such as rejection of non-climate sensitive produced meat and by-products by retailing outlets and consumers will drive producers, processors, and traders to adopt CSA TIMPs during production, processing, and transportation (FAO, 2018; FAO, 2019).

## 2.7 Enablers and Barriers of Climate Smart Integration by Micro, Small and Medium Enterprise Actors in Beef Value Chain

### 2.7.1 Enablers and Barriers

The core concepts which would drive the prediction of technologies, innovations and management practices (TIMPs) adoption are "perceived usefulness" and "perceived ease of use" of introduced TIMPs (Tang and Chen, 2011). Perceived usefulness is referred to as "the degree to which a person believes that using a particular TIMPs would enhance his or her job efficiency, yields, and profitability", while perceived ease of use is defined as "the degree to which a person believes that using a particular TIMPs would be free of effort" (Davis, 1989). Davis (1989) Technology Adoption Model (TAM) argues that actual technology usage is determined by an intention to use, which in turn, depends on attitude towards technology. Attitude, on the other hand, is jointly determined by perceived ease of use and perceived usefulness (Tang and Chen, 2011).

Additional factors that seem to have an impact on TIMPs acceptance by actors include individual differences, such as innovativeness (Kurulgan and Özata, 2010), concern for privacy and security (Flosi, 2008), and peer pressure (Salajan *et al.*, 2011). Through the extension of original TAM to TAM2 by Venkatesh and Davis (2000), additional constructs that span from social influence process (subjective norm, voluntariness, image) and cognitive instrumental processes (enterprise relevance, output quality, result demonstrability, perceived ease of use) were incorporated and considered to influence adoption prediction. Further extension of the model (TAM3) by Venkatesh and Bala (2008) brought in aspects of ease of TIMPs ability to be easily anchored and adjusted into contextual enterprises and new constructs for perceived ease of use of introduced TIMPs by actors.

Barriers to TIMPs adoption include diversity in actors' beliefs, actors' practices that are rooted in their beliefs, and that it is impossible to change and attitude towards the change associated with the integration of the TIMPs (Ertmer, 2005).

### 2.7.2 Actors' Knowledge, Attitude, and Practices

The ability to recognize changing contextual, theoretical, and contemporary issues that occur in one's enterprise is known as knowledge while the ability to accept or reject to respond to the occurring changes is referred to as attitude and the capability to act and effect occurring changes is termed as practices (Adelfio *et al.*, 2018; Xiao *et al.*, 2018). Knowledge about the climate-smart beef value chain, as being driven by global, national, and local context, is critical in understanding and transforming the sector. Moreover, awareness must be created for the actors for this to happen (Nabahungu and Visser, 2011). Actors seem to be alert to acquire sufficient knowledge on the causes and the potential solutions to combat issues affecting their livelihood enterprises to build up knowledge requisite for their survival (UNEP, 2010).

The sustainability of the beef value chain is highly dependent upon the knowledge, attitudes, and practices (KAP) of the actors on the same (Fielding and Hornsey, 2016). Several studies have shown that these attributes influence the behavior of the actors involved in the value chain in the way they interphase and interact with regulating institutions (J *et al.*, 2020). Such attributes are built through experience, formal training, peer-to-peer interactions, and social cues that end up influencing personal attitude (Dai *et al.*, 2018) and psychological factors that shape environmental identity and values (Fielding and Hornsey, 2016). In the beef value chain, for instance, actors would embrace CSA practices and skills by adapting strategies that ensure maximum benefits, i.e. yields and profitability (Ali *et al.*, 2014; Ericsson and Lindberg, 2018; Williamson *et al.*, 2010).

Innovation diffusion theory shows that ideas, behavior, and practices spread through social networks to influence actors through perceived benefits (Kim and Crowston, 2011; Pantano and Di Pietro, 2012). Utilitarianism theory, the right action is the action expected to produce the greatest good, hence this indicates that actors are willing to accept introduced TIMPs as long as the adoption has demonstrable benefits (good) to them. Such benefits could be improved social status, economic gains, self-confidence, and improved position in social networks (Savulescu *et al*., 2020).

Although numerous studies have been done on knowledge, attitude, and practices (KAPs) and how this affects the uptake of innovations in the last two decades, little has been studied on ASAL context and KAPs' effect in the adoption of CSA TIMPs by MSMEs in the beef value chain (Kgosikoma *et al.*, 2018; Waisman *et al*., 2019).

### 2.7.3 Legal and Institutional Frameworks

Governance and management are actions and decisions undertaken by the state, its agencies, local authorities, and actors to promote order and accountability in the utility of public goods/resources (UNEP, 2010). Every sector, including the beef value chain, has unique governance and management structures, albeit with some similarities. Environmental governance and management, on the other hand, is a concept of supreme consideration for regulating all human activities by advocating for political, social, and economic sustainability (UNEP, 2012).

Thus, in this context, beef value chain environmental governance and management refers to the processes of decision-making involved in the control and prudent use of the environment for production of beef and its effect on natural resources (J *et al*., 2020). Therefore, this governance would involve multi-level interactions (i.e., local, national, international/global) where all involved actors not only interact with one another but also legal and institutional frameworks (whether in formal or informal ways) to self-regulate their practices at all levels of the value chain based on laid down policies, regulations and industry best practices (UNEP, 2012).

Once mechanisms of actors' self-regulation are put in place through laws and policies, such actors then become bound by rules, procedures, and processes to respond to prevailing environment-related demands and inputs from the society thereby resulting in widely accepted behavior or characteristics for a climate-smart value chain that embraces environmental economic and social sustainability (J *et al*., 2020). Perceived benefits of such governance would among others be reduced actor conflicts over beef and its related production resources due to increasing global population; expected to reach 8.6 billion by 2030, 9.8 billion by 2050, and 11.2 billion by 2100 (UN Environment Annual Report 2017; Ishtiaq, 2019; Willy *et al*., 2019a), improved incomes, livelihood protection and reduction of GHGs ( FAO, 2018).

Developing a climate-resilient beef value chain through integration of sustainability frameworks such as CSA TIMPs requires the provision of an enabling environment for the adoption of the same by MSMEs through training, awareness creation, and actors' involvement in the formulation of climate-related and CSA based legal frameworks (Atela *et al.*, 2018). Failure to do this would lead to information asymmetry among actors and rejection of introduced CSA TIMPs (Kim and Crowston, 2011; Pantano and Di Pietro, 2012, FAO, 2016). Kenya is a signatory to several global and regional agreements and treaties that regulate the sustainability of consumption and production practices. Globally there is the 1992 Rio summit United Nations Framework Convention on Climate Change (UNFCCC) that aims to stabilize GHG emission through responsible consumption and production practices (Dowling, 2021). There is also the 1997 Kyoto Protocol that reinforced the UNFCCC by adopting legally binding emission reduction targets and timelines (ADB, 2020). Then came the 2015 Paris Agreement, which also within the UNFCCC framework called for respect and promotion of sustainable lifestyles through responsible consumption and production practices.

The Paris Agreement also sought to tame greenhouse gas emissions and stabilize the rising temperature of not beyond 2°C through sustainable production systems (Dowling, 2021). In

Augmenting the above agreement in 2015, Sustainable Development Goal (SDGs) were adopted and SDG 12 was passed on responsible consumption and production practices. Other SDGs supporting it include SDG 9 on industry, innovations, and infrastructure, SDG 13 on climate action, and SDG 11 on sustainable cities and communities (Dowling, 2021).

Regionally there is Africa's Agenda 2063 with guiding strategic intent and priorities on sustainable agriculture that committed within next 30 years to put in place a livestock value chain that consumes and produces from systems respecting socio-cultural values, animal welfare, sustainable utilization of natural resources, and climate-smart initiatives (FAO, 2016). To support the Africa 2063 agenda came the 2015-2030 Sendai Framework adopted by the African Union Commission for guiding actions for sustainable livestock value chains. In addition, the 2017 Africa Sustainable Livestock (ASL) 2050 initiative addresses existing and long-term effects of livestock production systems on the economy and people's livelihoods, public health, and the environment (FAO, 2017).

Nationally there is the Climate Change Policy of 2016 that supports the Climate Change Act, 2016 seeking to support production systems that enhance climate resilience and low carbon growth. The policy and the Act are protected by Article 2(6) of the Constitution of Kenya, 2010 that advocates for resilient and adaptive consumption and production systems by public and private entities. There is also the Kenya Micro and Small Enterprises Act of 2012 whose purpose is to promote, develop and regulate micro and small enterprises and the Public Health Act, Cap 242 that regulates meat slaughtering, handling, transportation, and consumption premises (Oloo and Oloo, 2010).

Kenya also has put in place strategies such as the Kenya Climate-Smart Agriculture Strategy 2017 – 2026 (KCSAS) that seek to have value chains adapt to climate change, build resilience and reduce GHG emissions. This is supported by the National Environmental Policy of 2013 that seeks to develop and implement integrated land use development plans in ASALs counties for guaranteed sustainable natural resource management. Other existing support instruments include Vision 2030, Big Four Agenda, and ASGTS 2019-2029 that seek to promote sustainable food production, Kenya Rangelands Management Plan, and Kenya Livestock Master Plan.

In terms of institutional frameworks, Kenya is a devolved government with three arms consisting of the Executive, Legislature, and Judiciary and both the national and county government levels. The executive is tasked through line ministries to provide policy direction and implement existing laws and policies while the legislature makes the laws and holds the other two arms accountable. The judiciary, on the other hand, exercises its judicial authority over public and private entities by interpreting the relevant written laws governing them.

To this effect, beef production and marketing is a devolved county function but the national government is involved in ensuring international treaties and agreements are adhered to and appropriate laws and policies are put in place to support sustainable production and consumption. The county governments through their line departments are tasked with the implementation of devolved functions by providing supportive extension services and development of local by-laws. In Kajiado there is an expectation to have beef value chain supportive instruments within the County Integrated Development Plan (CIDP).

In spite of the reviewed existing global, national, and local county legal and institutional frameworks little has been documented on the status of integration of CSA TIMPs by MSMEs actors of the beef value chain in ASAL counties through such frameworks (Tejada *et al.*, 2010; FAO 2018).

### 2.7.4 Contemporary Emerging Issues in Beef Production

The year 2020 came with the COVID-19 public health pandemic that caused a worldwide health crisis that disrupted economies. The crisis killed livelihood consumer markets, including those of beef production. As reported by Mercy Corps (2020), the production and marketing of beef in ASAL areas was literally brought to its knees due to the closure of retailing outlets like restaurants, outdoor eateries, and entertainment joints. The occurrence of such unforeseen pandemics and disasters serves not only to disrupt economies but also to drive unsustainable production systems.

## 2.8 Summary of Research Gaps

- Despite Kenya having key legal, policy, and institutional frameworks to regulate beef value chain practices, the level of integration of the same by MSMEs for climate-smart beef value chain is yet to be elucidated.
- Many factors may be affecting the integration of climate-smart TIMPs by MSMEs in the beef value chain including nonresponsive and or non-CSA context-based regulatory frameworks, absence, inadequate or disjointed extension services for the same, and failed sustainability values from actors.
- Actors' requisite skills of knowledge, attitude, and practices for sustainable integration of CSA TIMPs.
- Sustainable solutions for addressing the integration problem require a thorough understanding of enablers and barriers of the same among actors involved.
- The government of Kenya is encouraging scientists to research the topic to generate data that can inform policy on possible interventions for enhancing integration of CSA TIMPs by MSMEs actors in the beef value chain in ASAL counties like Kajiado.

## 2.9 Advanced Research Theoretical and Conceptual Frameworks

### 2.9.1 Theoretical framework

Integration of CSA TIMPs by MSMEs actors in value chains can be argued using four previously documented theories that include (i) Social Network Theory, (ii) Innovation Diffusion Theory, (iii) Technology Adoption Model Theory, and (iv) Transactional Theory.

All these theories put forward arguments that seek to understand and explain constructs for enablers and barriers of adoption and integration of CSA TIMPs.

### 2.9.2 Social network theory

Social network theory looks at actors as networked individuals existing within a given context such as a beef value chain and this theory explores the effect of their social relationships on the transmission of information, new technologies and practices such as CSA TIMPs, and the enabling attitudinal or behavioral change (Scott, 2004; Kim and Crowston, 2011; Pantano and Di Pietro, 2012; Liu *et al.*, 2017). It is also largely used in combination with innovation diffusion theory (Rogers, 1995; Zhang *et al.*, 2015).

Beef value chain actors operate within a closely networked ecosystem of complex relationships (Liu *et al.*, 2017) that could serve as either enablers or barriers to adoption/integration of CSA TIMPs (Kim and Crowston, 2011; Pantano and Di Pietro, 2012).

The advantaged position of an actor within the network, whether along with the core, extended, or enabling value chain, can determine the flow of information and value within the chain. Lead firms and actors within a value chain e.g., a commercial beef processor, with higher centrality, can influence the adoption and scaling of new practices such as CSA TIMPs, due to the power they hold within a value chain. They also play a key role in facilitating the adoption of new standards, technologies, innovations, behavior, and practices by other actors along the chain (Pantano and Di Pietro, 2012).

### 2.9.3 Innovation diffusion theory

This theory leverages social network theory in regards to the diffusion of a new idea, technology, behavior, or practice. The innovation diffusion theory states that the process of diffusion of an innovation is networked. As innovation moves through an interconnection of social relationships within an ecosystem, the rate and speed of adoption are determined by the structure of the social network and the value to be gained. In Rogers (1995), 'diffusion of innovations theory, he describes how innovations are implemented over time and define diffusion as, “the process by which innovations spread among the members of a particular social system or a common network over a period of time” in the case the beef value chain. Previous studies show that the uptake of technology is a complicated process, whether it is in regards to the implementation of a completely new technology or the modification, improvement, and adaptation of an already existing practice or technology to suit changing contexts, such as CSA TIMPs, beef production practices vis a vis a changing climate. Research goes on to point out that extrinsic features, for example, the characteristics of the technology (CSA TIMPs) and attributes of the external environment (pastoral beef production in socio-economic marginalized and environmentally vulnerable ASAL ecological zones) influence the decision-making processes of actors in adopting or integrating technologies (Meijer *et al*., 2015). An innovation can be an idea or concept, a method, technical information, a tool, or a practice that is perceived as new by the relevant individuals. According to numerous studies that attempt to understand and determine the application of new technologies, agricultural technologies have been influenced by the diffusion of innovations theory and it has also been applied in the improvement of farmer decision-making models in the tropics (Kuehne *et al*., 2017).

### 2.9.4 Technology adoption model (TAM)

TAM builds on the innovation diffusion theory by further categorizing actors into five groups of adopters based on their rate of adoption namely: innovators, early adopters, early majority, late majority, and laggards. There are other factors that affect this adoption process referred to as receiver variables, for instance, personality characteristics, social characteristics, and the perceived need for the innovation (Zhang *et al*., 2015).

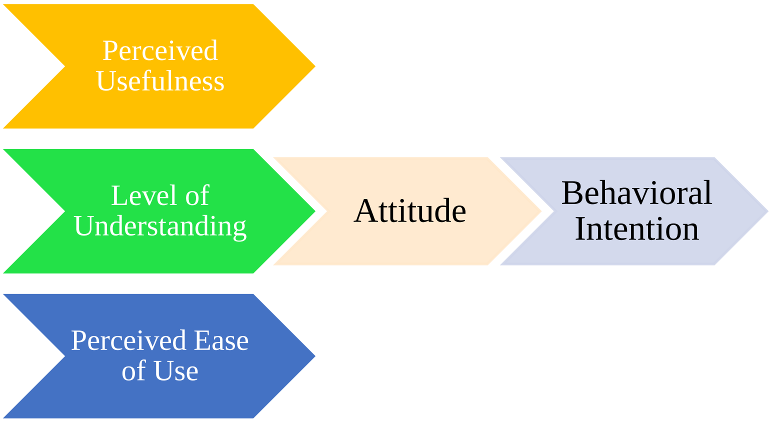


**Figure 3: Diffusion theory based on Davis' Technology Acceptance Model (TAM)**

The innovators are those who want to be the first to move with the technology and are always interested in novel ideas, more of risk-takers, ready and capable and there is just very little to be done for them to adopt a technology, practice, or concept (Zhang *et al*., 2015). The second group is early adopters who need a little convincing evidence. They represent opinion leaders and therefore enjoy leadership roles and embrace change opportunities (Smith *et al.*, 2018). Third, are the early majority, people who are not leaders but are capable of adopting new technologies and practices before the average person. They usually need to see some evidence that the practice or concept works and they will be willing to adopt, evidence of success stories may be the best strategies to be used in appealing to these categories (Zhang *et al*., 2015).

The late majority are the fourth group, they represent skeptical people, those who cannot take risks and can only risk adoption after a majority of people have tried it, then the last group called laggards, they are very conservative and bound by tradition, resist change, and tactics to persuade them include enforcement, prove of benefits of innovation, data, and influence from early adopters. Considering pastoral livestock where livestock is for prestige, this category is the group who may not be in a position to embrace climate-smart livestock practices unless they see evidence of CSA benefits, are enticed with incentives, and finally forced to comply through laws and regulations, (Zhang *et a*l., 2015; Smith *et al.*, 2018; Mukanyandwi *et al.*, 2019).

Additional factors that seem to have an impact on TIMPs acceptance by actors include individual differences, such as innovativeness (Kurulgan and Özata, 2010), concern for privacy and security (Flosi, 2008), and peer pressure (Salajan *et al.*, 2011). Through arguments by Venkatesh and Davis (2000), additional constructs like social influence process (subjective norm, voluntariness, and image) and cognitive instrumental processes (enterprise relevance, output quality, result demonstrability, perceived ease of use) influence adoption. In addition, Venkatesh and Bala (2008) brought in aspects of ease of TIMPs ability to be easily anchored and adjusted into value chain contextual aspects as new constructs for perceived ease of use by actors. Barriers to TIMPs adoption can result from diversity in actors' beliefs, and practices that are rooted in their beliefs that it is impossible to change and attitude towards the change associated with the integration of the TIMPs by actors (Ertmer, 2005).

### 2.9.5 Transactional Cost Theory

The Transaction theory (Williamson 1979, 1986) looks at actors or organizations as units within a complex ecosystem of interactions where units provide services and support to each other at a price and can influence value within a network reference. Actors within a network system are always seeking to make decisions that are economically advantageous to themselves by minimizing costs. Transaction theory is purely based on economic consideration, this theory also supports diffusion theory on perceived usefulness or benefit, that is, actors consider the value proposition of new technologies or practices, the cost and benefit analysis and if the benefit of adoption or economic value is less than the cost of adoption and benefits are not immediately imminent, the actors make a decision not to adopt new technologies, innovations or practices. Hence the introduction of a new technology such as CSA TIMPs has a likelihood of flopping or failing if its economic benefits do not exceed the cost of adoption and benefits are not quickly realized (Kim and Crowston, 2011).

As argued through these theories, the core concepts of predicted TIMPs integration by actors is based on “perceived usefulness”, “perceived benefits” and “perceived ease of use” of introduced TIMPs (Tang and Chen, 2011). Driving perceived usefulness translates into actors’ benefits such as enhanced efficiency, maximum yields, and profitability as well as personal beliefs that using introduced CSA TIMPs will ease mode of operation in a free of effort manner (Williamson 1979, 1986; Davis, 1989). Davis (1989) argued that actual technology usage is determined by an intention to use, which in turn, depends on attitude towards the technology. Attitude, on the other hand, is jointly determined by perceived ease of use and perceived usefulness or benefits (Tang and Chen, 2011).

### 2.9.6 Conceptual Framework

As shown in Figure 4, sustainable integration of CSA initiatives by MSMEs (dependent variable) is determined by factors such as actors requisite skills (actors knowledge, attitude and practices), and  enablers and barriers of integration (independent variables) as modulated by existing legal and institutional frameworks (laws, policies and institutions) (moderating variables). Enablers and barriers of integration include negative and/or positive prevailing political, social, economic, and environmental issues of the value chain (Weiss, 1995; Grantcraft, 2006; Funnell and Rogers, 2011).

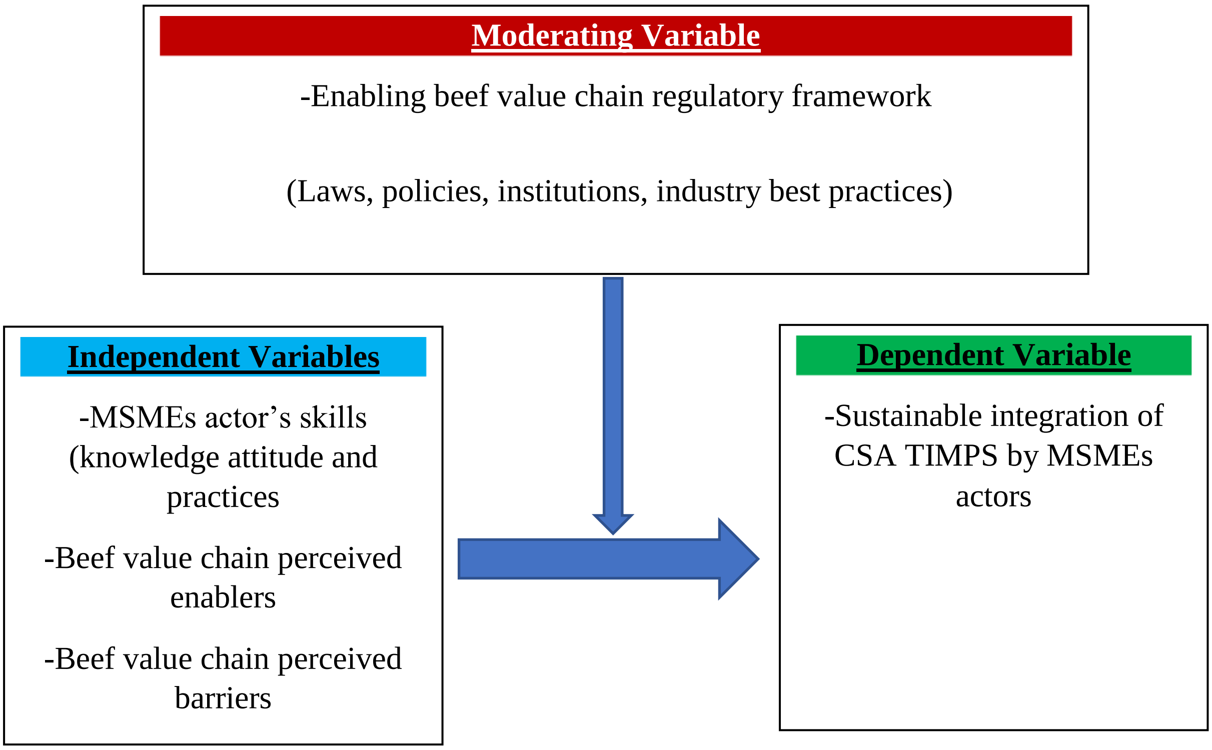


**Figure 4: Conceptualized framework for sustainable integration of CSA TIMPs by MSMEs actors in the beef value chain**

# CHAPTER THREE

## 3.0 General Materials and Methods

### 3.1 Study Area

Kajiado County which is approximately 21,900 $km^2$ has five sub-counties and a population of 1,117,840. The study was limited to three sub-counties (Kajiado North, Kajiado central. Kajiado East) with a population of 306,596, 161,862, and 210,473 respectively (Kenya Bureau of Statistics, 2019) and has 682,591 cattle (Kenya Bureau of Statistics, 2014) (Figure 5). The county has seven slaughterhouses that serve as red meat vending houses, and one cross-border cattle/meat trading center in Namanga.

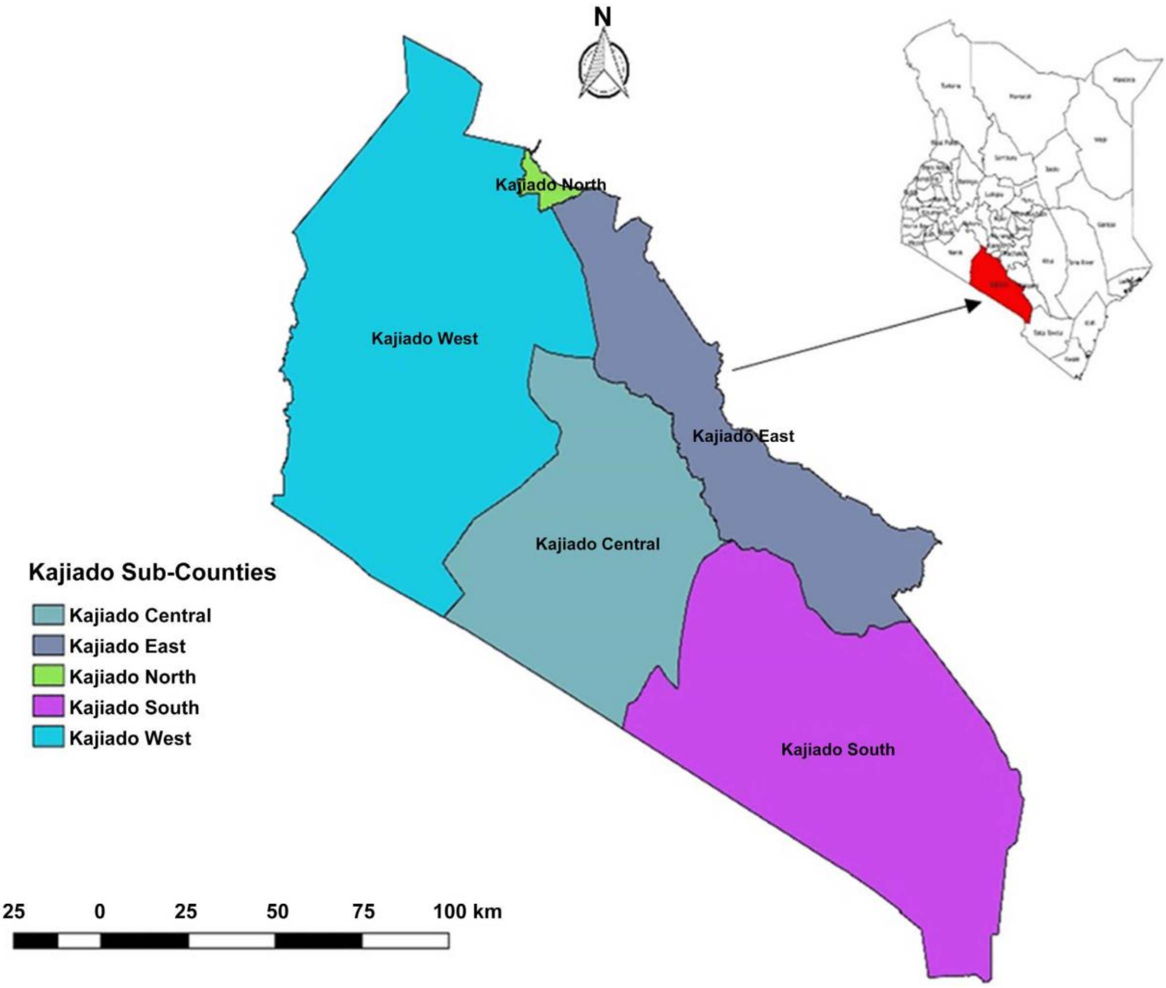


**Figure 5: Map of Kajiado County**

## 3.2 Research Design

A one (1) week reconnaissance study was done by visiting Kajiado county government offices where beef value chain discussions were held with the relevant officers. The officers shared their insights on the beef value chain, and the understanding of the sub-counties dynamics, and with their support mapping of the value chain actors was done (Katiku et al., 2013).

This study applied both cross-sectional research that involved looking at KAP data from beef value chain actor population at one specific point and correlational research where non-experimental research methods were used to study the relationship between the integration of MSME, adoption of CSA TIMPs, and environmental integrity variables with the help of statistical analysis (Mutembei *et al,*. 2015; Ishtiaq, 2019). Data for KAP was collected by applying the cross-sectional research study from beef value chain actors (farmers, traders, processors, and consumers). The correlational research study design was applied to collect data for enablers and barriers for integration of MSMEs and adoption of CSA in the value chain sustainability in relation to environmental integrity. Logit statistical model was utilized to test the effects of variables on integration (Mwongera *et al*., 2019a; Etwire *et al*., 2017a).

## 3.3 Sample size

Based on the Cochran formula which was later simplified and modified by Mugenda and Mugenda (2003) a sample size was determined. The Cochran formula ($N = Z^2$ p $q/e^2$) shows that when one has a population of more than 10,000 a minimum sample size of 384 was deemed as sufficient.

In this study the actors' total population of the three sampled sub-counties of Kajiado North, Central, and East, 678,931, exceeds 10,000 hence a sample size of 459, slightly more than the minimum of 384, was determined to cater for the various categories of actors in the core, enabling and extended beef value chain. The distribution of the actors across the value chain was based on the prevalence of the actors and value chain dynamics (Stein and Barron, 2017). Sampling numbers per dub-county were determined using proportionate distribution based on the percentage sub-county population to the Kajiado county population (Kajiado north; n=45%, Kajiado Central; n= 23%, and Kajiado East; n= 32%). Accordingly, the sampled number of actors were also proportionally allocated according to County statistics (Farmers; n=23%, Traders; n=45%, processors; n= 9% and consumers; n=23%). Six Key Informants were sampled. The total sampled actors were N=459 as indicated in the table below (Table 1).

**Table 1: Distribution of actors as per the percentages of the sub-counties' populations**

| | Kajiado north 45% | Kajiado Central 23% | Kajiado East 32% |
|---|---|---|---|
| Farmers -102 | 46 | 23 | 33 |
| Traders -203 | 91 | 47 | 65 |
| Processors-43 | 19 | 10 | 14 |
| Consumers -105 | 47 | 24 | 34 |
| Sub-totals | **203** | **104** | **146** |
| sub-counties totals | **453** | | |
| Key informants (KI) | 6 | | |
| TOTAL respondents | **459** | | |

## 3.4 Sampling Methodology

Data was collected along the drive route that stretches from Ngong to Namanga, individual farmers were sampled along Ngong to Namanga drive route, taking care of every fifth household along 10 sample points on the right and left side of the route, this route transverse all the three sub-counties and seven out of the eight major urban centers of Kajiado (Kajiado county CIPD 2018-2022).

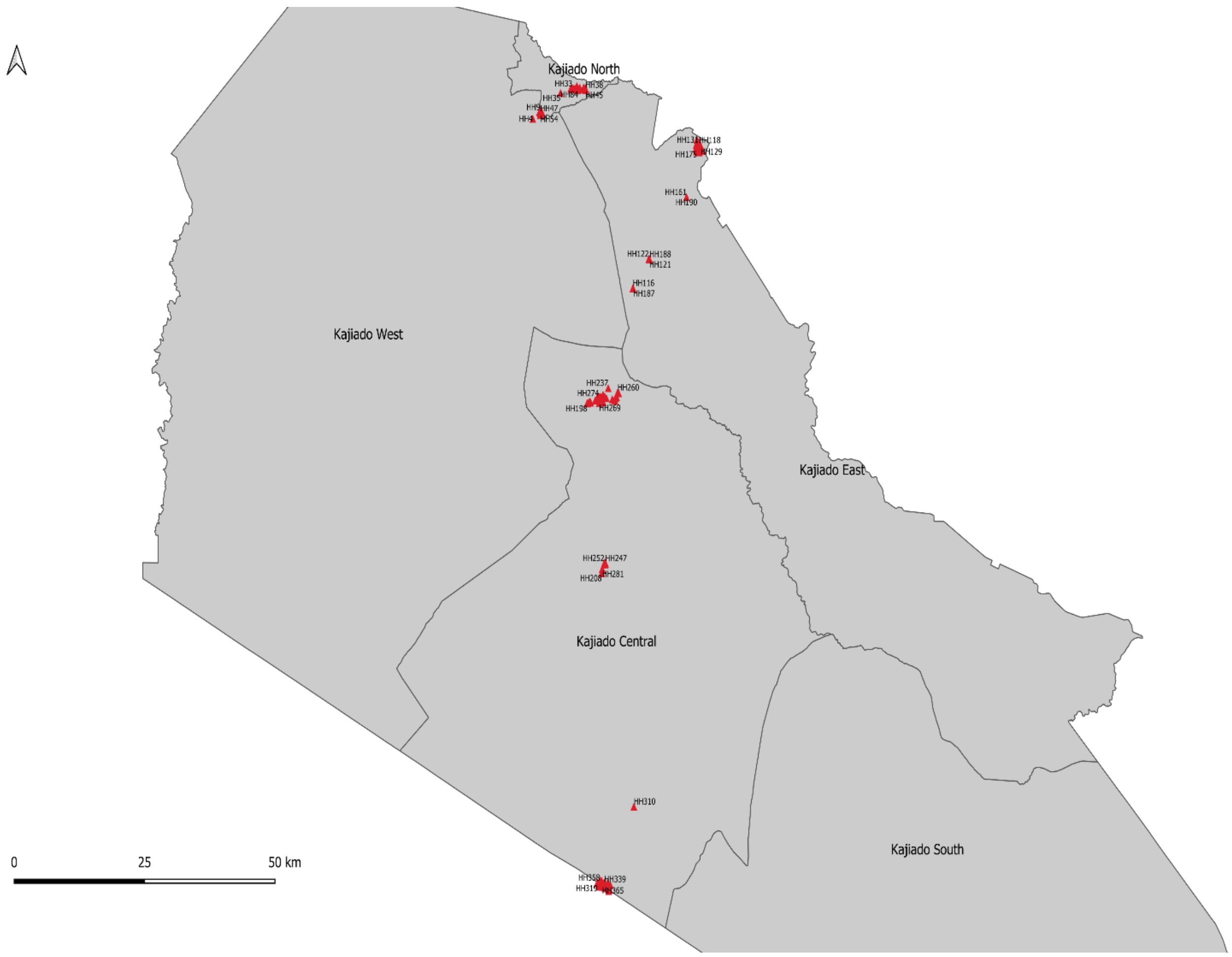


**Figure 6: ODK (Open Data Kit) sampling points in red (Source: GPS Application used in study data collection)**

Convenience non-random sampling method was applied to collect data from traders, processors, consumers, and Key Informants to circumvent the absence of a sampling frame (population statistics of these actors) as previously described (Etikan, 2017). The interviewed actors were traced in areas where they had conveniently located their trade and depending on the sub-county dynamics, i.e. mainly in major urban centers (slaughterhouses, urban centers/towns/shopping centers, and livestock market places). Along the sampling route, seven out of eight major urban centers of Kajiado (Namanga- Central, Isinya- East, Kajiado town- Central, Kiserian – North, Kitengela- East, Ngong- North, and Rongai- North) were covered. Key informants' interviews were found in their respective places of work and the following were sampled, County Agricultural officer, Environment officer, NEMA officer, livestock chief officer, Kenya Climate-Smart Project Coordinator, and UNEP officer (Katiku *et al*., 2013).

Key Informants were used to triangulate and also provide more information, especially on institutional and legal frameworks on enablers and barriers to CSA integration. Targeted desktop review of existing institutional and legal frameworks relevant to the value chain was also done.

## 3.5 Data Collection Methods

The study used a mixed-method approach that included field surveys, desktop literature review, and Key Informant (KIs) interviews. The data collection questionnaire was developed, pre-tested in Ngong town, because of its proximity to Nairobi and also being one of the largest urban centers in Kajiado, and the tool was modified accordingly. Data was collected using a survey questionnaire that contained semi-structured questions that sort to obtain information on KAP, enablers, and barriers for CSA TIMPs integration. Desktop review of secondary data and KII were also used to triangulate the data and collect additional data on institutional and legal frameworks for enablers and barriers for CSA TIMPs integration. The actors were also observed at their places of work.

## 3.6 Data Handling and Analysis

Data was collated into an Open Data Kit (ODK) and thereafter downloaded as an Excel sheet and reviewed and cleaned for consistency, accuracy, and completeness. The Excel data was then transposed to SPSS version 6 for analysis of descriptive statistics for quantitative data; mean, median, frequencies, skewness, percentages, and ranges, accordingly, from queried SPSS outputs. Outputs were appropriately presented using tabulations, graphics, and narratives. Statistical inferences were made using a 95% Confidence Interval. Systematic evaluation of qualitative data (content analysis) was applied to make valid inferences by interpreting and coding textual documents and qualitative data that became converted into quantitative data for descriptive statistical inferences. SPSS was used for statistical data. Logit model was utilized to test the effects of variables on integration and how they affected the adoption of TIMPs (Mwongera *et al*., 2019a; Etwire *et al*., 2017a)

# CHAPTER FOUR

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

(Mary W. Thongoh, HM. Mutembei, J. Mburu and B E. Kathambi. Asian Journal of Agricultural Extension, Economics & Sociology 39(4): 134-148, 2021; Article no. AJAEES 68508 ISSN: 2320-7027)

## 4.1 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 the integration of climate-smart initiatives into beef production and beyond into the entire value chain especially in ASALs where 80% of livestock production is found. Linking Climate-Smart Agriculture (CSA) to Micro Small and Medium Enterprises (MSMEs) within the livestock sector is imperative to producers' engagements within the beef value chain, reducing climate risks and increasing resilience. Sustainable integration of CSA technologies, innovations, and management practices (TIMPs) by MSMEs is determined by factors such as actors' requisite skills, KAP (knowledge, attitude, and practices). Studies have shown that KAPs influence the behaviour of the actors in the way they interphase and interact with regulating institutions. Although numerous studies have been done on knowledge, attitude, and practices (KAPs) and how this affects the uptake of innovations in the last two decades, little has been studied on ASAL context and KAPs' effect in the adoption of CSA TIMPs by MSMEs in the beef value chain.

Both cross-sectional research that involved looking at KAP data from beef value chain actor population at one specific point and correlational research where non-experimental research methods were used to study the relationship KAPs and integration of CSA TIMPs. Logit statistical model was utilized to test the effects of actors' characteristics on KAPs.

The study revealed that actors relate climate change to weather variability, extreme weather conditions, and drought, and CSA as a concept is not well understood. There is a general knowledge of climate change 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 a need to provide context-based CSA awareness and knowledge tailored to pastoral livestock production and ASALs value chains, strengthening of peer-to-peer learning and improving extension services to increase awareness, training to enhance awareness of climate change related concepts such as adaptation and mitigation and leveraging of social media technology to improve CSA awareness and value chain information.

**Key Words*:*** Adaptation; Climate-Smart Agriculture (CSA); Technology, Innovations, and Management Practices (TIMPs); Climate Change; Knowledge; Practices; Attitude; Mitigation; MSMEs.

## 4.2 Introduction

Beef 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% of anthropogenic greenhouse gas emissions (FAO, 2013). 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 landmass (Mureithi *et al.,* 2014; Wreford *et al.,* 2017 and MoA, 2018). Kajiado county of Kenya is part of these ASAL areas where there are untapped opportunities for integrating climate-smart practices within the beef value chain to achieve triple wins of improved productivity, enhanced resilience through adaptation, and mitigation by reduction of greenhouse gas emissions (MoA, 2018).

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 (Tánago *et al.,* 2016 and World Bank, 2019). Since beef production is key to the 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 (FAO, 2013; Stein and Barron, 2017). The value chain consists of a range of activities necessary to transform raw materials into products or services from farms (pasture) to consumers (plate), including all stakeholders that add value at each step (World Bank, 2017). The beef value chain in ASALs is composed of several actors of which the majority are MSMEs who play an important role in the whole value chain (FAO, 2013). MSMEs consist of businesses whose staff establishment range from 1-99 employees, they operate both formally and/or informally (MoA, 2018). Value chains can scale CSA objectives of boosting productivity, rural incomes, reducing poverty, improving food security, and addressing climate change challenges if well-integrated and efficient (World Bank, 2012; FAO, 2018; Manyise *et al.,* 2021).

CSA needs to be integrated into the production, marketing, and processing sectors of the livestock in order to achieve sustainability (Ogutu *et al.,* 2017; MoA, 2018). In order to mitigate against the 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 beef value chain actors need to be addressed (FAO, 2013; Grossi *et al.*, 2019; UN, 2019).

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 through -coordinated actions among different actors in the value chain towards climate-resilient pathways (FAO, 2013; Karami *et al.,* 2017). The beef value chain mainly consists 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 to the integration of climate-smart initiatives into MSMEs within the livestock value chain and factors such as knowledge, attitude and practices (KAPs) that affect this integration (FAO, 2013; Meijer *et al.,* 2015; Mwongera *et al.,* 2019). The sustainability of climate-smart initiatives is highly dependent upon the knowledge, attitudes, and practices of the actors on the same (Fielding and Hornsey, 2016). Studies have shown that these attributes influence the behaviour of the actors involved in such initiatives in the way they interphase and interact with governance and management practices (Raciti *et al.,* 2011). KAPs are built through experience, formal training, and social cues. Personal attitude and psychological factors such as environmental identity and values (Fielding and Hornsey, 2016) are also important. In the beef value chain, for instance, the actors would embrace climate-smart skills and practices that ensure maximum yields and profitability (Ali *et al.*, 2014; Ericsson and Lindberg, 2018; Williamson *et al.*, 2010).

This paper discusses the importance of understanding beef value chain actors' knowledge, attitude, and practices on climate-smart initiatives in order to integrate the same in managing their enterprises. Understanding and integrating CSA TIMPs into the value chain will lead to addressing climate change threats, resilience, and mitigation in the ASALs' beef production for sustainability (Chandler, 2018).

## 4.3 Theoretical and conceptual background

Three theories have been applied in this study, Social Network Theory, Technology Adoption Model and Institutional Theory. Social network theory looks at actors as networked individuals existing within a given context and this theory explores the effect of their social relationships on the transmission of information, new technologies and practices, and the enabling attitudinal or behavioral change (Scott, 2004; Liu *et al.,* 2017). It is also largely used in combination with innovation diffusion theory and Technology Adoption Model (TAM) (Rogers, 1995; Zhang *et al.,* 2015).

Previous authors have used social network and institutional theory to argue out a case of failed sustainability values in a society (Scott, 2004; Liu *et al.*, 2017). The institutional theory outlines 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 (Scott, 2004; Blankespoor *et al.*, 2010). 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 (UNFCCC, 2010). To effectively understand climate change in relation to beef production, awareness/education would be an essential element of the global response to climate change (Tasquier *et al.,* 2014). Climate change education helps individuals comprehend and address the impact of climate change. Furthermore, awareness and knowledge change attitudes and behavior and help actors adapt to the climate innovations and practices as a strategy in building resilience for sustainable futures (Oversby, 2015).

Figure. 7, shows that propagating sustainability values require building value chain actors' requisite capacity and skills (knowledge, attitude, and practices) and desire for meaningful behavior change. In this case, the farmer who rears the cattle, the trader and transporter who buys the cattle, the processor of the cattle into beef, the distributor and retailer, and the consumer of the beef. Such climate-smart behavior would then take a shape of sustained actor decisions and actions (the goals and practices of the transformed beef value chain), which would then become institutionalized to realize desired benefits, i.e. CSA triple wins of improved productivity and incomes, climate resilience, and reduction of GHGs emissions (Liu *et al.*, 2017).

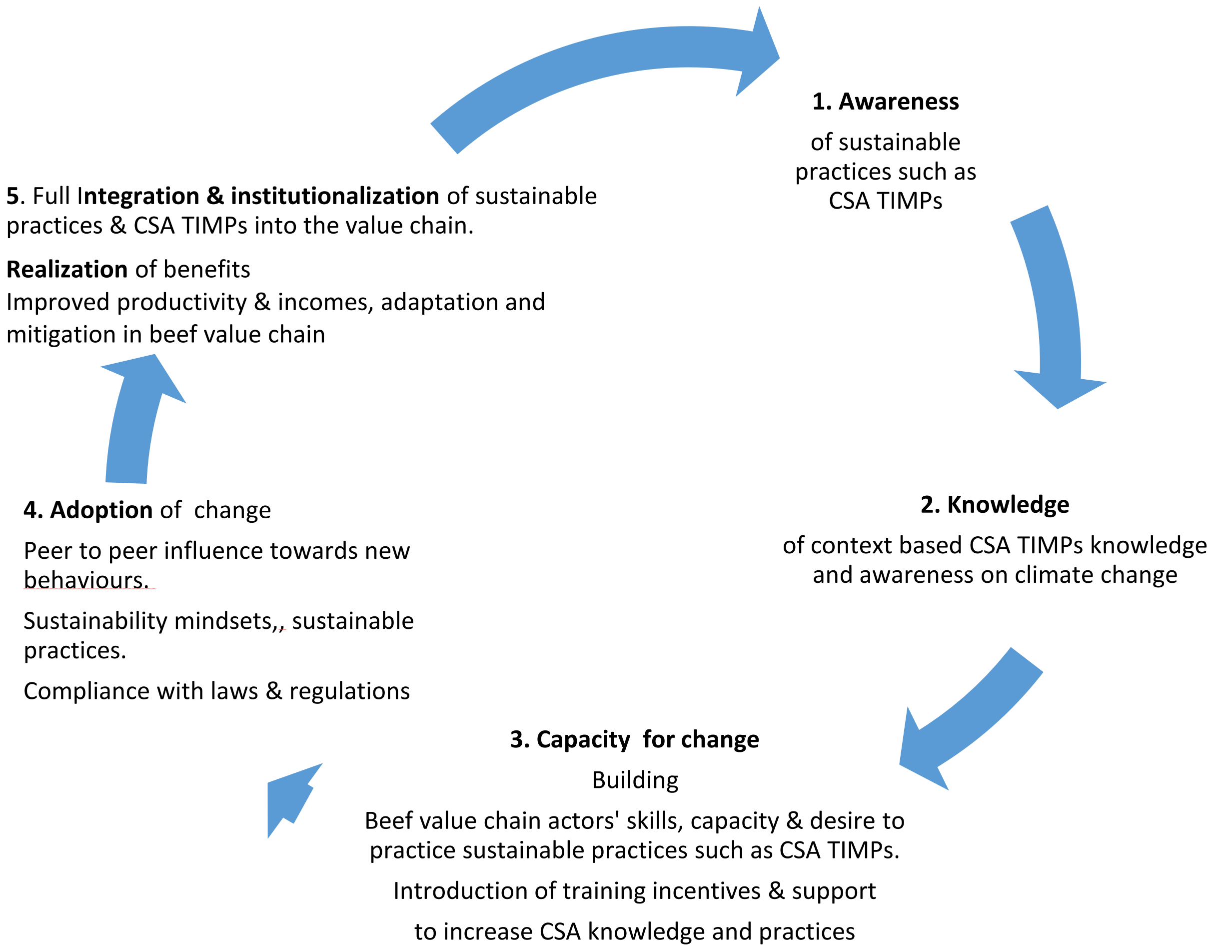


**Figure 7: AKCAIR Conceptual Model (Thongoh *et al.*, 2021)**

## 4.4 Research Methodology

### 4.4.1. Study Area

Kajiado County which is approximately 21,900 km$^2$ has five sub-counties and a population of 1,117,840. The study was limited to three sub-counties (Kajiado North, Kajiado central. Kajiado East) with a population of 306,596, 161,862, and 210,473 respectively (Kenya Bureau of Statistics, 2019). The county has seven slaughterhouses that serve as red meat vending houses, and one cross-border cattle/meat trading center in Namanga (Figure 8).

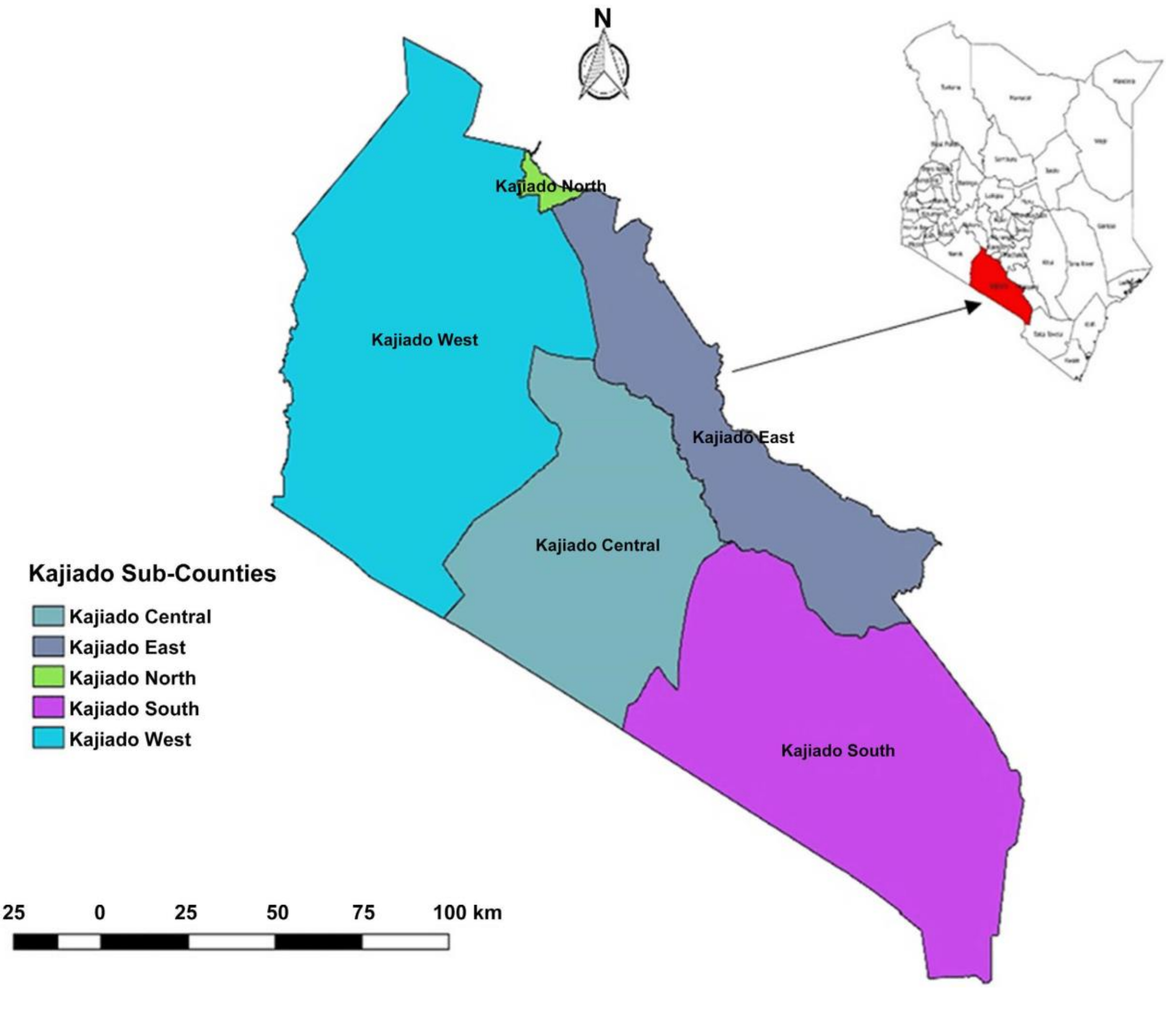


**Figure 8: Map of Kajiado County**

### 4.4.2 Research Design

This study applied both cross-sectional research that involved looking at KAP data from beef value chain actor population at one specific point and correlational research where non-experimental research methods were used to study the relationship between KAP, integration of MSMEs, and adoption of CSA TIMPs with the help of statistical analysis (Mutembei *et al,*. 2015; Ishtiaq, 2019). Data for KAP was collected by applying the cross-sectional research study from beef value chain actors (farmers, traders, marketers, processors, distributors, retailers, and consumers). The correlational research study design was applied to collect data on the integration of sustainability initiatives by MSMEs, adoption of CSA TIMPs, and value chain sustainability (Katiku *et al*., 2013).

### 4.4.3 Sample size

Based on the Cochran formula which was later simplified and modified by Mugenda and Mugenda (2003) a sample size was determined. The Cochran formula ($N = Z^2 p\ q/e^2$) shows that when one has a population of more than 10,000 a minimum sample size of 384 was deemed as sufficient.

In this study the actors' total population of the three sampled sub-counties of Kajiado North, Central, and East, 678,931, exceeds 10,000 hence a sample size of 459, slightly more than the minimum of 384, was determined to cater for the various categories of actors in the core, enabling and extended beef value chain. The distribution of the actors across the value chain was based on the prevalence of the actors and value chain dynamics (Stein and Barron, 2017). Sampling numbers per dub-county were determined using proportionate distribution based on the percentage sub-county population to the Kajiado county population (Kajiado north; n=45%, Kajiado Central; n= 23%, and Kajiado East; n= 32%). Accordingly, the sampled number of actors were also proportionally allocated according to County statistics (Farmers; n=23%, Traders; n=45%, processors; n= 9% and consumers; n=23%). Six Key Informants were sampled.

### 4.4.4 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, distributors/retailers, consumers, 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. 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). Logit model was utilized to understand how the actors' characteristics such as level of education, age, gender, etc. affected their knowledge, attitudes, and practices including their awareness of climate change and CSA related concepts (; Mwongera *et al*., 2019a; Etwire *et al*., 2017a).

## 4.5 Results and Discussions

### 4.5.1 Characteristics of beef value chain actors

The characteristics of the respondents are shown below (Table 2).

**Table 2: Characteristics of beef value chain actors**

| Variable | Frequency | Percent |
|---|---|---|
| **(i) Age of Respondents** | | |
| 18-25 Years | 94 | 20.5% |
| 26-35 Years | 205 | 44.7% |
| 36-45 Years | 95 | 20.7% |
| 46-55 Years | 42 | 9.2% |
| Above 55 Years | 23 | 5% |
| Total | 459 | 100 |
| **(ii) Size of Business*** | | |

| | | |
|---|---|---|
| Micro (1-9 ) | 295 | 80.8% |
| Small (10-49) | 29 | 7.9% |
| Medium (50-99) | 10 | 2.7% |
| None of the above | 31 | 8.6% |
| Total | 365 | 100 |
| **(iii) Age of Business** | | |
| 1-3 Years | 115 | 32.8% |
| 4-6 Years | 68 | 19.4% |
| 7-10 Years | 33 | 9.4% |
| 10 and above | 134 | 38.4% |
| Total | 350 | 100 |
| **(iv) Gender** | | |
| Male | 332 | 72.3% |
| Female | 127 | 27.7% |
| Total | 459 | 100 |
| **(v) Level of Education** | | |
| Primary Level of Education | 164 | 35.7% |
| Secondary Level of Education | 190 | 41.4% |
| University Level of Education | 100 | 21.8% |
| Post Graduate Education | 5 | 1.1% |
| Total | 459 | 100 |

* MSMEs classification is as per Kenya National Bureau of Statistics (KNBS)

As shown in table 2, beef value chain actors in Kajiado don't have significant formal education and economic support (P=0.04). Integration of CSA TIMPs by actors is dependent on such characteristics. From logit model analysis, characteristics such as gender and level of education were seen to affect the level of awareness, knowledge, and practices (Karami *et al.*, 2017).

### 4.5.2 Actors awareness on the beef value chain on Institutional Supportive Frameworks

The reported awareness level for various attributes are shown below (Table 3).

**Table 3: Actors' knowledge beef value chain**

| Parameter | Disagree % (Negative) | Agree % (Positive) |
|---|---|---|
| Being part of the value chain | 5.5±.4[a] | 88±4.4[b] |
| Market access facilitation | 16.7±.8[a] | 75.6±3.9[b] |
| Treating the value chain as livelihood | 16.4±.8[a] | 76.2±3.8[b] |
| Access to necessary value chain information | 17.9±.9[a] | 64.3±3.2[b] |
| Capacity building forums | 14.3±.7[a] | 71.6±3.6[b] |
| Existing legal support frameworks | 57.5±2.9[a] | 22.9±1.1[b] |

The evidence presented in the table above suggests actors were aware of the concept and importance of the beef value chain albeit having low awareness of the existence of legal supportive frameworks (22.9%). This was supported by the aggregate score of the Likert items in table 3 above which indicated an agreement level of 88% on value chain concept awareness. There was general disagreement amongst actors on the availability of institutional and legal support frameworks to participate in the beef value chain (22.9%), and on cross-tabulation, most of the actors who disagreed being distributors, consumers, and producers. Building awareness on such frameworks could fast-track integration by actors of CSA TIMPS in Kajiado and other ASAL counties (World Bank, 2012; Mwongera *et al.*, 2019). Value chain actors such as retailers in informal butcheries, eateries, kiosks, Nyama choma (meat roasting) joints, and distributors in processing points (slaughterhouses) could benefit a lot from such awareness creation (FAO, 2019; KALRO, 2017-2018).

### 4.5.3 Source of Actors' Knowledge

The perceived actors' rating on media, including mobile phone technology social media platforms, as a source of knowledge for the value chain is shown below (Fig. 8).

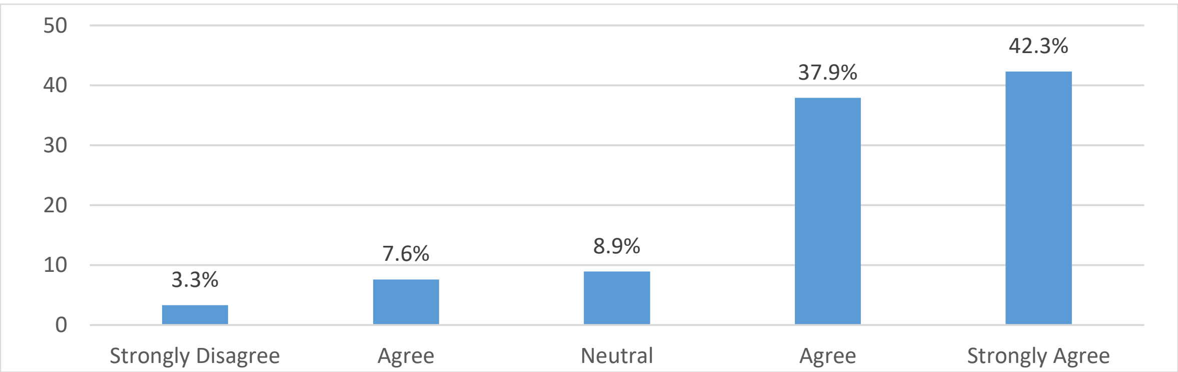


**Figure 9: Actors Perception on Media as a Source of Knowledge for the value chain**

There was significant agreement by actors that the media (both social, television, radio, and print) formed the avenues for information and awareness creation for MSMEs in the beef value chain (P= 0.031). This finding is in agreement with previously observed involvement of the media in actors' education on value chain practices (Mukanyandwi *et al*., 2018a; Mwongera *et al.*, 2019a). Previous studies show that sources of knowledge are critical in creating sustainability of value chains (Karamage *et al.*, 2016; Zhang, *et al.*, 2016; Mukanyandwi *et al*., 2018a; Woldemariam and Harka, 2020). The system of providing information to actors by media on sustainable value chain practices are avenues for creating networks of knowledge and sharing of good value chain practices such as CSA (Cioffo *et al*., 2016; Huggins, 2014; Mukanyandwi *et al*., 2018a). In pastoral communities with large mobile technology penetration, such as in Kajiado County, information dissemination on an issue pertinent to the beef value chain such as access to pasture, water, veterinary services, market, CSA and relevant incentives can be passed through mobile technology hence removing market information asymmetry, improving engagement with the value chain and building climate resilience and mitigation (Butt, 2015). The Government of Kenya and Kenya Agriculture and Livestock Research Organization (KALRO) are currently promoting the use of mobile phone technology as a medium of awareness and education for agriculture value chain actors (World Bank 2018; FAO, 2013) and a lot of effort is going towards agri-tech applications and mobile-based technologies to improve actors' engagement with value chains (ASGTS 2019-2029; Etwire *et al.*, 2017).

### 4.5.4 Actors Understanding of Climatic Change

The actors' understanding of climate change and its manifestation is shown below (Fig. 10).

Significantly, actors saw climate change as a weather index. Weather variability/uncertainty, extreme weather temperatures, and droughts were what the actors understood as climate change and or its manifestation (P=0.001). The actors' admission that climate change manifest as mainly negative weather effects which can have a harmful impact on the beef value chain is an important trigger point for integration of CSA TIMPS by the same actors and with far-reaching positive change on actors' knowledge, attitudes, and practices (Chigbu *et al*., 2017; Karamage *et al*., 2016; Nahayo *et al*., 2016).

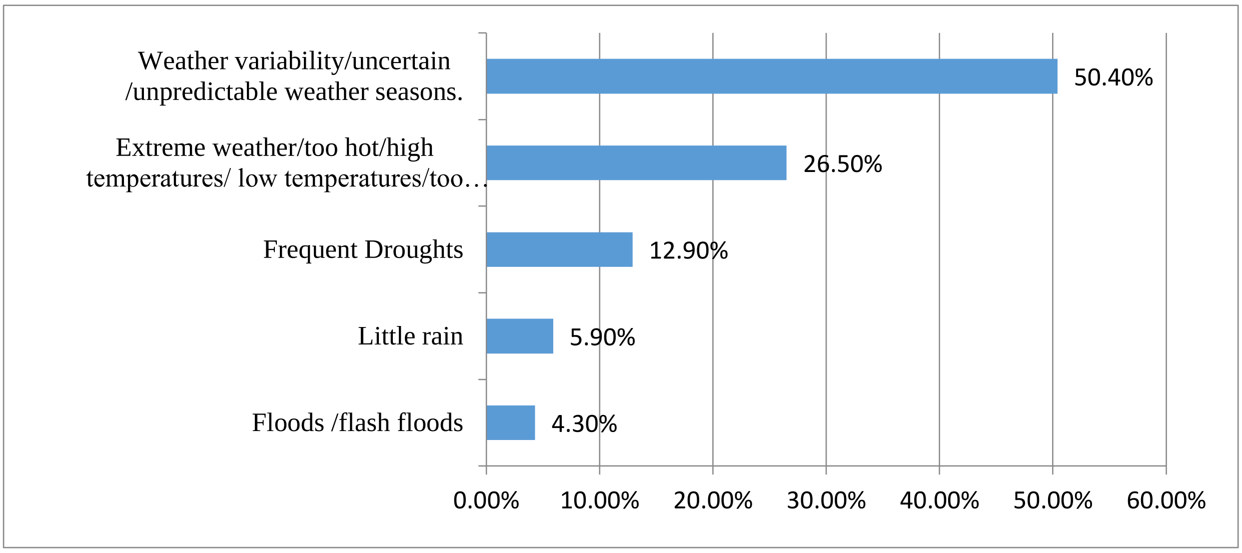


**Figure 10: Actors' Knowledge of Climate Change effects on Beef value chain**

This implies that integration of CSA TIMPs by MSMEs in Kajiado and other ASAL counties is feasible through perceived benefits of CSA in addressing negative climate effects from weather variability, such as irregularities, droughts and flooding, effects of climate change such as increased pest and diseases, loss of livestock to floods and drought, destruction of infrastructure by floods affecting transportation of animals and beef, the loss of beef shelf life due to increased temperatures; diminishing quality and quantity of forage and foliage (FAO, 2013; Huggins, 2014; Mwongera *et al.,* 2019; Zhang *et al*., 2015; Woldemariam and Harka, 2020).

### 4.5.5 Actors' awareness of various climate change-related Concepts in the Beef Value Chain

The actors' awareness of the various climate change-related concepts is shown below (Fig. 11).

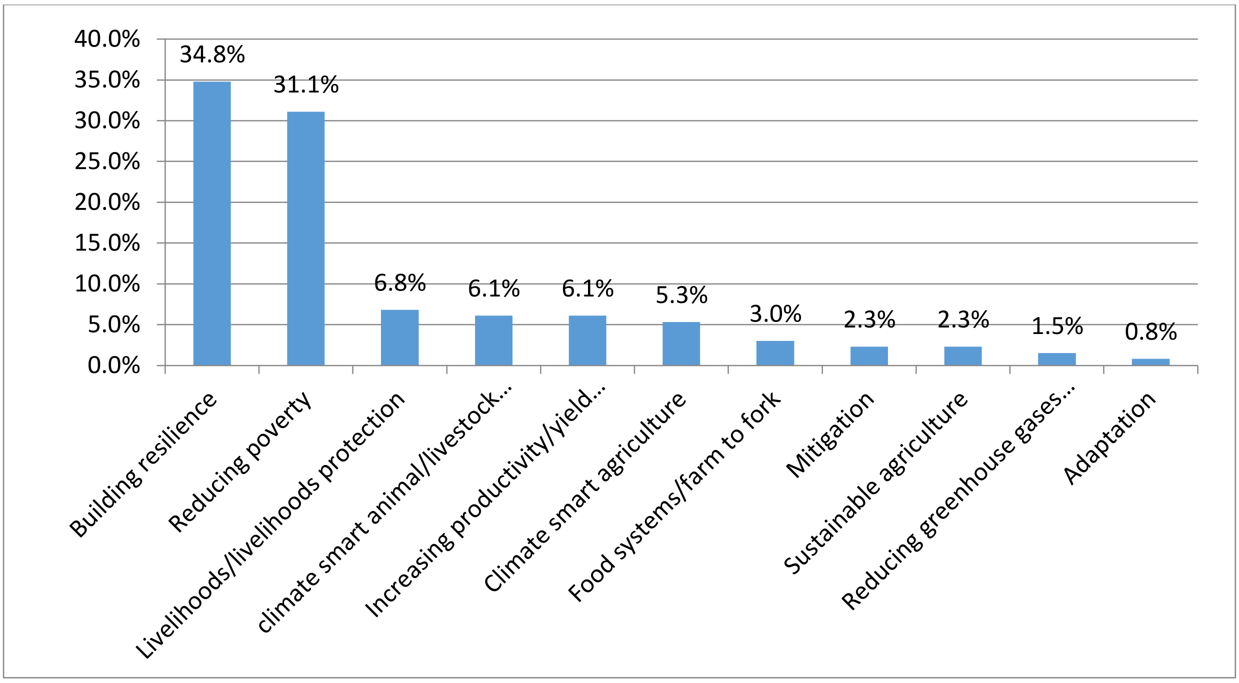


**Figure 11: Actors rating of Benefits of combating Climate Change in Beef Value chain**

Building resilience and reducing household poverty had significant awareness as climate change-related concepts in Kajiado ($P \leq 0.05$). However on key climate smart agriculture related objectives and concepts such as adaptation and mitigation the awareness was at worrying level of 0.8% and 2.3% respectively. Actors' awareness of climate change and related or similar concepts such as building resilience, reducing poverty and livelihood protection that had a relatively better level of awareness can be leveraged to improve knowledge on CSA and related concepts such as adaptation and mitigation to improve climate change management and knowledge (Cioffo *et al.*, 2016; Dawson *et al.*, 2016; Gwaleba and Masum, 2018). If actors can appreciate adaptation and mitigation as useful practices then according to innovation diffusion theory this awareness, perceived usefulness, or benefit, would influence the adoption of climate technologies such as CSA TIMPs (Kim and Crowston, 2011). Efforts that create positive perceptions of CSA through awareness would lead to better buy-in of CSA and CSA TIMPs (Ericsson and Lindberg, 2018; Mann and Berry, 2016; Nyenyezi Bisoka *et al.*, 2020).

### 4.5.6 Stakeholders' Attitude towards Beef Value Chain

The stakeholders' attitude towards the beef value chain is shown below (Table 4).

**Table 4: Actors' attitudes to Beef Value Chain**

| Parameter | Yes (%) | No (%) |
|---|---|---|
| Has a negative impact on the environment | 39.5±2[a] | 60.5±3[b] |
| Protects livelihoods | 71.1±3.6 | 28.9±1.4 |
| Is profitable | 16.7±.8[a] | 75.6±3.9[b] |

Actors had a positive attitude towards the beef value chain based on improved livelihoods and but were divided in regards to its impact on the environment. Some actors believed that the beef value chain has a negative impact on the environment (39.5%) while others (60.5%) believed their enterprises cannot have a negative impact on environment. Previous studies show that the activities in the beef value chain have both direct and indirect effects on the environment. Moreover, the beef production sector is an emitter of GHGs, and this includes carbon monoxide, methane, and nitrous oxide from cattle rearing and beef production (Grossi *et al.*, 2019). It is therefore of critical importance that actors integrate sustainable ways to ensure that production is maintained at an optimum level while the environment is safeguarded (Dekens and Daze, 2019; Carabine and Simonet, 2017; Thornton *et al.*, 2019).

The actors significantly felt that the beef value chain is not profitable to them ($P \leq 0.05$). This observation is surprising since the actors in their responses believed the beef value chain can help protect livelihoods (71.1%) which also agrees with table 3 on the value chain as a source of livelihood (76%), showing that there was a poor appreciation of the relationship of this two concepts of livelihood protection and profitability. On further interrogation of the actors, they viewed livelihood as their survival while profitability as riches, affluence, or money in the bank. Showing there is a need to improve knowledge and understanding of the link between climate change, cattle productivity or yields, food security, household incomes and livelihoods, and profitability, and eventual linking to the accrued benefits of investing in sustainable practices such as CSA. This require a paradigm shift towards a sustainable entrepreneurship mindset (FAO, 2016). This agrees with previous studies that shows producers and value chain actors require new practices and technologies should make economic sense before they can invest in them (FAO, 2013). To the actors, the linkage is not clear. The actors also did not effectively understand climate change in relation to the beef value chain profitability, implying that this awareness would be essential in responding to climate change risk in beef production (Tasquier *et al.*, 2014).

### 4.5.7 Producers Observed Integrated CSA related Practices in Beef Value Chain

The producers observed integrated CSA-related practices in the beef value chain are shown below (Table 5).

**Table 5: Producers Integrated CSA Practices**

| **Parameter** | **Practiced by (%)** |
|---|---|
| Livestock insurance/emergency fund | 12±.6[a] |
| Water harvesting | 12±.6[a] |
| Mixed farming | 11±.55[a] |
| Breeding and keeping of adaptive breeds | 11±.55[a] |
| Manure and composting | 10±.5[a] |
| Livestock diversification | 10±.5[a] |
| Conversion of manure into Biogas | 9±.45[a] |
| Use of agro-weather advisories | 9±.45[a] |
| Conservation of grasslands and fodder | 8±.4[a] |

Significant at Confidence Interval (CI) = 95%

A significantly low number of producers have integrated some form of CSA-related practices into their production system in Kajiado ($P \leq 0.05$), this is what is deemed as 'no regret options' in the adoption of new technologies and practices as advanced by (EbA), ecosystem based adaptation model (IUCN, 2014a). However the observed low, 'no regret option,' adoption ranging from 8% -12%, tallies with those of actors' low awareness on CSA (5.3%). On the other hand, based on the earlier observations of actors' knowledge of the negative effects of climate change on beef production, these may be their best bet efforts, in absence of other affordable and accessible climate risk management instruments/practices, towards climate risk management and mitigating the negative climate change effects of droughts and floods (Cioffo *et al.*, 2016; Mwanjalolo *et al.*, 2015; Carabine *et al.*, 2017; Gannon *et al.*, 2018; Godde *et al.*, 2019). Producers' training could help link the cause and effects and relationship between climate change, adoption of sustainable practices, adaptation, mitigation and CSA benefits in order to enhance CSA TIMPs integration (Byamugisha, 2014; Nyenyezi Bisoka *et al.*, 2020).

### 4.5.8 Actors perceived benefits for Integrating CSA Practices in Beef Value Chain

The actors' observed benefits for integrating CSA practices in the beef value chain are shown below (Fig. 12).

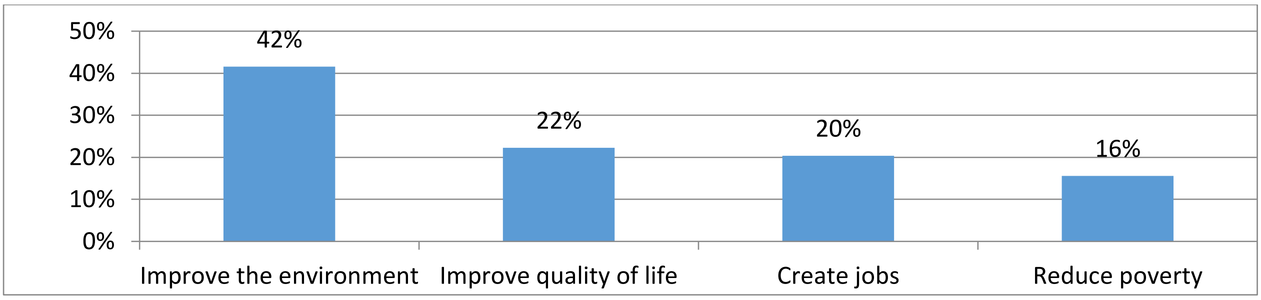


**Figure 12: Actors' Perceived benefits for Integration of CSA Practices in Beef Value Chain**

Environmental improvement is significantly mentioned as a perceived benefit of integration of CSA TIMPs in the beef value chain in Kajiado ($P \leq 0.05$). This observation is interesting because previous observation shows actors' awareness that climate change has a negative effect on beef production but some (60%) believed that the beef value chain does not have a negative impact on the environment. Perception of actors on new practices plays a critical role in solidifying the implementation of such practices as CSA TIMPs and as such knowledge gap analysis and tailoring responsive education is critical to improving adoption (Byamugisha, 2014; Cioffo *et al.*, 2016; Nyenyezi Bisoka *et al.*, 2020).

This points to the need to approach the beef value chain sustainability holistically, linking cause and effects, feedback loops, and actors practices (FAO; 2013). Actors are willing to embrace CSA TIMPs based on Technology Adoption Model (Davis, 1989; Scott and Mcguire, 2017; Dearing and Cox, 2018) and transaction theory, if CSA TIMPs are profitable to them. Additionally, actors need to create positive perceptions beyond monetary gains to enhance TIMPs buy-in (Ericsson and Lindberg, 2018; Mann and Berry, 2016; Nyenyezi Bisoka *et al*., 2020). This holistic approach towards a sustainable beef production system will lead to the actualization of full benefits i.e. economically, socially, and environmentally sustainable beef value chain while managing the tensions, trade-offs, and synergies between these three dimensions (FAO, 2016).

### 4.5.9 Actors (traders, processors, and consumers) observed integrated Practices

The actors (traders, processors, and consumers) expressed practices in the beef value chain are shown below (Fig. 13).

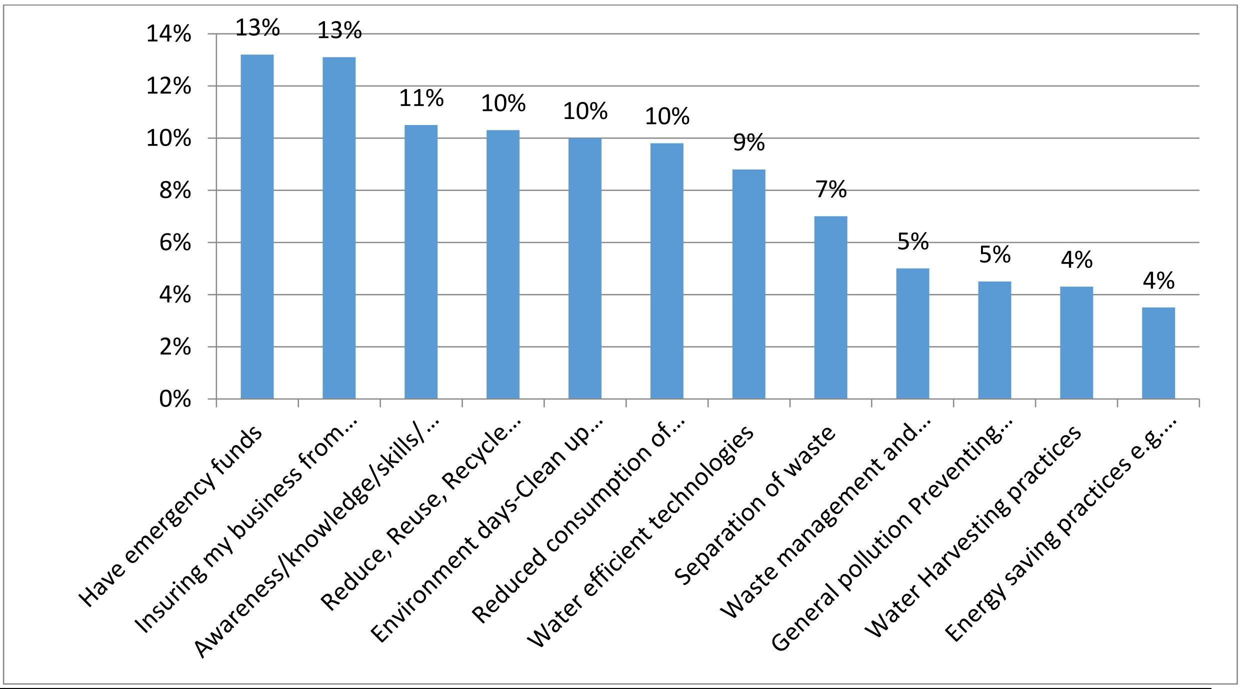


**Figure 13: Actors (traders, processors, and consumers) expressed for CSA Integrated practices**

### 4.5.10 Actors Waste Management Practices in Beef Value Chain

The actors' waste management practices in the beef value chain are shown below (Table 6).

**Table 6: Actors Expressed CSA Waste Management Practices in Beef Value Chain**

| Practice | Percent |
|---|---|
| Conversion of meat waste into meal | 75% |
| Conversion of dung into farm use manure | 22% |
| Selling off hide and skin waste for economic gain | 2% |
| Converting beef by-products (hooves, horns, bones, teeth) into ornaments | 2% |

Actors seem to be aware of CSA TIMPs for waste management albeit with more bias towards dealing with meat and dung waste. The observation points towards a higher actors driver based on their knowledge on waste management economic benefits but not effects on climate change (Cioffo *et al*., 2016; Mwanjalolo *et al.*, 2015).

## 4.6 Common Discussion of the Chapter Results

The beef value chain in ASALs is composed of several actors who play an important role in the whole value chain (FAO, 2013). The 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 (Ministry of Agriculture, Livestock, Irrigation and Fisheries, 2018). In assessing the characteristics of the value chain actors, most of them were youths (65.2%), and male, (72.3%) suggesting that the beef value chain is male-dominated. This is because beef keeping and trading are cultural and by gender roles mainly a male role among the pastoralists. Beef production requires an economic capacity of which women are at a disadvantage, especially in the ASALs pastoralist community (IFAD, 2018).

Knowledge, attitudes, and practices (KAPs) are also influenced by the characteristics of the value chain actors, which comprise of personal characteristics such as age, gender, or marital status among others. Socioeconomic characteristics such as education, income, or assets; personality characteristics such as independence or self-confidence; position in social networks; status characteristics such as control over economic resources and understanding of the technology also have an influence on the level of KAPs (Zhang *et al.*, 2015). Understanding how the social systems that include the level of education, age, and gender affect awareness and practices is critical in the application, adoption, and scaling of CSA TIMPs among the beef value chain actors (Kuwornu, 2013). Using the logit model, this study found that the three critical factors affecting the CSA knowledge level on the value chain concept were; the age of the business, gender, and level of education.

Most of the actors in the study were aware of the value chain concept and its contributions to their livelihoods. They were conscious that they interact with other actors, exchanging and getting value within the beef value chain and this was important to their livelihoods yet they did not see the beef value chain as profitable, in this case, they viewed profitability as affluence and money in the bank. Majority of the respondents were aware of 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 they were not aware of climate-smart agriculture (5.3%), mitigation (2.3%) and adaptation (0.8%) as climate change-related concepts (Mwongera *et al.,* 2019; Thornton *et al.,* 2018). The actors did not effectively understand climate change in relation to the beef value chain practices, implying that this awareness would be essential in responding to climate change risk in beef production (Tasquier *et al.,* 2014). 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 (FAO, 2013). Equally, knowledge of CSA in the livestock sector would be low because more emphasis has 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 sustainability (Tasquier *et al.,* 2014; UN, 2019; UNFCCC, 2010; Thornton *et al.*, 2019).

Awareness and knowledge can help the actors appreciate and address the impact of global warming on their activities and vice versa. Knowledge of all the aspects of the value chain is key in adopting CSA TIMPs (Mwongera *et al.*, 2017). The knowledge on the concept of the value chain, its value on livelihoods and climate change as a weather index, and its effects among the actors can act as an entry point to knowledge on key related concepts on CSA, adaptation, mitigation, and the role of CSA TIMPS on value chain sustainability. Furthermore, improving the actors' knowledge would encourage changes in attitudes and behavior and help actors adapt to the climate change management practices as a strategy in building resilience for sustainable futures (Oversby, 2015).

It's interesting to note that the actors believed the beef value chain was important to their livelihoods yet they did not believe the climate-smart beef value chain was profitable. Innovation diffusion, technology adoption model, and agency theories state 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 (Tang and Chen, 2011). Hence increasing awareness of climate change and CSA is not enough for CSA TIMPs adoption, education efforts must also sell the benefits of CSA knowledge, linking increased productivity, yields, incomes to profitability with and application to the beef value chain actors' livelihood sustainability. Further, the level of climate change awareness if linked to value chain productivity, livelihood protection benefits, and profits can be used to effectively engage the actors to adopt CSA TIMPS (UN, 2019). When actors appreciate how CSA TIMPS can mitigate the effects of climate change on their productivity incomes and profits, i.e. perceived benefits they will be willing to adopt (Zhang *et al*., 2015; Kuehne *et al*., 2017). Further, Creation of a climate-smart beef value chain will require innovative thinking and hence an entrepreneurial mentality. While entrepreneurship is looked at strictly in terms of profits, the sustainable entrepreneurship concept combines entrepreneurship and sustainability of the beef value chain. Actors' attitude on perceived benefits of CSA integration, in this case, profitability can be improved through moving them toward sustainable entrepreneurship, using the training that is based on well-discussed benefits of maximum yields, profitability, environment, social impact, and the effect on the long term sustainability of the value chain (Mwanjalolo *et al.*, 2015; Meijer *et al*., 2015; Cioffo *et al*., 2016; Scott and Mcguire, 2017; Dearing and Cox, 2018). However in terms of levels of adopters, for the late majority who remain skeptical and laggards who cannot take risks, are very conservative and bound by tradition, and resist CSA adoption, other tactics to persuade them would include proof of benefits of CSA, such as profitability and influence from early adopters whose enterprises may have realized benefits from CSA adoption (Zhang *et a*l., 2015). Considering pastoral livestock where livestock is for prestige, this category is the group who may not be in a position to invest in CSA TIMPs unless they see evidence of CSA benefit (more cattle and profits), are enticed with incentives, and finally forced to comply through laws and regulations, (Zhang *et a*l., 2015; Smith *et al.*, 2018; Mukanyandwi *et al*., 2019).

Collectively as a beef value chain it can be seen from the results that the actors had a fair appreciation of climate change-related concepts even though individually at the actor level there were noticeable gaps. The context, characteristics of the actors and their exposure, can determine various levels of attitude and knowledge of climate change effects and CSA TIMPs along the value chains and further affecting their understanding and adoption of climate adaptation and mitigation practices in the entire network of the value chain (Makate *et al.,* 2017; Mwongera *et al.,* 2017).

The beef value chain is a form of a social network that does not only exchange products, (goods and services) but also information and knowledge and due to their higher level of education and thus awareness, input suppliers, consumers, and end customers, who were found by the study to have secondary and tertiary education level, can be leveraged as key sources of information to other actors within the beef value chain. This means that the beef value chain actors can be leveraged to disseminate information, and share knowledge especially if knowledge exchange platforms are availed such as technology-enabled platforms e.g. social media groups, community-based organizations, and other opportunities provided by the market days where actors congregate to transact business (Mwongera *et al.,* 2019). 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-related concepts (Devaux *et al.,* 2018).

The choice of capacity building and communication media for MSMEs integration into climate-smart beef value chain plays an important role in determining effectiveness and efficiencies of capacity building efforts on KAPs (Mwongera *et al.*, 2017; Thorton *et al.*, 2019;) Different value chain actors have different preferences when it comes to the source of capacity building and information owning to the dynamics of engagement, education, language, cultural norms, affordability, etc. and their position in the value chain (Wreford *et al.*, 2017; Nyariki and Amwata, 2019). 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 with regard to investing and adoption of sustainable practices such as climate-smart technologies, innovation, and practices (Mwongera *et al.,* 2017; Wreford *et al.*, 2017; Nyariki and Amwata, 2019). And hence the need to contextualize capacity building approaches to the needs, nature, and characteristics of the actors/MSMEs, for example, not all can attend workshops or understand the language of instruction, or not all have radio, TV or mobile phone or can read leaflets or brochures (Etwire *et al.,* 2017). The varying levels of awareness among the MSMEs can be leveraged for peer-to-peer education, on related awareness and knowledge on CSA but there would be the need to create peer education collaboration avenues and platforms. Community-based organizations (CBOs) can expand their scope to include peer learning, exchange of information, and engagement beyond their main responsibilities of just managing the market days, levying market fees, and animal transportation logistics (Atela *et al.,* 2018; Carabine et al., 2018; Mwongera *et al.,* 2017).

To effectively transfer CSA knowledge and information there is a need to find innovative ways to tailor the CSA information and modes of transmission to the actors' level of literacy (Mwongera *et al.,* 2018). Availability of extension officers is also very critical to promoting adoption and innovation such as CSA TIMPs (Eskesen *et al.,* 2014) and will effectively complement sources such as media, social media, and workshop/training. Engagement platforms would also provide an opportunity for participatory learning and action (PLA). PLA would provide an avenue for beef value chain actors to analyze their own situation in relation to climate change, adaptation, and mitigation, and develop context-based solutions, CSA TIMPs that enhance the translation of learning into action. It would also help them clearly connect the dots and close the gaps between concepts such as livelihoods, mitigation, adaptation, and value chain profitability and sustainability (Atela *et al*., 2018; Carabine et al., 2018; Mwongera *et al.,* 2017).

The findings from some of the respondents that they believed the value chain affects the environment and are consequently willing to be involved in the protection of the environment can be a step towards building sustainability mindset among the actors and hence enabling climate-smart beef value chain through adoption of CSA TIMPs (Krishnan *et al.,* 2019; MoA, 2018).

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 the beef value chain in Kajiado is still very low and this can be related to the findings on low awareness of CSA among the actors. Even though actors were aware that climate change, which the actors understood as negative weather manifested as floods or droughts, can have harmful effects on the beef value chain (Grossi *et al.*, 2019) they had only adopted some no-regret options at maximum of 12% as climate change coping mechanisms (World Bank, 2017; Crick *et al.,* 2016; Gannon *et al.*, 2018). Beef being one of the high carbon footprint foods, points to the importance of addressing the beef value chain in ASALs which is predominantly pastoral and most affected by climate change yet a key contributor to land degradation through overstocking, grazing, and contributes to climate change through GHGs emissions (Grossi *et al.*, 2019; Carabine and Simonet, 2017; Bhatta *et al.*, 2013). Beef producers and MSMEs along the beef value chains and their households, experience direct and indirect impacts of negative climate change such as flooding and drought. The effects of negative climate change, such as floods and droughts, at both household and business levels compound and augment each other hence amplifying the climate risks to the MSMEs (Gannon *et al.,* 2018. The effects may include the death of cattle, damage to farms/rangelands, business assets, infrastructure that serves the value chains, especially roads hence disrupting transportation, production, and input supplies thus having a negative ripple effect on the entire value chain productivity, profitability and sustainability (Crick *et al*., 2018; Carabine *et al.,* 2018; Grossi *et al*., 2019)

On governance and management, there was a low understanding of the various legal and regulatory frameworks. If governance roles are played effectively they would promote the knowledge and awareness necessary for the adoption of CSA TIMPs thus creating a climate-resilient beef value chain. The Meat Control Act, Cap 356 provides for the regulations that govern the handling of meat to ensure food safety and hygiene, such practices would enhance the actors' skills in the provision of better services to beef consumers thus promoting value chain productivity (Oloo and Oloo, 2010). In addition to the Meat Control Act, the Public Health Act, Cap 242 creates rules regarding the inspection of animals intended for human consumption, slaughterhouses, shops, and other places where any article of food is manufactured, prepared, or kept and other requirements regarding the standards of food (Section 134 and 135). Jointly these two Acts would go a long way to promote a safe and sustainable beef value chain if well enforced. The handling of beef may have improved considerably over the last few years, however, the entire value chain is yet to meet the minimum standards of hygiene and public health. The unsanitary handling and consumption of beef has become a significant risk to human health in the recent past. There are also some customary practices of handling sick and dead animals that could also pose great health hazards (Mutua *et al.*, 2017).

## 4.7 Conclusion and Recommendations

### 4.7.1 Conclusion

The following three key conclusions can be made from this chapter:-

i) The evidence points to a poorly understood concept of Climate-Smart beef production and consumption by respondents due to a lack of adequate requisite skills (knowledge, attitude, and practices).

ii) Value chain actors were concerned about the impacts of climate change on the beef value chain and were willing to take part in CSA initiatives aimed at ensuring environmental protection.

iii) Actors were willing to adopt introduced CSA TIMPs as long as they perceived them to bring about economic gains such as maximum yields and profitability.

### 4.7.2 Recommendations

Based on the conclusions made, the following can be recommended:-

1) Reported low knowledge on CSA among beef value chain actors requires enhanced awareness creation on the CSA and related concepts such as adaptation and mitigation through context-based information and innovative channels of knowledge dissemination. And leveraging actors' existing knowledge on reducing poverty and building resilience, while demystifying the relevant legal and institutional frameworks to promote sustainability awareness hence compliance, strengthening extension services, creating engagement and knowledge exchange platforms for actors' participatory learning and action, and leveraging social media platforms on mobile phone technology.
2) Poor actors' attitudes and low integration of CSA practices in the beef value chain need a concerted effort from local government, researchers, and development actors to address them, linking the effects of climate change on the beef value chain and vice versa, while leveraging the actors' willingness to participate in actions that protect the environment.
3) CSA awareness and education efforts must go beyond popularizing the TIMPS to selling the benefits, especially linking increased productivity, yields, to incomes and profitability and ultimately to value chain long term sustainability.

# CHAPTER FIVE

## 5.0 Assessment of Enablers of Integration of Micro, Small, and Medium Enterprises into Climate Smart Beef Value Chain, Kajiado County

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## 5.1 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 beef production, and or the entire value chain, pasture to plate. Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in enhancing the ability of producers to engage with value chains, integrate women and marginalized groups, and innovate. They are key drivers of community resilience, social adaptation, poverty reduction, and protection of livelihoods due to their greater adaptability and flexibility yet they are most affected by climate change due to low adaptive capacities. Climate adaptation research, climate risk management, and interventions have largely ignored small businesses i.e. MSMEs, and have had little recognition of the potential opportunities in climate change management that can be found in involving MSMEs. In the light of the global 2030 agenda, (Sustainable Development Goals) SDG 12, sustainability of the beef value chain would only be assured through the integration of responsible production and consumption practices such as CSA technologies, innovations, and management practices (TIMPs) by the beef value chain MSMEs. Thus, establishing and analyzing the enablers to MSMEs' integration of CSA TIMPs is critical to a climate-smart beef value chain. Linking CSA to MSMEs within the beef value chain will strengthen the chain, improve incomes, reduce climate risks and increase resilience for pastoralists' communities in ASALs. The study applied cross-sectional research that involved looking at KAP data from actors at one specific point and correlational research where non-experimental research methods were used to study the relationship between characteristics of MSME actors, enablers for adoption of CSA TIMPs, and sustainability of the value chain, with the help of statistical models. Data for KAP and enablers was collected from value chain actors (N=459; farmers, traders/marketers/distributors, processors, and consumers).

This study revealed that there are inadequate enablers to support MSMEs towards a climate-smart beef value chain in ASALs. The chain is still informal, underdeveloped, and fragmented, with little application of modern technologies and practices, unsustainable, and predominantly still transhumance. Further, there is low MSMEs' integration of CSA initiatives due to limited capacity building, lack of incentives, and financial risk instruments to support the adoption of CSA technologies, innovation, and management practices (TIMPs). This leaves the value chain weak, inefficient, vulnerable to climate risks, and unsustainable. Enablers such as context-based CSA integration approaches that include awareness and knowledge, affordable context-based modern CSA TIMPs, infrastructural support, contextual policy instruments for MSMEs in ASALs beef value chain, market information, and financial incentives are important in realizing a climate-resilient beef value chain.

**Keywords**: Climate Change; Climate Risk; CSA and CSA TIMPs; Incentives; MSMEs integration; Value Chain.

## 5.2 Introduction

The role of micro, small, and medium-sized enterprises (MSMEs) in supporting climate risk management is starting to receive enormous attention (Kuruppu *et al.*, 2014; Dekens and Dazé, 2016). MSMEs consist of businesses whose staff establishments range from 1 to 99 employees (KNBS, 2020). MSMEs span over many sectors in the Kenyan economy, operating both formally and/or informally (GOK, 2012; KNBS, 2020). Kajiado is among the top five counties with the highest 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 are a major employer in Kajiado, absorbing at least 36 percent of the 2018 projected population (Kajiado, CIPD 2018- 2022).

Global beef production has been on a rapid expansion in the past decades while responding to a growing demand largely compelled by expanding populations and increasing incomes (Amole and Ayantunde, 2016). In Sub-Saharan Africa, the beef sector is a major contributor to food security. Kenya is a developing country with approximately 85% of the landmass being ASALs, with about 9 million poor livestock farmers that make up 28% of Kenya's rural population, (ILRI, Country Stocktake, 2019; KALRO, 2017-2018). Pastoral production makes up 80-90% of Kenya's beef market, with an estimated 80% of Kenya's livestock being found in the ASALs, and supports 38% of Kenya's population, (Thornton *et al.*, 2019). Population growth, increased urbanization, and a ballooning middle class is set to drive the demand for meat products, in Kenya, upwards (Thornton *et al.,* 2017; GOK, 2018; FAO, 2018).

The beef value chain starts with the primary producers of cattle, and ends with consumers, covering all stages from 'pasture to plate. The suppliers' inputs into beef production are animal health products including drugs and vaccines; feeds, nutritional supplements (conserved forages, concentrates, mineral and vitamins), pasture seeds, breeding animals (mostly males) and artificial insemination, fixed and mobile equipment, and tools and credit (Ogutu *et al.*, 2016; Njoka *et al*., 2017; Mwongera *et al*., 2019).

Kajiado County's beef value chain is primarily made up of cattle that are extensively reared on communally and private-owned rangelands (FAO, 2013; Alarcon *et al.*, 2017; Ministry of Agriculture, Livestock, 2018). 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 90% of beef production (Nyariki *et al.*,2019), 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 ecosystem already strained by climate change effects and land degradation (Carabine and Simonet, 2017; Bhatta *et al.*, 2013). The MSMEs within the value chain are all affected by the fluctuation in the supply of cattle due to climate effects on beef production (Mwongera *et al.*, 2017; Njoka *et al.*, 2016).

Cattle are trekked or trucked by road by producers, traders, and middlemen, along major livestock routes, from pastoral areas to primary and secondary markets such as Bisil and Kiserian, and thereafter to terminal markets in Nairobi (Alarcon, *et al.*, 2017). The animals are slaughtered in urban slaughterhouses and abattoirs 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, and institutions. 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 (Otieno *et al.*, 2012; Jayne *et al.*,2019).

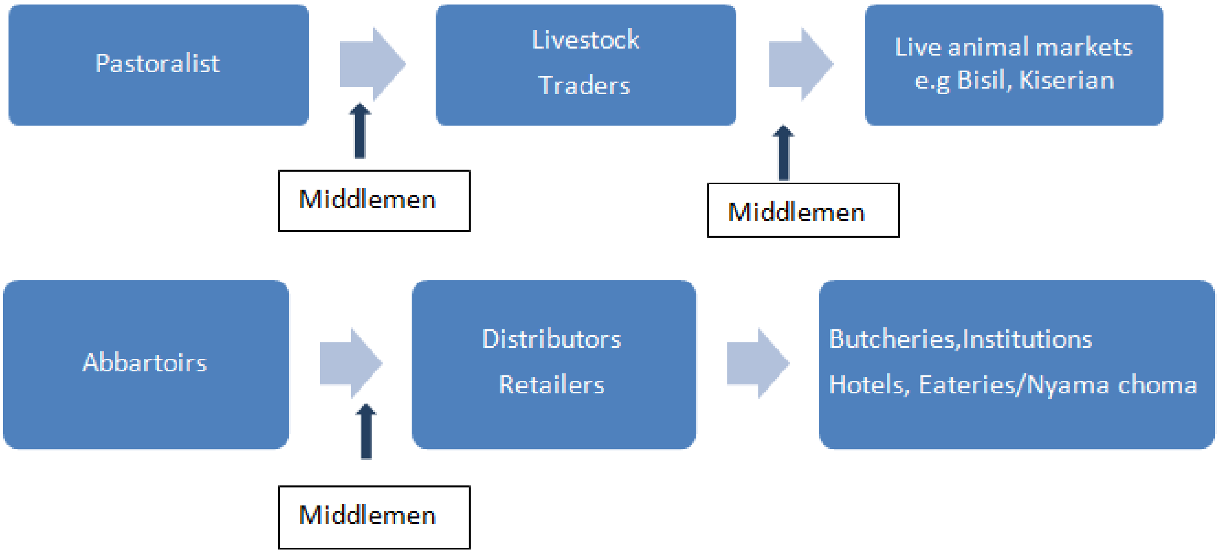


**Figure 14: Author's Extract of The Pastoralist Value Chains (Source: Author, 2021)**

## 5.3 Theoretical and Conceptual Framework

### 5.3.1 Theoretical Framework

The theory of change (TOC), (Weiss 1995; Grantcraft 2006), the concept of sustainability (Wals, 2007), and social network theory (Scott, 2004; Liu *et al.*, 2017) is useful in the integration of new approaches in a social network by identifying current gaps, and challenges and final desired end goal to be achieved. TOC steps involve identification of 'where we are' (current state, challenges, and barriers) and 'where we want to go' (future state or end goal), the backward mapping is done to identify steps needed to get from where we are to where we want to go, this also enables the identification of the context and preconditions necessary to motivate, enable and drive the change, i.e. enabling change conditions or enabling environment. These steps require evidence-based assessment of current conditions by use of research methods and clarification of assumptions. The outcome of evidence-based evaluation is followed by delineation of possible approaches and interventions to achieve the desired goal (Weiss, 1995; Grantcraft, 2006; Funnell and Rogers, 2011) in this case enablers for a climate-smart beef value chain.

Social network theory looks at actors as networked individuals existing within a given context and this theory explores the effect of their social relationships on the transmission of information, adoption of new technologies and practices, and the enabling attitudinal or behavioral change (Scott, 2004; Kim and Crowston, 2011; Pantano and Di Pietro, 2012; Liu *et al.*, 2017). It is also largely used in combination with innovation diffusion theory and technology adoption model that posit that adoption is determined by perceived ease of use and perceived benefits of new technologies, innovation, and practices (Rogers, 1995; Zhang *et al.*, 2015).

The sustainability concept that balances economic with social and environmental perspectives (WCED, 1987), is this study is applied to the perspectives on CSA integration by MSMEs to improve the value chain economically (productivity, incomes), socially (protect livelihoods, employment and poverty alleviation), and environmentally (reduction of land degradation, building climate resilience and reduction of greenhouse gases). A sustainable system requires an analysis of the social networks that make the food systems from 'pasture to plate' including all actors, support services, and an enabling environment. The holistic approach towards the sustainable beef sector and value chain required identification of environmental, social, economic, and governance challenges and assessment of context-based integration approaches for MSMEs and CSA TIMPs. These factors must be viewed in the light of ASALs unique challenges and pastoralist beef production for realistic actualization of the full benefits; i.e. economic, social, and environmental positive impact while managing tensions, trade-offs, and synergies between these three dimensions (FAO, 2013).

These concepts and theories have been employed in assessing the challenges and needed enabling environment for CSA integration by MSMEs and adoption of CSA TIMPs that would lead to the realization of a climate-smart beef value chain.

### 5.3.2 Conceptual Framework

The framework is based on the 3Cs Theoretical background (Table 7).

**Table 7: Application of the 3Cs in the beef value chain**

| **1st C- Challenges**<br>**(Current status)** | **2nd C- Change actions (enabling conditions) for integration** | **3rd C- CSA Benefit realization**<br>**(Desired outcome)** |
|---|---|---|
| **Environmental challenges.**<br>**Climate change**.<br>ASALs-Low rainfall, Diminishing Water and fodder supply, Overstocking, Land degradation/Soil erosion Livestock footprint,<br>Encroachment of marginal lands and wetlands.<br>**Social issues**<br>Ballooning population<br>Low development, High Poverty,<br>Food insecurity, Poor nutrition, Cultural beliefs, Gender, and youth marginalization<br>Low awareness of sustainability practices<br>**Economic issues**<br>Poor infrastructure, Poor Finance, and Market access, Few or no MSMES in the beef value chain, Low productivity, and profitability.<br>High-risk value chain (perception and factual) discouraging investors.<br>**Governance issues.**<br>Inefficient value chains.<br>High transaction costs, Policy gaps, Buyer-driven/Middlemen captive value chain**.**<br>Low institutional quality and weak regulations | **Enabling value chain actors**<br>Enablers- Enabling Political, Economic, and Social Environment.<br>Strong vertical linkages and Governance in the chain.<br>Access to markets and infrastructure.<br>Sustainable social enterprise/sustainable entrepreneurship Models and Financial Incentives<br><br>**Core value chain actors.**<br>Mainstreaming of context-based CSA technology, innovation, and management practices Addressing unique needs of MSMEs/actors in the ASALs beef value chain.<br>Awareness and knowledge of sustainability thinking and CSA among value chain actors.<br><br>**Extended value chain actors with specific**<br>Finance and Insurance services for MSMEs in ASALs beef value chain, Climate Financing; Climate risk instruments<br>Context-based CSA policy actions.<br>De-risking the value chain, | **Sustainable and climate-smart beef value chain.**<br>Sustainability of the beef value chain and Adaptive capacity of value chain actors.<br>Sustainable Climate-Smart practices<br>**Social impact**<br>Food security, Livelihood protections<br>Poverty alleviation.<br>Youth and gender mainstreaming<br>social norms, values, and beliefs that promote sustainability mindsets<br><br>**Economic impact**<br>High yield adaptive breeds<br>Effective, Efficient, and Profitable value chain,<br>Strong value chain linkages,<br>High productivity and profitability.<br>Job creation<br>ASALs Economic development,<br>Economic safety nets for value chain actors,<br>Low-risk value chain<br>**Environment impact.**<br>Reduced stocking,<br>ASALs adaptive and efficient breeds, |

| | | |
|---|---|---|
| | Early warning systems, and participation of CBOs, availability of networking platforms for actors to collaborate and self-organize. | Non-encroachment into marginal lands and wetlands,<br>Reduced land degradation,<br>Reduced GHGs emissions.<br>Reduced occurrence of drought and flooding. |

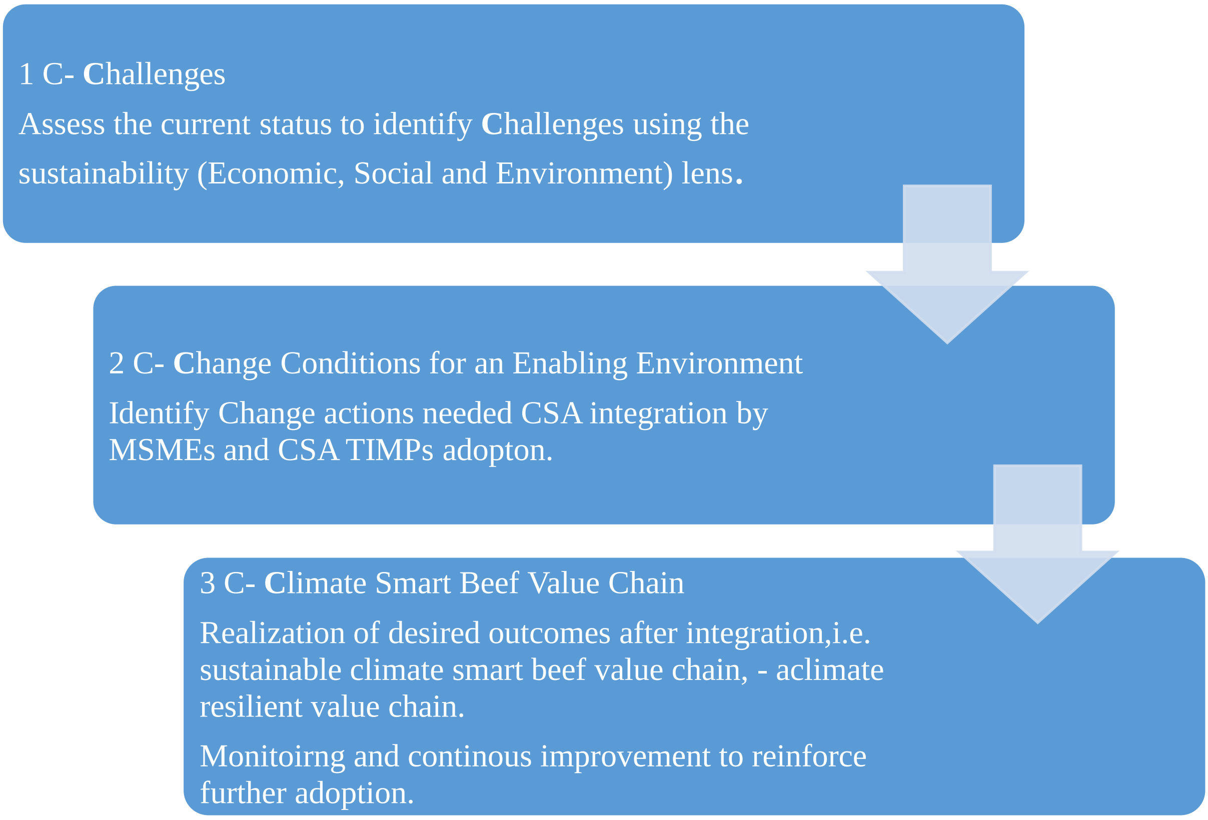


**Figure 15: Developed Conceptual Framework**

## 5.4 Materials and Methods

### 5.4.1. Study Area

Kajiado County which is approximately 21,900 km$^2$ has five sub-counties and a population of 1,117,840. The study was limited to three sub-counties (Kajiado North, Kajiado central. Kajiado East) with a population of 306,596, 161,862, and 210,473 respectively (Kenya Bureau of Statistics, 2019). The county has seven slaughterhouses that serve as red meat vending houses, and one cross-border cattle/meat trading center in Namanga (Figure 16).

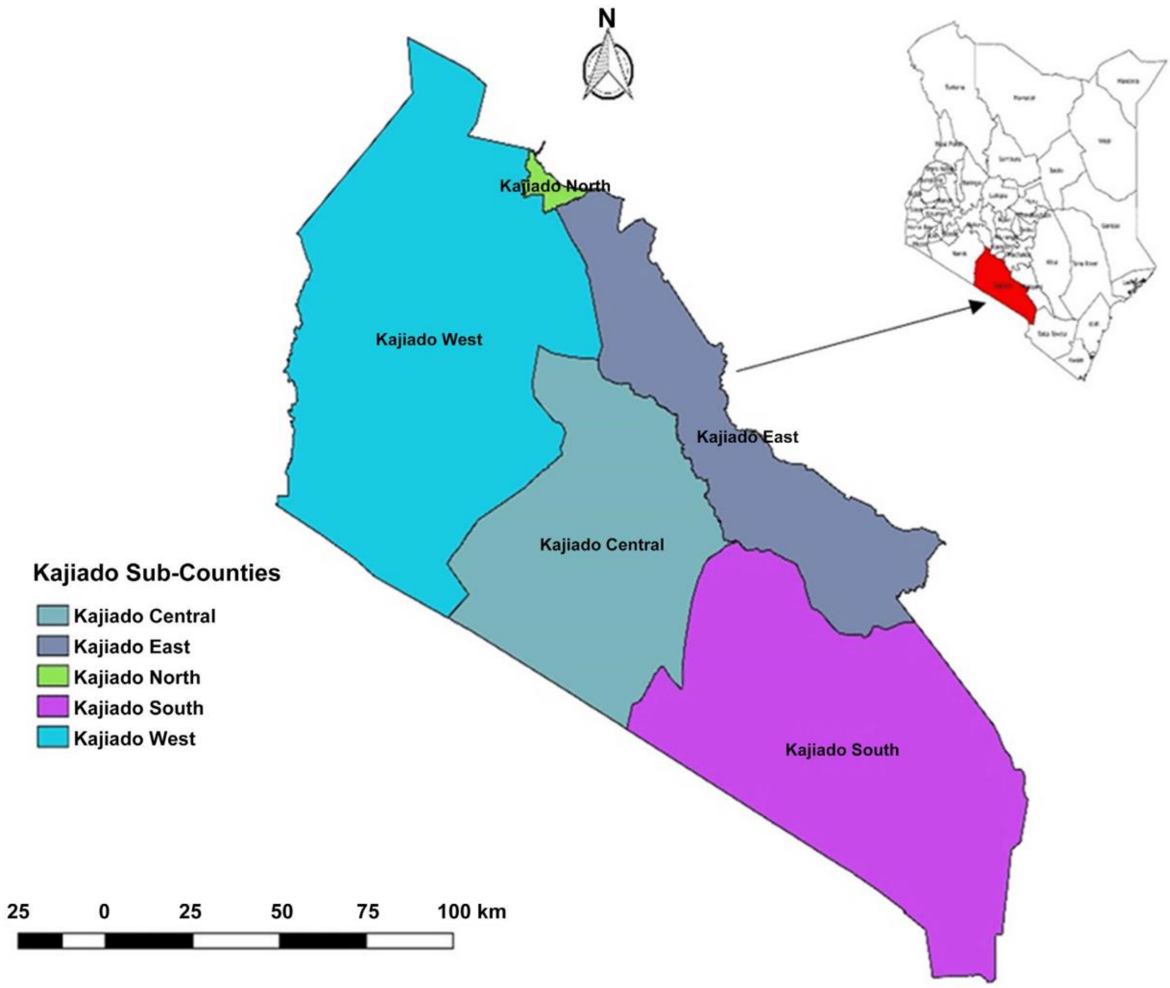


**Figure 16: Map of Kajiado County**

### 5.4.2 Research Design

This study applied both cross-sectional research that involved looking at KAP data from beef value chain actor population at one specific point and correlational research where non-experimental research methods were used to study the relationship between the integration of MSME, adoption of CSA TIMPs, and environmental integrity variables with the help of statistical analysis (Mutembei *et al,.* 2015; Ishtiaq, 2019). Data for KAP was collected by applying the cross-sectional research study from beef value chain actors (farmers, traders, processors, and consumers). The correlational research study design was applied to collect data for enablers and barriers for integration of MSMEs and adoption of CSA in the value chain sustainability in relation to environmental integrity (Katiku *et al*., 2013).

### 5.4.3 Sample size

Based on the Cochran formula which was later simplified and modified by Mugenda and Mugenda (2003) a sample size was determined. The Cochran formula ($N = Z^2\ p\ q/e^2$) shows that when one has a population of more than 10,000 a minimum sample size of 384 was deemed as sufficient.

In this study, the actors' total population of the three sampled sub-counties of Kajiado North, Central, and East, 678,931, exceeds 10,000 hence a sample size of 459, slightly more than the minimum of 384, was determined to cater for the various categories of actors in the core, enabling and extended beef value chain. The distribution of the actors across the value chain was based on the prevalence of the actors and value chain dynamics (Stein and Barron, 2017). Sampling numbers per dub-county were determined using proportionate distribution based on the percentage sub-county population to the Kajiado county population (Kajiado north; n=45%, Kajiado Central; n= 23%, and Kajiado East; n= 32%). Accordingly, the sampled number of actors were also proportionally allocated according to County statistics (Farmers; n=23%, Traders; n=45%, processors; n= 9% and consumers; n=23%). Six Key Informants were sampled.

### 5.4.4 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, and distributors/retailers, consumers, 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. 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, $P \leq 0.05$, (Katiku *et al*., 2013). Logit statistical model was utilized to test the effects of variables on integration (Mwongera *et al*., 2019a; Etwire *et al*., 2017a)

## 5.5 Results and Discussion

### 5.5.1 Governance and Management frameworks for Enabling Actors' Knowledge, Attitudes and Practices (KAP) for CSA Integration

Various existing frameworks were observed that seek to enable KAP of beef value chain actors in Kajiado (Table 8).

**Table 8: Frameworks for enabling KAPs of Actors in the Beef value chain.**

| Frameworks | Aspects of Integration |
|---|---|
| Capacity building | Enhanced knowledge, attitude, and practices skills |
| Offering extension services | Built practical skills for TIMPs introduced |
| Providing incentives | Facilitated adoption of integration of TIMPs |
| Putting in place policies and regulations | Improved governance and management of the value chain |

The presented evidence indicated the presence of institutional frameworks that can be leveraged for the integration of CSA TIMPs by MSMEs in the beef value chain in Kajiado. Even though these frameworks were envisioned before the introduction of CSA, they can act as levers in tandem with existing climate frameworks to drive environmental and sustainability-conscious needs to enable CSATIMPs in the beef value chain. Such frameworks may be available at the level of government reports (Lamek *et al*., 2016) but unfortunately, albeit poor ground implementation actions (Mukanyandwi *et al*., 2018b; Nyenyezi Bisoka *et al*., 2020). If existing frameworks are well implemented, integration of CSA TIMPs could be a success story of how institutions could play a major role in enhanced CSA integration through tasked institutions (Mukanyandwi *et al*., 2018b; Nyenyezi Bisoka *et al*., 2020).

The available frameworks could be a response to fulfill national requirements for implementation; Constitution of Kenya 2010, Vision 2030, Big Four Agenda, and Agriculture Sector Transformation and Growth Strategy (ASGTS 2019-2029) through the Kenya Climate Smart Agriculture Strategy and Implementation Framework (KCSAS, 2017).

### 5.5.2 Legal and Institutional Governance frameworks as Levers for Integration of CSA in the Beef Value Chain

Various legal and institutional frameworks that can be leveraged in the integration of CSA in the beef value chain are documented below (Table 9).

**Table 9: Legal Value Chain Governance Instruments**

| Legal instrument/institution | Regulated aspect/mandate |
|---|---|
| 2010 Kenyan Constitution (Article 43) | Responsible consumption and production systems |
| Micro and Small Enterprises Act of 2012 | Responsible MSMEs actors and markets |
| Meat Control Act (edited in 2012) Cap 356 | Responsible meat production |
| Public Health Act (edited in 2012) Cap 242 | Responsible meat processing and consumption hygiene practices |
| Vision 2030 Medium Term Plan III | Sustainable livestock production systems and marketing |
| Big Four Agenda | Sustainable production and consumption of beef by Kenyans |
| Agriculture Sector Transformation and growth strategy (ASGTS 2019-2029) | Sector transformation system for enhanced resilience and protection of the environment |
| Kenyan Climate Smart Agriculture Strategy and Implementation Framework | Sustainable consumption and production of beef |
| Kajiado County Integrated Development | |

| | |
|---|---|
| Plan (CIDP 2018-2022) | Responsible livestock production systems |
| National Environment Authority | Environmental protection |
| Ministry of Environment | |
| Ministry of Agriculture, Livestock, Fisheries, and Cooperatives | National policy direction for livestock and cooperatives |
| Ministry of Trade | National policy direction for trade |
| County Government of Kajiado Department of Environment | County policy direction for livestock and implementation of devolved functions |
| County Government of Kajiado Department of Environment | County policy direction on environment and implementation of devolved functions |
| County Government of Kajiado Department of Trade | County policy direction on trade and implementation of devolved functions |

The presence of elaborate laws and policies as evidenced by presented data is useful in beef value chain regulation by national and county governments (Lamek *et al*., 2016). Regulatory frameworks are the key governance instruments in supporting sustainability of the regulated actions (Mukanyandwi *et al*., 2018a; Nyenyezi Bisoka *et al*., 2020). The existing regulatory framework for governance and management of land-use practices could play a major role in supporting institutions tasked with implementation of the instruments (Mukanyandwi *et al*., 2018a; Nyenyezi Bisoka *et al*., 2020).

The results indicate that there are legal and institutional frameworks in Kenya that can be leveraged to support beef value chain actors for enhanced integration of CSA. This finding is also in agreement with government reports, Institutional frameworks are important pillars of enforcement of governance instruments through the mandate of the institution. The institutions usually control and monitor the integration of practices (Cioffo *et al., 2016;* Lamek *et al.*, 2016; Li *et al.,* 2019*;* Nyenyezi Bisok*a et al.,* 202*0;* Ozsahi*n et al*., 2018). Effective enforcement of laws, policies, and regulations by institutions could foster sustainable governance and management of integrated practices (Cioffo *et al*., 2016). It also noted that some of the regulatory frameworks may have come into existence well before the introduction of the CSA concept in the 2010 Hague conference (FAO, 2010) however they can still be leveraged for initial integration of CSA, and later enhanced while CSA specific frameworks are being developed.

### 5.5.3 Role of County Government and Local Communities in Integration of CSA Practices in the Beef Value Chain

The County government and communities were observed to have various roles as shown below (Table 10).

**Table 10: Local Government and Community roles in Governance and Management of Beef Value Chain in Kajiado**

| Local Government | Community-based NGOs |
|---|---|
| Undertake public awareness and conduct public consultations | Large scale changes strengthened by improved governance, policies, and backing from government, industry bodies, and other market players |
| Finance, through grants and loans, the implantation of climate change adaptation and mitigation actions | Mainstreaming climate smart approaches in the critical upgrades as part of market and value chain governance strengthening. |
| Educating the public on climate change and climate change mitigation | Creating consumer awareness on beef products, quality, and safety to increase demand |
| Develop and administer certified demand-driven capacity building and entrepreneurship programs | Endorsing application of food safety standards by slaughterhouses and meat retailers |
| Promote and provide business development services for the micro and small enterprises | Beef value addition and product differentiation |
| Promote the technological modernization and development of micro and small enterprises | Integrated Animal Health Service Provision for production inputs to promote production that is market-oriented |
| Provide technical assistance in the development of products | Validation of internal sector interventions as to being climate smart |
| Find markets for the products generated by micro and small enterprises and provide linkages between the micro and small enterprises and potential markets | Community mobilization |
| Organize trade fairs and shows to promote products generated by micro and small enterprises | Provide business training to support farmers |
| Conduct market research, survey, and analysis | |

These enabling frameworks exist but actors are not aware or knowledgeable about them and in addition, the responsible institutions are not fully enforcing or leveraging these frameworks to enable full integration and support of MSMEs in the climate smart beef value chain. Services such as policy guidelines, training of value chain actors, and extension services serve to boost and build confidence in actors' efforts in practicing sustainable practices (Wreford *et al.*, 2017a; Mukanyandwi *et al.*, 2018; Li *et al.*, 2019; Mwongera *et al*., 2019). Technical backup to value chain actors has been demonstrated as a powerful institutional instrument for ensuring sustainability building in terms of community empowerment (Chigbu *et al*., 2017; Dawson *et al*., 2016; Mwanjalolo *et al*., 2015). An understanding of the existing operating environment, market structure, legal and policy frameworks, and institutions is key for enabling integration of MSMEs and adoption of CSA TIMPs (ILO, 2015; Crick, *et al.*, 2016; World Bank, 2014, 2017; Orr *et al*., 2018; Wreford *et al*., 2017a; Girvetz *et al*., 2019; Tankha *et al*., 2020).

### 5.5.4 Status of CSA KAP Capacity building as an Integration Approach in Kajiado

Evidence shows that other than the actor's feeling that they do not have the support to effectively participate in the beef value chain, all of them significantly felt integrated into the beef value chain in Kajiado ($P \leq 0.05$) however they were not aware of the supportive frameworks for their integration.

The majority of respondents had received some awareness of climate change. To most actors, climate change was 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 was a weather index factor.

Most actors had received knowledge on 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 fact that efforts to integrate actors through knowledge and 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 have received awareness interventions on climate-smart agriculture/livestock as a stand-alone concept while concepts such as building resilience and poverty alleviation were being disseminated and only 0.8% could appreciate the concept on climate adaption. This is not surprising especially since there has been minimal research and study on climate change impacts on livestock systems and corresponding value chain (Mwongera *et al.,* 2018; Thornton *et al.,* 2019). Also given the fact that Kenya government, development partners, and Non-Governmental Organizations'(NGOs) efforts have been concentrated mainly on concepts such as poverty alleviation via strategies like 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 received varied awareness of the various sustainability and climate change concepts. Producers, middlemen/aggregators, distributors/retailers, and consumers were aware of reducing poverty and building resilience, while input suppliers were 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). These results indicate that there has been minimal or no efforts by national or local government, development partners, and community-based organizations to collectively integrate the MSMEs and CSA TIMPs through capacity building as a value chain.

On avenues for capacity building integration, capacity building workshops and training courses were reported at 36.7%, media including mobile technology (31.7%), and extension and agriculture officers from the County government (18.3%). The channels were through development partners and NGOs through value chain actors' association, and CBOs/chama (Fig 17). This implies that value chain actors received capacity-driven integration from both formal and informal sources, and different value chain actors may have different preferences when it comes to avenues of knowledge and awareness owing to the dynamics of engagement (Mwongera *et al.*, 2019).

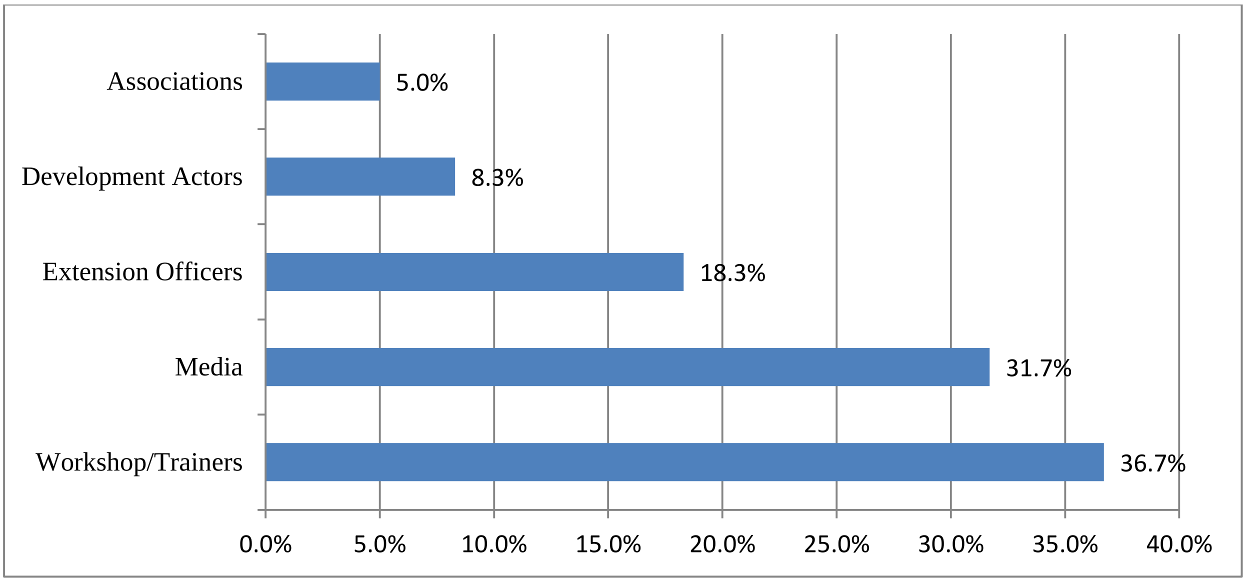


**Figure 17: Types of Capacity Building Channels for Beef value chain actors in Kajiado**

Sustainability capacity building, as observed previously by other authors, involve training activities undertaken by supportive agencies to enhance actors' level of knowledge and individual actor practices choices towards sustainability mindsets (Karamage *et al.*, 2016; Mwanjalolo *et al.*, 2015). The context and perceptions, attitude, and knowledge of CSA and TIMPs along the value chains have been shown to determine various levels of understanding and adaptation to climate change (Makate *et al.*, 2017). Once actors acquire skills and perceive the benefit of the same skills, they can engage in recommended sustainability efforts such as CSA TIMPs (Huggins, 2014; Ozsahin *et al.*, 2018).

### 5.5.5 Status of Integration for enhanced Environmental Protection

Table 11 presents results on the integration of actors concerning the aspect of environmental protection and conservation practices. As can be seen, a majority of the actors (61%) had not been made aware that their business can impact the environment negatively. However, seventy one (71%) of the actors acknowledged that their business should be involved in protecting the environment. These findings are not surprising bearing in mind that the county government and county NEMA (National Environment Management Authority) were driving environmental awareness through initiatives such as cleaning up the county urban areas, enforcing the banning of plastic bags, and exercising penalties for effluents violations, littering and business premises, hence this is what the actors perceived as participating in environmental awareness. However, the awareness did not translate to integration on CSA practices since the environmental efforts were not CSA specific, and hence actors could not connect climate change and related concepts such as adaptation and mitigation to environmental protection, their business practices, and beef value chain sustainability. The county government efforts were also driven towards compliance and not towards a change of behavior and acquiring of sustainability mindsets that could act as levers to actors' awareness of climate change, CSA, and making of climate smart decisions for their enterprises (Huggins, 2014; Ozsahin *et al*., 2018).

**Table 11: Integration of MSMEs into climate smart beef value chain through environmental awareness.**

| | | **Frequency** | **Percent** |
|---|---|---|---|
| Negative impact on the environment. | Yes | 15 | 39.5 |
| | No | 23 | 60.5 |
| | Total | 38 | 100 |

| | | | |
|---|---|---|---|
| Participation in environmental protection. | Yes | 27 | 71.1 |
| | No | 4 | 10.5 |
| | Not Applicable | 7 | 18.4 |
| | Total | 38 | 100 |

On assessing the three sustainability perspectives, i.e., environment, social and economic perspectives, actors had been fairly integrated with regards to their awareness of the impact of their business activities beyond the environment (42%), quality of life (22%), and creation of jobs (20%) reduction of poverty (16%). This integration provides an entry to integrating the MSMEs into sustainability practices such as CSA TIMPs in climate smart enabled value chains.

The value chain actors especially the abattoirs were mainly disposing of their liquid waste into open drainages or septic pits, while the solid waste was sold or given off to farmers as manure. The actors were now aware that their waste management practices and manure especially contributes to GHGs gases such as carbon dioxide and methane, further they were not aware that they can contribute to the climate change solutions by changing their practices (Breu *et al.*, 2016; Torquebiau *et al*., 2018; IPCC, 2019). Hides and skins were sold albeit at very low prices, due to a lack of operational and efficient leather processing industries. This was further compounded by flooding of cheap leather imports in the market thus lowering the prices of the locally available hides and skins, leading to most hides and skins going to waste. Heads and offal were sold off to retailers and abattoir workers for traditional dishes, bones, and hooves were used for soaps and jewelry making. The findings show that there was little or no efforts by the county government, development partners, and community to integrate CSA TIMPs that would promote and, enforce sustainable waste management practices, apart from the NEMA inspection efforts that penalized actors for lack of effluent discharge license as stipulated by the environmental regulations. There was further a need to support waste management practices that would be economically viable (FAO, 2014).

The results show that the actors were willing to participate in environmental protection. This is in agreement with previous observations that suggest multilevel actor involvement is required to attain sustainable management of natural resources, and waste management including within the beef value chain (Gwaleba and Masum, 2018; Willy *et al.*, 2019).

### 5.5.6 Integration of CSA Related Practices MSMEs in Kajiado County

In assessing CSA-related practices used by actors in the beef value chain, the study found minimal integration which can be described as 'no-regret options. No regret options are defined by UN jointly with IUCN as, "those actions, including autonomous measures by communities which do not worsen vulnerabilities to climate change or which increase adaptive capacities; and measures that will always have a positive impact on livelihoods and ecosystems regardless of how the climate changes". Efforts were found to have been made to integrate the actors to various processes/practices ranging from as low as 8% to 12% which implies that integration efforts on use sustainable or CSA related practices by MSMEs in beef value chains was still fairly low. However, extension services had been integrating the actors by encouraging adoption of 'no regret options' such as the use of animal manure to promote better crop yield, mixed farming where livestock keeping and growing of crops was complementary and provided for diversification of livelihoods and incomes (FAO, 2018). However producers did not relate these no-regret options directly to climate adaptation and mitigation they looked at them more from a livelihoods diversification and protection perspective and poverty alleviation effort (IUCN EbA, 2014). They understood that integration of livestock keeping with crop farming could be used to improve incomes and savings (Mwongera *et al.*, 2019; Thornton *et al.*, 2019). Yet this savings inadvertently could act as a reserve against climate disasters such as drought and floods brought by climate change, hence can be regarded as a climate adaptation and resilience measure (Devaux *et al.,* 2016; Carabine *et al*., 2017; FAO, 2018). This was not surprising because previous studies show government and development actors' efforts had been focused on poverty alleviation and livelihood protections through strategies such as poverty reduction strategy i.e. (PRSP) 2000, Economic Recovery Strategy (ERS) of 2003- 2007, and vision 2030 by GOK. This study while testing awareness of climate-related concepts, MSMEs were found to be aware of building resilience (34.8%) and reducing poverty (31.1%) while concepts such as CSA, climate smart livestock, mitigation, and adaptation were only at 5.3%, 6.1%, 2.3%, and 0.8% respectively. This low integration of MSMEs into the climate smart beef value chain through capacity building also agrees with previous studies that show that previous CSA capacity building efforts had been focused mainly on crop and not livestock farming. And in addition, the CSA integration efforts stopped at producer level without permeating the entire value chain i.e. farm to fork, causing thus diffusion along the entire agricultural value chains to be slow and limited yet awareness is essential to managing climate risks in food systems (Sourcebook, 2013; Tasquier *et al.,* 2014; Mwongera *et al.,* 2019). It can also be noted from the results that the actors recognized that some practices like manure use in soil fertility were productivity-enhancing interventions for reversing negative land-use changes (environmental aspect) that could then have an impact on beef production (economic aspect). This is in agreement with other observations that suggested creating localized solutions and linking the environmental, social, and economic aspects as an important way of dealing with the integration of sustainable production practices such as CSA (FAO, 2014; Gwaleba and Masum, 2018).

It was also noted that beyond producers, the CSA-related integration efforts were mainly targeting cost management to ensure the economic viability of MSMEs' enterprises. They were also efforts towards mitigation of financial loss from natural disasters such as floods by insuring their businesses (13%) and having emergency funds 13%) while at the same time putting efforts towards compliance with county environmental laws to avoid penalties, which would result in a financial cost (Manyise and Dentoni, 2021). Therefore, these integration and compliance efforts were not necessarily targeted towards addressing climate resilience per se as related to awareness of climate change risks but safeguarding economic loss. There was little appreciation of the direct link between MSMEs' practices, climate change, CSA TIMPs, and value chain sustainability (Grossi *et al.,* 2018; Thornton *et al.,* 2019; Manyise and Dentoni, 2021).

Further results on the integration of actors and CSA TIMPs in the extended and enabling value chains, such as financial institutions and actors' associations/cooperatives/chama showed there had been efforts and 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 integration perspective or building of climate resilience (Mwongera *et al.,* 2019).

### 5.5.7 Incentive-driven integration approaches

When asked, the MSMEs said they received little or no incentives at all to help their integration into the climate smart beef value chain and the adoption of sustainable practices such as CSA TIMPs. Results in Figure 18 shows the incentives the actors would prioritize towards enabling their integration into climate smart beef value chain were, 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%), showing that different actors require different incentives to enable their effective integration (Mwongera *et al*., 2018). Environmental schemes such as carbon credits/trading and payment of ecosystem services scored a measly 2% each, implying there had been little efforts towards provision of awareness and knowledge on ecosystem services/value and the possible opportunities presented by these services to the value chain actors/MSMEs are yet to be explored. Apart from extension services, all the other incentives had a direct financial component to it and this accounted for 75% of the incentives requested by actors, pointing to the great need for financial incentives to enable MSMEs integration into climate smart beef value chain (Nyariki and Amwata, 2019).

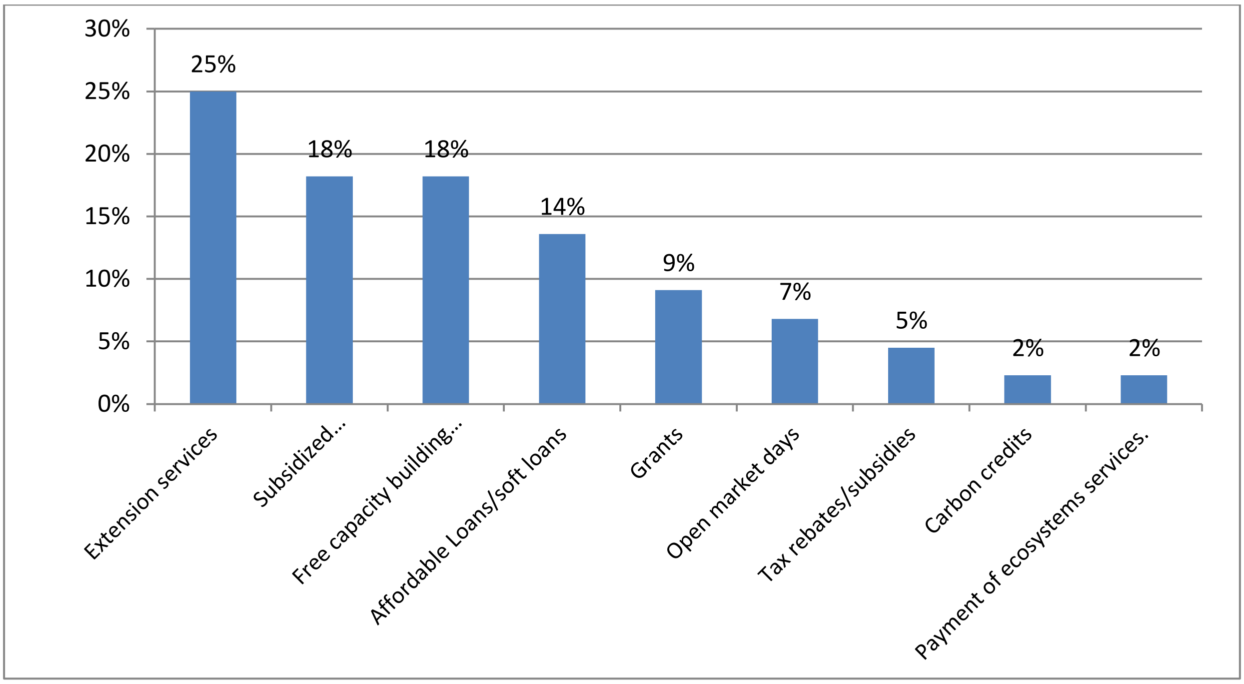


**Figure 18: MSMEs' preferred incentives for their integration into climate smart beef value chain**

On further examining financial solutions and efforts available in addressing finance-related challenges in integrating actors and CSA TIMPs in the beef value chain, the results in Figure 19 show that 16% lacked financial support services, while 17% lacked access to available CSA TIMPs. 15% would consider the return on investments (ROI) before investing in CSA TIMPs in their enterprises, others simply felt that CSA TIMPs were costly (14%) while others said they had other pressing needs to spend invest in (8%). This is in agreement with transaction cost theory and technology adoption model that perceived cost and benefit of technology was a key determining factor in adopting it (Zhang *et a*l., 2015; Smith *et al.*, 2018; Mukanyandwi *et al*., 2019).

It is interesting to note that, 10% of the actors felt that customers would not be willing to pay the additional cost on the final product if produced using climate smart technologies and practices (WWF, 2021). Customers can be key enablers in the adoption of new technologies, innovation, and practices because they can use their purchasing power to force value chains actors to use responsible production practices such as climate smart TIMPs (Sutcliffe *et al.*, 2019).

The results also indicate that at least 63% of the actors faced financial challenges to their integration and adoption of CSA TIMPs, pointing to minimal efforts by the livestock sector, policymakers, regulators, development actors, and other interlocutors in providing financial incentives, products, and solutions as enablers to MSMEs' integration of CSA TIMPs in the beef value chain.

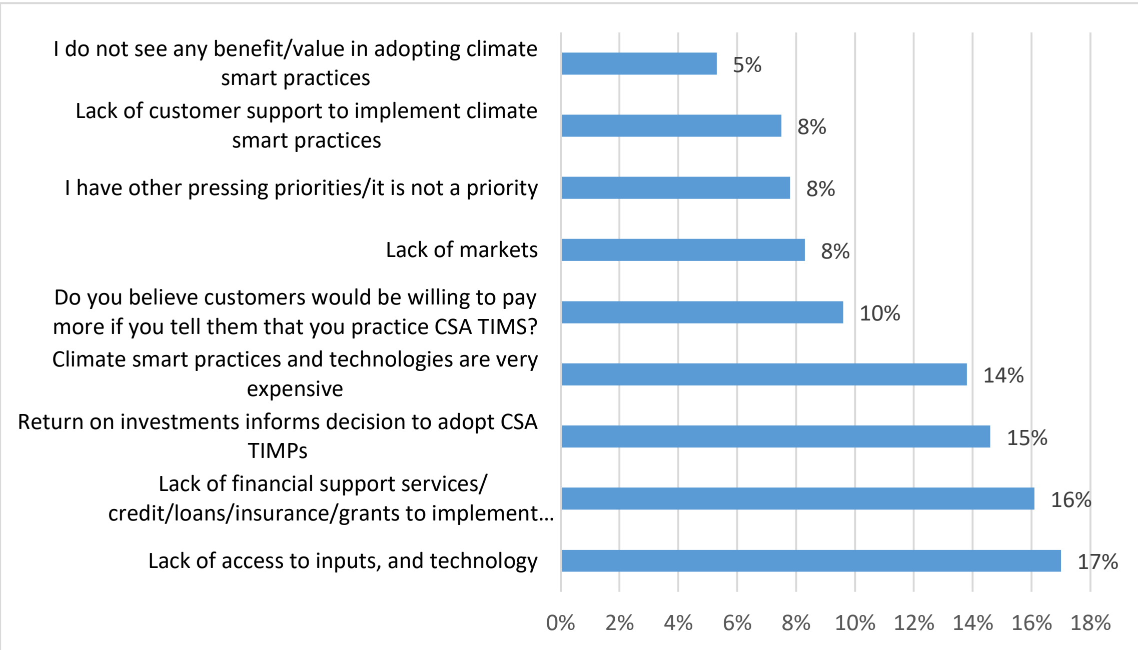

**Figure 19: Financial and market incentive integration approaches into climate smart enabled beef value chain**

Interviews with key informants further indicated that the majority of the existing incentives efforts geared towards MSMEs by the ministry of agriculture and development partners are currently geared towards awareness creation on better breeds, control of pest and diseases, and environmental protection but the sentiments of most actors and key informants indicated that to be fully integrated into climate smart beef value chain financial incentives (43%), i.e. soft loans (14%), grants (9%), tax rebates (2%), and subsidies (18%), as approaches to MSMEs integration should be the priority. 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 MSMEs (Mwongera *et al*., 2017). Several integration approaches tend to assume that resources are evenly distributed across all actors and households irrespective of their position in the value chain, and economic abilities and actors do not face significant trade-offs when using resources and are capable of assuming higher risks when reinvesting capital and labor yet these assumptions rarely reflect the circumstances of the rural poor, especially those in ASALs.

Efforts to ensure sound infrastructure as an enabler of MSMEs integration into climate smart beef value chain was low as shown by the challenges faced by MSMEs such as poor roads, like of proper waste disposal infrastructure, and supply challenges in water and electricity. In addition, lack of modern slaughterhouses for full processing and grading of beef and lack of live animal handling infrastructures at live animal markets were infrastructural factors that were heavily impacting MSMEs integration into climate smart beef value chain and equally increasing the operating costs. Infrastructural challenges impede both the value chain economic efficiencies, environmental and social sustainability of the value chain. Poor infrastructure also hampers the reach of extension services especially to producers due to inaccessibility of remote areas.

Services such as government incentives, training of actors, extension services, and enabling infrastructure serve to boost and build confidence in actors' efforts in practicing sustainable practices (Mukanyandwi *et al.*, 2018; Li *et al.*, 2019). Technical and economic backup to actors has been demonstrated as powerful institutional instruments for ensuring sustainability building in terms of community empowerment (Chigbu *et al*., 2017; Dawson *et al*., 2016; Mwanjalolo *et al*., 2015).

### 5.5.8 Actors Expression on Institutional Support; Policy-driven Integration Approach

Figure 20 presents the degree to which the MSMEs felt policy-driven approaches have been used or not used to integrate them into the climate smart beef value chain. The majority of the value chain actors (25%) cited lack of government support, incentives, subsidies, governance systems, and programs; 24% cited lack of regulatory frameworks such as government laws, rules/policies that promote or demand the adoption of sustainable practices such as CSA; 22% cited lack of governance and management standards for CSA adoption; governance challenges on land ownership (10%); land tenure system (10%) and property rights (9%). Thus pointing to the fact that the use of regulatory and institutional frameworks that are key to governance and management as an integrated approach of MSMEs into climate smart beef value chain were inadequate (Gwaleba and Masum, 2018; Willy *et al.*, 2019).

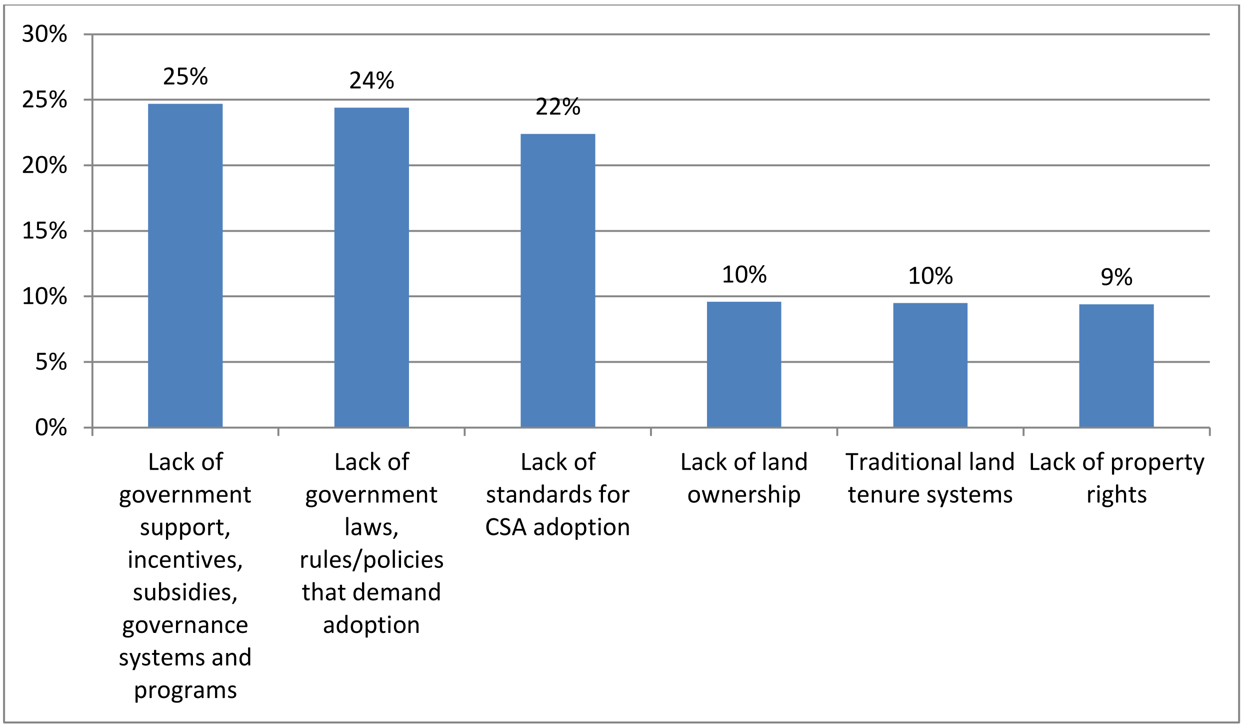


**Figure 20: MSME integration into climate smart enabled beef value chain through institutional and regulatory approach**

## 5.6 General Discussion of all Chapter Results

Climate-smart agriculture is part of the larger sustainable practices and it follows that even though MSMEs may not be aware of CSA and climate-smart livestock as concepts they may be aware of practices that enhance productivity, save operating costs, while inadvertently protecting the environment and hence the concept of CSA can leverage this existing knowledge. Sustainable agricultural practices, technologies, and efforts towards environmental protections have been in existence way before 2010 when CSA as a concept was introduced and they are blurred lines between them and CSA TIMPS, hence CSA as a concept may need expanding to explicitly address broader practices that go beyond food crops or agriculture per se, to the entire value chain beyond core and producer level (Krishnan *et al.*, 2019; Ministry of Agriculture, Livestock, 2018). The findings that the majority of the respondents had been made aware that their business affects the environment is a good start to building sustainability mindsets, and norms among the beef value chain actors (UNEP, 2010). Additionally, existing knowledge and practices on other concepts such as livelihood protection, poverty alleviation, and environmental protection can be leveraged to increase awareness, on climate-related concepts such as adaptation and mitigation and thus enabling MSMEs integration into climate smart beef value chain (Tánago *et al.*, 2014; UN, 2019; UNFCCC, 2010). MSMEs could not appreciate the concept of GHGs emissions and climate change, and how this affects their businesses even though they had been made aware, that their businesses have an impact on the environment in one form or another. There were limited capacity-building efforts towards helping the MSMEs in translating this awareness to practical ability and practices that would promote lasting change towards environmental sustainability and MSMEs becoming climate smart enterprises (FAO, 2014; Grossi *et al*., 2019; Manyise and Denito 2021).

In addition, poor infrastructure, combined with the nature of nomadic pastoralism that creates a challenge of permanency, impeded access and follow up on extension services as a front line form of capacity building. However, this challenge can be addressed by taking advantage of increased mobile phone and technology penetration (Butt, 2015). Technology can provide new avenues and opportunities for climate innovation and adaptation that beef value chain actors can capitalize on, e.g. satellite technology can enhance climate resilience among the pastoral beef value chain through early warning systems, satellite generated data and GIS maps are key avenues for monitoring of forage quality, and water availability and transmitting market information (FAO, 2017).

MSMEs were found to be using various sustainable practices albeit at very low levels. There was little appreciation of the direct link between MSMEs' practices and response to the challenges faced by the value chain sustainability due to effects of climate change (Biagini and Miller, 2013; Crick, *et al*., 2016; FAO, 2018). Equally, the study points to the very little or no 'modern' production among the pastoral livestock value chain actors and hence it's imperative that moving forward integration efforts are geared towards not just economics of the modern-day technologies and methods but adaptation of the same to the changing dynamics of the value chain, and climate change responses in order to ensure optimal operations, MSMEs sustainability while safeguarding environment integrity (Atela *et al*., 2018; Grossi *et al.*,2018). The study also found that most actors may not have funds to invest in relevant CSA education bearing in mind that most beef value chain actors are micro-enterprises and livestock keeping is mainly practiced by the rural poor (Njoka *et al.,* 2016). These micro-enterprises are mostly led by the youth and are less than 5 years old and may not be economically sustainable yet. The micro-enterprises lack the extra cash flow to invest in self-initiated capacity building and modern technologies. This points to the need to prioritize MSME targeted financial and incentive-driven integration approaches by the policymakers, national and local government institutions, and development actors (Devaux *et al.,* 2019; Benton *et al*., 2021).

Training, awareness, and extension services coupled with financial incentives are quick wins in integrating the actors into climate smart thinking and form a critical starting point to climate resilience (FAO, 2017; Atela *et al.*, 2018). Without the capacity-building approach acting together with financial benefits and incentives approaches, it’s difficult for MSMEs operating in a complex system such as the ASALs livestock sector to have a holistic appreciation of cause and effect. It’s also difficult to link CSA practices to their enterprises' profitability, do an informed cost-benefit analysis on CSA TIMPs adoption without access to financial support (Descheemaeker *et al.*, 2016; Atela *et al*., 2018; FAO 2018).

The study shows that there is little or no incentive-driven integration currently existing for MSMEs to invest in climate smart interventions in the beef value chain (Devaux *et al.*, 2018b). Financial support is key in addressing climatic disasters, such as floods or droughts because after such disasters livestock are wiped out and it would take years to restock thus affecting supply across the entire chain. In ASALs, following a drought period, it takes years for herd size to recover, affecting livelihoods, and an absence of financial resources to proactively re-stock through animal purchases, it's difficult for actors to re-integrate again into the value chain causing value chain disruption (Godde *et al.*, 2021). This disruption is seen by lack of continuity and stability i.e. lack of resilience of the MSMEs in the value chain, hence actors engage with the value chain on and off based on ability to recover from the shocks of a previous disaster. The long period taken to recover after a disaster has far-reaching ramifications on the continuity, productivity, strengthening, and resilience of the entire beef value chain and the sector itself (Mwongera *et al.*, 2017; Thornton *et al.*, 2019; Godde *et al.*, 2021).

Investing in the beef value chain and 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 economic benefits otherwise referred to as return on investment (ROI) almost immediately after their investment (Wreford, *et al*., 2017; Girvetz *et al*., 2019; ASTGS, 2019; Tankha *et al*., 2019). Bearing in mind that some impacts and benefits are realized in the long term compared to the short term, this would discourage investment based on ROI, hence requiring some form of incentives to enable especially the early technology adopters to invest in a climate smart beef value chain (Eskesen *et al.*, 2014).

In considering where to invest, the actors would embrace agriculture value chains and climate-smart intervention that ensure maximum yields and profitability (Tankha *et al*., 2019). This may be the reason there is more investment in high yield crop value chains as opposed to the pastoral beef value chain that is viewed as high risk investment with low returns (Wreford, *et al*., 2017; Girvetz *et al*., 2019; ASTGS, 2019; Tankha *et al*., 2020). More so in the absence of climate risk instruments to shield MSMEs from climate-related risk often associated with ASALs and beef production (Williamson *et al.*, 2010; Kgosikoma *et al.*, 2018; Mwongera, *et al.*, 2019). 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 beef value chain in the long term (FAO, 2016; Devaux *et al.*, 2018).

Different MSMEs require different incentives, yet integration approaches tend to assume that resources are evenly distributed across all actors and households irrespective of their position in the value chain and economic abilities (Devaux *et al.*, 2018). Yet these assumptions rarely reflect the circumstances of the rural poor and micro enterprises, more so, climate-vulnerable ASALs pastoralist communities that already suffer from extreme environmental vulnerability and socio-economic marginality (Carabine *et al.*, 2018). Microenterprises face substantial trade-offs when using resources and cannot assume higher risks when reinvesting capital and labor, towards such things as modernizing their assets or initiatives such as CSA TIMPS (Biagini and Miller, 2013; Kuruppu *et al*., 2014; Thorton *et al.*, 2019). There is therefore a need for context-based integration support and incentives that would address the needs of these communities collectively and specifically for each actor along the chain (Daze *et al.,* 2016; Atela *et al.,* 2018; Carabine *et al.,* 2018; Grossi *et al.*, 2018).

Interviews with key informants also indicated provision of reliable and robust infrastructure had not been prioritized or optimally applied as an MSME integration approach into the beef value chain. Availability of a wide and quality network infrastructure promotes MSMEs investment in a region or a sector due to easier access to markets by producers and MSMEs access to raw materials thus reducing supply chain costs (FAO, 2018).

Governance and management frameworks exist that can be used to promote the integration of MSMEs into the value chain however actors were not aware or knowledgeable on them and in addition, the enforcing institutions were not fully leveraging these frameworks to enable full integration and support of MSMEs investment in the beef value chain and adoption of CSA initiatives (UNEP, 2010).

Understanding the context, needs of actors and MSMEs is paramount in decision making in regards to the forms of integration efforts needed to integrate them into climate smart beef value chain whether in terms 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 chain (Sourcebook, 2013) and (Mwongera *et al.*, 2017). Integration of MSMEs and CSA adoption in the beef value chain requires consultations with all relevant stakeholders to advise suitable enabling actions (Sourcebook, 2013; Mwongera *et al.*, 2017)**.**

## 5.7 Conclusion and Recommendations

### 5.7.1 Conclusion

From this chapter, a number of conclusions could be arrived at such as:-

1) Inadequate level of County investment in terms of MSMEs' capacity building on climate change, its effects, and its relationship with the beef value chain and enterprises' profitability and sustainability
2) MSMEs could not appreciate the concept of GHGs emissions and climate change, and how their enterprise activities affect climate change though they had been made aware, that their activities can have an impact on the environment.
3) Legal and institutional governance and management frameworks relevant to the beef value chain exist, these frameworks were only enforced for the sake of compliance and not seen as an opportunity to support MSMEs build sustainable practices. MSMEs were also not fully aware of the various provisions of these frameworks they only appreciated the punitive consequences if they were found not complying.
4) There were inadequate financial incentives to enable MSMEs integration of CSA TIMPs in the beef value chain.

### 5.7.2 Recommendations

Based on conclusions made, the following recommendations are made:-

i. Enhance county government's efforts on MSMEs' capacity building on climate change, its effects, and its relationship with the beef value chain and linking it to enterprises' profitability and sustainability and further contextualize the capacity building to specific nodes and needs of actors within the beef value chain.

ii. There is a need for scaling up of research, and capacity-building efforts on climate change-related terms such as GHGs emissions adaptation and mitigation, and how MSMEs' enterprise activities affect GHGs and thus climate change.

iii. Increase awareness creation on existing legal and institutional framework including use of participatory learning and action (PLA), policy dialogues, and advocacy to ensure beef value chain actors are fully aware and can participate in their review and design not just for compliance but the embedding of sustainability mindsets and pride behavior towards climate smart governance and management practices in the beef value chain.

iv. National and County government to design contextualized policy interventions targeted towards financial incentives, climate risk instruments, and necessary investments to encourage and enable MSMES' integration of CSA TIMPs in order to realize a climate smart ASAL beef value chain.

# CHAPTER SIX

## 6.0 Assessment of Barriers to Micro Small and Medium Enterprises' Adoption of CSA in Livestock Value Chain, Kajiado County, Kenya

(Mary W. Thongoh, HM. Mutembei, J. Mburu and B E. Kathambi. American Journal of Climate Change, 2021, 10, 237-262, Article no. 2167-9509 ISSN: 2167-9495).

### 6.1 Abstract

Climate change poses great risks to poverty alleviation, food security, and livelihood sustainability in sub-Saharan Africa, and especially in ASALs that already suffer from fragile ecosystems characterized by frequent droughts and low rainfall. Climate Smart Agriculture (CSA) objectives of improving productivity and incomes, adaptation, resilience to climate change, and mitigation of GHGs emissions, is a response to these climate risks. CSA technologies, innovation, and management practices (TIMPs) in general do exist, however, they are concentrated in crop farming neglecting livestock production, and especially in marginalized areas such as ASALs, which form 85% of Kenyan landmass and is dominated by pastoral and nomadic livestock production. Most CSA practices are mainly at the production level and hardly extend to the entire value chain, and diffusion is slow due to several barriers. A mixed-method approach was used to evaluate barriers to actors' adoption of CSA in the pastoral beef value chain starting from input suppliers, producers, to consumers (pasture to plate). This study used six broad perspectives to examine the barriers; (1) Knowledge and institutional, (2) Market and financial, (3) Policy and incentives, (4) Networks and engagement platforms, (5) Cultural and social (6) Physical infrastructure barriers. These barriers can be surmounted with concerted efforts from the government, development partners, pastoral communities, value chain actors, and public-private partnerships among others. Efforts such as modernization of the pastoral beef value chain, de-risking the ASAL beef value chain to support the integration of MSMEs into the chain, access to affordable financing, availability of context-based, affordable CSA TIMPs, incentives, policies, and institutional support, which currently remains inadequate. Institutional barriers like lack of capacity, coupled with knowledge and behavioral barriers hinder adoption. Financial institutions and cooperative societies can be enablers, however, their reluctance to invest in the sector is a barrier too.

**Key Words**: ASALs; Barriers; CSA TIMPs; Enablers; Incentives; Policies; Institutional Support; Value chain.

## 6.2 Introduction

Climate change has given rise to new challenges in the fight against poverty and sustainability of agricultural livelihoods in sub-Saharan Africa through declining crop yields and livestock productivity as a result of rainfall variability, rise in temperatures, and increased pest/disease incidences (Grossi *et al.*, 2019c; Jordaan *et al.*, 2014; Torquebiau *et al.*, 2018). Increasing climate variability and extremes, which affects both crop and livestock systems, are indicated as one of the causes leading to recent rise in global hunger, malnutrition and severe food crises (FAO, 2018). The livestock sector is one of the major components of agriculture in Kenya and according to the Agricultural Sector Development Strategy, (ASDS 2010–2020), the livestock sector contributes 7% of the national GDP and 17% of agricultural GDP which accounts for 50% of the agricultural labor force.

Kenya has launched the Agricultural Transformation and Growth Strategy (ASTGS 2019-2029), which acknowledges that the Kenyan economy has made impressive progress in areas like innovation and entrepreneurship, infrastructure, private sector enterprise, public service delivery and human capabilities but that agriculture is still the foundation of Kenyan economic development and creation of equitable and sustainable growth for Kenyan people. ASTGS has three anchors among them; reduce the number of food-insecure Kenyans in ASAL regions while reducing the cost of food and improving nutrition and protect households against environmental and economic shocks. Improved agricultural productivity will also create more jobs, increase food supply, and lower food prices, making food accessible and affordable (World Bank KEU, 2019; ASTGS 2019-2029).

There are about 9 million poor livestock farmers in Kenya, which is approximately 28% of Kenya's rural population, (Njoka *et al.*, 2016). Kajiado County forms part of Kenya's major meat production region with the beef value chain predominantly made up of cattle extensively reared on communally owned rangelands (Sourcebook, 2013; Alarcon *et al.*, 2017; Ministry of Agriculture, Livestock, 2018). Beef production in Kenya can be divided into three main systems: 1. Pastoral production system (informal): responsible for 80–90% of red meat production in Kenya. 2. Ranching production system (formal): responsible for about 2–3% of total production, principally for the high-value market. 3. Highland's production system (formal): produces the remainder (Bergevoet *et al.*, 2014).

Beef production is becoming more relevant to climate change management strategies (Aggarwal *et al.*, 2018; Khatri-Chhetri *et al.*, 2019) from both mitigation and adaptation strategies as beef production contributes almost one-quarter of the global human-induced GHG emissions and hence the need to mitigate through reduction of GHG emissions (FAO, 2003; Mwongera *et al.*, 2019; Stein and Barron, 2017; Tankha *et al.*, 2020). At national level, the Climate Change Act, 2016 envisions "a climate resilient and low carbon growth sustainable agriculture that ensures food security and contributes to the national development goals."

## 6.3 Conceptual Underpinning

There is minimal research and study on climate change impacts on livestock systems and corresponding value chains (Thornton *et al.*, 2018) but indications are that the livestock sector is and will continue to suffer significant loss of productivity due to climate related reduction in forage and forage quality, hence impacting the entire beef value chain livelihoods, and sustainability. In ASALs, following a drought period it takes years for herd size to recover, affecting livelihoods, and in the absence of financial resources to proactively re-stock through animal purchases it takes decades (Godde *et al.*, 2018), pointing to the need for climate risk instruments such as emergency funds, grants, loans, animal and drought insurance and government supported policies on drought compensation scheme.

CSA advocates for coordinated actions among different actors in the value chain in the journey to climate resilient pathways through; building evidence-based research, increasing local and institutional effectiveness, encouraging unity between climate and agricultural policies and linking climate and agricultural financing. Even though CSA has the ability to provide adaptation and mitigation benefits, it's still not clear what type of transformation in policy frameworks, institutions and funding, are necessary to aid adoption (Tankha *et al.*, 2020). Appreciating the variables and dynamics which affect the technology diffusion is an important factor in determining which CSA initiatives can successfully be integrated into livestock systems. Understanding and applying system and value chain thinking to food security and nutrition is important in order to get to the root cause of systems success or failure regarding climate change variability, impacts and resilience on food security (FAO, 2018). CSA TIMPs that increase productivity sustainably, support farmers' adaptation to climate change, and reduce levels of greenhouse gases in general do exist, however, their diffusion is slow and limited (Mwongera *et al.*,2018; Tankha *et al.*, 2020). And where they exist it's on crop farming, and mainly addressing producer level and not permeating the entire value chain (Pantano and Di Pietro, 2012).

Addressing barriers and challenges to CSA adoption requires consultations with all relevant stakeholders to advice suitable financial interventions, incentives, and relevant legal and institutional frameworks, and policy options (Descheemaeker *et al.*, 2016; Khatri-Chhetri *et* *al.*, 2019; Mutoko *et al.*, 2015). This study evaluates the barriers that reduce the effectiveness of climate adaptation strategies such as CSA, along the beef value chain represented in Figure 21 below.

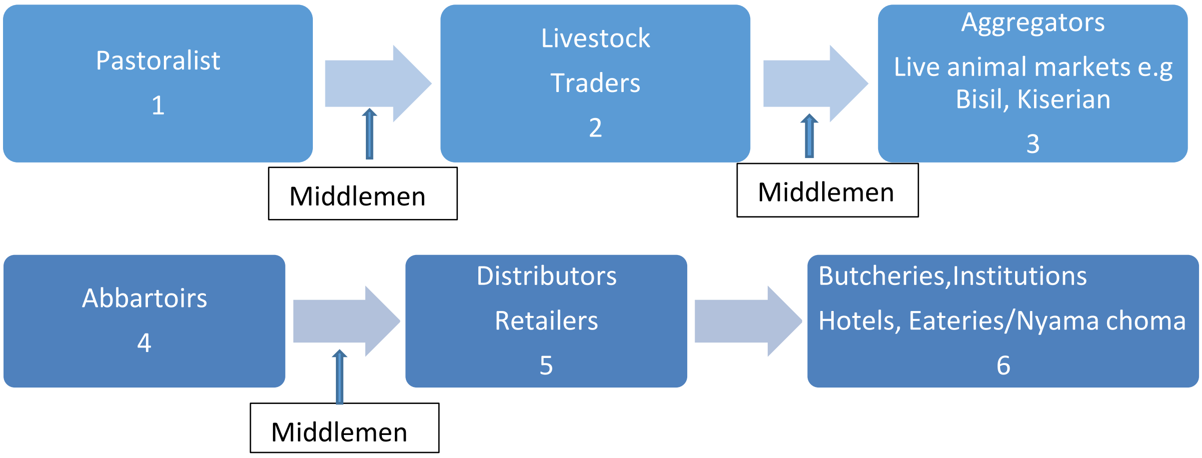


**Figure 21: Pastoral beef value chain in Kajiado County (Source: Author, 2021)**

The practice of beef production, in Kajiado has been pastoralism that is dependent on migrating large herds of cattle, sheep and goats (shoats) into open grasslands (Tánago *et al.*, 2014; World Bank, 2019). Middle men connect farmers to traders who act as aggregators buying animals from farmers even though some farmers choose to also act as traders buying from others and adding onto their own herd and transporting to the live animal markets using hired transporters (Alarcon *et al.*, 2017). All along the chain there are opportunities to integrate CSA practices however there are barriers that hinder fast and full integration (Mutoko *et al.*, 2015; Descheemaeker *et al.*, 2016; Khatri-Chhetri *et al.*, 2019).

## 6.4 Theoretical Underpinning

Three theories (Fig. 22) underpin the conceptual model of this study; the innovation diffusion and transactional theory and the social network theory. In the innovation diffusion and transactional theory, it is argued that the adoption of a given concept or technology is hindered by the knowledge and attitude of the individuals adopting it and the perceived benefit of their actions (Kim and Crowston, 2011; Pantano and Di Pietro, 2012). Moreover, if the benefit is not imminent, e.g. in case of CSA where the benefits tend to be realized in the long term, there is lack of buy-in (Kim and Crowston, 2011). In the social network theory actors exist in a networked environment where they exchange goods, values and information and they tend to influence each other in adoption of new behavior and practices. Social network theory therefore looks at actors as networked individuals existing within a given context and this theory explores the effect of their social relationships on diffusion of information, new technologies and practices and the enabling attitudinal or behavioral change (Scott, 2004; Liu *et al.*, 2017). It is also largely used in combination with innovation diffusion and TAM (technology adoption model) (Rogers, 1995; Zhang *et al.*, 2015).

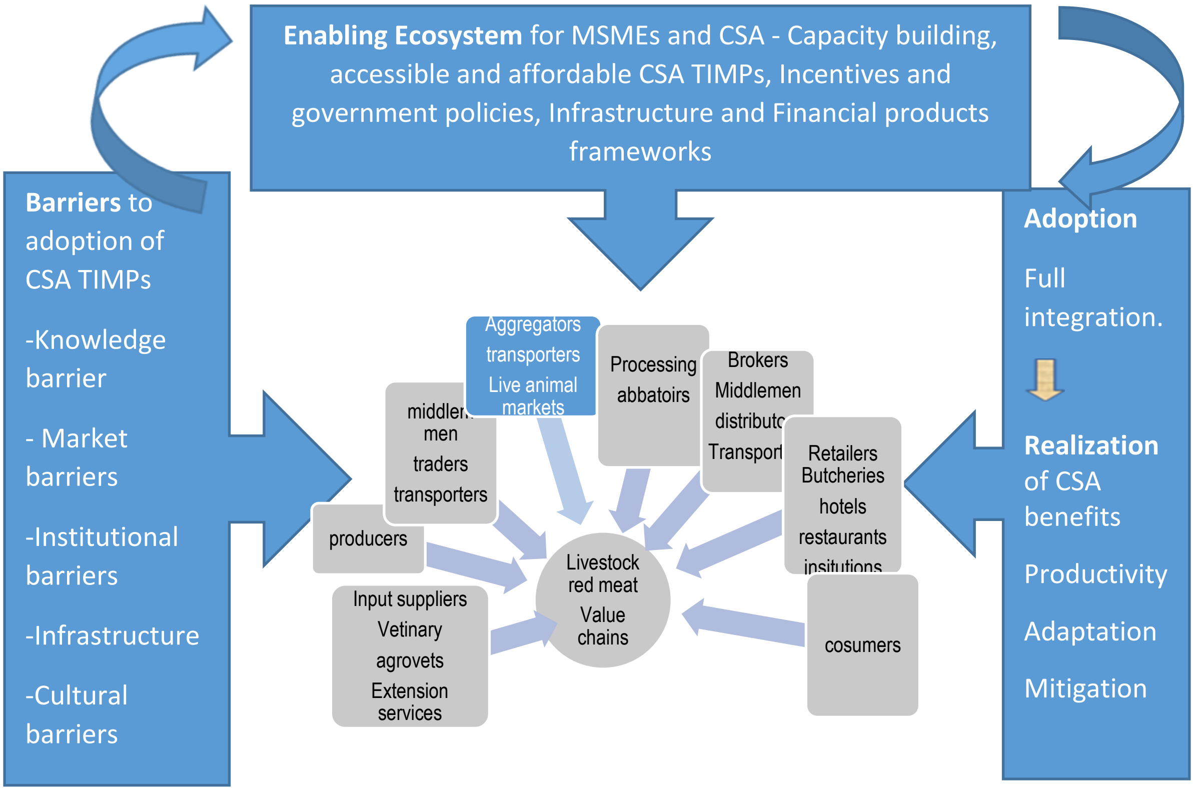


**Figure 22: Authors' "BEAR'' Climate smart value chain model (Thongoh *et al.*, 2021)**

## 6.5 Research Methodology

### 6.5.1 Study Area

Kajiado County which is approximately 21,900 $km^2$ has five sub-counties and a population of 1,117,840. The study was limited to three sub-counties (Kajiado North, Kajiado central. Kajiado East) with population of 306,596, 161,862, and 210,473 respectively (Kenya Bureau of Statistics, 2019). The county has seven slaughterhouses that serve as red meat vending houses, and one cross border cattle/meat trading center in Namanga (Figure 23).

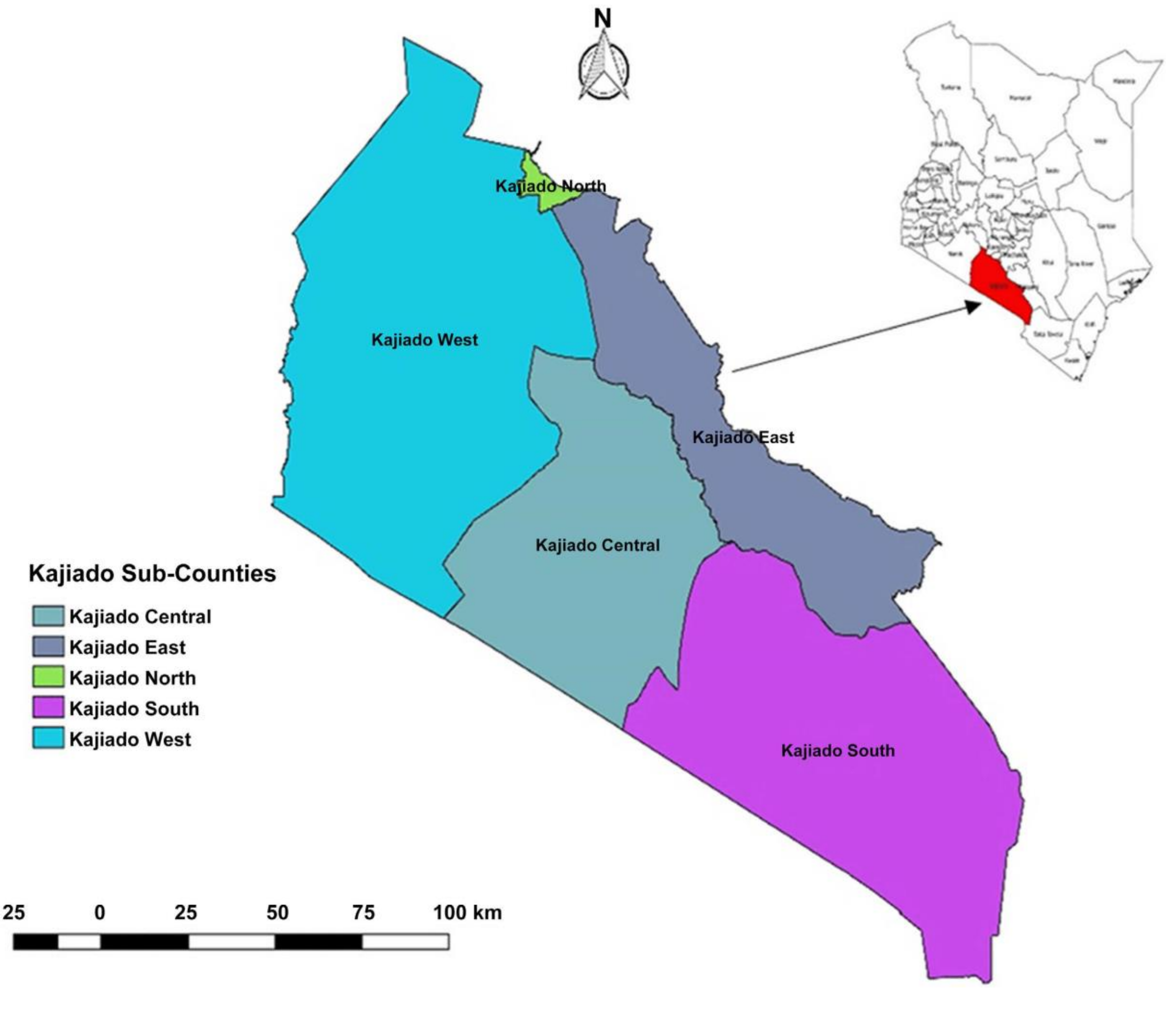


**Figure 23: Map of Kajiado County**

### 6.5.2 Research Design

This study applied both cross-sectional research that involved looking at KAP data from beef value chain actor population at one specific point and correlational research where non-experimental research methods were used to study the relationship between integration of MSME, adoption of CSA TIMPs and environmental integrity variables with the help of statistical analysis (Mutembei *et al,.* 2015; Ishtiaq, 2019). Data for KAP was collected by applying the cross-sectional research study from beef value chain actors (farmers, traders, processors and consumers). The correlational research study design was applied to collect data for enablers and barriers for integration of MSMEs and adoption of CSA in the value chain sustainability in relation to environmental integrity (Katiku *et al*., 2013).

### 6.5.3 Sample size

Based on Cochran formula which was later simplified and modified by Mugenda and Mugenda (2003) a sample size was determined. The Cochran formula ($N = Z^2 p\ q/e^2$) shows that when one has a population of more than 10,000 a minimum sample size of 384 was deemed as sufficient.

In this study the actors' total population of the three sampled sub-counties of Kajiado North, Central and East, 678,931, exceeds 10,000 hence a sample size of 459, slightly more than the minimum of 384, was determined to cater for the various categories of actors in the core, enabling and extended beef value chain. The distribution of the actors across the value chain was based on the prevalence of the actors and value chain dynamics (Stein ad Barron, 2017). Sampling numbers per dub-county were determined using proportionate distribution based the percentage sub-county population to the Kajiado county population (Kajiado north; n=45%, Kajiado Central; n= 23%, and Kajiado East; n= 32%). Accordingly, the sampled number of actors were also proportionally allocated according to County statistics (Farmers; n=23%, Traders; n=45%, processors; n= 9% and consumers; n=23%). Six Key Informants were sampled.

### 6.5.4 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, 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. 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, $P \leq 0.05$, (Katiku et al., 2013). Logit statistical model was utilized to test effects of variables on integration (Mwongera *et al*., 2019a; Etwire *et al*., 2017a).

## 6.6 Results

This study categorized and examined the barriers to adoption from 6 perspectives namely; (1) Knowledge and institutional barriers, (2) Market and financial barriers, (3) Policy and incentives barriers, (4) Networks and engagement platforms barriers, (5) Cultural and social barriers (6) Physical infrastructure barriers. The results presented in this study, provide an overview of the barriers that the livestock red meat value chain actors (MSMEs) experience in adoption of CSA TIMPs.

### 6.6.1. Knowledge and institutional barriers

In Table 12, we examine knowledge and institutional capacity of the value chains actors, this revealed that most actors lacked awareness or information regarding climate smart agriculture (28%), in addition to lack of extension or advisory services as shown by 28% of the actors. Another 27% of the actors expressed that the lack of capacity building was a hindrance towards adoption of CSA technologies while 18% cited a lack of understanding on the difference between CSA, other sustainability practices and CSR (corporate social responsibility), these barriers are echoed by other studies (Gledhill & Herweijer, 2012; Mutoko *et al*., 2015; Smith *et al*., 2018; Abegunde *et al*., 2020). There is need for minimum definition, interventions and innovations of what would consist of sustainable practices in a changing climate and how CSA fits into this, to guide design of context based TIMPS and practices contextualized to the ASALs livestock red meat value chain and the unique needs of the pastoral and nomadic communities (Smith *et al*., 2018; Abegunde *et al*., 2020).

**Table 12**: Knowledge-based barriers to implementing CSA practices

| **Knowledge Infrastructure** | **Percent** |
|---|---|
| Lack of awareness/Information on climate smart livestock | 28% |
| Lack of extension/advisory services | 28% |
| Lack of education, training, empowerment, communication | 27% |
| Confusing Climate smart Livestock with corporate social responsibility (CSR) and other sustainability initiatives. | 18% |
| **Total** | **100%** |

Cross-tabulation results indicated that actors had varied awareness of the various sustainability and climate change concepts with producer, middlemen/aggregators, distributors/retailers and consumers being more aware on reducing poverty and building resilience, input suppliers being aware of increased productivity and building resilience and processors, being relatively knowledgeable on the five constructs (climate smart animal/livestock agriculture, increasing productivity, building resilience, livelihoods/livelihoods protection and reducing poverty). This is supported by previous studies that show various actors in a social network such as a food system or within a value chain may have varied levels of knowledge and capacities on practices and technologies based on their positions and power within the value chain (Gereffi *et al.,* 2005; Pantano and Di Pietro, 2012). Further climate change knowledge by itself is not sufficient to drive adoption if the MSMEs do not have capacity to innovate and invest in new ideas and technologies (Meijer *et al*., 2015).

### 6.6.2 Market and financial barriers

Fig 24. Shows barriers associated with market infrastructure and financial barriers, which reveals that the majority of the actors lacked access to inputs and technologies on CSA (17%) and financial support services that would enhance adoption (16%). In addition, 15% of the actors expressed that return on investments would inform their decision to adopt the CSA TIMPs while 14% felt that CSA TIMPs were costly. The main marketing channel indicated by producers is the live animal markets (primary and secondary markets which are dominated by middlemen and traders). Previous studies shows that nearly three quarters of pastoralists usually do not have prior access to market information, leading to information asymmetry and vulnerability to unscrupulous middlemen (Otieno, Hubbard and Ruto, 2012). Consumers believed that information asymmetry allows middle men to take advantage of farmers, giving them lower prices for their animals yet meat in Kenya is a high price food whose economic benefit does not trickle back to farmers (Abebe *et al*., 2016). Therefore this affected the producers' incomes and their ability to invest in modern technologies and sustainable practices that required adequate financial resources. This is also collaborated by previous studies were pastoralist regard livestock production as a cultural and a livelihood factor yet they report it as being not profitable as an enterprise (Njoka *et al.*, 2016). For abattoirs/slaughterhouses, they indicated that the key inputs into their processes are water, labor and electricity, these three form the highest overheads, eroding their already thin margins and hinder their ability to invest in sustainable practices or modernize the slaughterhouses. Lack of slack capital affect the ability of actors to re-invest in the beef value chains and acquire the necessary equipment and technologies to modernize the value chain (Devaux *et al.,* 2018)

The perceived high cost of CSA TIMPs, prevalence of middlemen combined with lower prices to producers and slim profit margins for value adding activities along the chain, were among the key issues identified as hindering adoption and investment into CSA. This is not surprising because nearly 800 million of the livestock keepers are rural poor, surviving on less than 2 USD a day (FAO, 2011) and especially for ASALs rural poor households that are living in already environmentally vulnerable ecological zones that suffer from socio-economic marginality (Carabine *et al.*, 2019).

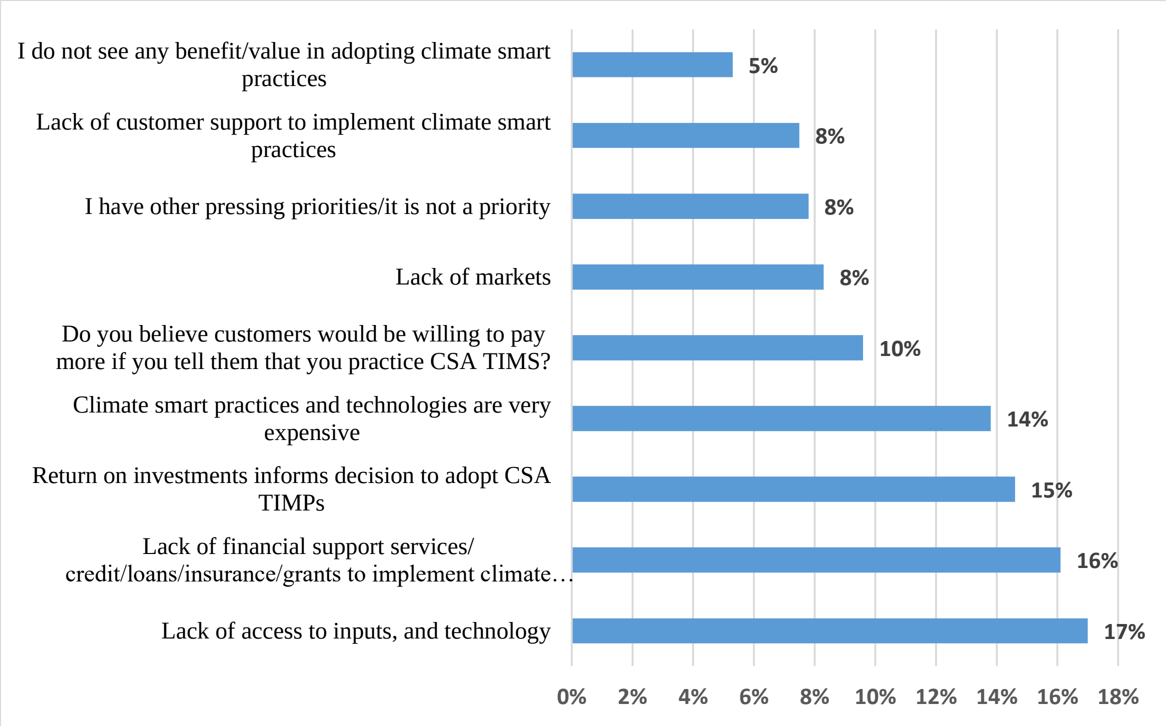


**Figure 24: Market and financial Barriers**

Table 13 shows that among the sustainable practices adopted by producers to mitigate against climate change ranged between 8% and 12% and only one financial product/practice i.e., livestock insurance/emergency fund, was utilized at a minimal level of 12%. Indicating that the producers resorted to practices that they deemed, easy to adopt, affordable and that would not involve high financial outlays, practices that would be deemed as safe bets and no regret options (IUCN Technical paper, 2014; World bank 2017). This agrees with technology adoption model and innovation diffusion theory, that states that perceived ease of use, usefulness and benefits of a technology or innovation are key determinant of speed and rate of adoption (Kim and Crowston, 2011; Pantano and Di Pietro, 2012). Crop and livestock mix was adopted at 11% by producers, this agrees with previous studies that indicate that combining livestock keeping with crop farming can act as a form of income diversification, savings or collateral, and climate risk reduction for the poor rural populations and would further aid CSA investment and adoption by providing needed extra resources for purchase of CSA TIMPs (Thornton *et al.*, 2019).

**Table 13: sustainable practices, technologies or innovations used by actors**

| 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. 25, shows the technologies and practices employed by the value chain actors beyond production level and only two were financial products i.e., an emergency fund (13%), insuring businesses against weather effects (13%). Among retailers and abattoirs only retailers had cold storage facilities and just a few of them reported that they did not need storage facilities (37.8%) and that cold storage equipment was expensive (21.8%) hence indicating a financial barrier. 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% of consumers buy enough for consumption for a day due to high cost of meat.

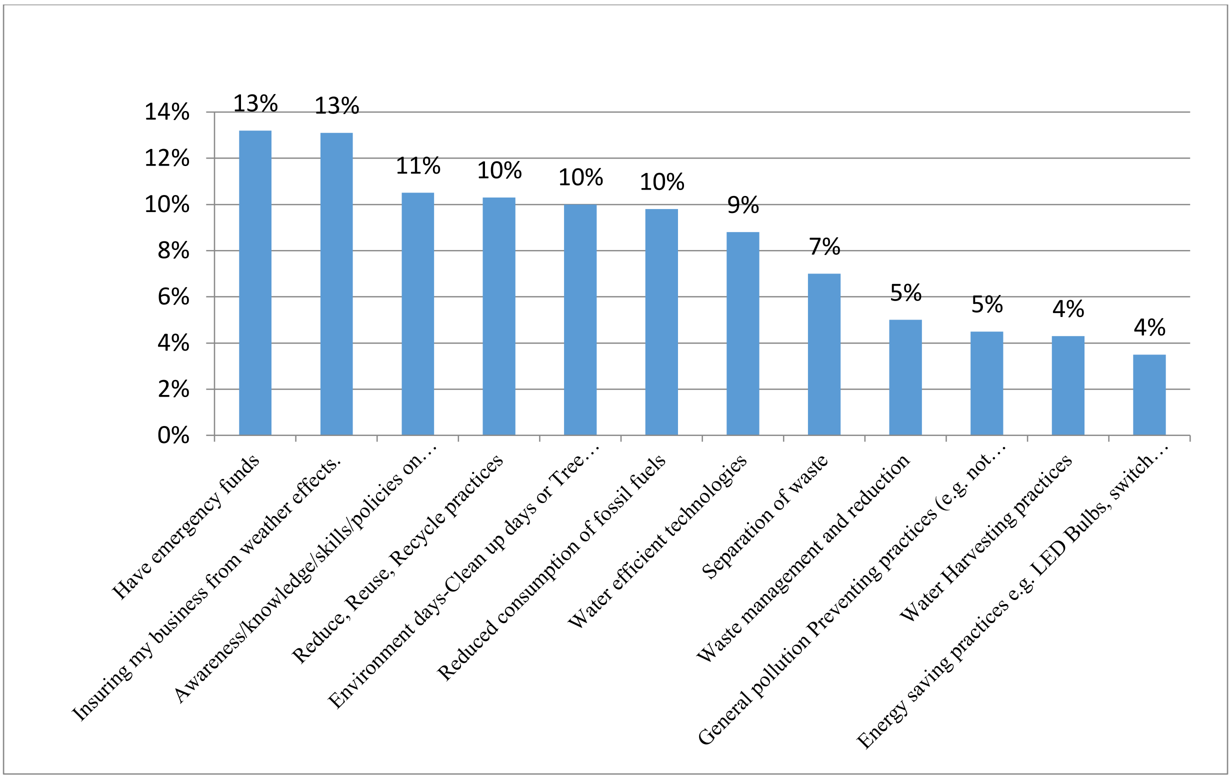


**Figure 25: Climate Smart technologies in use by the Value Chain Actors**

A veterinary officer in one of the abattoirs indicated that lack of storage facilities meant abattoir operated daily based on the daily consumers' demand and orders placed by traders and aggregators, this further implied the abattoirs were not optimally utilizing their 100% capacity each day hence driving up their overheads and increasing their annual operating costs. If they had storage facilities, they could operate optimally at 100% on certain fixed days of the week where they would slaughter the entire day and store supply for distribution for the rest of the week, reducing operating costs through leveraging economies of scale. The low use of storage facilities due to cost is further compounded by cultural social norms that dictate consumer behavior, whereby consumers especially pastoralist prefer freshly slaughtered meat because it's said to taste better compared to stored meat and for this reason 90% of consumers surveyed bought their meat from local butcheries compared to supermarkets, because the supermarket meat is stored in cold fridges for many days and hence was said to lack taste.

### 6.6.3 Policy and regulatory barriers

Fig. 26, presents the results on barriers associated with policy barriers. 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 and regulations that demand adoption of CSA and CSA TIMPs and 22% cited lack of standards for CSA adoption. Policy and regulatory barriers account for 71% of the barriers.

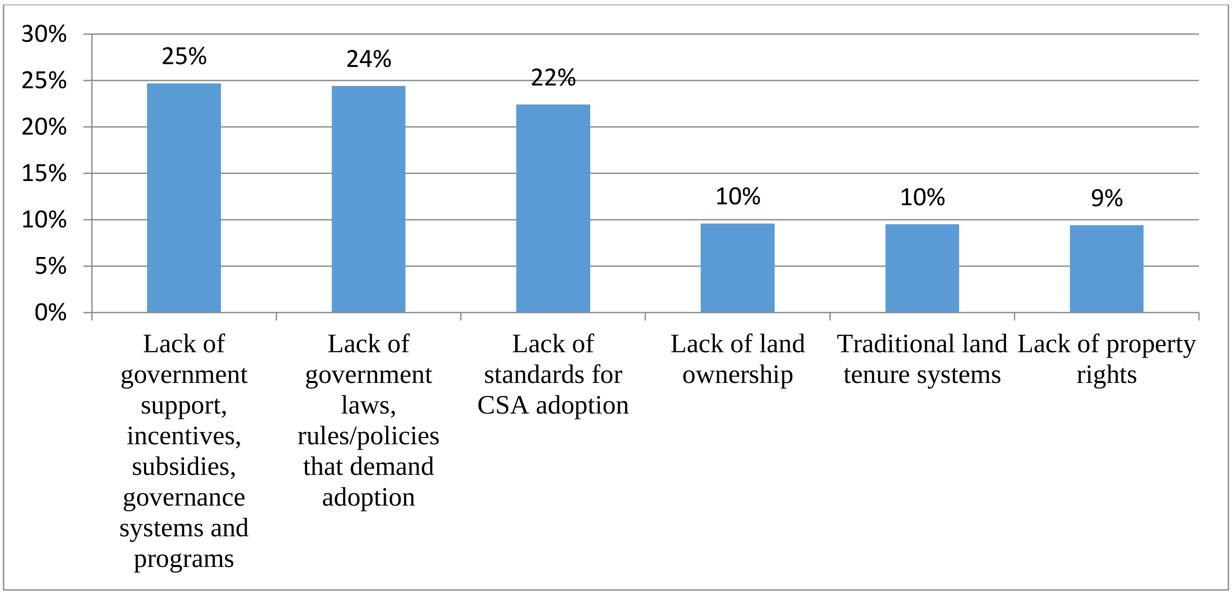


**Figure 26: Policy and institutional barriers**

### 6.6.4 Networks and engagement platforms barriers

Other barriers cited were related to the interactions of the actors within and among core value chain and extended and enabling value chains, through networks, horizontal and vertical linkages, collaborations and partnerships. From the results, half of the actors felt that there were no associations in place to exchange information, ideas, and collectively advocate and push for incentives, better enabling environment and even for the implementation of sustainable practices such as CSA. While the other half cited lack of specific frameworks for collective actions such as cooperatives, partners, including opportunities for public private partnership (PPP) within beef livestock value chain that would support investment, development and modernization of the beef value chain. Actors pointed that lack of such multi-stakeholders' platforms that would mobilize and leverage numbers and resources among the ASALs beef value chain actors was a hindrance towards adoption of practices such as the CSA and modernization of the value chains (Fig. 27). For instance, knowledge and awareness level of the concept of climate change and CSA among the actors show that collectively there is a fair level of knowledge but separately there are knowledge gaps among the actors which can be closed if the actors had platforms of interactions where they can share knowledge and exchange information. Input suppliers such as private sector agro vets, Ngong veterinary farm and county veterinary doctors, attached to each abattoir, indicated that livestock production in ASALs faces unique challenges due to the transhumance nature of pastoralism, predisposing it to conflicts from land grazing rights and water resources, which is further complicated by the blockage of migratory routes due to acquisition of land along migratory routes for housing due to ballooning urban population, and indiscriminate use of livestock drugs and antibiotics coupled with counterfeit drugs leading to drug resistance and exacerbation of livestock diseases, all these challenges can possibly be resolved through participatory learning and action (PLA) models that would also afford the value chain actors opportunities to learn, exchange ideas, network, self-organize and come up with sustainable localized solutions to the beef value chain challenges (Chambers, 2008).

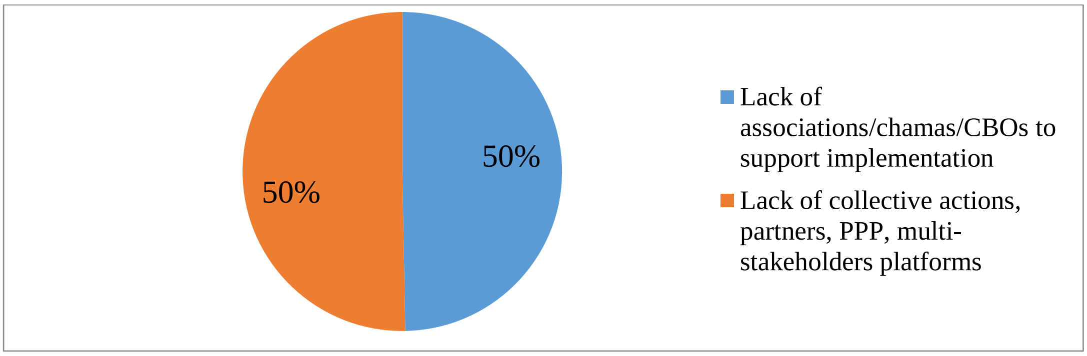


**Figure 27: Networks and Interaction platforms Barriers**

Concerning sources of information on climate change-related concepts results, (fig. 28), indicate that the commonly used sources of information were workshops, training courses and media, these three accounting for 68.4% and extension and agriculture officers (18.3%) and only 5% get their information from business association/(CBOs) community based organizations or informal groups known as chamas. This implies that value chain actors do not have an avenue to network and exchange relevant information yet some of the challenges faced by the beef value chain actors can be addressed through strong producers and value chain associations (Mwongera *et al.*, 2018). Networking and engagement platforms can strengthen actors' participation, and engagement with the beef value chain and enable adoption of new practices, technologies and sustainable practices such as CS (ILO, 2011).

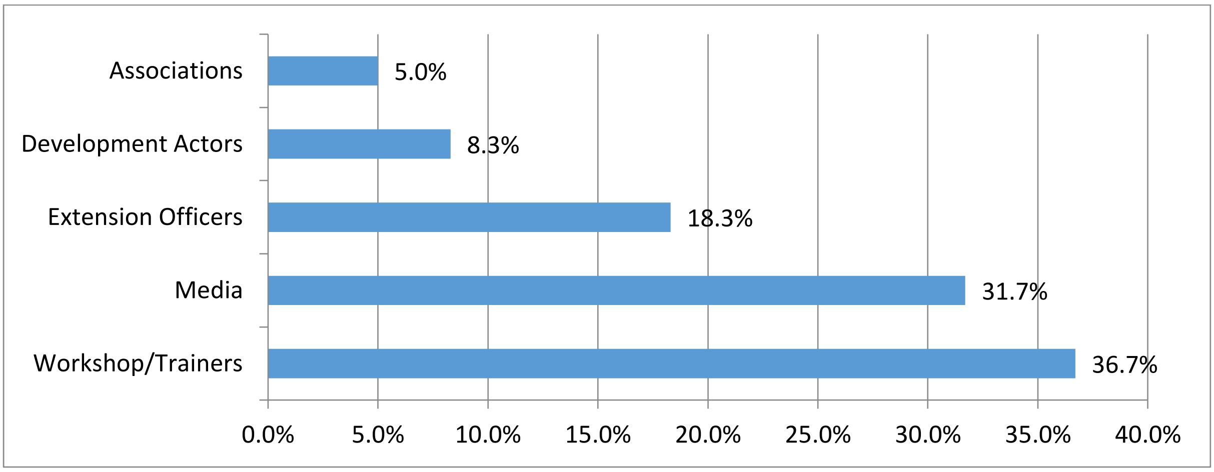


**Figure 28: Sources of Information on climate change-related concepts**

This study found only two community-based organizations, and whose main role was to manage the live animal markets in Kiserian and Bisil Markets. Their roles are limited to managing the market days, providing security, cleaning the market, levying fees from livestock traders and solving disputes. There was no evidence of organized awareness, knowledge and capacity building efforts for livestock chain actors, mainly farmers, traders, middlemen and transporters who patronized the markets. The CBO manager at Bisil Market indicated that the main information exchanged is informal market banter and mainly on issues such as price, weather, animal breeds and livestock diseases and possible drugs to use. Knowledge and awareness can be built through experience, formal and informal training, exposure and social cues like peer-to-peer influence and exchange of information among the actors in the value chains if platforms were available.

Community based organizations and actors engagement platforms can act as a springboard for participatory learning and action research (PLAR) for the beef value chain. PLAR would provide an avenue for an in-depth interrogation of the climate related unique challenges in the ASALs pastoralist beef value chain because local communities and value chain actors hold the answers to localized solutions. This would subsequently have faster, better and cheaper transfer of learning into practice for sustainable practices such as CSA TIMPs, thus yielding better results in CSA adoption and its scaling in the beef value chain.

**6.6.5 Cultural perceptions and social barriers**

With regards to barriers related to the cultural perception and attitudes of the actors towards CSA practices, results in table 3 indicate that majority of the actors (44%) thought that CSA TIMPs are a preserve for commercial, large farms and businesses while 25% expressed that their pastoral and nomadic traditions and religious beliefs would somehow discourage the adoption of CSA TIMPs. 21% of the actors just did not believe that CSA practices are good/suitable for them. The Kajiado county government and financial institutions collaborated this view, citing the prevailing thinking that new technologies such as CSA TIMPs are for commercial, large farms and businesses because they are economically able to adopt them. One respondent indicated, '" you need to have made enough money like the huge multinationals to adopt some of these technologies". The low level of knowledge led to low level of capacity on CSA, this agrees with a similar study on institutional related barriers (Baker, 2005) where it was found that inadequate institutional capacity and commitment, uncertainty about the technology and its reliability as the leading institutional barriers

(Mukherjee & Sarkar, 2018; Smith *et al*., 2018). This biased perceptions were where new technologies and management practices are positively correlated with large commercial enterprises was a critical barrier hindering the MSMEs integration of CSA TIMPs within the pastoral beef value chain. Previous study also show that climate research has previously tended to ignore MSMEs yet they are the one most affected by climate change due to their low climate adaptive capacities (Crick *et al*., 2016; Carabine *et al.*, 2017; Godde *et al.* ,2021). Previous climate action has had little recognition of the potential opportunities in climate risk management that can be found in involving the small businesses, MSMEs can contribute to negative climate effects through their actions but can equally be part of climate change solutions (Crick *et al*., 2016; J. Dekens *et al*., 2016).

Further, traditional customs, social norms and lack of trust in regards to new practices and technologies was cited as barrier to adoption of CSA. Traditional and cultural practices that persist even today, such as payment of dowry using cattle, keeping of cattle for prestige and as a preserve for older men in the community, hinder the ability of cattle rearing being viewed beyond its cultural value to being seen an enterprise that needs certain entrepreneurial skills, investments, modern technologies and management practices necessary to improve productivity, incomes, livelihoods as a source of youth employment, climate risk management and sustainability of the beef value chain. These cultural practices become barriers to integration of CSA objectives and adoption of CSA TIMPs (Jobbins *et al.,* 2016). In pastoralist communities are heavily patriarchal and girl child education is discouraged by cultural practices such as female genital mutilation and early marriages. Without education and economic empowerment that springs from education women are therefore hindered from effectively participating in beef value chain from their lack of knowledge/education and financial capital needed to invest in beef value chain. Education of women and their economic empowerment would promote women participation in beef value chain investment and development (FAO, 2018). Adoption of sustainable environmental practices such as CSA TIMPs can only result from social norms and behavior that promotes environmental sustainability (UNEP, 2010).

**Table 14: Soft Institutional related barriers**

| **Soft institutional- social cultural dimension, customs, values, attitudes, gender** | **Percent** |
|---|---|
| CSA TIMPs are for commercial, large farms and businesses | 44% |
| Traditional customs/norms or religious beliefs discourage CSA TIMPS | 25% |
| I do not trust or believe CSA Practices are good. | 21% |
| Because I am male or female | 10% |
| **Total** | **100%** |

However at the local level, the study found that incrementally small scale producers and value chain actors had adopted some sustainable practices through trial and error of 'no regret' options i.e. alternatives that are viable and beneficial such as mixed crop farming, ASALs adaptable livestock breeds, feeds supplements, indigenous livestock treatments and drugs, water pans, solar panels and energy saving bulb to increase climate resilience though there is still need for scale and major transformation of the ASALs' beef value chains if tangible benefits and sustainability is to be realized, since there are limits to what benefits can be realized through incremental adaptation especially for the poor ASALs livestock value chain actors.

### 6.6.6 Physical infrastructure barriers

The physical infrastructure for beef value chain mainly consist of roads, availability of power, and connection to power lines, water and sewer lines especially for abattoirs, built areas/ physical market for live animals, processing structures and equipment i.e., slaughter houses and abattoirs, animal handling equipment both at the live animal markets and in the slaughter houses, trucks and infrastructure for transportation of the animals to the live animal markets and to slaughter houses, transportation of slaughtered carcasses and meat by distributors and retailers.

Table 15, shows the barriers associated with physical infrastructure, 50% of the actors expressed lack of physical infrastructures, as a hindrance towards adoption of sustainable practices such as CSA e.g. availability of adequate road network and all weather roads that do not flood or get washed away during the rainy season while the other 50% cited lack of power or energy sources or where present, the power being too costly. Climate and the associated environmental disasters, such as droughts and floods damages physical infrastructure, interrupts supply chains and leads to high cost of development, repairs and maintenance (Godde *et al.*, 2021).

**Table 15: Physical Infrastructure Associated Barriers**

| **Physical infrastructure** | **N** | **Percent** |
|---|---|---|
| Lack of access to transport/roads/facilities/ some form of assets | 252 | 50% |
| Lack of power/source of energy or energy costs are high | 249 | 50% |
| Total | 501 | 100% |

In ASALS Climate change also has impacts on human productivity and animal health, traders indicated that during the many long days of trekking the animals many kilometers on rural roads to live primary animal markets, and due to extreme heat there is significant animal body weight loss due to dehydration, affecting productivity, meat quality and price. The producers preferred easily accessible markets and abattoirs that eliminate the long treks, especially as youth who are used to trekking the animals migrate to urban areas leaving the aged to trek the animals.

## 6.7 Discussions

This study found that even though Climate-smart agriculture (CSA) is one response to the challenges faced by the agriculture sector, the adoption and diffusion of CSA technological innovations and novel management practices is slow. This is due to several barriers, the first being a lack of awareness and knowledge on both the process and tools of CSA among the wide demographic of value chain actors that is mainly dominated by youth and male actors. The actors did not have full knowledge and understanding of the climate change concept in relation to beef production and value chains, even though knowledge was unevenly distributed with input suppliers such as agrovets, and processors having higher levels of knowledge (Thorlakson & Neufeldt, 2012; Abegunde *et al*., 2020).Therefore understanding how the social systems that includes level of education, age and gender affects awareness and sustainability mindset can be critical in addressing the barriers to application, adoption and scaling of CSA TIMPs among the actors (Etwire *et al*., 2017a; Mwongera *et al*., 2019a). Sustainability mindset need to start with awareness and knowledge, in order for CSA TIMPs to be adopted across the entire value chain beyond production, into marketing and processing sectors of the livestock (Ogutu *et al.*, 2016; Nkonya *et al*., 2017; GOK, 2018).

Sustainability of climate smart initiatives are highly dependent upon knowledge, attitudes and practices (KAPs) of the actors on the same (Fielding *et al.*, 2016). Adoption and sustainability of climate smart initiatives is dependent on knowledge, attitudes and practices of the actors (Fielding *et al.*, 2016), and these attributes influence the behaviour of the actors involved in the way they interphase and interact with new technologies, innovation, value chain management, governments, legal and institutional frameworks (J *et al*., 2020). There is urgent need to enhance awareness and enforcement of sustainability values and mindsets among citizens and in particular CSA within the beef value chains, beyond enforcement for compliance sake. Institutional theory approach should be considered, because it outlines a deeper and more adaptable aspects of social structure, whereby values are built by social and cultural institutions that establish schemes, rules, norms, and routines, which then become accepted as authoritative guidelines for social behavior and mainstreamed into policy and regulations (Scott, 2004), leading to buy-in hence better and faster adoption of sustainable practices (UNEP, 2010).

Financial barriers were a major hindrance to adoption of sustainable practices such as CSA TIMPs. Typically, Individuals require evidence and or demonstrations that the technology to be adopted works before they make a decision to embrace it (Dearing and Cox, 2018). Since many actors along the chain have not adopted CSA TIMPs, there is limited evidence to convince other actors to adopt. In addition, after adoption CSA TIMPS require some time to start showing some returns on investment, hence discouraging adoption when commercial benefits of investing in CSA TIMPs are not immediately feasible. In social network theory actors exist in a networked environment where they exchange goods, values and information (Barro and Sala-I-Martin, 1992; Fang, 2009; Thorlakson and Neufeldt, 2012;) hence peer to peer influence to adopt CSA TIMPs can be built through informal exchange of ideas and experiences, formal training and social cues as beef value actors intersect but engagement opportunities/platforms are a precursor to exchange of information.

The study also found that there were limited platforms or organised networking opportunities for actors to exchange information that can positively impact adoption and strengthen their participation in the value chains. Successful adoption of a given technology depends on team work and going by the diffusion and adoption theory (Abegunde *et al*., 2020;), it is only when the late adopters and laggards, as they interact with their peers who are early adopters, see the realized benefits of CSA TIMPs as demonstrated by the early adopters and innovators that the late adopters and laggards could be willing to support (Zhang *et al*., 2015; Smith *et al*., 2018;) hence the need to create possible ease to access and use platforms such as leveraging of mobile phone technology and social media where actors can interact, exchange ideas, model desired behaviors and practices and influence their peers. Personal attitude (Dai, Weisenstein, and Keith, 2018) and psychological factors such as environmental identity and values, return on investment (Fielding and Hornsey, 2016), are also important to adoption of sustainability practices such as CSA. In beef value chain for instance, the actors, especially those beyond producer level indicated they would consider return on investment before adopting CSA TIMPs and hence would embrace climate smart practices that ensure maximum yields and commercial benefits such as increased revenue and profitability if they saw evidence of the same among their peers (Ali *et al.*, 2014; Ericsson and Lindberg, 2018; Williamson *et al.*, 2010).

The study also found institutional capacity barriers where the MSMEs felt they were not large enough to adopt the CSA TIMPs or practices. The beef value chain actors perceived new technologies and practices as a preserve of large commercial businesses. Large, in enterprise terms, would mean revenues, staff capacity and market reach to adopt CSA TIMPS. And therefore there is an urgent need to challenge such biased perceptions, raise awareness on sustainable practices as being a necessity for all enterprises and further customize CSA to microenterprises who dominate the pastoral value chains in order to improve their climate change adaptive capacities bearing in mind that ASALs livestock sector and related micro enterprises are the most impacted by climate change (Njoka *et al.,* 2016). The organization theory on innovation activities can also shed further light on this. It has long been posited that constrains in capacity limits an organization's ability to innovate, and that slack resources, (whether human, financial or technical), are key elements for organization's ability to make investments in new innovations. Lack or limited slack resources inhibits experimentation which is even more necessary, for this resource constrained MSMEs, to fuel their innovation and growth. Experimentation is often considered as an unaffordable luxury or waste by resource constrained MSMEs, especially because of uncertainty of success or return on investment. Moreover, tightly wound enterprises experience higher levels of internal conflict, which is also unfavorable to innovation (Tankha *et al*., 2020)

This study found out that there are many barriers to the scaling up successful CSA pilots and issues related to an enabling environment, among them being financing and equity barriers (Westermann *et al*., 2018; Blythe *et al*., 2018; Aggarwal *et al*., 2018). MSMEs in the beef value chain are not willing to take loans to enable them adopt the available CSA TIMPs due to lack of financial security and the high interests by the financial lenders are always prohibitive. Additionally the financial institutions were also reluctant to venture into the livestock sector citing unproductivity, climate stress risks, the transhumance nature of pastoralist, lack of security and poor loans repayment as a big risk in lending to the rural pastoralist and poor beef producers (Gledhill and Herweijer, 2012 ;Thorlakson and Neufeldt, 2012; Descheemaeker *et al*., 2016). The banks also indicated that there is a lack of available range of TIMPs for actors to choose from making what is available limited, not compatible to the needs of the actors or expensive, and when the actors look for loans, they do not have enough knowledge about available technologies or the banks' policies and product catalogue does not have any options specifically tailored to CSA and CSA TIMPs. Among financial institution interviewed the only possible CSA Technology loan product that was available from two banks in Kajiado was the solar panel loan, which even the large slaughter houses such felt installation of solar panel was quite expensive and were not convinced on return on investment. A slaughter house that had taken a loan to put up a biomass plant which eventually ran into operating and maintenance challenges, could not produce sufficient energy to mitigate the slaughter house high energy costs and eventually the project was abandoned without having paid back the capital investment.

To effectively understand climate change and design appropriate TIMPs and related financial products in relations to the unique circumstances of pastoral beef value chains, awareness and knowledge by both the core value chains actors and financial institution is an essential element in the response to climate change and related climate risks (Tasquier *et al*., 2014). Financial Institutions and cooperatives play a major role as enablers in the value chain, with their financial assistance, they enhance access and adoption of the technologies however they can also be barrier if they do not have sufficient knowledge and interest on to provide climate risk products fit for related value chain (Descheemaeker *et al*., 2016; Gledhill and Herweijer, 2012; Thorlakson and Neufeldt, 2012). Innovative mechanisms for de-risking pastoral beef value chains and enhancing financial institutions' (FIs) focus to lend to MSMEs in the beef value chain is important. There is also the need for technical assistance to FIs and MSMEs to ensure that adequate products and services are developed to address climate resilience and adoption of CSA TIMPs and MSMEs have adequate institutional capacity to experiment, innovate, adopt and scale their use of sustainable practices such as CSA TIMPs.

That notwithstanding, MSMEs in the sector have reported that apart from lack of sufficient financial resources, other competing priorities for the same resources hinders them from adopting CSA. Rural poor household in ASALs have different competing needs to allocate the limited financial resources and face substantial trade-offs when using resources, and value chain actors are not able to assume higher risks when reinvesting limited capital (World Bank, 2017; Devaux *et al.*, 2018). In addition the fact that consumers will be unwilling to pay more for end products if the cost of adopting CSA was included into the costing of the final product is a barrier to adoption of new sustainable production and consumption practices as envisioned by SDG 12 (UNEP, 2010; Dai *et al.*, 2018; Kgosikoma *et al.*, 2018; J *et al.*, 2020).

The study found that actors consider return on investment as a key criteria when adopting a practice and would willingly embrace climate smart practices that ensure maximum yields and profitability (Ali *et al.*, 2014; Ericsson and Lindberg, 2018; Williamson *et al.*, 2010). Cost factors, as seen from the study, have an influence of how actors adopt climate smart practices. 15% of the value chain actors cited return on investments being the basis of the decision to adopt CSA TIMPs. Moreover, according to the transactional theory of technology adoption, individuals will be willing to adopt a particular concept or theory if there is a benefit they will gain from it otherwise they will not adopt (Dearing, 2009; Khalifa and Ning Shen, 2008). The costs of technological innovations are prohibitive, especially early on in the diffusion process due to difficulties in initial commercialization efforts. The expense of establishing production facilities, as technology developers transform themselves into technology producers, often means that profits are hard to obtain and increase the costs of the innovative product or service (Cullen *et al.*, 2013; Faber and Hoppe, 2013; Luthra *et al.*, 2017); these can be expressed as 'early adopter costs' (Gonzalez, 2005), and impact both technology users as well as technology producers. According to diffusion theory, if the benefit of a new technology or management practice is not immediately imminent, e.g. as in the case of CSA TIMPs where the benefits tend to be realized in the long term, the actors will be slow to embrace the technology (Kim and Crowston, 2011). This means that there is need to subsidize both the technology suppliers and the users, in this case CSA technology suppliers in order to make readily available CSA TIMPs that are also affordable to the beef value chain actors and for the actors to consider purchasing on the basis of affordability and return on investment. The challenge though is that, CSA being a new initiative that is barely over ten years does not yet have a range of affordable technologies to choose from or those available have not been fully tested or contextualized, since CSA was only introduced in 2010 at the Hague conference. This further means that there is an urgent need for technology innovators and investors with financial capacities to be encouraged to design and put into the market a wide range of affordable CSA TIMPs addressing a cross section of agricultural value chains and more so beef sector which had previously been ignored and is now gaining serious attention due to its impact on climate change and GHGs emissions and the need for sustainable food systems (Crick *et al.*, 2016; FAO, 2018; Cheung *et al.*, 2018; Grossi, *et al.*, 2019).

This study also found that the consumers are demanding for better meat quality and safety especially following recent public awareness on meat safety in Kenya and government enforcement of the same even though there are relevant institutional governance and management framework such as the Public Health Act, Cap 242 that regulates meat slaughtering, handling, transportation and consumption premises, enforcement has been poor (Oloo and Oloo, 2010). Hence this presents an opportunity to not only comply but to develop and green the red meat value chains, through investments and adoption of sustainable practices such as CSA TIMPs.

The study also confirmed the need for systems approach to assessment and design of CSA solutions, enabling policies and incentives, taking into account the entire value chain pasture to plate, since currently the majority of CSA related practices being used by beef value chain actors, address mainly producer level and overlooking value chain actors beyond producers i.e. to aggregators, transporters, processors, distributors, retailers and consumer and to extended value chain to actors such as equipment and machinery suppliers, financial institutions (FIs), micro finance (MFIs) and insurance companies as can been seen by their low knowledge and practices on CSA TIMPs in the study.

System approach should also be applied in creating an enabling environment, strong climate governance frameworks and government institution are needed, to not only support capacity building and promotion of society values toward climate change awareness, adaptation mitigation and monitoring but also towards integration of social and economic factors for holistic sustainability deployment and tracking. The current sectoral legal and institutional frameworks were put in place before introduction CSA as a concept was introduced and hence there is a gap in their enabling adoption of CSA. Previous studies shows that there are a number of barriers, in general, limiting small holder farmers in Kenya from integrating into agriculture value chains and adopting sustainable technologies, especially where policies and actions to address barriers still remain inadequate (Descheemaeker *et al.*, 2016; Mutoko *et al.*, 2015). The impacts of climate change transverse across sectors and geography, greatly affecting ecosystem sustainability and food systems, therefore response initiatives, policy and actions need to be holistic, occur at multiple scales and targeting multiple sectors. This will require cross collaboration within the value chains and more so among the enabling government institutions, development partners and stakeholders. There is an urgent need for a cross-sectoral coordination mechanism encompassing policy and governance frameworks, including NDCs (nationally determined contributions under), the Paris climate agreement and the growing number of climate-smart agriculture TIMPs, programmes, plans and policies, infrastructural development and social change, to work in synergy to create a favorable enabling environment for MSMEs in the livestock sector and especially in ASALs pastoralist communities who are most impacted by climate change to create climate resilient pastoral beef value chains. For a sectoral transformation to occur, the implementation of various policies should be expedited with emphasis on effective governance mechanisms made up of central and local governments, value chain governance and actors, aggregators' associations/cooperatives, development partners, all the way to inclusive community-based organizations. There is also a need to leverage efforts and synergies across sectors and hence develop a cross-sectoral coordination mechanism to tap incentives for climate action coming from other sectors such as energy, finance and ICT, and especially leveraging the use of mobile technology to deliver CSA, policy and market information to the value chains.

## 6.8 Conclusion and Recommendations

### 6.8.1 Conclusion

From evidence observed in this chapter, the following can be concluded:-

1) Even though CSA TIMPs may be available diffusion and adoption remains a big challenge due to several barriers.
2) Lack of Knowledge, awareness of CSA TIMPs, their usefulness, benefits and CSA remains a key barrier to adoption.
3) Beef value chain actors indicate they mainly face financial barriers that discourage their adoption of CSA TIMPs.
4) Financial institutions and investors can be enablers for CSA adoption however their hesitancy to invest and lend to pastoral beef value chain is a barriers since they perceive the chain to be high risk.
5) Inadequate actors' association and engagement platforms, hindered exchange of information and participation of actors in identification of challenges and solution necessary to develop, strengthen the beef value chain and adoption of sustainable practices such as CSA TIMPs.

### 6.8.2 Recommendations

From the conclusions reached, the following recommendations are made:-

i. The county government, should enhance effort in addressing barriers to CSA TIMPs adoption by providing knowledge and awareness to beef chain actors in order to reduce information asymmetries and to support their adoption of CSA TIMPS.
ii. Additionally, county government should mediated the economics of the decision-making process by beef value chain actors by offering financial incentives for the adoption of CSA TIMPs until CSA is capable of making for itself a compelling economic case for rapid and widespread diffusion.
iii. There should be concerted efforts to educate financial institutions, micro finance, cooperatives, and insurance companies on CSA and CSA TIMPs and create policies and incentives to de-risk the beef value chain and further to encourage them to invest in climate change products and risk instruments for the unique needs of ASALs beef value chains.
iv. The county government should map all actors within the beef value chain and create suitable engagement platform for exchange of information and collaboration of all relevant stakeholders to generate suitable solutions, and policy options to drive CSA TIMPs adoption while using inclusive efforts that leverage voices from the marginalized such as the women and youth.

# CHAPTER SEVEN

## 7.0 General Discussion, Conclusion and Recommendations

### 7.1 General Discussions and Conclusions

This chapter discusses the overall research key observations and conclusions made from the study in their context uniqueness, expectation and/or to the extent to which they conformed or differed with similar observations, as advanced through previous theories. To this end, the key issues observed by this study for discussion included:-

i) MSMEs' poor understanding of the concept of climate smart agriculture by beef value chain actors and related concepts such as adaptation, resilience and mitigation.

ii) MSMEs' recognition that the beef value chain is affected by the climate change and their activities and practices within the value chain could also affect the environment.

iii) MSMEs' willingness to take part in CSA initiatives that protected the environment as long as they also brought about economic gains.

iv) Existence of legal and institutional frameworks that can be leveraged in the beef value chain governance and management and MSMEs' integration of CSA TIMPs within the beef value chain, even though MSMEs' had poor knowledge and compliance on the same due to weak enforcement, and further these frameworks were not specifically developed with CSA in mind.

v) Inadequate enabling environment and presence of barriers to MSMEs' CSA integration and adoption of CSA TIMPs. This study categorized the barriers into six broad areas; (1) Knowledge and institutional barriers, (2) Market and financial barriers, (3) Policy and incentives barriers, (4) Networks and engagement platforms barriers, (5) Cultural and social barriers (6) Physical infrastructure barriers.

### 7.1.1 Discussions

CSA technologies, innovation and management practices (TIMPs) in general do exist, however the range is limited and does not encompasses the entire agricultural value chains. The CSA TIMPs found among the beef value chain actors were limited and their diffusion and adoption is low and slow due to several barriers.

There was poor understanding of the concept of CSA by the beef value chain MSMEs though not entirely surprising because, first, CSA as a concept is still fairly new having been introduced in 2010 during the Hague conference (FAO, 2010). Second, CSA was initially introduced to crop farming and not to the entire agricultural sector thus it initially excluded livestock farming and focused on subsistence crop farmers (Pantano *et al*., 2012). Third, CSA initiatives initially concentrated largely around the producer and had not extended to include actors in the aggregation, marketing, processing, distribution, retailing and consumption nodes of the core value chain, i.e. 'farm to fork', 'pasture to plate' (Mwongera *et al*., 2018). Forth, CSA had not been introduced to the extended and enabling value chains that supported and enabled the core values chains, hence it initially took a crop production approach rather than a food system approach. Further, climate change adaptation research and practices have largely focused on small holder food crop farmers while little has been done on smallholder livestock farmers as seen by the latter limited adaptive capacity and low practices (Kgosikoma *et al*., 2018). In addition, even though climate change poses potential risks and opportunities for all actors within a food system a lot of research on adaptation in developing countries have neglected involving key actors in the private sector food systems (Wreford *et al*., 2017a). Equally, climate adaptation research and climate risk management has largely ignored small businesses like MSMEs and has had little recognition of the potential opportunities in climate risk management that can be found in involving the small businesses (Crick *et al*., 2016; J. Dekens *et al*., 2016). Lack of a value chain and systems approach to CSA integration may be the reason for varied awareness levels of climate change and its effects among the value chain actors and also the varied observed application by beef value chain actors of CSA related practices. Yet due to interconnection and interdependence of actors along the value chain and food systems, the negative impacts of climate change at one part of the chain or system has a ripple effect within the entire food system. It's possible that the value created by application of any sustainable practices such as CSA at the producer level can either be eroded or scaled as value addition activities and product inputs change hands from one actor to another along the value chain, ultimately creating a collective positive or negative impact, in the entire chain or food system. Value chain actors' interdependency requires that all actors along the value chain must collaborate to manage climate risks to ensure profitability and sustainability of the entire value chain and their businesses. Without application of systems thinking to climate change management and appreciation of existing interdependencies among the actors the opportunity for collaborative growth, development and sustainability is entirely missed out (Angie *et al*., 2018). To utilize the full benefit of CSA the focus should be broad-based to include not just the beef producers because a producer exists within a food ecosystem from pasture to plate with other actors within a networked system and even further beyond to the extended and enabling value chain actors such as farming equipment suppliers, technology (CSA TIMPs) innovators, incubators and those involved in commercialization of value chain technologies, financial institutions, micro finance institutions, insurance companies, cooperatives and chamas/association, community based organizations, aggregators and networks/engagement platforms, government and development actors. Further in terms of knowledge and awareness of CSA and related concepts the actors had a gap in directly linking climate change, its effects, and the effects of their activities on climate, such as GHGs emission, the resilience, productivity and sustainability of the entire value chain hence their low awareness of terms such as adaptation (0.8%) and mitigation (2.3%). The actors in the extended and enabling value chain had low appreciation on their role in supporting and creating an enabling environment for adoption and scaling CSA education/awareness and practices of TIMPs in the beef value chain as part of the large food system (FAO, 2018; Mwongera, *et al*., 2019). For example, since the core value chain actors can only develop an interest in an innovation or a new practice if the same will ease their mode of operation in a free of effort manner and delivered economic benefits, (Davis 1989; Kim and Crowston, 2011; Zhang *et al*., 2015).) I.e. if the innovation will not require a lot of effort to learn and practice, then this would mean involvement of those actors concerned with incubation and commercialization of technologies in order to understand the beef value chain actors' unique needs and attitudes and incorporate them in design and production of those technologies CSA TIMPs with ease of learning, use. The actors pointed out the lack of a variety of CSA TIMPs to choose from beyond producer level, yet availability of CSA TIMPs, by innovation incubators, that are context based and affordable are key to actors inclusion into climate smart livestock value chain (Mwongera *et al.*, 2018; Thornton *et al.*, 2019). Financial and micro finance institutions pointed this limitation as a barrier to their ability to design financial products appropriate for climate risk management within pastoral beef value chain. Providing networking and engagement platforms for actors within the beef food system is critical because these platforms will not only provide the opportunity for actors to self- organize, advocate and regulate themselves towards climate responsive beef value chain management practices but also faster and better diffusion of CSA TIMPs. Value chain actors operate within a closely networked ecosystem of complex relationships (Liu *et al.*, 2017) that could serve as either an enabler or barrier to adoption/integration of CSA TIMPs (Kim and Crowston, 2011; Pantano and Di Pietro, 2012). Therefore, actors within the value chain if well understood can be leveraged as part of climate change solutions and not just viewed as part of the problem (Mwongera *et al*., 2018; Grossi *et al*., 2019; Devaux *et al*., 2018; Atela *et al*., 2018).

Understanding the food systems and engaging private actors/MSMEs is important to get to the root cause of system success and failure especially in regards to climate change vulnerabilities, impact, and resilience-building on food security, livelihoods and poverty alleviation. It requires the assessment of participation, integration and interdependency among the actors including women and youth within the food system, such as beef, in order to address the twin problem of food security and ending hunger, and beef food print and environmental protection (FAO; 2018).

A systems approach in CSA initiatives, awareness, education and integration therefore will allow the value chain actors to realize the hidden potential in scaling the CSA benefits for economic development, positive social outcomes, environmental protection, and increase rural incomes while reducing rural poverty in the entire food systems and beef sector specifically (Mwongera, *et al*., 2019, A. Orr *et al*., 2017, FAO, 2016). It is hence imperative to note that there should be a change in thinking so that CSA TIMPS adoption is not just viewed as the delivery of an external, usually a science-based innovation with beef value chain actors as probable end users, but as a more complex learning process that involves an extensive range of players (Meijer *et al*., 2015). This food systems approach can enhance the integrate of actors along the value chain by engaging them to improve on the knowledge and information they possess as opposed to waiting for innovations out of their reach both financially and within their scope of knowledge. There is an emergence of knowledge systems thinking, whereby a defined set of players, networks and organizations in food systems are expected or managed to work synergistically to support knowledge processes through use such models as participatory learning and action research to in order to enhance adoption of sustainable practices such as CSA TIMPs (Ro¨ling 1992; Chambers 2008).

The study shows MSMEs' awareness of climate change as a weather variability index, that affected the value chain and on the other hand the recognition that the value chain activities could affect the environment negatively though not precisely how in terms of climate change. This awareness, presents an opportunity or an entry point for introduction of CSA awareness and further CSA TIMPs integration.

This study observed that factors such as gender, level of education and age affected the level of awareness on climate change and related concepts, pointing to the need to understand and address social dynamics that affect adoption of sustainable practices in agricultural value chains and in this case ASALs beef value chains that have unique social cultural dynamics. This also can be combined with additional innovation adoption factors like individual differences, such as low drive for innovativeness (Kurulgan and Özata, 2010), socio-cultural and socio-economic barriers in terms of gender, age, education level and privacy and security among the pastoralist communities who are the major beef producers (Venkatesh and Davis 2000; Flosi, 2008) and peer pressure (Salajan *et al.*, 2011). Sustainable environmental practices can only result first from awareness that then leads to social behavior, values, norms and sustainability mindsets that promotes protection of the environment (UNEP, 2010).

Prudent environmental governance and management requires society values and socio- cultural norms that get created, diffused, adopted, and adapted over space and time, to lead into the same being anchored and practiced over generations (UNEP, 2010). Thus, social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (enterprise relevance, output quality, result demonstrability, and perceived ease of use) may have affected the need to make efforts to understand the CSA concept or adopt it all together. This makes it a need for the county government to build capacity for the affected actors in terms of ensuring they understand the CSA concept as a sustainability (economic, social and environmental) measure in relations to their social values and norms (UNEP, 2010).

This study observed that the actors had integrated some sustainable practices that may be classified as, ‘safe bets’ and ‘no regret options’, (World Bank 2017) in their business mainly for risk reduction and profit optimization but not necessarily out of CSA awareness. In addition the MSMEs in beef value chain were willing to adopt CSA TIMPs as long as they brought about economic gains. The observed actors' willingness to take part in initiatives that protected the environment as long as they also brought about economic gains can be leveraged to introduce CSA TIMPs climate adaptation and mitigation interventions that would lead to economic gain. Previous studies show that most climate change adaptation decisions, are made by 'private actors' such as MSMEs seeking to maximize their own welfare by managing their risk exposure and to maximize opportunities when they arise (Gannon *et al*., 2018). To effectively manage climate risk actors would require the knowledge and skills to link interventions such as CSA TIMPs with improved incomes and risk reduction (Carabine *et al*., 2018; Gannon *et al*., 2018). CSA awareness must also include an emphasis on the economic benefits to the actors this is supported by a previously argued theory where actors develop interest for a concept based on awareness of its perceived usefulness and ease of use (Tang and Chen, 2011). Beef value chain in ASALs is informal and driven by actors whose perceived usefulness translates into value chain benefits of enhanced efficiency either through maximum beef yields and/or profitability of sold meat/by-products (FAO, 2019). As Davis (1989) argued that actual usage of an innovation, in this case CSA TIMPs, is determined by intention to use, which in turn depends on the attitude towards the TIMPs. The attitude of the actors in this case demonstrated lack of interest as jointly determined by low perception of ease of use and usefulness of CSA TIMPS (Tang and Chen, 2011).

Legal and institutional frameworks that can be leveraged to drive actors' integration of CSA TIMPs within the beef value chain were found to exist, albeit weak enforcement, not specific to CSA and poor actors' knowledge and compliance. This agrees with previous studies that shows that even though CSA has the ability to provide adaptation and mitigation benefits to pastoralists, it's still not clear what type of transformation in policy frameworks, legal and institutional frameworks and funding were necessary to aid adoption (Tankha *et al*., 2020). Equally diffusion of CSA is ASAL may faces many institutional barriers, due to the fact that ASALs ecosystems have low institutional quality and weak regulations to support integration of MSMEs and adoption of sustainable practices such as CSA TIMPs into the beef value chain. In addition, ASALs have low levels of trade and economic integration due to their inaccessibility and poor access to markets, low levels of human capital mostly due to cultural norms, poor physical infrastructure, low level of productivity due to lack of financing, and uncompetitive markets leading to high levels of livelihoods vulnerability and socio-economic marginality, which will further worsens with climate change (Crick, *et al*., 2016; Njoka *et al.,* 2016; Gannon *et al.,* 2018).

The national and county governments are critical in creating an enabling environment and removal of barriers to climate change management and adoption of CSA TIMPs. This is through their enabling of platforms for the emergence of new knowledge delivery systems for initiatives such as CSA and coordinating the implementation of already existing legal and institution frameworks, revision and creation of new context based policies that would aid or incentive CSA TIMPs adoption and bringing in private actors, public private partnerships and development sectors to work with and support the MSMEs capacity augmentation in the value chains (Carabine *et al.,* 2018; Devaux *et al.,* 2018; Gannon *et al.,* 2018).

Globally small been business have been left out in climate change conversations, it does not help much when initiatives in climate risk management have focused on multinational enterprises (MNEs) and large companies within the global value chains especially in the context of reduction of their carbon footprint, mitigation of GHGs emissions, and promotion of green practices e.g. use of sustainable business practices, reduction of fossil fuels and use of renewable energy, leading to little recognition of the potential opportunities in Climate Risk

Management that can be found in involving the small business such as MSMEs (Dekens *et al*., 2016).

It's clear that, scaling of CSA objectives cannot depend on MNEs because globalization shifts the power away from local actors and National governments to MNEs. MNEs have been known to take advantage of their market power, exploiting farmers and workers while pushing governments to reduce environmental and labor standards in developing countries (World Bank, 2014). Any existing inclusion of small business (MSMEs) by civil society and public sector donors into any climate initiatives tend to lump and generalize them under generic models with one size fit all solutions, yet to effectively involve the MSMEs in marginalized ecological zones such as ASALs, MSMEs must be understood and approached in more nuanced ways if any significant contributions to scaling of climate risk management and related initiatives such as CSA is to be realized (Rosenstock *et al*., 2019). This would mean contextualization of climate interventions such as CSA at spatial, temporal and assets levels of MSMEs in beef value chain that operate in unique and vulnerable areas such as ASALs and depend on pastoral and nomadic beef producers.

Socio-cultural beliefs and norms that hinder women from fully participating in education, land ownership and owning assets such as cattle is a barrier to climate adaptation and mitigation (Batool and Saeed, 2017). Livestock value chains especially large ruminants (in this case cattle) are still largely and culturally considered a male-dominated trade among nomadic and pastoral ASALs inhabitants. There is minimal participation by women and youth due to cultural norms and prohibitive assets requirements necessary to participate in livestock value chains, yet development strategies must be pro-poor and inclusive (Crick *et al.,* 2016; Gannon *et al.,* 2018). Women and youth in ASALs, face innumerable impediments from the lack of adapted social services, such as schooling, health provision and financial inclusion, to loss of resources, and greater market barriers. Services such as education, healthcare, and banking are yet to fully adapt to the nomadic pastoralism and transhumance lifestyle in ASALs. (FAO, 2017). Women can be key agents of change in CSA integration and CSA TIMPs adoption in beef value chain because women entrepreneurs may be more likely to engage in sustainable adaptation than men, allocate economic returns more efficiently to the most critical household assets, including health, education and food security, which in turn contribute to climate resilience (Crick *et al*., 2018). Women and youth can be integrated and supported into the beef value chain through addressing the socio-cultural and systemic barriers that hinder their participation in the value chain and ensuring their voices are included in climate change and CSA policy dialogues and formulation (Gannon *et al*., 2018).

Engagement platform that leverage technologies such as mobile phones and social media are central to engaging women and youth while driving CSA awareness and adoption through participatory learning and action approach that involves the beef value chain actors in identifying and developing solutions to the climate resilience and mitigation while improving their incomes (Chambers, 2008). Because an innovation moves through an interconnection of social relationships to create integration that is determined by the structure of the social networks and perceived gains (Rogers, 1995; Liu *et al.*, 2017). The actors can influence each other as they interact more intentionally and exchange information towards adoption of CSA TIMPs, with early adopters and early majority demonstrating benefits of CSA adoption to late majority and laggards, hence further reinforcing adoption in the beef value chain (Zhang *et al.*, 2015; Kuehne *et al.*, 2017). Advances in education and technology penetration provide significant opportunities for pastoral beef value chain actors, including the marginalized women and youth, to engage with the value chain and in climate resilience and mitigation efforts (FAO, 2017).

Due to their proximity to the problem, actors through participatory learning and actions, can effectively explore and generate solutions to the challenges of adoption of CSA TIMPs and scaling of CSA knowledge with the beef food system. Effective engagement platforms can provides core value chain actors opportunities to engage with extended and enabling value chain actors such as government, development actors, FIs, MFIs and cooperatives to propose policy actions, incentives and interventions to institutional, infrastructure and financial barriers to investment and re-investment in developing and modernizing the value chains.

In conclusion, CSA advocates for coordinated actions among all food systems actors towards climate change resistant pathways through four main action areas: (1) building evidence (research); (2) increasing local institutional effectiveness; (3) fostering coherence between climate and agricultural policies; and (4) linking climate and agricultural financing (Leslie *et al*., 2014; FAO, 2018; Gwaleba and Masum, 2018; Willy *et al.*, 2019).

## 7.2 General Recommendations

The overall interventions recommended by this study, based on conclusions, for enhanced integration of CSA TIMPs by beef value chain actors in ASAL counties like Kajiado are:-

a) This study recommends five CSA integration approaches to yield desired outcomes of leveraging MSMEs to scale CSA adoption as follows; capacity driven, process and technology driven, Market and financial incentives driven, policy and institutional frameworks driven and infrastructural driven integration approaches.

b) This study recommends application of system thinking towards a climate resilient beef value chain, coordination and leveraging of multiple actors to strengthen the beef value chain and address climate risks, mitigation and adaptation.

c) This study recommends creation of synergies and cross-sectoral coordination mechanisms to tap incentives for climate action towards the beef value chain, such as leveraging green energy, ICT sector mobile technology solution to drive climate awareness, climate financing, and use of public private partnerships to embed a commercial beef processor as a lead actor to strengthen the beef value chain.

d) County governments need to encourage and enable actors engagement platforms/strong producer and value chain associations for participatory learning and action on climate smart beef value chain. Platforms that also leverage mobile technology platforms for actors to partner together/self-organize, exchange information, educate, advocate/lobby for an enabling environment including legal, institutional and regulatory frameworks and eventually develop to a self-regulating organization (SRO) for a climate smart beef value chain.

e) The National and County governments needs to de-risk the pastoral beef value chain by developing policy actions, legal and institutional frameworks that remove barriers to value chain investments, and provide enabling value chain actors such as development actors, public private partnerships, investors, FIs, MFIs and technology providers with incentives in order for them to provide affordable financial and technology services, including climate risk instruments to core value chain actors towards a climate smart beef value chain.

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# APPENDICES

## Appendix 1: Research Tool - Questionnaire

**Title Section**

An assessment of integration of MSMEs in climate smart livestock red meat value chains: case study of Kajiado County.

**Introductory Part**

My name is Mary Waceke Muia, a PhD student at Wangari Mathai institute, University of Nairobi. I am conducting a research to assess the integration of MSMEs into climate smart livestock red meat value chains. All the information provided will be confidential and will not be used for any other purpose but academic.

**Section one on Biodata of the Respondent and Company information**

Please tick the appropriate box.

1. Sex: female ( ) Male ( )
2. Age in years:
3. Formal education: How many years have you been in school?
4. Sub county
   (a) Kajiado North
   (b) Kajiado Central
   (c) Kajiado East
   (d) Kajiado west
   (e) Kajiado South
5. Are you a member of any farmer group or business association

   Yes ______________________ No

   If Yes, which one ____________________

6. What is your main trade/business/Value chain activity? …………………………………

**<u>MSMES/value chain actors' information.</u>**

**Your name/Farm/business/work/activity (Optional)……………………………………………**

7. Age of your business/this value chain activity:

   1 to 3 years ( ) 4 to 6 years ( ) 6 to 10 years ( ) 10 and above ( ) Not Applicable ( )

8. Size and Number of employees: ( ) Micro (1-9 employees) ( ) small (10-49 employees) ( ) medium (50-99 employees).
9. Is your business formally registered? Yes ( ) No ( ) Not Applicable ( )
10. Are you a member of a business association or a chama/cooperative? Yes( ) No ( ) Not Applicable ( )
11. Where do you mainly buy your meat from? Supermarket ( ) Butchery ( ) Abattoir ( ) Other ( ) please name the source

**Section B on integration of MSMEs/actors into climate smart livestock value chains in Kajiado County**

12. Which role do you play in the Livestock value chain? (Tick the main activity you are involved in).

| **Core value chain** | **Extended value chains (BSD support providers)** | **Enabling value chains** |
|---|---|---|
| Farmer/ Producer | Bank | National Governments. |
| Aggregator/middleman | Microfinance | County government |
| Transporter | Sacco | Multilateral agency |
| Abattoir/Processor | Insurance co | NGOs /INGOs |
| Butchery/supermarket/ Kiosk / Hotel/restaurant/nyama choma joint | Farmers and livestock associations. | Development partner |
| Inputs supplier - agro vets/ Machinery /feeds /cattle dip | Business association/chamas | Research institutions |
| Veterinary services | Trainers | Council of elders |
| Extension services | CBOs | Others |
| Breeder | | |
| Consumer | | |

**To assess awareness of value chain concept.**

| | | | | | |
|---|---|---|---|---|---|
| I believe I am part of the livestock/red meat business/value chain in Kajiado county | Strongly Disagree - 1 | Disagree - 2 | Neutral -3 | Agree - 4 | Strongly agree -5 |
| I have a market/someone to sell my product/services to | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| The livestock/red meat value chain contributes to my income | | | | | |
| I believe I am well compensated for my product or services/price is right. | | | | | |
| I have access to necessary information I need to participate effectively in the value chain | | | | | |
| I have the skills to effectively participate in the value chain | | | | | |
| I have the support/enablement to effectively participate in the value chain | | | | | |

**Section C on knowledge, practices and attitudes of actors/MSMEs on C.S.A/L.**

13. Do you know what climate change is? ( ) Yes ( ) No
14. Tick appropriately what describes climate change?

a) Extreme weather/too hot/high temperatures/ low temperatures/too cold/too windy

b) Weather variability/uncertain /unpredictable weather seasons.

c) Frequent Droughts

d) Floods /flash floods

e) Little rain

f) Do not know

15. Kindly tick the appropriate box on whether you have ever heard of the following words/concepts?

| | | | |
|---|---|---|---|
| Climate smart agriculture. | Yes | No | Observed |
| climate smart animal/livestock agriculture | Yes | No | Observed |
| Increasing productivity/yield /incomes | Yes | No | Observed |
| Building resilience | Yes | No | Observed |
| Livelihoods/livelihoods protection | Yes | No | Observed |
| Reducing poverty | Yes | No | Observed |
| Mitigation | Yes | No | Observed |
| Adaptation | Yes | No | Observed |
| Greenhouse gases (GHGs) | Yes | No | Observed |
| Reducing greenhouse gases emissions / carbon footprint | Yes | No | Observed |
| Sustainable agriculture | Yes | No | Observed |
| Food systems/farm to fork | Yes | No | Observed |

9a. If yes in any of the above, from whom did you hear about it. Tick any

a) Colleagues /fellow value chain actors/friend ( )

b) Extension and agriculture officers from the National/County government ( )

c) NGOs/development actors ( )

d) Farmers FBOs or business association/CBOs/chama ( )

e) Politicians and political rallies ( )

f) Church/mosque or religious groups ( )

g) Media (TV, Newspaper, social media, magazines, radio, SMS,) ( )

h) Workshop, training courses ( )

i) Family members ( )

j) Other (name)…………………………….

16. Do you believe that businesses/ your activities/ have an impact on the environment?

( ) Yes ( ) No

17. Should your business/ your activities/actions be involved in protection of environment?

( ) Yes ( ) No ( ) Not Applicable

18. Can your businesses/activities/actions have positive social impacts on the community? Tick any.

| | | |
|---|---|---|
| Create jobs | ( ) Yes | ( ) No |
| Reduce poverty | ( ) Yes | ( ) No |
| Improve quality of life | ( ) Yes | ( ) No |
| Improve the environment | ( ) yes | ( ) No |

**Section D on integration approaches and its effects to scaling CSA/L knowledge and practices**

19. What support do you currently receive to help you integrate into CSA/L value chains? Or adopt climate smart livestock TIMP? (Tick )

a) Training and awareness ( )

b) information materials ( )

c) Financing (soft loans/interest free loans and grants) ( )

d) Extension services ( )

e) Insurance services ( )

f) Incentives ( )

g) Emergency funding during disasters/drought/floods/disease outbreak ( )

h) Access to available technologies ( )

20. Do you receive any incentives to adopt CSA practices? Yes No

21. If yes which incentives if any do you receive to adopt CSA practices? Tick table below.

22. And are they helpful in your adoption of CSA practices.

| **Incentives** | **helpful** | **Not Helpful** | **Not Applicable** |
|---|---|---|---|
| Grants | | | |
| Affordable loans/soft loans/interest free loans | | | |
| Free Extension services/free advisory services | | | |
| Subsidized drugs/seed/inputs/feeds/implements/technologies | | | |
| Tax rebates/subsidies | | | |
| Carbon credits. | | | |
| Payment of ecosystems services. | | | |
| Open market days | | | |
| Free capacity building opportunities- information on market prices, training, awareness, free technology, general information on CSA etc. | | | |

**To interrogate existing MSME practices on climate smart agriculture and livestock red meat value chains in Kajiado County.**

23. Which form of livestock production do you practice? (Tick one).

| | | | | |
|---|---|---|---|---|
| Land based system/grazing in open lands. | Land less systems /Feed lot system | Mixed crop and livestock keeping | Don't know | Not applicable |

| | | | | |
|---|---|---|---|---|
| | | | | |

24. Which Climate smart livestock practices, technologies or innovations do you use in your livestock farming? (Tick one).

a) Grassland management and restoration/Pasture management ( )

b) Manure and composting ( )

c) Reduce/reuse/recycling e.g. Biogas ( )

d) Crop and livestock mix ( )

e) Adaptive breeds /animal breeding/appropriate breeds/animal genetic resources ( )

f) Better feeds and feed supplements ( )

g) Keeping a variety of livestock ( )

h) Weather warning/agro- weather systems ( )

i) Livestock insurance/emergency fund ( )

j) Water harvesting for livestock ( )

k) Any other approach- briefly describe it in the space provided below.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

………………

25. Which Climate smart technologies or innovations/management practices (TIMPs) do you use in your home/work/activities/business?

| | **TIMPS-Technologies, Innovations, Management Practices** | **Yes** | **No** |
|---|---|---|---|
| Energy | Use of Renewable energy (solar, biogas etc.)<br><br>Energy saving practices e.g. LED Bulbs, switch off lights | | |
| Water | Water efficient technologies<br>Water Harvesting practices | | |
| Resource use | Reduced consumption of fossil fuels and other resources/inputs/raw materials | | |
| Waste management | Waste treatment/ management and reduction<br>Separation/recycling of waste | | |
| Sustainable Management practices/polices | Reduce, Reuse, Recycle practices<br>General pollution Preventing practices (e.g. not littering)<br>Environment days-Clean up days or Tree planting exercises<br>Awareness/knowledge/skills/policies on sustainable practices among staff and stakeholders | | |
| Risk management | Insuring my business from weather effects.<br><br>Have Emergency funds | | |

Others

………………………………………………………………………………………………

………………………………………………………………………………………………

……………………………………………………………………………………………………
………………

……………………………………………………………………………………………………
……

**26. Do you have a cold storage facility for preserving meat? Yes ( ) No ( )**

If yes which one?

If No why?

**27.** Do you have meat wastes? ( ) Yes ( ) No ( ) Not Applicable

28. How do you treat your wastes, if yes above?

**Section E on barriers to MSMEs' adoption of CSA in Livestock red meat value chains**

29. What prevents you from implementing climate smart livestock /agriculture management practices, innovations and technologies? (Tick)

| **Barriers** | **Yes** | **No** | **Not Applicable** |
|---|---|---|---|
| **Knowledge infrastructure** | | | |
| Lack of awareness/Information on climate smart livestock | | | |
| Lack of extension/advisory services | | | |
| Lack of education, training, empowerment, communication | | | |
| Confusing Climate Smart Livestock with corporate social responsibility (CSR) and other sustainability initiatives. | | | |
| **Market infrastructure-markets, inputs and support value chains** | | | |
| Lack of access to inputs and technology | | | |

| | | | |
|---|---|---|---|
| Return on investments inform decision to adopt CSA TIMPs | | | |
| Lack of financial support services/ credit/loans/insurance/grants to implement climate smart practices. | | | |
| Climate smart practices and technologies are very expensive | | | |
| Lack of markets | | | |
| I have other pressing priorities/it is not a priority | | | |
| I do not see any benefit/value in adopting climate smart practices | | | |
| Lack of customer support to implement climate smart practices | | | |
| Do you believe your customers would be willing to pay more if you tell them to practice CSA TIMS | | | |
| **Hard institutional- policy and governance** | | | |
| Lack of government laws, rules/policies that demand adoption | | | |
| Lack of government support, incentives, subsidies, governance systems and programs | | | |
| Lack of standards for CSA adoption | | | |
| Traditional land tenure systems<br>Lack of property rights | | | |
| **Interactions- networks, collaborations and partnerships** | | | |

| | | | |
|---|---|---|---|
| Lack of associations/chamas/CBOs to support implementation | | | |
| Lack of collective actions, partners, PPP, multi-stakeholders platforms | | | |
| **Soft institutional- social cultural dimension, customs, values, attitudes, gender** | | | |
| Traditional customs/norms or religious beliefs discourage CSA TIMPS | | | |
| I do not trust or believe CSA Practices are good.<br>CSA TIMPs are for commercial, large farms and businesses | | | |
| Because I am male or female | | | |
| **Physical infrastructure** | | | |
| Lack of access to transport/roads/facilities/ some form of assets | | | |
| Lack of power/source of energy or energy costs are high | | | |

**Thank you for your time**.

# Appendix 2: Key Informant's Interviews Guide

**Introductory Part**

My name is Mary Waceke Thongoh, a PhD student at Wangari Mathai Institute, University of Nairobi. I am conducting a research to assess the integration of climate initiatives by micro, small and medium enterprises (MSMEs) into Beef Value Chain, in Kajiado County, Kenya. I believe your knowledge and expertise will provide valuable input and insights into this study. Therefore, what you will share will contribute to development of climate smart beef value chain in not only Kajiado County but also in ASALs and help achieve the government of Kenya agriculture transformation strategies and sustainable development goal, SDG 12, on sustainable production and consumption. All the information provided will be confidential and will not be used for any other purpose but for this academic work.

**Section one: General Information**

Name of the Organization/ Where You Work/your activities………………………………….

Your Job Title…………………………………………………………………………….

Number of Years in organization/job/activity ………………………………………………

Role of your organization in the Beef value chain: (Core Value Chain), (Extended Value Chain), (Enabling Value Chain), please tick one.

**Section two: Biodata of the Respondent and Organization information**

Please tick the appropriate box.

30. Gender: female ( ) Male ( ), please tick one
31. Age in years: 20 to 30 years ( ) 31 to 40 years ( ) 41 to 50 years ( ) 51 to 60 years ( ) 60 and above ( )
32. Formal education: How many years have you been in school?

33. Sub county

i. Kajiado North

ii. Kajiado Central

iii. Kajiado East

**Section three: General Information**

1. Kenya's economy is heavily reliant on agriculture especially subsistence agriculture for food consumption and cash crops for export, do you think the livestock (beef) sector is as important in the Kenyan Economy and why?
2. Most of the livestock (Cattle, Sheep and Goats) in Kenya are found in ASALs, what do you think is the future of beef value chain in Kenya bearing in mind that it's mainly practiced by agro-pastoralist, pastoralists and nomads in ASALs, in climatic zones that are now facing serious climate change challenges, already suffer from environmental vulnerability and socio-economic marginality?
3. It is remarked that climate smart agriculture (CSA), to an extent, offers solutions to combating the climate change risks in the agricultural sector. How do you perceive CSA in relation to the beef value chain in general and specifically in ASALs? And how can it be effectively used to realize the triple wins of (i) improved productivity and incomes, (ii) climate resilience i.e. climate adaptation, (iii) reduction of GHGs i.e. climate mitigation?
4. Do you think CSA has been equally applied to combat the climate change challenges in the livestock sector, like it has in the crop sector? If yes, how? If No, why?
5. How do CSA TIMPs differ in their application in crop compared to livestock? And specifically the beef value chain?

6. Are there sufficient CSA TIMPs specific to the beef value chain and those that are available in your perspective are there suitable (context), accessible, and affordable to actors in the ASALs?
7. How do climatic zones affect the application of CSA and CSA TIMPs? Any specific comments in regards to ASALs and Kajiado County?
8. A lot of public and private sector investment has been channeled towards the crop value chains in the agriculture sector, according to you, has the livestock (beef) sector received equal attention or has it been neglected/lagging behind crop, and why?
9. Are there enough efforts and government support to actors/MSMEs wanting to invest in the beef value chain? ( ) Yes, ( ) No, Please explain your answer.
10. What risks do you think prospective investors into beef value chain face and further specifically in the ASALs region which are environmentally vulnerable and suffer from socio-economic marginality?
11. What are the existing legal and institutional frameworks that can enable the adoption and scaling of CSA TIMPs in the beef value chain by MSMEs? Please comment on level of awareness among actors, enforcement and any gaps that need to be addressed to ensure effectiveness of these frameworks.
12. Most or some of available legal and institutional frameworks were designed before introduction of CSA, does this pose a gap in their awareness, application, adequacy and enforcement in CSA integration efforts into the beef value chain?
13. What do you think would be the challenges/barriers of introducing and scaling CSA and CSA TIMPs in beef value chain -specifically pastoral beef value chain in ASALs?
14. What perceptions, stereotypes, attitudes, beliefs, cultural and social norms would hinder adoption of CSA among the beef value chain actors especially the pastoralist communities.

**Thank you for your time.**

# Appendix 3: Author’s Abridged Curriculum Vitae

Mary Waceke Thongoh is an Inspirational and Transformational Leader with recognized expertise in Organization Design & Development, Strategy Formulation & Execution, Business Transformation, Change & Performance Management and HR. She is an expert on Gender, Diversity, Equity & Inclusion and Facilitator on Unconscious/Implicit Bias, Future fluency and Cultural intelligence. She has successfully led several Business & Culture Transformations both in Private and Public sector. She has worked for large Multinationals and Public sector organizations both in Kenya & regionally, was Head of Performance & Change in Total and Kengen where she created innovative frameworks for strategy execution, project management, Leadership development, performance & culture transformation. Her last role was HR Director in a large financial institution. She has overseen diverse Business Change Projects from Business process re-engineering, re-organization of delivery and performance structures, Job Evaluation, Automation rollout & ICT upgrades, and was a HR advisor in a Merger of 2 Multinationals. She also supports organizations’ sustainability efforts focused on triple ‘P’ (People, Profit and Planet) bottom line, and ESG (Environmental, Social and Governance) frameworks.

Currently she is a leadership and management consultant, a leading consultant on Race & Racism, Diversity, Equity and Inclusion for Global organizations and is an Expert Panelist for Centre for Global Inclusion and a contributor to the Global Diversity, Equity, Inclusion Benchmark report, GDEIB 2021-2026. She supported the **United Nations Secretary General’s Task Force on Addressing Racism and Dignity for all at the UN.** She also led Organization-wide race dialogues initiative for **United Nations Office of Coordination of Humanitarian Affairs (UNOCHA)**. She is a highly sort after C-Suite Executive coach and is an adjunct faculty for United Nations Systems Staff College (UNSSC) and an Executive Coach with United Nations Agencies and other global Institutions. She also facilitated the Target Gender Equality work for the UN Global Compact Kenya Network.

She is a Mechanical Engineer, holds a MA in Environmental management and planning with Focus on Sustainable Development. She is an accredited Executive Coach from the Academy of Executive Coaching –UK and Pacific Institute USA, a Certified Master Professional in

Balance Score Card from George Washington University, a Certified Change Expert by Prosci USA, Certified Project management Professional with Prince II UK, Certified Public Secretary, is also an alumnus of Harvard Kennedy School of Government and Strathmore Business School. She has HR, Pension Schemes Trustee and Corporate Governance Certifications. She has been a Board Member of Energy Regulatory Commission, Insurance Regulatory Authority, and Board Chair and was founder member of Association of Change Management Professional in Africa-ACMP Africa.

She has been among the Top 40 under 40 successful women in Kenya, Overall Winner in ‘Rising Stars Awards’ 2014 -service category in Private and Public Sector. She sat on the panel of Judges for the prestigious AABLA (All Africa Business Leaders Awards) by CNBC & Forbes Africa for 2 years, was chief judge for East Africa. She is a much sought after Facilitator, Speaker, and Moderator at Local and International forums including the UN agencies’ strategy and leadership retreats. She facilitates organizational effectiveness dialogues towards creating high performance organizations through consensus & clarity building on complex issues and stakeholders’ interest mapping. She works with organizations using system thinking to Clarify, Contextualize & Customize Organizational goals, high level functions, business process and talent alignment leading to, ‘fit for purpose solutions’ that deliver sustainable value. Her frameworks incorporates best practices in Complex adaptive system thinking, Governance, Leadership & management, Agile, structural and cultural change, and sustainability principles. She has the inspiration, competency, discipline and the courage to drive broad-based Organizational and Social Change and Sustainability initiatives that enhance Governance, Inclusion, Social, Economic and Environmental justice. She believes that every organizations must contribute to Sustainable Development Goals (SDGs) through individual and collective choices in a way that creates value for all stakeholders and towards a more Sustainable, Just, Fair and Equal world.