

**AN ANALYSIS OF THE FACTORS INFLUENCING PARTICIPATION OF
PASTORALISTS IN COMMERCIAL FODDER VALUE CHAIN FOR LIVELIHOOD
RESILIENCE IN ISIOLO COUNTY, KENYA**

BY

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DECLARATION

This thesis is my original work and has not been presented for an award in any other university.

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DEDICATION

This thesis is dedicated to my lovely mother Fatuma Hassan Adan and my siblings (Habune, Abdullah, Alinoor, Fardosa, Ralia, Awes and Ahmed) for their love, prayers and support that have continually inspired my personal and academic life.

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LIST OF ACRONYMS

AAK	Action Aid Kenya
AgGDP	Agricultural Gross Domestic Product
AfDB	African Development Bank
ALRMP	Arid Lands Resource Management Programme
ASALs	Arid and Semi-Arid Lands
AVCD-LC	Accelerated Value Chain Development-Livestock Component
AU	African Union
CIDP	County Integrated Development Plan
CLMC	County Livestock Marketing Council
DRSLP	Drought Resilience and Sustainable Livelihoods Programme
ELMT	Enhanced Livelihoods project in the Mandera Triangle
FAO	Food and Agriculture Organization (of the United Nations)
FFA	Food For Assets
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GFD	General Food Distribution
ILRI	International Livestock Research Institute
KALRO	Kenya Agricultural and Livestock Research Organization
KII	Key Informant Interview
KNBS	Kenya National Bureau of Statistics
KVDA	Kerio Valley Development Authority
NCCRS	National Climate Change Response Strategy
NDMA	National Drought Management Authority
NGOs	Non-Governmental Organizations

PREG	Partnership for Resilience and Economic Growth
RAE	Rehabilitation of Arid Environments Trust
REGAL-AG	Resilience and Economic Growth in the Arid Lands-Accelerated Growth
REGAL-IR	Resilience and Economic growth in the Arid Lands- Improving Resilience
SDGs	Sustainable Development Goals (of United Nations)
SNV	Netherlands Development Organization
TLUs	Tropical Livestock Units
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
USAID	United States Agency for International Development
WFP	World Food Programme

ABSTRACT

Pastoral communities in the drylands of Kenya face a myriad of challenges including prolonged and recurrent drought coupled with institutional bottlenecks. These factors largely contribute to livestock feed insecurity which impedes livestock production in drylands, thus threatening livelihoods of millions of poor pastoralists. Various interventions have been undertaken by the government and development partners to enhance the coping capacity of pastoralists to the negative effects of climate change. In recent years, the focus of these interventions has been directed to building resilience contrary to disaster risk reduction expenditures such as direct food assistance by various projects. The World Food Programme's (WFP) project dubbed food for asset creation (FFA) was implemented in thirteen dryland Counties through a collective action approach. The project supports pastoralists in Isiolo County to adopt fodder enterprise in order to address the problem of constant feed shortage. As a result, fodder producer groups and markets have emerged in the County as pastoralists continue to embrace fodder enterprise as a livelihood diversification strategy. However, these developments are happening in the absence of empirical evidence on the socio-economic and institutional factors influencing participation of pastoralists in fodder production and marketing. The present study was conducted in Isiolo County to characterize the commercial fodder value chain, analyze the determinants of individual pastoralist participation in fodder producer groups, and assess the socio-economic and institutional factors influencing pastoralists' participation in fodder markets. Survey data were collected from 201 randomly selected pastoral households from twenty fodder producer groups. Household interviews, focus group discussions and key informant interviews were used to gather data. Data were analyzed using descriptive statistics, binary Probit model and a Heckman two-step model.

The descriptive results showed that fodder producer groups are dominated by women, majority of whom had no formal education. Fodder is majorly produced on small-scale basis under rain-fed system, and the commonly grown grass species are African fork tail (*Cenchrus ciliaris*) and Maasai love grass (*Eragrotis superba*). Adoption of fodder production formed an integral part of the dryland farming technologies used such as *zai*-pits and semi-circular bunds. These have been associated with high water retention and penetration, reduced loss of grass seeds by wind and increased fodder productivity. The fodder value chain is underdeveloped with fodder producer groups as dominant actors. The chain was majorly supported by the FFA project through provision of inputs, food incentives and capacity building.

The results of the Probit model show that access to credit, off-farm income, land size and age of respondents positively and significantly influenced individual commitment to the fodder group. However, fodder group attributes like age and size were found to have negative effects. Fodder markets are informal and the group members acted as primary marketing channel. Results of Heckman model indicate that fodder market participation was significantly determined by age of respondents, herd size, exposure to shocks, land tenure, access to credit, market and weather information. The quantity bought was influenced by herd size, shocks, weather information and tenure system. However, reliance on external support had a negative influence on pastoralists' participation in both fodder groups and markets, indicating its adverse impact on household's long-term resilience.

The study recommends the need to develop sustainable market-based strategies to promote private sector participation in provision of inputs and support services. Creating market linkages for hay and grass seeds through contracting arrangements is also crucial. There is also need by the national and County governments as well as development partners to harmonize and direct funds for emergency responses to support sufficient fodder production

ex-ante. These funds can also be used to support fodder groups' engagement in diversified businesses like livestock finishing and retail trading, in order to give them some level of autonomy and financial stability. The County government should fast track the formal land registration and titling process in Isiolo County to enable pastoralists to adopt more productive land uses on individual farms. Moreover, policy interventions geared towards improving pastoralists' access to infrastructure such feeder roads, water harvesting technologies, hay baling machinery and storage bans; and prioritization of fodder in the County development plan would be a milestone in upscaling commercial fodder production and sustainable development of the drylands of Kenya.

Key words: Pastoralists, feeds, fodder value chain, collective action.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Drylands are characterized by arid, semi-arid and dry sub humid zones and account for 43% of Sub-Saharan Africa (SSA) and are home to 268 million people (AU-IBAR, 2012). In Kenya, approximately 82% of total land mass is arid and semi- arid lands (ASALs). The ASALs is home to over 14 million people who predominantly depend on pastoralism as the main livestock production system. It is characterized by extensiveness, livestock mobility and communal management of natural resources (Republic of Kenya, 2012b). The livestock subsector plays a crucial cultural and socio-economic role among the pastoral communities and the country's welfare at large. It is estimated to contribute 10% to national Gross Domestic Product, about 42% to agricultural Gross Domestic Product (AgGDP), and employs about 50% of the agricultural labour force (Republic of Kenya, 2008). In view of these significant contributions, the Government of Kenya in its Vision 2030 strategy acknowledges the potential of the livestock for economic growth and sustainable development of the ASALs (Republic of Kenya, 2012b).

The natural rangelands make up the bulk of animal feed resources in the ASALs combined with crop residues especially from maize stalks (Ndathi et al., 2013). However, the potential for biomass production and carrying capacity of these natural rangelands are constrained by climate change which manifest itself through; erratic rainfall patterns, recurrent droughts, extreme temperatures, increased cases of livestock pests and diseases as well as reduction in quantity and quality of pasture resources (NCCRS, 2010; FAO, 2018). The pastoral communities used to depend on the traditional adaptation strategies like seasonal migration of livestock to utilize the sparse feed resources (Wanyoike et al., 2018), and use of different

herd management strategies such as herd diversification, herd splitting and herd maximization (HPG, 2009). However, this has been rendered ineffective and unsustainable due to climate change, population pressure, land degradation and fragmentation as well as frequent inter-community conflicts, thus making them very vulnerable (Kidake et al., 2016; Ndathi et al., 2013).

The Government of Kenya in partnership with development partners has in the past undertaken several interventions to cushion pastoralists from these adverse climatic risks (Republic of Kenya, 2012a). These interventions include both food and non-food aid which are normally implemented as a short term strategy response to emergencies and disasters. However, these interventions have proven to be unsustainable and inappropriate over the years. As a result, more focus has now been shifted from direct food assistance to resilience building or asset creation interventions (AU-IBAR, 2012; WFP, 2016; Muricho et al., 2019). Resilience is defined as the ability of an individual or a system to absorb, cope with current changes, adapt their livelihoods, and improve governance systems and ecosystem health to recover from future shocks and stresses (Walker and Salt, 2006; Pasteur, 2011). Several programs such as Drought Resilience and Sustainable Livelihoods Programme (DRSLP), Resilience and Economic growth in the Arid Lands - Improving Resilience (REGAL-IR), Resilience and Economic Growth in the Arid Lands-Accelerated Growth (REGAL-AG) and Accelerated Value Chain Development (AVCD) were implemented in the ASAL counties. The aim of these programs were to improve livestock productivity through drought tolerant fodder production hence increasing access to improved grazing resources (IGAD, 2015; Kutu and Wamwere-Njoroge, 2017).

Over the past nine years (2009 – 2018), the World Food Programme (WFP) has been supporting the Government of Kenya, through the National Drought Management Authority

(NDMA), to implement Cash/Food for Assets (C/FFA) projects in thirteen ASAL Counties including Isiolo. These C/FFA activities focused majorly on re-establishing livelihoods, nutrition and food security for the most vulnerable communities. These were to enable communities to withstand shocks, become independent of relief foods and attain sustainable diversified livelihoods (WFP, 2016; Thomas et al., 2016). In Isiolo County, the FFA project supported pastoralists to build rain water harvesting structures for fodder production. This has led to a transformation in terms of land use, livelihood and mindset changes as pastoralists gradually embrace “grass as a crop” for both subsistence and commercial use. They are producing fodder in groups, which are supported by the FFA project and other implementing partners through input provision and capacity building (Kutu and Wamwere-Njoroge, 2017).

Fodder production and marketing have been considered as potential livelihood strategies to improve pastoral households’ income through enhanced livestock production (Kuria et al., 2015; Lugusa, 2015; Mureithi et al., 2015; Nyangaga et al., 2009), hence improving their resilience against recurrent drought and escalating food commodity price shocks (USAID, 2012). The common fodder production technologies promoted in ASALs include natural pasture development through reseeding technologies and use of enclosures (Kidake et al., 2016). The rangeland enclosure systems have been at the centre stage of the key land use transformation being witnessed in Baringo and West Pokot Counties. The enclosures have facilitated better management of land and rangeland resources, livelihood diversification, institutional change from communal land tenure to private land ownership and changes in gender roles associated with sedentary lifestyles among agro-pastoral households (Lugusa, 2015; Nyberg et al., 2015; Wairore et al., 2015).

1.2 Statement of the Research Problem

Forage scarcity, in terms of both quality and quantity, is a perennial challenge to pastoralists' livestock productivity and a source of conflicts in the ASALs of Kenya (Ayele et al., 2012; Ndathi et al., 2013; Kidake et al., 2016; Lugusa, 2015). This shortage is caused by a combination of factors including; inadequate and unreliable rainfall, overgrazing leading to land degradation, shrinking of grazing resources due to encroachment by crop producers, dynamics in land use patterns facilitating urbanization as well as climate change (Ayele et al., 2012).

It is against this backdrop that commercial fodder production, through a value-chain approach, was widely promoted in the drylands to enhance fodder accessibility and as a livelihood diversification strategy (Kutu and Wamwere-Njoroge, 2017). Several studies on fodder production and use of enclosure systems have been conducted in the drylands. Their findings show that fodder production is a climate resilient and environmentally sustainable livelihood strategy (Kidake et al., 2016; Mwaura et al., 2015; Nyangaga et al., 2009). The enclosure approach on the other hand, has been cited as an appropriate mechanism for rangeland rehabilitation and a key driver of institutional change, land use and livelihood dynamics in the drylands of Kenya (Mureithi et al., 2015; Nyberg et al., 2015; Wairore et al., 2015).

Several fodder producer groups have emerged in Isiolo County following the implementation of FFA project that supported commercial fodder production (WFP, 2016). Lugusa (2015) explored factors influencing pastoralists to join fodder producer groups in Baringo County. However, the individual commitment and degree of participation vary within the fodder groups, which in turn affect the group's achievements, growth and sustainability (Fischer and

Qaim, 2014). Thus, there is need to analyze the underlying factors influencing individual commitment to fodder groups' shared goals.

Isiolo County is generally characterized by inadequate infrastructure such as road networks, communication facilities, limited storage and marketing facilities combined with institutional bottlenecks (Republic of Kenya, 2015). Given this scenario, it is imperative and of empirical interest to assess the potential determinants of pastoralists' participation in fodder markets as well as challenges associated with participation. Moreover, information about the organization of the fodder value chain in Isiolo County in terms of key actors and their roles is scanty. This can impede development of the emerging fodder value chain and diminish its livelihood benefits to pastoral households in Isiolo.

1.3 Objectives of the Study

The main objective of the study was to analyze the factors influencing participation of pastoralists in commercial fodder value chain for livelihood resilience in Isiolo County, Kenya.

The Specific objectives were to:

- i. Characterize the commercial fodder value chain in Isiolo County.
- ii. Analyze the determinants of individual pastoralist participation in fodder producer groups.
- iii. Assess the socio-economic and institutional factors influencing pastoralists' participation in fodder markets.

1.4 Research Hypotheses

H₀: Individual-specific and group characteristics have no significant influence on individual pastoralists participation in the fodder group.

H₀: Institutional and socio-economic factors have no significant influence on individual pastoralists' participation in fodder markets and intensity of participation.

1.5 Justification of the Study

The study provides vital information on fodder production and marketing behaviour of pastoralist communities in northern Kenya. This information can benefit various stakeholders involved in fodder value chain. First, the characterization of the commercial fodder value chain in Isiolo County provides clear information on the existing fodder markets, diverse actors, challenges and opportunities that exist along the chain. This provides useful insights to the government and development partners on the appropriate point of entry for policy interventions, to enhance the efficiency and functioning of the chain, as well as its competitiveness as a potential livelihood option. Most importantly, it will induce market-based development efforts for creating business and employment opportunities that benefit pastoral communities.

Secondly, following the establishment of fodder producer groups in Isiolo County, it is essential to understand their organizational structure and individual commitment to the groups' objectives as this informs decisions on sustainability strategies. Thirdly, assessing the determinants of pastoralists' participation in fodder markets and intensity of participation, provides analytical insights to inform policies aimed at enhancing accessibility and use of requisite institutional and support services needed by resource poor pastoralists. It also

ensures that the institutional support services offered are compatible and adaptable to the dynamic nature of pastoralists' lifestyle and livelihoods.

The findings from this study are envisaged to contribute wholesomely to the achievement of Isiolo County livestock strategy 2015-2020 (Republic of Kenya, 2012b), Kenya Vision 2030 development Strategy for Northern Kenya and other Arid Lands (Republic of Kenya, 2015), Malabo commitment of enhancing resilience of at least 30% of households and production systems by 2025 (AU, 2014), and the United Nations (UN) sustainable development goals (SDGs) 1 of eradicating poverty, goal 2 of zero hunger and goal 13 of combating climate change (UN, 2015). This will eventually reduce disparities in socio-economic development of ASALs in the long term.

1.6 Study Area

Isiolo County is located in northern Kenya with an area of 25,700 Km². The County has three ecological zones as shown in Table 1.

Table 1 : Agro-ecological Zones in Isiolo County

Agro-ecological zones	Percentage of total area	Average rainfall (mm)
Semi-Arid	5	400-650
Arid	30	300-350
Hyper Arid	65	150-250

Source: Republic of Kenya (2013)

The County has bimodal rainfall pattern with short rains in October and November, while long rains occur in March and May. However, this pattern has been interrupted with climate

change hence it is unpredictable. The average rainfall and temperatures are 580.2 mm and 29 °C, respectively (Republic of Kenya, 2013).

The County has a human population of 143,294 and high poverty levels of 71% (KNBS, 2009). Isiolo County is among the largest livestock producing regions in Kenya with an estimated livestock population of 198,424 cattle, 398,903 goats, 361,836 sheep and 39,084 camels. Thus, livestock keeping is the mainstay of the County's economy constituting about 80% of residents' livelihoods, and employs about 70% of the rural labour force. About 80% of the land is communally owned under trusteeship of County government, with a large share being utilized by pastoralists for grazing and remaining parts by agro-pastoralists for crop farming (Republic of Kenya, 2013).

Nomadic pastoralism is the dominant production system and has been a major cause of environmental degradation due to high incidences of overstocking and overgrazing (Republic of Kenya, 2013). The County was severely hit by a series of droughts in the years 2000, 2005/6 and 2010/11 resulting to significant loss of nearly over 50% of livestock (SNV, 2013). According to NDMA (2017), the Vegetation Condition Index (VCI) for Isiolo County was estimated at 12.2 indicating a severe vegetation deficit. Therefore, the 2017 dry spell resulted in deterioration of the animal body conditions, low birth rates and high mortality rates of over 10% due to starvation (UN, 2017).

Over the past few years, there has been emerging new livestock production systems like intensive dairy and poultry production, undertaken by pastoral communities as a business venture in agro-pastoral and peri-urban areas of the County. This has further escalated the demand for fodder, which in turn, motivated some pastoral communities to also engage in fodder production and sale as a complimentary livelihood to pastoralism (Republic of Kenya,

2015). These observations show a significant transition in pastoralist’s culture for their long held traditional beliefs in naturally occurring grass for livestock feeds.

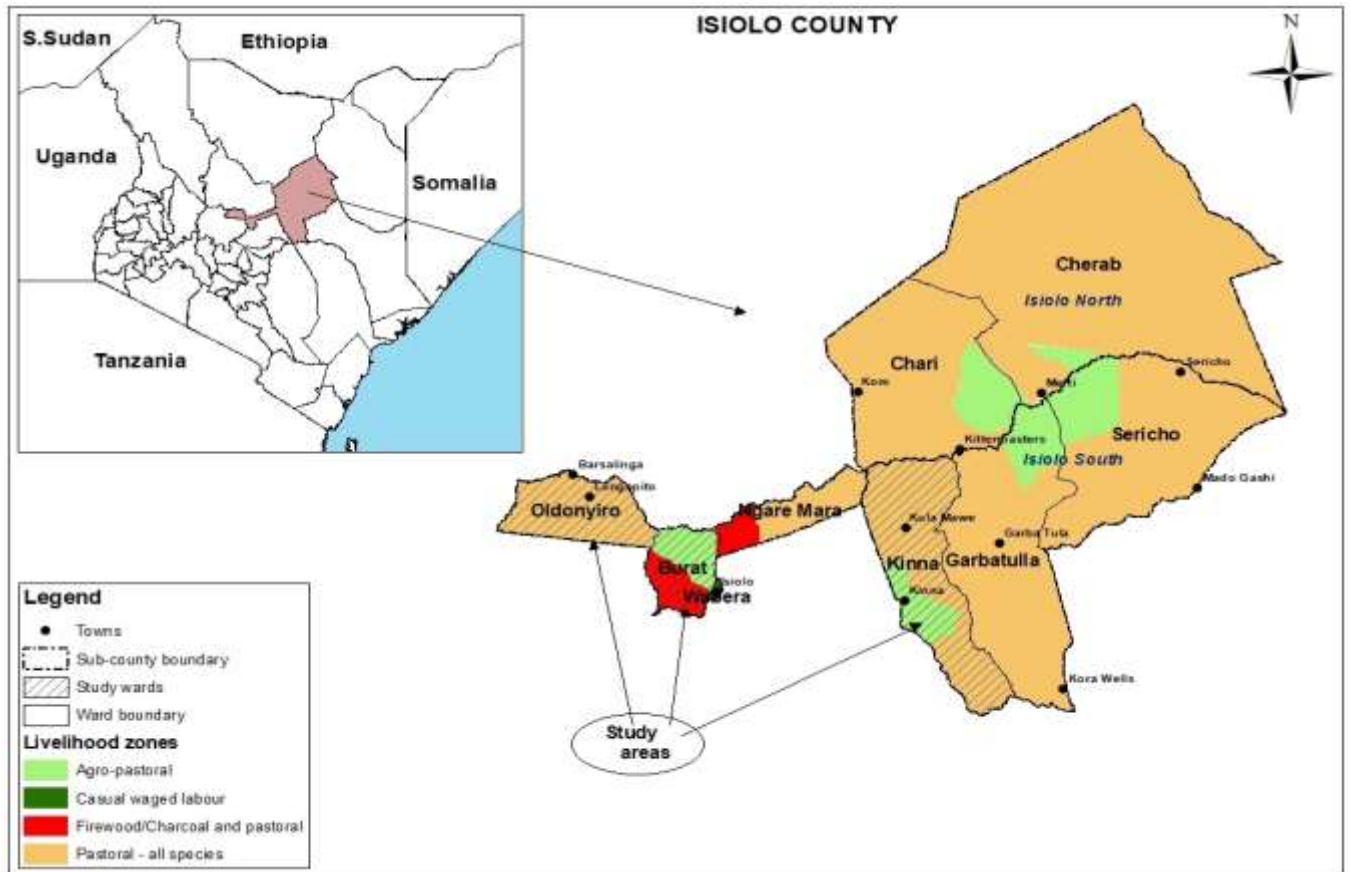


Figure 1 : Livelihood Zones of Isiolo County and Study Sites

Source: Few's.netBoundaries:gadm.org (2019).

According to the first Isiolo County AVCD-LC report (2017), there are 22 fodder groups with approximately 2,300 members being supported in Isiolo County. The total acreage under fodder production is currently 194 hectares. These fodder groups are spread across the arid and semi-arid region of Isiolo County. As stipulated in Kenya’s Vision 2030 document, Isiolo County is regarded as the gateway of Kenya’s future development and foster greater economic integration with its northern neighbors, especially Ethiopia and South Sudan. It is one of the major beneficiaries of the mega projects, set to benefit from the Isiolo international

airport, a Resort City and a railway link under the Lamu Port South Sudan-Ethiopia Transport (LAPSSET) project. These developments are expected to increase market access, improve government service delivery, employment creation and emergence of new livelihood activities (LAPSSET Project, 2016). These infrastructural developments, however, coexist with recurrent drought patterns, feed scarcity and significant transitions in pastoralists' livelihood and culture. These changes make Isiolo County an appropriate study site for the present study.

1.7 Organization of the Thesis

This thesis is organized into six chapters. The research issue, objectives, hypotheses and justification of the study, and the study area have been explained in Chapter one. Chapter two provides a review of the relevant literature on the research topic. The methodology and results are discussed in Chapters three, four and five, which are presented in paper format focusing on each specific objective. Finally, chapter six summarizes the main findings, policy implications and suggestions for further research.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Trends in Fodder Production and Marketing in the Drylands of Kenya

Drylands experience regular and severe shocks caused by recurring extreme and prolonged droughts, which directly affect the availability of feed and water resources. This deteriorating situation limits the livelihood opportunities available to millions of resource-poor pastoral households hence persistence of high poverty incidences in the ASALs (Cervigni et al., 2016). The 2010/2011 drought was considered as the worst ever experienced in the ASALs since 1996. It resulted to an estimated loss of approximately US\$ 11.3 billion that was attributed to loss of income streams across all sectors of the economy. The livestock sector was most affected with 72% of total losses and damages (Republic of Kenya, 2012a).

Farmers have over time adopted several coping strategies to overcome feed scarcities during the dry spells. These include: use of public land such as road sides for grazing, utilization of conserved feeds, buying off-farm feeds and commercial feeds (Nangole et al., 2013). Fodder production and use in drylands is highly motivated by extreme seasonality of feeds and existence of permanent water sources that enable irrigation. In addition, growing population and improved incomes have led to increased demand for livestock products in urban and peri-urban areas. This in turn generates derived demand for fodder enterprise (Nyangaga et al., 2009).

Several stakeholders have promoted fodder production in ASALs to compliment the practice of utilizing communal grazing resources for livestock feeds. The concept of fodder production was first introduced in ASAL areas through the Arid Lands Resource Management Programme (ALRMP). The ALRMP phase one covering 1996 to 2003 was jointly financed by Republic of Kenya and World Bank and implemented in ten arid areas;

Baringo, Garissa, Isiolo, Mandera, Marsabit, Moyale, Samburu, Tana River, Turkana and Wajir. The second phase was implemented between 2003 and 2010, and was extended to other semi-arid areas of Kenya. The programme promoted adoption of improved fodder types under its broader component of natural resource management. This was done through intense extension services to build capacity of pastoral households and provision of grass seeds. The overall objective of the project was to improve access to basic services, enhance food security and reduce vulnerability in 28 drought-prone districts located in the ASALs (Nyangaga et al., 2009).

In Mandera County, fodder production was promoted by the Enhanced Livelihoods project in the Mandera Triangle (ELMT). The aim was to empower the pastoral communities to diversify income and sustain their livestock-based livelihoods. Fodder production was undertaken by agro-pastoralists living along the permanent river Daue on the Kenya-Ethiopia border, Dollow of Ethiopia and river Jubba of Somalia. They were provided with inputs such as seeds, farm implements and water pumps. The common fodder types found in these areas include sorghum stalks, cowpeas vines, maize stover, weed bundles, Napier and fresh Sudan grass. The agro-pastoralists mostly sourced labour from relatives on the basis of share-cropping arrangements and hired labourers. About 75% of produced fodder was sold to the urban and peri-urban livestock keepers, while the rest was used to feed home-based livestock during dry spell (Nyangaga et al., 2009).

The Kenya Agricultural and Livestock Research Organization (KALRO) and KALRO-Kiboko Centre has been spearheading research and initiatives of improving feed resource base in the ASALs of Kenya. The focus has been on provision of suitable grass species and capacity building on improved pasture development for rehabilitating degraded lands. This facilitated adoption of grass seeds and hay production through community based forage seed

system especially among the women groups in the southern eastern region of Kenya. Fodder growing has provided agro-pastoralists with a complimentary source of income from sale of pasture seeds and hay, which was used to purchase livestock (Kidake et al., 2016).

The Agricultural Productivity and Climate Change in Arid and Semi-Arid Kenya project supported fodder production in Garissa County in 2011. The main objective was to improve livestock productivity through enhancing capacity of pastoralists to adopt drought resistant livestock species and breeds. Also, enhancing fodder growing, conservation and storage in order to mitigate feed crisis especially during dry seasons. As a result, farmers are now able to produce sufficient feed to maintain milk production for the home-based livestock throughout the year (Kuria et al., 2015). In the same County, Mwaura et al. (2015) assessed economic viability of pasture enterprise and found out that pasture strategy is economically viable and had been adopted by 50% agro-pastoralists.

Adoption of enclosure system for fodder production and rehabilitation of degraded land has also been increasingly used in drylands ecosystems. For instance, in Baringo and West Pokot Counties, enclosures have been promoted by Non-governmental organizations like RAE Trust and Vi-agroforestry respectively. The objective was to restore indigenous vegetation and facilitate forage cultivation as a crop. This initiative provided the pastoral communities with opportunities to diversify their livelihood options and means of generating income; through sale of hay, grass seeds, improved livestock production, crop production and other potential ecosystem and environmental services (Lugusa, 2015; Wairore et al., 2015).

In Isiolo County, rangeland rehabilitation and fodder production through pasture reseeded technology was promoted by the World Food Programme's Food for Asset creation (FFA) project, which was implemented in partnership with REGAL-AG, Action Aid Kenya (AAK), AVCD-LC, National Drought Management Authority (NDMA) and the county government.

The REGAL-AG supported pastoralists to set up demonstration plots which were used for technical trainings on land tilling, seeding, processing hay and storage. The AVCD-LC project provided fodder producer groups with a total of 1,051 Kilograms of grass seeds, promoted rain water harvesting structures and market linkages for fodder selling (Kutu and Wamwere-Njoroge, 2017). As a result, 87 hectares of land was reseeded through various fodder producer groups located in Garba Tulla, Kampi ya Juu, Tuale, Merti areas and all the WFP/Action aid FFA sites. The project also constructed a hay barn storage facility and procured harvesting and baling equipment under its business development grants components (USAID, 2015). Currently, about 22 fodder groups exist in the County (WFP, 2016). Fodder growing was motivated by the already existing forage shortfalls and increasing demand due to emerging intensive dairy production enterprises. The common crops produced and utilized as fodder include maize stover, beans straw, Napier grass, African fox tail grass and Sudan grass (Wanyoike et al. 2018).

2.2 Fodder and Grass Seed Value Chain Dynamics

A value chain is defined as the full range of activities which are required to bring a product or service from its conception to consumption and waste disposal. According to Kaplinsky and Morris (2001), it involves different intermediate phases of production (involving a combination of physical transformation and the input of various producer services) and delivery to ultimate consumers. Mapping is an integral part of any value chain analysis. It is used to illustrate the flow of transactions starting from the point of sourcing raw materials and inputs, to production, processing, marketing and final sale. It also shows costs, value addition, secondary services and constraints at each stage (Stein and Barron, 2017).

According to Faße et al. (2009), there are two approaches for mapping a value chain: the functional and institutional analysis approach, which entail constructing a preliminary map of

a given chain where all chain actors and their functions represent the institutional analysis, and the functional analysis is the forms of interactions between them. The chain map can be represented in a flow chart or table. The second approach is the social network analysis, which involves understanding interactions and flows between organizations, groups and people. Stein and Barron (2017) used this approach to analyze fodder value chains in Burkina Faso and Nigeria. The social network analysis approach is applicable when the value chain is characterized by a network than a single vertical chain. In addition, this approach is still in the early stages to be used for value chain analysis hence has been so far used in few studies (Faße et al., 2009). The current study used the functional and institutional analysis approach to develop fodder value map in Isiolo County because it has been used in a similar study to assess grass seed value chain in Baringo County (Lugusa et al., 2016).

Several empirical studies have analyzed fodder value chains in different parts of Kenya. The main actors in the fodder and grass seed value chain are individual and group producers (agro-pastoralists), input suppliers, independent traders, processors and consumers, and their roles complement each other (Nyangaga et al., 2009; Nangole et al., 2013; Lugusa et al., 2016). Nyangaga et al. (2009), reported that the roles of each chain actors were well defined but alludes that they were mainly based on cultural system of the communities in Mandera County. However, in Baringo County, Lugusa et al. (2016) noted that the grass seed value chain was dominated by processing and bulking agents who also acted as input suppliers and buyers of grass seeds and they include Kerio Valley Development Authority (KVDA), RAE Trust and KALRO. The major fodder consumers in Mandera County are peri-urban livestock keepers, while in Baringo the grass seeds were mainly purchased by locals who use it for reseedling and new pasture establishment.

In their study in North Rift Valley and Central regions of Kenya, Nangole et al. (2013), reported that fodder trading was taking place at location and Constituency levels. The location level was dominated by input sellers, fodder producers who sell directly to retailers and consumers based in rural areas. Whereas, the constituency level was dominated by traders who bought fodder from outside and sold to wholesalers who in turn sold to the major fodder market within the constituency. Additionally, the local feed marketing was seasonal in nature with common occurrence in dry seasons hence characterized by seasonal feed price variations. In Mandera County, the fodder marketing structure was informal with no clear governance, power relations and lacks well-coordinated supply chain system. Thus, transactions were mainly based on cash payments and no contractual arrangements were used (Nyangaga et al., 2009). On the other hand, Lugusa et al. (2016) reported that the transactions between producers and the major actors in Baringo were based on contractual arrangements that integrated inputs provision and purchase of seeds. But, this was noted to be disadvantageous to producers as they preferred market channels that allow for price negotiations as opposed to fixed seed prices in contracts.

The agro-pastoralists in Mandera were reported to enjoy higher profit margin compared to other actors in the chain. This is because they gained incomes from sale of both surplus fodder and own-livestock off-takes. Also, fodder traders were mainly women selling freshly cut grass bundles while transportation was dominated by young males (Nyangaga et al., 2009). Lack of working capital, insufficient storage space, poor seed quality and seasonality of feeds availability are reported to be the main challenges facing all actors along the chain (Nangole et al., 2013). Moreover, Lugusa et al. (2016) cited labour scarcity, lack of market and low grass seed prices as the main constraints facing producers, while that of independent traders are poor seed quality and delayed payments. The study also reported that there exist private-public partnerships between organizations such as SNV, RAE Trust, KALRO and

KVDA in providing various services on fodder production, and this was noted as key driver towards sustainable development of grass seed value chain in Baringo County.

2.3 Determinants of Individual Participation in Collective Action

Collective action is defined as “an action taken by a group (either directly or on its behalf through an organization) in pursuit of members’ perceived shared interests” (Meinzen-Dick et al., 2004). Group formation brings together individuals with common problems and inspirations, and enables them to pool together their labor, capital and other resources to undertake profitable activities (Place and Kariuki, 2005). Group membership also contributes to building social capital, which positively influences human welfare through income generation and sharing among the poor households (Coppock et al., 2006). Collective action has been widely recognized as an important strategy for poor and marginal smallholders to overcome marketing barriers and remain competitive in a rapidly changing environment (Fischer and Qaim, 2014). It has also been cited as an effective means of fostering rural development and improving risk management strategies among rural communities (Coppock et al., 2006). Thus, community-based organizations are regarded as a critical component of developmental projects for most development agencies and donors around the world (Meinzen-Dick et al., 2004; Prokopy, 2009).

In the recent past, government and development partners have used various collective action approaches to support pastoralists to undertake fodder production and marketing. These have led to formation of various fodder production groups in Laikipia, Baringo, Marsabit and Isiolo counties of Kenya (Lugusa, 2015; WFP, 2016). Likewise, Coppock et al. (2006) noted emergence of self-help groups, especially women groups, in northern rangelands of Kenya. This move was mainly occasioned by the trends towards sedentary lifestyle, as ex-pastoralists and semi-settled active pastoralists settle in small towns and villages.

Various studies have explored the determinants of farmers' participation in collective actions either through cooperatives, farmer or developmental groups. In most of these cases, participation is equated to group membership (Adong et al., 2013; Olila 2014; Lugusa, 2015; Woldu et al., 2015). However, membership alone does not explain intensity of individual participation in group activities (Fischer and Qaim, 2014). This is because, within the groups, the commitment and degree of individual participation in group activities varies since the marginal costs and benefits are not uniform across different categories of members (Meier zu Selhausen, 2016; Ochago et al., 2017). Different authors have defined participation in many ways depending on the context. For the current study, participation refers to individual pastoralist involvement in the fodder producer groups in Isiolo, with the aim of building own capabilities to have access to and control of resources, benefits and opportunities towards self-reliance.

In literature, several approaches have been used to measure individual involvement in group activities. For instance, Beard (2005) investigated individual determinants of participation in community development in Indonesia. The study measured participation in terms of individual knowledge of the development programs, involvement, contributions of time and money. Study findings show that gender, educational level and literacy, membership to social groups and economic status as key determinants of individual participation in community development projects. The participation decision was however assessed as a nested behaviour, which occur in a sequential manner. The current study specifically sought to understand individual behaviours by taking participation decision as a discrete choice of either making capital contribution or not to the fodder groups.

Another study by Prokopy (2009) used meeting attendance and capital cost contributions to analyze the determinants of household level participation in rural drinking water projects in

India. A bivariate Probit model was used to analyze determinants of participation since there are two dependent variable explained by similar explanatory factors. The results show that wealth status, household size, literacy level and village size significantly influenced the probability of household's meeting attendance and make capital contributions. Also, number of children below five years, distance to sources and reliability of water positively predicted capital cost contributions. However, the scope of study was broad as it was analyzed at the village level hence insufficient to explain individual behaviour at lower levels such as farmer groups. Therefore, the present study endeavored to specifically analyze the determinants of individual participation in the fodder groups.

Fischer and Qaim (2014) analyzed intensity of smallholder farmers' participation in collective action in Kenya using frequency of group meetings attendance, quantity and share of marketable banana sold through cooperatives. Participation in group meetings was categorized into low, moderate and high-degree levels, then sequential ordered Probit (SOP) model was used to assess the determinants of an individual falling in any of those levels. Then a double hurdle model was employed to analyze the determinants of quantity and share of marketable bananas because the decision to attend group market days and quantity of banana sold was taken as a sequential process. Previous benefits obtained through group was found to positively influence intensity of participation. Low participation on the other hand was attributed to group size, timing of payments and farmers engaging in diversified sources of income. However, the study was analyzed in a case where production decisions were undertaken individually and only marketing was through a collective action. On the contrary, the present study was contextualized in a situation where both production and marketing decisions were undertaken collectively by fodder group members. Thus, both individual specific and group attributes were expected to influence member participation in collective action.

When analyzing determinants of women's participation intensity in collective action in Uganda, Meier zu Selhausen (2016) used coffee marketing and share capital contributions. The coffee sales to cooperative or side selling was taken as a binary choice, then regressed against the various factors using a Probit regression model. OLS regression was used to analyze determinants of women members' share capital acquisitions. The study reveals that more equal intra household power relations, joint land ownership, length of membership and access to extension services positively affected women's ability to commit to collection action. The study was more of a gendered analysis as it focused exclusively on women participation in collective action. However, the current study aimed to analyze participation behaviour of both male and female members of the fodder groups in order to provide more comprehensive inferences.

Ochago et al. (2017) used participation index to assess the degree of member's participation in the coffee Integrated Pest Management (IPM) farmer groups in Uganda. Participation Index (PI) was computed based on the number of meetings an individual attends, ideas contributed, ideas accepted and individual ranking of satisfaction level of benefits attained from the coffee IPM group. The index was computed on a scale of 1-3 and regressed against the determinants using an ordered Probit model. Their findings show that gender, age, size of household labour, off-farm income and membership in economic groups significantly and positively influenced intensity of participation. Household size and farming experience was found to have a negative influence. However, the study focused only on individual-specific characteristics to explain their participation behaviour in coffee IPM group. The current study included group characteristic such age and size as other determinants of individual participation in collective action as reported in scientific literature (Prokopy, 2009; Fischer and Qaim, 2014; Meier zu Selhausen, 2016). Moreover, the effects of climate-induced shocks and reliance on external support were also assessed.

The extensive literature on determinants of individual decision to participate in collective action was majorly focused on food crops. Though, they are all in agreement that variations in individual participation are influenced by various factors which are dynamic and specific to contextual nature of social processes. Therefore, little empirical evidence exists to explain the factors influencing pastoralist's participation in fodder groups bearing in mind fodder production itself is an unconventional practice. The present study sought to fill this gap.

2.4 Review of Empirical Approaches for Modeling Market Participation

Most empirical studies evaluating market participation and the extent of participation use the Tobit model as developed by Craig (1971), and Heckman's (1979) sample selection model. In such analysis, the decision of household participation and intensity of participation in agricultural commodity markets is modeled as a two-step process. The Tobit modeling approach assumes that the decision of a household to participate and volumes of produce to be sold or bought in the market are made simultaneously. Thus, the same set of parameters and variables determine the participation decision and the level of transactions in terms of volumes (Burke, 2009). It further assumes that zero values traded are because of household rational choice, even though prohibitive market barriers may be the factor restricting market participants. Thus, the application of Tobit model is considered restrictive by some empirical studies (Komarek, 2010).

To overcome the restrictive assumptions of Tobit model, Heckman (1979) suggested a non-zero two-step model of Heckman two-stage, which allows for different mechanisms to explain the participation decision and level of participation. The current study was specifically interested in analyzing fodder market participation behaviour of pastoralists' as a two-step decision making process; that is the decision to buy fodder or not, and the quantity bought. Moreover, a case of sample selection bias exists since the study focused on fodder

group members in Isiolo County. The Heckman two-step model deals with a sample selection bias by computing lambda (λ), or selection term, from the participation equation and including it as an explanatory variable in the second stage regression to correct for self-selection. This is because the selection bias is regarded as an omitted variable hence corrected by this procedure (Wooldridge, 2002). Therefore, a Heckman two-step model is considered suitable for this study, and has been applied by previous empirical studies to analyze market participation (Vance and Buchheim, 2005; Kabeto, 2014).

2.5 Conceptual Framework

Pastoralists experience numerous unique challenges and changes that are driven by climatic shocks and inappropriate policies. These factors contribute either directly or indirectly to their increased vulnerability to food and livelihood crises (HPG, 2009). As show in Figure 2, these perennial challenges bear a great influence on the extent of support provided by the external actors (both government and non-governmental organizations). These support are in form of input subsidies and community mobilization, and are expected to stimulate cultural change among the pastoralists. Thus, influences formation of collective action for fodder production among the pastoralists in Isiolo County.

As noted by several authors, the enabling conditions for successful collective action are broadly categorized as group characteristics, institutional arrangements, type of products and markets, and external environment (Agrawal, 2007; Barham and Chitemi, 2009; Markelova et al., 2009). Group characteristics in terms of size, heterogeneity, structure and functions are posited to be influenced by individual characteristics, external support and climate-related shocks. Institutional arrangements concern the rules governing group activities, while external environment relates to changes in demographic, technology, markets and state of governance (Agrawal, 2001).

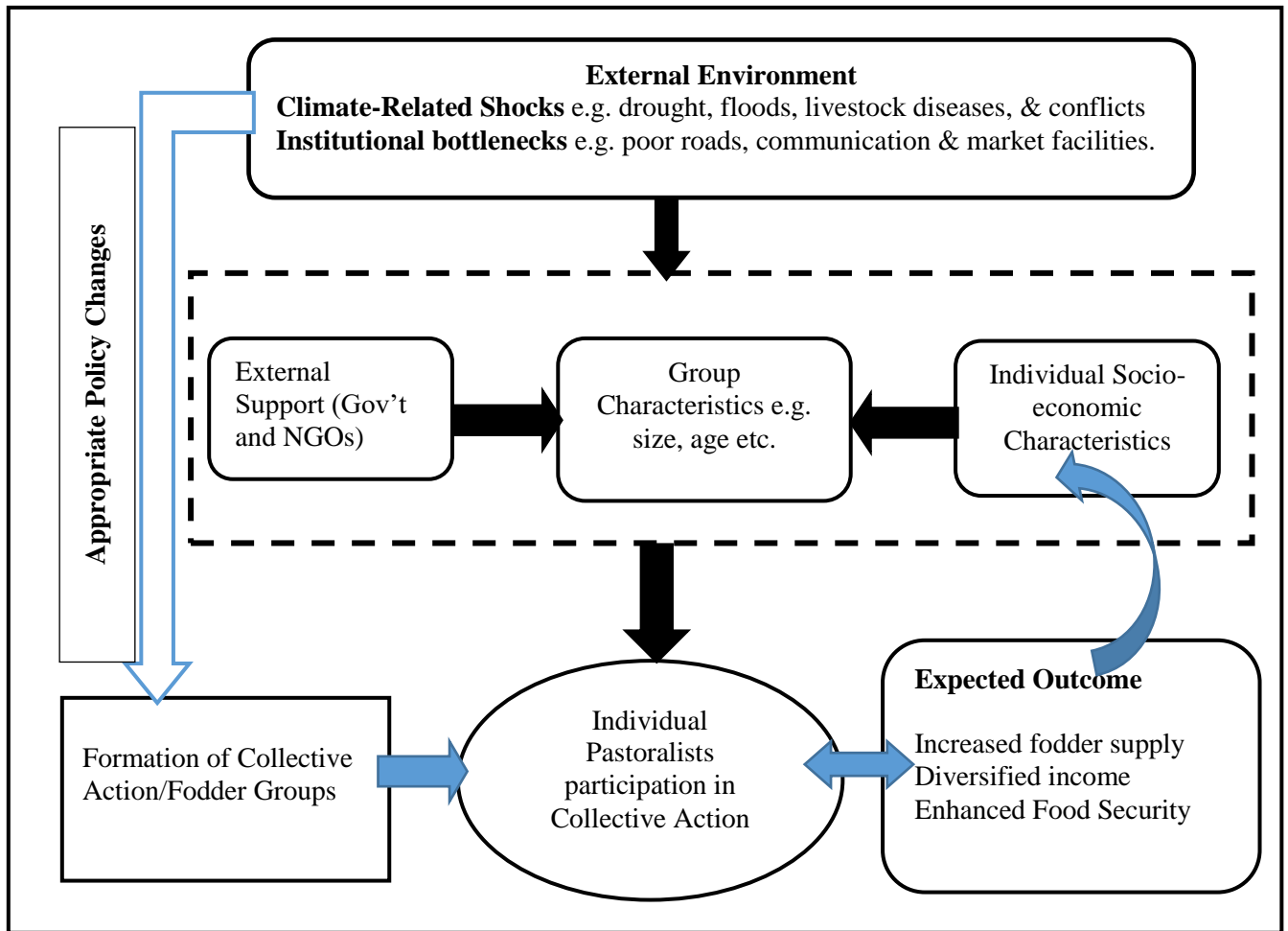


Figure 2 : A Conceptual framework for Collective Action in Fodder Production in Isiolo County

Source: Author's Conceptualization.

In this case, the external environment is explained by the climate-related shocks and institutional bottlenecks (such as poor physical infrastructure, inadequate credit, extension and market services) that characterize the study area. The individual participation in collective action on the other hand is determined by their socio-economic characteristics (such as age, gender, education levels, household size, herd size, social capital and income), marginal cost and marginal benefits associated with participation. Besides that, group characteristics are also hypothesized to influence individual participation in fodder groups

(Fischer and Qaim, 2014; Meier zu Selhausen, 2016; Ochago et al., 2017; Prokopy, 2009). The current study therefore hypothesizes that individual attributes, group characteristics, external support, and climate induced shocks coupled with institutional bottlenecks to have a significant influence on effectiveness of collective action in terms of market participation. As illustrated in Figure 2, appropriate policy changes and continued support will enable pastoralists to participate in commercial fodder value chain in order to enjoy potential livelihood benefits. Some of those benefits include increased fodder supply, income diversification, enhanced food security and reduced vulnerability.

2.6 Theoretical Framework

This study is anchored on the expected utility maximization theory. The mathematical form of expected utility theory was originally developed by Cramer (1728) and Bernoulli (1738), who sought to explain how individuals make choices involving risky prospects (Schoemaker, 1982). This theory is considered a major paradigm in decision making process, hence it has been prescriptively applied in many empirical studies analyzing decision making behaviour of households (Ouma and Abdulai, 2009; Awotide et al., 2015). Under this framework, households' decision to participate in fodder groups and markets is based on the assumption of expected utility maximization. Though choices are made under conditions of uncertainty, in this study, the decision maker is assumed to be risk neutral and aims at maximizing expected utility. An individual pastoralist is assumed to weigh up the expected utility from participating in fodder groups and market, and that from non-participation. The theory presumes that a household's decision to participate is influenced by a set of their socioeconomic and institutional variables. The household J 's expected utility of participation and non-participation in the fodder groups and markets can be expressed as follows:

$$EU_{MJ} = \beta_M Z_J + \varepsilon_{MJ} \dots\dots\dots (1)$$

$$EU_{KJ} = \beta_K Z_J + \varepsilon_{KJ} \dots\dots\dots (2)$$

Where EU_{MJ} and EU_{KJ} denote the expected utility with participation and non-participation in the fodder groups and markets respectively; Z represents the vector of covariates (households' socioeconomic and institutional variables) influencing the perceived desirability of each choice a set; and ε is a random disturbance term which is assumed to be independently and identically distributed with zero mean (Greene, 2011). The individual decision to participate in fodder group and market occurs when $EU_{MJ} - EU_{KJ} > 0$.

Then, the difference in expected utility may be written as:

$$EU_{MJ} - EU_{KJ} = (\beta_M Z_J + \varepsilon_{MJ}) - (\beta_K Z_J + \varepsilon_{KJ}) = (\beta_M - \beta_K) Z_J + \varepsilon_{MJ} - \varepsilon_{KJ} = \beta Z_J + \varepsilon_J \dots\dots\dots (3)$$

Therefore, the difference of the expected utility between participation and non-participation is the potential factor influencing households' decision. In this case, the dependent variables are participation in fodder groups and fodder markets. The Probit model and Heckman two-step approach were used to assess the key socio-economic attributes, group dynamics, external support and shocks influencing households' decision to commit to fodder group activities as well as participate in fodder market.

2.7 Description of Variables in the Analysis and their Expected Signs

The choice of the explanatory variables for this study was guided by extensive literature review of past studies pertaining determinants of household's participation in collective action as well as market participation. This study hypothesized that group market participation was influenced by group and individual characteristics as well as institutional factors.

2.7.1 Individual Variables

Age of respondent: Age of respondents (or household head) has been used as a proxy for experience in agricultural production, in this case livestock keeping (Muricho et al., 2015). The age of the household head depicts household's experience and a buildup of local knowledge on adverse effects of climate variability, coping measures and informational support from external actors. Age of the household head also influences access to and utilization of productive resources by the household members (Lugusa, 2015). Various studies have found household age to positively influence the degree of member participation in groups (Ochago et al., 2017; Adong et al., 2013; Sseguya et al., 2013). The age variable was measured in number of years and was expected to positively influence participation in fodder group and market.

Sex of household head: Most studies have found gender to influence participation in groups. Low women participation in meetings and group activities are attributed to membership to mixed sex groups, their domestic chores and socio-cultural norms that limit their mobility and level of public engagement (Beard, 2005; Ochago et al., 2017). Therefore, the gender of the household head was expected to negatively influence individual participation in fodder group. It was coded as a dummy variable, whereby value of 1 was recorded for male and 0 for female headed households.

Household size: Household size is commonly used to measure household labour supply. There are mixed findings about the effect of household size on group participation. Davis et al. (2010) found a negative influence. Other studies noted that household size is directly proportional to its demand for food and income to cater for other necessities, thus increases their participation in production (Elhadi et al., 2012; Gebremedhin et al., 2015). Therefore, the influence of household size on household participation in fodder group was indeterminate.

Herd size: This variable was captured in terms of the number of livestock a household owns. The Tropical Livestock Units (TLUs) was computed as: cattle = 1, camels = 1, donkeys = 0.8, goats and sheep = 0.2 and poultry = 0.04 (WISP, 2010). The herd size depicts household asset ownership and was expected to influence participation in fodder production due to high feed demand. Herd size is commonly used as a proxy for wealth status and studies have cited wealth status to positively influence individual participation in group activities (Prokopy, 2009). The current study hypothesized herd size to positively influence participation in fodder producer group's activities.

Land Size: This variable was used to depict household's asset ownership and was assessed based on land area owned. Household access to farm land for growing fodder is a necessary condition for fodder group membership and market participation. Land size also shows productive assets owned and can be used as a collateral to access credit for investment in production (Randela, 2008; Komarek, 2010). Farm size was measured in hectares and was expected to have a positive influence on fodder market participation.

Number of livelihood options: Pastoralists predominately depend on livestock to meet food and income needs. However, the pastoral production systems are prone to high risks and uncertainty due to climate-induced shocks. Thus, livelihood diversification has been

promoted to augment subsistence from livestock, hence reduces their vulnerability (Elhadi et al., 2012). Thus a household with multiple sources of income is hypothesized to understand the benefits of income diversification hence expected to participate in fodder group activities (Lugusa, 2015). On the contrary, Sseguya (2013) found that households engaging in alternative livelihood activities have networks outside the community to access valued services hence were less committed to hold leadership or any other role beyond ordinary membership. Thus, the influence of this variable on member participation was indeterminate.

Past experiences with drought: The ASALs are prone to climate-induced shocks such as drought, floods, diseases and conflicts over natural resources. Household experience with these shocks represents a buildup of local knowledge on climate variability, its adverse effects, coping measures and informational support from external actors. Since shocks are experienced by all households at the same time but at varying degrees, this factor was assessed in terms of the number of shocks a household was exposed to over the last ten years. This variable was expected to positively influence household decision to participate in fodder group and markets (Lugusa, 2015). The variable was assessed in terms of the number of shocks experienced by the household in the last 10 years.

Membership to social groups: Household's access to social networks has been commonly mentioned as an important element of social capital. Membership to social, cultural, economic and religious groups or organization provides a rich environment for learning and sharing new ideas and techniques as well as enhancing social ties (Grouter, 2001). Thus, social capital is widely cited to facilitate collective action (Meinzen-Dick et al., 2004). This study measured the structural social capital in terms of the number of social or developmental groups a household belonged to apart from fodder producer groups and was expected to positively influence degree of individual participation in fodder group and markets.

2.7.2 Group Variables

Group Age: This referred to a number of years a group has been in existence and it shows group maturity. Barham and Chitemi (2009) found that group maturity was positively associated with group performance in terms of improving market situation. In this case, group maturity was measured in terms of number of years the group has been in existence and undertaking fodder production. It was captured as a continuous variable and hypothesized to have a positive influence on member commitment to the group.

Group Size: This referred to the total number of individuals in the group. There exist mixed findings about the influence of group size on group performance. Some studies have found group size to positively influence individual commitment to collective action (Meier zu Selhausen, 2016; Prokopy, 2009) and others cited negative influence (Fischer and Qaim, 2014). Group size was measured as the number of active group members for both gender and captured as a continuous variable. The influence of group size on fodder market participation hypothesized to be indeterminate.

2.7.3 Institutional Factors

Access to market information: Access to market information is considered a critical factor determining market access in most cases. Farmers with good access to market information are able to plan effectively on time and produce in response to market demand and supply (Kabeto, 2014). Marketing efficiency is not only hindered by infrastructural factors but also informational bottlenecks, which increase transaction costs (Randela et al., 2008). This variable was captured as a dummy variable and assessed based on if a household received any information on input prices, fodder demand and supply as well as prevailing fodder prices in the last one year. The sources and channels of information were also captured. This variable was expected to have positive influence on market participation.

Access to extension information: Extension approaches provide platforms for training and disseminating information on new technology or practices on fodder agronomy, harvesting and processing. These extension services were offered by both County government and NGOs operating in Isiolo County on broader livestock/fodder production, marketing issues, climate change and diversified income. This was expected to play a crucial role in influencing individual decision regarding production, sale, income generation activities and eventually livelihood security (Elhadi et al., 2012). This variable was measured in terms of if an individual received any forms of extension services individually outside the fodder group in the last one year. Pastoralists' participation in these extension services was expected to positively influence participation in commercial fodder value chain (Gebremedhin et al., 2015).

Access to credit facilities: The study area has weak institutional support for accessing inputs such as credit facilities (Republic of Kenya, 2013; 2015). However, empirical studies have shown positive relationship between credit access and agricultural production (Gebremedhin et al., 2015). Other studies have found that individuals join collective action in order to access credit and other institutional support services (Olila 2014; Place and Kariuki, 2005) and this was expected to influence member participation in group activities. This variable was captured as a dummy variable and was anticipated to positively influence individual participation in fodder group and market.

Reliance on external support: Fodder production in drylands was being promoted and supported by both private and public organizations through provision of inputs such as grass seeds, farm implements and trainings (USAID, 2015; Kutu and Wamwere-Njoroge, 2017). This variable was used to assess the influence of external support on individual pastoralists'

participation in group activities as well as group market participation. It was expected to have a positive influence.

Land tenure systems: Insecurity of land tenure, both in terms of property ownership and resource access, has been acknowledged as one of the key constraints to the introduction and adoption of sustainable land management practices in drylands (AU-IBAR, 2012). Low adoption of innovative land management practices such as use of enclosures and fodder growing was attributed to lack of tenure security among pastoralists in West Pokot County (Muricho et al., 2017). This variable was assessed based on if the household had a title deed to guarantee land ownership and was anticipated to positively influence group market participation.

2.8 Sampling Design and Data collection

A multi-stage sampling procedure comprising three stages was used to select the respondents for this study. In the first stage, Isiolo County was purposively selected because of the presence of emerging fodder enterprise supported by the WFP's Food for Asset (FFA) creation project. In the second stage, the three wards; Isiolo Central, Kinna and Oldonyiro, were purposively selected based on the following criteria; (i) fodder production is actively being undertaken by various fodder producer groups (ii) some fodder groups are currently selling fodder as an income generating activity. In the third stage, a random sampling technique was employed to select individual respondents to be interviewed from the fodder groups. The unit of analysis for this study was the individual pastoralists who were representative of both fodder groups and households in Isiolo County. Other key stakeholders such as County government, NDMA and AAK were also engaged through key informant interviews to get more insights and broader understanding of the chain.

A list of fodder group members was obtained from WFP reports of 2016 and used as a sampling frame. As per these reports, there were 2,313 pastoralists who were members of fodder groups being supported by FFA project in Isiolo. Following Mugenda and Mugenda (2003), the sample size for the current study was determined using equation (4):

$$n = \frac{N}{1+N(e)^2} \dots\dots\dots (4)$$

$$n = \frac{2,313}{1+2,313(0.07)^2} = 188$$

where: n is the sample size, N is the population size (which in this case was 2,313 fodder group members), and e was the level of precision (the current study chose a higher sampling error of 7% because of expected high probability of disturbances attributed to movements by pastoralists and insecurity). The current study however targeted a larger sample size of 220 respondents in order to give allowance for non-responses/refusal to participate, and incomplete questionnaires with inconsistent data. Some questionnaires were dropped during the data entry and cleaning process due to incompleteness and inconsistencies. Ultimately, a sample of 201 respondents, who were representative of fodder groups and households, was used in the analysis.

The study used semi-structured questionnaires to collect data on household socio-economic characteristics, group attributes and institutional factors. These were administered through face-to face interviews with pastoralists who were currently members of fodder groups. Focus group discussions (FGD) and key informant interviews (KII) were some of the exploratory tools used to gather qualitative data needed on group history and organizational structure, sources of inputs, volumes of seeds/fodder produced and marketing channels. Challenges experienced, opportunities existing and their level of involvement along the value

chain were also captured. These tools are very useful in bringing out a range of different opinions and possibly contrasting understandings of fodder value chain by different groups and actors (Stein and Barron, 2017). Two FGDs each comprising 22 members drawn from different fodder groups was conducted. Four KII with the county government-ministry of Agriculture, NDMA, AAK and fodder group leaders were also conducted (Lugusa, 2015).

The information obtained was used to contextualize and understand the operations of the whole chain, hence aided in mapping the commercial fodder value in Isiolo County. It was also used to assess determinants of individual participation in fodder producer groups as well as market participation. Documents analysis of publications including government and NGO projects reports that contain relevant information on significant statistics of fodder productions, key areas and target unit of analysis was used as a source of secondary data for this study. The data collected was captured using SPSS and analyzed using descriptive statistics, Probit and Heckman two-step model in STATA software version 14.0.

2.9 Model Diagnostics

2.9.1 Multicollinearity

Variance inflation factors (VIFs) were computed in order to ascertain lack of correlations among variables included in both the Probit and Heckman two-step model. The mean VIF was 1.40 (Appendix 3 and 4), which is less than the threshold of 10, suggesting absence of multicollinearity and suitability of the hypothesized variables in the two models (Gujarati 2004).

2.9.2 Assessing Goodness of fit of the models

The Hausman test for model specification was used to test for correct Heckman two step model specification, and the test result was insignificant. This means that we fail to reject the

null hypothesis that the beta coefficients are consistent, thus the model is appropriate for this study (see Appendix 3). For the Probit model, results in Table 7 demonstrate that the model was well fitted since it had an explanatory power of 34.9% which is within the acceptable threshold range of 20% to 40% (Greene, 2011).

CHAPTER THREE

3.0 CHARACTERIZATION OF COMMERCIAL FODDER VALUE CHAIN IN ISIOLO COUNTY

3.1 Abstract

Pastoralists' livestock-based livelihoods in the drylands of Kenya are exposed to threats associated with prolonged and successive droughts coupled with demographic factors. These threats undermine the productivity and sustainability of natural rangelands hence persistent feed scarcity in the drylands. These call for interventions that build long term resilience such as asset creation as opposed to direct food assistance. Following the implementation of the World Food Programme (WFP) food for asset creation (FFA) project, fodder producer groups and value chain have emerged in Isiolo County. The study characterized these producer groups, fodder value chain actors and their activities in Isiolo County. Focus group discussions and key informant interviews were used in data collection, and subsequently data were analyzed using descriptive statistics. The results showed that fodder producer groups have been in existence for an average of 5 years and their formation was facilitated by the FFA project. Fodder production is mainly on a small-scale with African fork tail (*Cenchrus ciliaris*) and Maasai love grass (*Eragrotis superba*) as the most common grass species planted. The groups adopted rain water harvesting technologies such as *zai*-pits and semi-circular bunds to boost fodder production and productivity. The fodder value chain was relatively short hence presenting more opportunities for growth. The input supply stage of the chain was majorly dominated by external actors who offered input and technical services while fodder producer groups were the main actors in the other stages from production, processing, marketing and consumption. Recurrent droughts, limited storage facilities, intrusion by both livestock and wildlife, and inadequate inputs were found to be among the challenges facing fodder production and marketing in the study area. These results call for

more concerted efforts and investment in infrastructure such as hay baling machinery and appropriate storage barns by the County government in order to enhance post-harvest management, conservation of fodder and fodder commercialization. It is also crucial to support women and youth to exploit various employment opportunities presented by the underdeveloped fodder value chain.

3.2 Introduction

Pastoralist communities derive more than 50% of their gross income and food from livestock, livestock products and livestock-related activities. Pastoralism as a dominant livelihood system in drylands depends heavily on natural resources such as extensive rangelands, water and minerals (AU-IBAR, 2012; WISP, 2010). The overreliance on these natural resources exposes pastoralist to continuous threats posed by factors such as land degradation, droughts and changes in demographic patterns. Environmental degradation and recurrent drought undermine the productivity and sustainability of the natural rangelands (UNCCD, 2013). In addition, the developments associated with increased population and urbanization have reduced the frequency and distance of transhumance movements of the African pastoralists. This has decreased effectiveness of pastoralists' traditional mobile strategy and accelerated resource-based conflicts (Ayele et al., 2012; Ndathi et al., 2013; Lugusa, 2015).

These imminent threats call for interventions that build long term resilience and help in asset creation as opposed to disaster risk reduction expenditure such as direct food assistance (AU-IBAR, 2012; WFP, 2013; 2016; Muricho et al., 2018). These include: the World Food Programme (WFP) project dubbed food for asset creation (FFA) that was implemented in thirteen ASAL Counties of Kenya since 2009, through the National Drought Management Authority (NDMA). The project's main objective was to re-establish livelihoods, nutrition and food security for the most vulnerable communities in the drylands. These were to enable

them to be independent of relief foods and attain sustainable diversified livelihoods (WFP, 2016; Thomas et al., 2016).

3.2.1 Evolution of Fodder Producer Groups in Isiolo County

The WFP project in Isiolo County initially started in 2009 as General Food Distribution (GFD) program, with 30,000 beneficiaries from 6,600 households receiving direct food assistance. However, the program was changed from direct food reliefs to food for asset (FFA) creation in 2012 and implemented through a collective action approach. The project aimed to reduce pastoralist's vulnerability to perennial food security shocks. The targeting of the beneficiaries was done based on drought assessment report and consultations with the community leaders. Through collaboration with National and County government technical staff and cooperating partners, the FFA project supported pastoralists to build rain water harvesting structures for both domestic use and food crops production. In return, the project provided food incentives to the beneficiaries.

The uptake of crop production was high in Isiolo Central because of relatively favourable climatic conditions. However in Isiolo South, crop production was curtailed by limited and unpredictable rainfall patterns coupled with frequent droughts leading to constant crop failure. Low uptake of project interventions by the local people and the donors' failure to realize value for money from the project investments necessitated the redesigning of the project to incorporate pasture production in the arid regions in the year 2015. Fodder production was considered suitable because it requires less rainfall and minimum tillage. It also requires less labour and is not capital intensive. Furthermore, it is a necessity for the pastoralists to augment fodder production with the natural pastures particularly during dry seasons. Following these interventions, several fodder producer groups were formed in Oldonyiro, South-Gafarsa, Kombula and Garbatulla areas of Isiolo County. Therefore, this

study was conducted to characterize these fodder producer groups and the commercial fodder value chain in Isiolo County.

3.2.2 Institutional Arrangements of the FFA Project

The WFP and AAK have registered all the beneficiaries' information such as name, age, sex as well as names and number of dependents in a master register. The beneficiaries were categorised into working members and non-working members. The non-working members included the elderly, disabled and mentally ill who were exempted from working due their delicate conditions. The working members were expected to undertake fodder farm activities. The project developed work norms, which stipulate that the group members work on fodder farms thrice a week from 8.00 am to 12.00 pm; twelve days per month, but the specific working days vary with the groups. The FFA project provided food incentives to both the working and non-working members of the fodder groups in exchange for their participation in the project. The number of days worked determined the quantity of food incentives one receives. The food rations comprised cereals, pulses and vegetable oil were distributed once every month for eight months in a year. The WFP designed standard rations quantity where each participating individual received 3.75 kg of cereals, 0.75 kg of pulses and 0.23 kg of vegetable oil for each day s/he worked (WFP, 2016). The group attendance register was used during the food distribution to ensure that member got rations commensurate with the number of days they worked.

3.3 Methodology

The study purposively selected twenty fodder producer groups being supported by the FFA project in Isiolo County. Key informant interviews (KII) and focus group discussions (FGDs) were used to collect information for this objective (see Appendices 5, 6 and 7). The KIIs were held with the fodder group leaders, staff from the County Department of Agriculture, NDMA

and Action Aid Kenya (AAK). Two FGD each comprising 22 members drawn randomly from different fodder groups in Kinna and Oldonyiro wards were conducted. Information on group's structural composition, governance, activities, labor and benefit sharing mechanisms, sources of inputs, volumes of seeds and fodder produced, marketing channels and the key actors involved in fodder value chain was gathered. Documents from government agencies and NGOs were reviewed to obtain relevant statistics and information on fodder production. Descriptive statistics were used to analyze the information obtained in order to characterize the fodder groups and fodder value chain.

3.4 Results and Discussions

3.4.1 Fodder Group Characteristics

The fodder groups' key attributes are summarized in Table 2. On average, the fodder groups have been in existence for about 5 years, and their formation was facilitated by the FFA project between 2009 and 2017. The AAK, as the local implementing partner, employed the locals as field monitors in every village to act as contact persons on the ground and help the targeted households to form groups. The criterion for group formation was that at least 20% of the members must be from the most vulnerable groups in the communities. These include the elderly, people living with disabilities, chronically sick and the mentally handicapped. This is consistent with previous studies which noted that external influence from government or NGOs played a key role in formation of development groups in central and northern Kenya. This was mostly through the provision of technical training, inputs and equipment (Place and Kariuki, 2005; Coppock et al., 2006).

On average, each fodder group had about 58 members, out of which approximately 88% were female implying that women dominated the fodder groups. This is consistent with the observations by the SNV (2013) that women were more actively involved in fodder

production in Baringo, Isiolo, Marsabit, Samburu, Tana River and Wajir Counties which are dominated by pastoralists. At the initial stage of group formation, female members were more than their male counterparts with a mean of 38 and 5, respectively. Also, the number of male members was declining while that of women was increasing over the years.

Table 2 : Fodder Producer Group Characteristics

Variables	Mean (n=20)	Standard Deviation
<i>Group Governance</i>		
Age of the group	5.57	2.31
Number of group members	57.85	52.79
Frequency of meeting held per month (%)	3.25	
Percentage of groups formally registered	80	
<i>Group farm size and ownership system</i>		
Groups' fodder farm size (ha)	9.7	12.08
Private group farm with title deed (%)	5	
Communal group farm (%)	75	
Registered group farm with allotment letter (%)	20	
<i>Fodder production and trade</i>		
Quantity of fodder produced (bales)	56.95	89.98
Quantity of fodder sold (bales)	43.45	90.42
Selling price for hay/bale (Kshs):		
<i>Group members</i>	283.33	44.38
<i>Neighbours</i>	316.67	112.55
<i>Traders</i>	366.67	115.47
Quantity of grass seed produced (kgs)	35	119.39
Quantity of grass seeds sold (kgs)	5.7	16.33
Selling price of grass seeds/Kg (Kshs)	700	141.42

Note: 101 Kenya Shillings (Kshs) were equivalent to 1 USD at the time of survey.

Source: Survey Data (2018).

On average, the groups met at least four times a month, with a minimum of once and a maximum of four times a month, respectively. All the meetings were held at the group farms where members undertook farm activities ranging from land preparation to fodder harvesting

and sale. About 80% of the sampled fodder groups were formally registered with the Ministry of Social Services. The formal registration enables the groups to obtain external resources and assistance from NGOs and Government development funds like women and youth funds. It also facilitated opening of bank accounts for saving incomes from the group's businesses. As revealed by one of the KII, the NDMA linked some of the fodder groups to the Ministry of culture and social services for formal registration to enable them access development funds such as *Uwezo*, women and youth funds.

The fodder group's overall operations are governed by the work norm developed by the project. The management structure of the groups comprise of a chairperson, secretary and treasurer who are elected by members. All the decisions in the group are made by the leaders in consultation with the members although the project provides some oversight role. The group chairperson is in charge of the supervision of the group activities and ensuring that every member participates in group activities. They are also the liaison person between the donors, local implementing partners and the fodder groups. The group secretary is the custodian of the group register and in charge of taking attendance roll call to ensure all members participate in the group farm activities. The chairperson and the secretary are also members of the project committee assisting the field monitors in ensuring that the work norms are followed when rationing food distribution. The treasurer ensures that the proceeds from the fodder sales are deposited in the group's bank account. The groups also have a complaint committee that is in charge of handling issues arising from the group's operations. Cases of conflicts often arise where some community members didn't want to work but still want to receive food rations. The non-cooperating members are sanctioned through forfeiture of food rations.

The average groups' fodder farm size was 9.7 hectares. The total area under fodder production for the sampled groups was 188 hectares, which is about 40% of the overall area under fodder production in the whole of Isiolo County (Kutu and Wamwere-Njoroge, 2017). This indicates growing efforts towards rehabilitation of the land that has for a long time been previously left bare and unproductive. In terms of land tenure systems, the results showed that three-quarter of the groups communally owned their farms, but exclusive to non-members. At least one-fifth of the groups possessed allotment letters, which is a temporary document indicating some form of land ownership as one awaits the formal title deed, while 5% had private land title deeds. These findings indicate a gradual transformation of Kenya's pastoral areas in terms of both land use and land tenure systems. Previous studies in the drylands have documented similar transitions in land use, livelihood and tenure systems from communal to private land ownership due to adoption of enclosure systems for pasture production (Mureithi et al., 2015; Nyberg et al., 2015; Wairore et al., 2015).

On average, the groups produced 57 bales of fodder and 35 kilograms of grass seeds in the last planting season. Out of the total production, an average of 43 bales of fodder and 6 kilograms of seeds were sold mostly through the primary marketing channel (group members). The hay prices varied with the marketing channels and specific actors involved. For the group members, the average buying price was Kshs 283, while that of neighbors and traders was Kshs 317 and Kshs 367, respectively. The low purchase price for group members is one of the benefits enjoyed by the members and acts as an incentive to encourage group participation. The selling price of grass seeds ranges between Kshs 800 and Kshs 1000. This is noted to be relatively high compared to prices in Baringo County where a kilogram of seed was sold at an average price of Kshs 250 (Lugusa et al., 2016). The low price in Baringo could be because of over supply due to large scale seed production by big actors like RAE trust, KALRO and KVDA.

3.4.1.1 Livelihoods Diversification of Fodder Groups

Apart from fodder sales, some groups are also engaging in livestock finishing business in a bid to diversify income sources, although on a very small scale. As shown in Table 3, half of the sampled groups bought emaciated livestock, especially goats, sheep and cattle, at relatively low prices, then fattened them using own produced fodder and later sold them at relatively higher prices.

Table 2 : Animal Finishing Business

Type of livestock	Number of groups keeping	Number of animals kept/group	Fattening period (months)	Buying Price (Kshs)	Selling price (Kshs)	Marketing margins (Kshs)
Goats	10	17.70	5.10	2,170	4,450	2,280
Sheep	6	8.67	5.83	2,333	4,833	2,500
Cattle	2	5.00	4.00	11,500	24,000	12,500

Note: *Figures are in averages*

Source: Survey Data (2018).

Goats are the commonly used livestock for fattening business followed by sheep. This is because small ruminants are relatively more tolerant to harsh climatic conditions, and diseases. They also exhibit early maturity, high off-take rates and feed on locally available pastures and shrubs (Rutto et al., 2012) and are, thus highly preferred by pastoralists. The groups bought about 18 goats at an average price of Kshs 2,170 and resold them at almost double price of Kshs 4,450 after fattening for about 5 months. About six groups bought sheep at Kshs 2,300 and resold them at about Kshs 4,800 after finishing for about six months. Cattle are not very common as only two groups are keeping them. The finishing period for cattle is on average five months, buying price was Kshs 11,500, while the selling price was Kshs 24,000. The results showed that the finishing business for all livestock species yielded considerable gross margin. This indicates the great potential of this enterprise as an income

diversification strategy for the groups. It also provides a more beneficial way of utilizing fodder produced. Some groups had also started poultry and bee keeping enterprises.

In addition, the project also train fodder groups on soft entrepreneurship skills. They are encouraged to engage in small retail business in between the planting seasons, to smoothen their income flows throughout the year. The type of retail businesses adopted included sale of food items like sugar, maize flour, honey and tobacco. They also make and sell traditional beads and jewelries locally known as “*shanga*”. Some groups also organize self-credit for members through table banking initiatives. This entails members contributing to a common fund from which they could obtain credit services at 10% interest rates. However, leasing out of group farms for income was very rare among the groups in the study area. All these enterprises broaden their income base and potentially contribute to the sustainability of the groups in the long term.

3.4.1.2 Future Plans of Fodder Groups

The future plans reported by all groups were similar as they revolved around fodder production and related activities. The groups aimed to increase inputs usage and farm acreage under pasture for up-scaling fodder enterprise. The groups also planned to expand their livestock fattening enterprises and also venture into poultry and bee keeping. Others aimed to contribute money for drilling dams in order to connect their group farms to water for cultivation of food crop cultivation (such as beans, legumes, kales and spinach).

All the groups planned to encourage members to start own fodder production farm in future. However, the groups acknowledged that they still needed some support in accomplishing some of the aforementioned future plans. The desired support included capacity building, enhanced access to credit facilities and inputs such as ploughing tools, wheelbarrows,

harvesting and baling. They also needed support in infrastructure development such as appropriate storage bans, dams and boreholes as well as appropriate fencing materials.

3.4.2 Functional Characteristics of the Fodder Value Chain Actors

Figure 3 shows the fodder value chain map for Isiolo County. The fodder and seed value chain in Isiolo County is underdeveloped and relatively short as it is still at the early stages of development, thus have few actors.

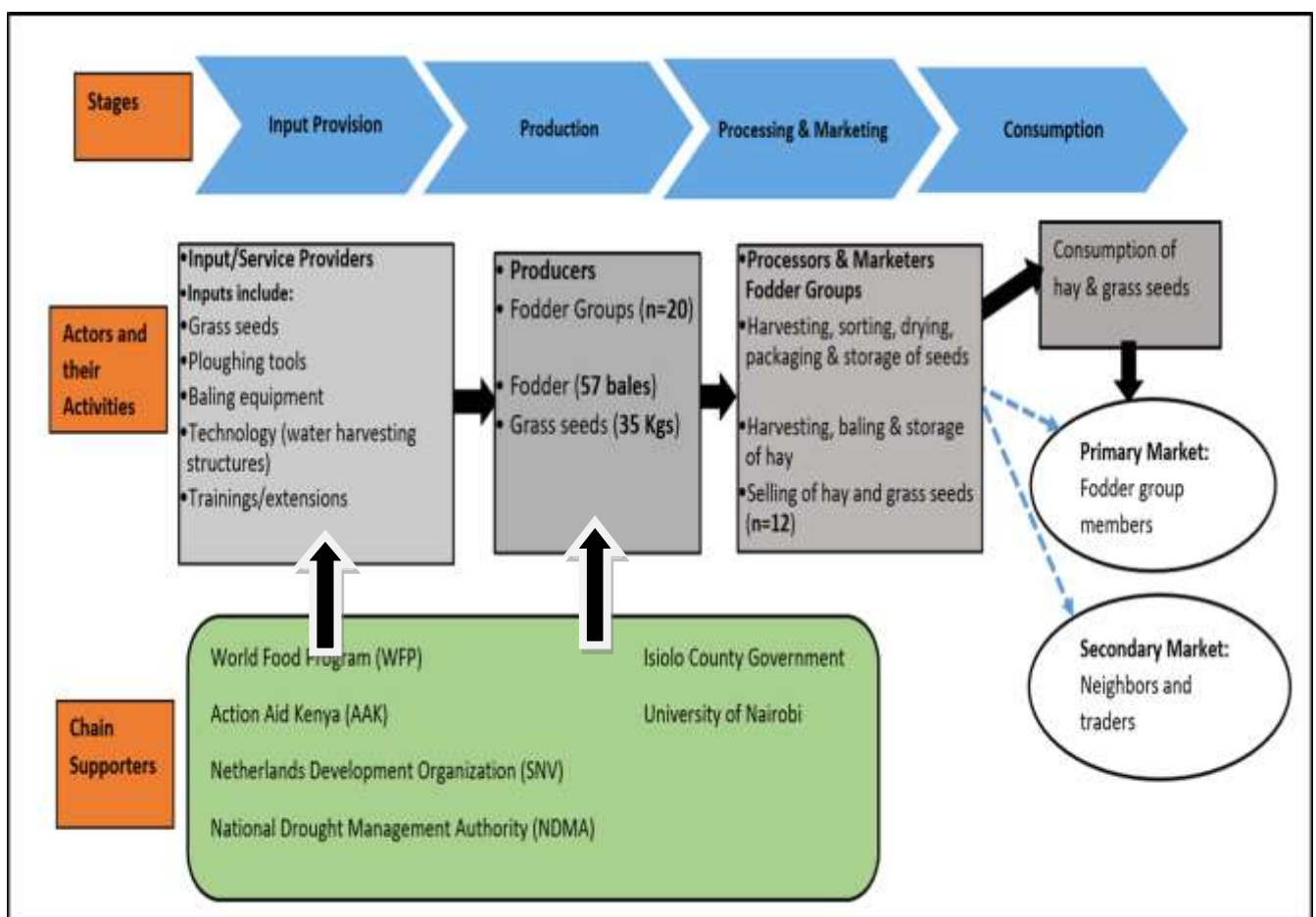


Figure 3 : Fodder Value Chain Map in Isiolo County

Source: Survey Data (2018).

The first stage comprise the input and support service providers, who include fodder groups and other external actors. Groups only provide own labour on their farms. However, input

and services are offered free of charge and highly dominated by external actors who incentivized pastoralists to adopt commercial fodder production. They include government agencies, development partners and non-governmental organizations who work together through the Partnership for Resilience and Economic Growth (PREG) initiative (Kutu and Wamwere-Njoroge, 2017). The partners include Isiolo county government, NDMA, AVCD-LC, REGAL AG, WFP and AAK. The WFP provides food incentives for the FFA project, while others support implementation. The NDMA as an agency tasked with coordination of all activities related to drought mitigation and management, plays a coordination role between the project implementing partners and county line Ministries.

The rest of the stages from production, processing, marketing and consumption of hay and grass seeds are dominated by the fodder producer groups. The main buyers of hay are fodder group members, neighbouring livestock keepers and local traders. Nonetheless, it is worthy to note that the fodder value chain in Isiolo started to develop in a unique environment as it is embedded in the food for asset creation initiative. The chain is mainly boosted by support from external actors who mostly offer production-oriented interventions with limited support and involvement in marketing. This is contrary to the developments in other drylands where fodder and grass seed value chains are well developed and market-oriented. For instance in Baringo County, the grass seeds value chain is dominated by external actors such as KVDA, RAE Trust and KALRO, who acted as input suppliers, consumers as well as seed processing and bulking agents (Lugusa et al., 2016). Similar findings were also reported in Kajiado and Makueni Counties (Omollo et al., 2017).

3.4.2.1 Input Supply for Fodder Production

Fodder production in Isiolo County is highly characterized by low input usage. The inputs used included grass seeds, fertilizer, farm implements and tools, and labour. The groups were

provided with the initial inputs by the PREG partners. Through AVCD-LC project, the International Livestock Research Institute (ILRI) provided initial startup quality rangeland seed varieties such as African fork tail (*Cenchrus Ciliaris*) and Maasai Love grass (*Eragrotis superba*). The groups received about 18 kg of seeds on average. The University of Nairobi-ADIS and the County Government livestock production officers provided technical training focusing on seed selection, land preparation, reseeding, construction and implementation of rain water harvesting structures for fodder production.

Extension services were disseminated mostly through seminars/*barazas* and use of group farms as demonstration sites. These trainings were provided free of charge. In addition, the groups also received extension on livestock husbandry, crop agronomy and business skills. The groups mostly utilized organic manure from own goats in growing pasture. The AAK as the project implementing partner provided the groups with initial farming tools and implements. These included ploughing tools such as hoes, rakes, spades, jembes, harvesting and bailing equipment. The group farms are fenced off using thorny dried logs combined with acacia tree branches sourced locally from the villages. Fodder growing is labour intensive hence group labour is utilized in all group farm activities starting from fencing, land preparation, sowing grass seeds, weeding, harvesting, pasture security as well as marketing.

3.4.2.2 Fodder Production and Processing

Fodder production is carried out on a small-scale with low-output due to high dependence on rainwater, which is largely unreliable in the area. The common grass species planted in the study area is African fork tail (*Cenchrus ciliaris*) and Maasai Love grass (*Eragrotis superba*). These are most commonly promoted and cultivated rangeland species in the drylands of Makueni, Kajiado and Baringo because of their high tolerance to drought and harsh climatic conditions (Omollo et al., 2017; Lugusa et al., 2016). These grasses are easy to establish with

ability to propagate itself and produce viable seeds which can be easily harvested (Mnene, 2006; Koech, 2014).

Important fodder activities undertaken include land tilling, constructing structures, seeding, weeding, harvesting and storage. The groups undertake land preparation twice a year during the months of March and September. These are periods of short and long rains in the study area. Land clearing is done before building the water harvesting structures. The dominant fodder production practice adopted by the groups is broadcasting grass seeds inside the structures. The groups utilize goats manure as organic fertilizer for growing pasture. There is no use of irrigation in fodder production because of limited water in the area. Weeding is done four weeks after planting and once every season to remove unwanted plant species. Grasses are ready for harvest once they have seeded and dried. Harvesting is done twice a year in the months of February and August before the onset of rainy seasons. The grass seeds are mainly harvested using the stripping method while grasses are cut using hand tools like machetes. These corroborates past studies in drylands (Mnene, 2006; Lugusa, 2015).

Fodder and grass seed processing was also done although on a limited scale hence loss of opportunities for value addition and employment. The common baling method used was wooden boxes. The dried hay is manually compressed into the wooden boxes and bales tied using sisal threads. The harvested grass seeds are bulked, sorted by seeds varieties, sun-dried and packaged in sacks for storage. At least 65% of the sampled groups stored produced fodder and seeds for future sale, reseeding, consumption and mitigate theft. Common places of storage include group's fodder store, on farm and member's storage facilities.

3.4.2.2.1 Dryland Farming Technologies Used for Fodder Production

Adoption of fodder production is an integral part of the sustainable dryland farming technologies used in Isiolo County. The FFA project empowered pastoralist communities to

implement rain water harvesting innovations such as micro-catchment structures like *zai*-pits and semi-circular bunds; and macro-catchments like trapezoidal bunds and terraces. However, the fodder groups mostly adopted *zai*-pits and semi-circular bunds because of their adaptive capabilities and simplicity in implementation. The construction of structures like *zai*-pits system are highly labour intensive, hence more viable when undertaken in farmer groups as opposed to individual farms (Danjuma and Mohammed, 2015). The benefits realized include high water retention and penetration, prevents carrying away of grass seeds by wind, increased fodder productivity and easy harvesting. Similarly, Barry et al. (2008) noted that *zai*-pits are efficient in water use and storage, soil structure improvement, reduce sand friction and increases clay content.

There exists extensive literature on the use of these rain water harvesting technologies especially in the Sahel zone of West Africa. They were invented by farmers in Burkina Faso to regenerate severely degraded farmlands. These innovations have been celebrated for their ability to retain soil moisture content, re-establish vegetation cover and restore soil fertility. They have been associated with improved crop productivity and food security of the households in Sahel zone of West Africa (Barry et al., 2008; FAO, 2012; Danjuma and Mohammed, 2015). Moreover, there is also evidence of successful adoption of these dryland farming innovations for crop production in some drylands of Kenya. For instance, farmers in Mtito Andei, Makueni and Mbooni areas have in the past been supported by NGOs to adopt these techniques for production of drought tolerant crops such as millet, green grams, sorghum and cassava (Mbogo, 2014).

3.4.2.3 Marketing of Hay and Grass Seeds in the Study Area

The PREG partners also support marketing of hay and grass seeds by encouraging fodder groups to add value and sell harvested hay in the livestock markets (Kutu and Wamwere-

Njoroge, 2017). At least 60% of the sampled groups are currently selling fodder and grass seeds produced for income generation. There are two established fodder marketing channels in the study area: primary and secondary markets. The primary marketing channel comprise the group members who buy fodder from their own fodder group, while the secondary markets include non-fodder group members such as neighboring livestock keepers, local traders, NGOs and County government. Hay was mainly sold through the primary marketing channel and the hay prices varied with the marketing channels and specific actors involved. However, the fodder marketing structure is mainly informal and transactions are based on spot cash payments. This is similar to other fodder markets in Mandera County (Nyangaga et al., 2009). On the contrary, contractual arrangement is the main transactions method used in Baringo because of the well-integrated fodder input and output markets (Lugusa et al., 2016).

In terms of products, baled hay contributed up to 72% of all fodder sold to the various markets, while green fodder and standing pasture accounted for 14% each. In addition, the groups also harvested acacia pods from acacia trees in their farms and sold as supplemental feeds at Kshs 300 per kilogram. Acacia pods are preferred by goat farmers as they are perceived to have medicinal benefits. At least 35% of groups had access to prior market information on fodder and grass seed prices and demand. About 71% of those with access to market information received it from the implementing partners, 14% from other fodder groups and 15% from RAE Baringo. The information was delivered through seminars/*barazas* and group farm visits.

During the FGDs, the groups were asked to rank the challenges they face in fodder production and marketing on a Likert scale of one to five. The highly ranked challenges constraining fodder production in the study area are summarized in Figure 4. Three-quarters of the respondents strongly agree that drought as the main factor constraining fodder

production and as a result low volumes of fodder are produced and marketed. Droughts also affect the FFA projects because the group farms are abandoned when the pastoralists migrate in search of pasture and water. Elsewhere, Mwaura et al. (2015) noted that frequent droughts increased cost of fodder production in Garissa County.

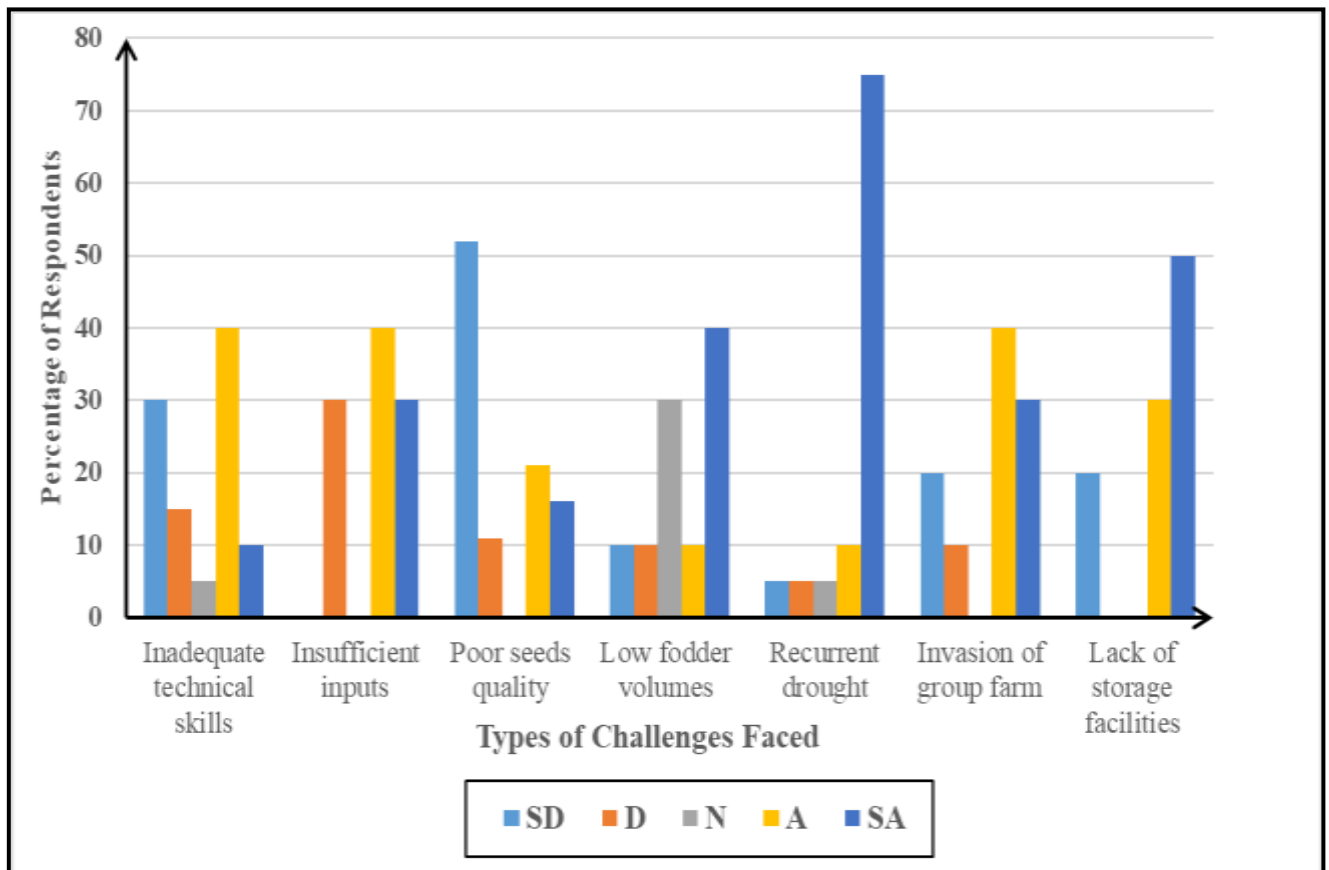


Figure 4 : Major Production Challenges Faced by Fodder Groups

Note: SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree

Source: Survey Data (2018).

Invasion of group farms by both domestic animals and wildlife due to poor fencing materials, was another key challenge noted by two-fifth of the respondents. The thorny branches used for fencing do not provide sufficient protection from elephants which destroy the farms, while goats, donkeys, dick-dicks and gazelles feed on the growing pasture. In order to counter this, some groups have hired a guard to look after the farms while others used a

rotating schedule where members guard the farm on shifts. Inadequate storage facilities was also reported as another key challenge since many groups did not have appropriate stores for hay and grass seeds. The temporary wooden structures that are currently used are prone to termite infestation hence are not sustainable. Proper and adequate storage facilities are necessary to ensure constant supply of hay to mitigate droughts.

Inadequate technical skills on fodder agronomy due to infrequent visits by the County extension officers were also noted to be a challenge affecting fodder production. These findings corroborate past studies in other drylands of Kenya (Nangole et al., 2013; Mwaura et al., 2015; Lugusa, 2015). Moreover, the group activities are constrained by insufficient inputs especially farming tools such as wheelbarrows, harvesting and baling equipment. This limits the number of people working on group farms considering some groups are large.

On the other hand, main marketing challenges faced by fodder producer groups in the study area are inadequate storage facilities, low fodder volumes, lack of market and limited market information. There are limited market outlets especially for grass seeds as most groups could not sell the produced seeds. At the time of survey, most of the groups had several bags of packed seeds in the store due to lack of buyers. These results are consistent with those of Lugusa (2015) and Nangole et al (2013), which reported that lack of storage space and consistent markets were key challenges faced by fodder value chain actors in Baringo County and other parts of the Rift Valley region of Kenya.

CHAPTER FOUR

4.0 ANALYSIS OF THE DETERMINANTS OF INDIVIDUAL PASTORALIST

PARTICIPATION IN FODDER PRODUCER GROUPS

4.1 Abstract

Collective action through developmental groups can be a vital pathway for pastoralists to enhance their economic and social status, thus attaining sustained household food security and long term resilience. However, the effectiveness of these groups significantly depends on individual member commitment to their shared goals and activities. This study assessed the factors influencing individual participation in fodder producer groups in Isiolo County. A household survey was done with 201 randomly selected fodder group members to collect information on their socio-economic and demographic factors. Group participation was measured in terms of whether a member contributed money to facilitate group activities. Results from binary Probit model show that the fodder groups were dominated by women, majority of whom were in their middle age and had no formal education. The average tropical livestock unit (TLU) was 11.32 indicating the importance of livestock to pastoralists as they serve as a store of wealth. The average group age was five years with about fifty members each. The money contributed in the groups was mostly used for merry-go-rounds, savings and acquisition of groups' registration certificate. The Probit model result indicated that cash contribution was positively and significantly influenced by respondent's age, credit access, and asset variables such as herd size, land size and off-farm income. The groups' characteristics such as age and size were found to have negative effects on individual commitment due to diversified interests and free rider problem respectively. However, reliance on external support negatively influenced members' commitment to group activities, signifying pastoralists' immense dependency syndrome on donors' support. Therefore, there is need to promote more resilience focused interventions through asset creation to enhance

pastoralists' access to resources, and opportunities towards self-reliance. These will facilitate the achievement of a sustainable socio-economic development in line with Kenya's Vision 2030 and global development agenda.

4.2 Introduction

Collective action has been commonly acknowledged as an effective approach for improving communities' risk management strategies and fostering rural development (Coppock et al., 2006). As a result, most development agencies and donors have promoted community-based organizations such as groups as a critical component in implementation of developmental projects (Meinzen-Dick et al., 2004; Prokopy, 2009). Therefore, pastoralists' participation in these groups is regarded as one of the promising strategies for building their resilience against climate-induced shocks. This is because groups enable individuals with common problems and inspirations to pool together their resources in order to achieve shared goals (Place and Kariuki, 2005). Following the implementation of the World Food Programme (WFP) project dubbed Food For Asset creation (FFA) in ASAL Counties including Isiolo, several fodder producer groups have emerged. However, understanding the key drivers of pastoralists' participation in collective action is essential for the survival and growth of the fodder groups in the long run. This is because the success of collective action crucially depends on members' active participation.

Previous studies addressing the determinants of collective action have explored various approaches for measuring individual participation in groups. Some studies used frequency of meeting attendance, time and money contributions (Beard, 2005; Fischer and Qaim, 2014; Ochago et al., 2017; Prokopy, 2009), while others used quantity and share of collective sales through cooperatives as a measure of individual commitments to the groups (Fischer and Qaim, 2014; Meier zu Selhausen, 2016). In the context of the current study, all the fodder

group members were formally required to attend group meetings, during which they undertake group farm activities. However, it was not plausible to use meeting attendance as a measure of individual commitment to the group because the number of meetings attended actually determined the amount of food incentives they got for that month. This means that meeting attendance was motivated more by the food component of the project than individual willingness to commit to the group activities. Besides labour and time, the fodder group members also contributed money to fund some of the group activities from time to time. However, this was not a formal requirement hence it was on voluntary basis.

4.3 Methodology

4.3.1 Sampling and Data Collection

The study focused on analyzing the determinants of pastoralists' participation in fodder producer groups. Participation was measured in terms of capital contribution towards supporting some of the group activities. In order to assess this, group members were asked if they made any cash contribution to the group for the last one year prior to study. This was used to represent the decision and willingness to commit to the group, and was captured as a dummy variable taking a value of one for those who contributed and zero for non-contributors. The study further collected information on the actual amount of cash contributed by each member for the last one year, in order to use it a dependent variable in a regression model. However, a large number of households could not recall the exact amount paid, others reported 'don't know', while some quoted questionable figures. This resulted in several missing data which would have made analysis very unrealistic and difficult. As a result, a binary equation of whether or not households contributed cash for the last one year was fitted to measure individual commitment to the fodder group. Capital contribution was preferred as a measure of member commitment to the group because it represents an active

way of facilitating group's operations hence contributing towards achievement of its shared objectives (Prokopy, 2009).

In this case, the sample was restricted to pastoralist households who are currently members of the 20 fodder producer groups in Isiolo County. A list of all the fodder group members was obtained from the master register of the FFA project. Then a random table was used to select a certain number of individual members from each group proportionate to the group size. The group leaders and AAK field monitors were consulted to help mobilize the selected members to be interviewed. A household survey was done with 201 randomly selected fodder group members using a semi-structured questionnaire (see Appendix 4). Data was collected on household's socio-economic and institutional characteristics.

4.3.2 Data Analysis

The participation in collective action was assessed based on individual decision to make capital contribution to fodder groups. Capital contribution behaviour is a discrete choice phenomenon which elicits a yes or no response, thus a Probit regression model was applied. Theoretically, the Probit model is preferred to Logit model by researchers because of its flexibility to allow correlated variables to explain the latent variable. This relaxes the condition of independence from irrelevant alternatives of the logit model (Train, 2009). Pastoralists' participation in fodder producer groups (Y) was captured as a dummy variable with the value of 1 assigned to pastoralists who made capital contribution to fodder group and 0 for otherwise. Thus, individual-specific and group characteristics was used to predict members' participation in fodder group activities.

Following Martey et al. (2014) and Etwire et al. (2013), the binary Probit for the two choice models was specified as follows:

$$Y_i^* = \begin{cases} 1 & \text{if } Y_i^* > Y \\ 0 & \text{if } Y_i^* \leq 0 \end{cases} \dots\dots\dots (5)$$

where Y is a threshold which is assumed to be zero for this study.

Assuming a normal distribution of errors and following Greene (2011), the probability of a pastoralist's participation in fodder group is given by:

$$P_r(Y = 1) = \int_{-\infty}^{\beta'x} \phi(t) dx = \Phi(\beta'x) \dots\dots\dots (6)$$

where: (Φ) is a standard normal distribution, $(Y=1)$ implies that a pastoralist is contributing money to fodder group activities. The x is the exogenous variable likely to influence pastoralist's participation in fodder group. In addition to probabilities, the marginal effect of individual independent variables on the probability of household participation in fodder group was also estimated. Following Etwire et al. (2013), the marginal effects for continuous variables were estimated using Equation 7.

$$\frac{\partial E(Y|x)}{\partial x} = \phi(\beta'x)\beta \dots\dots\dots (7)$$

whereas that of dummy variables were estimated following Equation 8.

$$P_r(Y=1|x,d=1) - P_r(Y=1|x,d=0) \dots\dots\dots (8)$$

where \bar{x} refers to the mean values of all continuous variable.

4.4 Results and Discussions

4.4.1 Characterization of Fodder Group Members' Demographic and Socio-economic Attributes

The results of descriptive statistics of the relevant socio-economic and institutional characteristics of sampled households are presented in Table 4. Most of the respondents (91%) were female. Out of those, 32% were household heads implying that fodder production in Isiolo County was predominantly undertaken by women. Women in pastoral communities play a central role in livestock management besides their domestic chores. During the dry seasons, they go as far as up hills and mountains in search of pasture especially for the homestay lactating livestock. This activity is very strenuous, time consuming, labor-intensive, and even risky given the steep slopes and exposure to wildlife attacks (Kaufmann et al. 2012). More women engaging in fodder producing groups could therefore be explained by the proximity of the group farms to their homesteads and also because fodder growing requires less labor. Furthermore, fodder group require members to participate in farm activities thrice a week, and men are always away from homesteads hence their lower participation.

During the FGD deliberations, women reported that nowadays, many men leave them with the responsibility of providing food for the family while they sit under trees to chat. This trend has forced women to engage in all kinds of work ranging from casual jobs to groups just to get food. A study by Peishi (2018) noted that women participation in FFA projects was motivated by the need to have better livelihood; proximity of FFA activities to their home and that assets could benefit the community at large. It further noted that the FFA programmes supported women's empowerment and transformed gender dynamics. This is mainly through women holding key leadership positions in the groups' committees;

expanding their social networks and mutual support; providing opportunities for income generation and improved diet and improved technical skills and confidence. These enhance their economic and social status thus contributing to their sustained household food security and long term resilience.

Table 3 : Characteristics of the Sampled Households in Isiolo County

Variable (n = 201)	Mean	Standard Deviation
Age of respondents (years)	38.33	11.52
Household size (numbers)	6.42	2.67
Years of schooling of respondent	2.00	3.61
Land size owned (ha)	3.28	4.94
Number of years keeping livestock	17.03	14.22
Number of years accessing communal pasture	15.57	12.05
Transhumance distance (walking hours)	2.06	2.17
Tropical Livestock Units (TLUs)	11.32	13.25
Annual household income (Kshs)	16,511.58	31,495.46
Number of shocks experienced (in the last 10 years)	2.58	1.49
Age of group (years)	5.57	2.31
Size of group (numbers)	57.85	52.79
	Percent	
Female respondents (%)	91.04	
Female respondent who is a household head (%)	32.34	
Proportion of off-farm income in total income (%)	16.00	
Land tenure system: <i>Private with title deed</i>	5.97	
<i>Private without title deed</i>	8.46	
<i>Communal</i>	85.57	
Access to extension services (%)	32.84	
Access to market information (%)	28.36	
Access to weather information (%)	54.73	
Access to credit (%)	43.28	
Reliance on external support (%)	65.17	
Membership in other developmental groups (%)	39.30	
Receive benefits from fodder group (% yes)	67.16	

Notes: TLU computed as: cattle = 1, camels = 1, donkeys = 0.8, goats and sheep = 0.2 & poultry = 0.04 (WISP, 2010).

1 USD was equivalent to Kenya Shillings (Kshs) 101 at the time of the study

Source: Survey Data (2018).

Previous studies have documented that women's motivation of undertaking production ventures differs from that of men. Women's production objectives focus more on the feeding of the family while men are commercial-oriented as they tend to focus on maximizing herd productivity to increase livestock sales for cash (Place and Kariuki, 2005). Male pastoralists are widely known for their high preference to engage in livestock-based activities, and this could explain the less male membership in fodder production since it is still small-scale with limited commercialization. This finding concurs with that of Watson (2010), who noted that pastoral men in Somali and Afar Regions of Ethiopia regarded non-livestock productive activities as low status. Thus, they preferred chewing khat, consequently burdening their wives with the task of providing for their families. Sedentarization and advocacy for gender and women empowerment by development partners can also be considered to have played a role in increasing women participation in fodder groups. Sedentarization provides pastoral women with opportunities to engage in diversified livelihoods such as petty trading, sale of firewood and handicrafts (Watson, 2010).

The average age of the respondents in the study area was 38 years, implying that fodder production was mainly practiced by the middle-aged pastoralists. This is considered a productive stage of life and hence farmers in this age group are energetic and productive. This concurs with the Isiolo CIDP, which stated that the County's economically active labour force falls in the age group bracket of 15 to 64 years (Republic of Kenya, 2013). The result is also consistent with Beard (2005), who observed that women and men in the prime-age range of 31-45 years were more likely to participate in civil society organizations in India, and this was attributed to their family responsibilities. The average number of years of formal education was two years, implying that most of the respondents did not complete basic education. Furthermore, there was a noticeable discrepancy in literacy level across the gender lines, with male and female respondents having an average of two and four years,

respectively. These differences are statistically significant at 5% (p -value 0.05). Over three-quarter of the female respondents had no formal education and only one-third had at least primary education. On the contrary, more than half of male respondents had at least primary education, while only 44% had no formal education. This is consistent with the Isiolo CIDP (2013) which stated that over 85% of community members in Isiolo had no formal education, and illiteracy level was higher among the female. The County's literacy level stands at 42.8%, which is relatively low as compared to the national level of 71.4% (KNBS, 2009; Republic of Kenya, 2013). This implies that pastoral households have weak human capital base and this may have negative implications on livestock production and marketing. This can consequently inhibit investments and employment opportunities, as well as achievement of the County's development agenda and goals.

The average household size for the respondents in the sample was about seven persons, which is slightly higher than the county's development plan of 6 persons and Kenya's national mean of 4 persons (KNBS, 2009, Republic of Kenya, 2013). The number of members of a household reflects the cash needs of the household in terms of food and other basic needs. It also shows the labor availability as large household sizes enable households to implement labor-intensive adaptation strategies (Nyangena, 2008; Deressa et al., 2009).

The average experience of respondents in pastoralism was 17 years. This indicates that most households started practising livestock production at adult age as it enabled them to inherit livestock from the parents. Similarly, the mean number of years of accessing communal pasture was about 16 years, with an average transhumance distance of 2 walking hours. These results are consistent with the definition of pastoralism as a way of life for the people and characterized by extensive mobility and dependence on communal grazing resources (WISP, 2010). The average tropical livestock unit (TLU) in the study was about 11 indicating the

importance of livestock to pastoralists as they serve as a store of wealth and source of livelihoods (Barrett et al., 2004; WISP, 2010). The dominant breeds kept are indigenous and they are highly preferred because of their high adaptability to limited pasture and water supply, tolerance to droughts and diseases. The breeds include Zebu and Boran for cattle, Galla goats, Black Head Persian sheep, Somali, Turkana and Rendille for camels. The composition of livestock kept was 16.5% cattle, 43.2% goats, 28.4% sheep, 1.6% camel, 0.9% donkeys and 9.5% chicken. There is evidence of pastoralists' preference of small ruminants as the shoats combined accounted for 72%. This is because shoats are relatively more tolerant to harsh climatic conditions, and diseases. They also exhibit early maturity, high off-take rates and feed on locally available pastures and shrubs (Rutto et al., 2012).

Figure 5 shows the various livelihood activities undertaken by sampled households in Isiolo County.

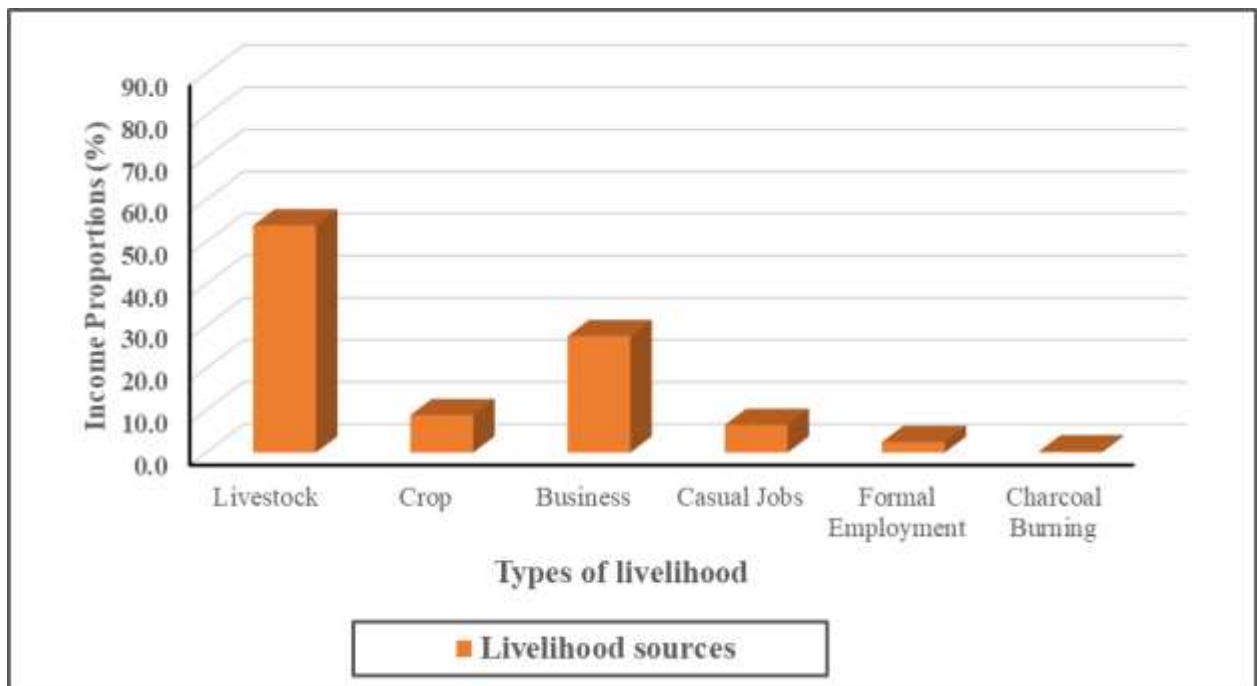


Figure 5 : Respondent's Livelihood Sources

Source: Survey Data (2018).

On average, results indicated that 86% of the respondents practiced livestock keeping. This concurs with the Isiolo CIDP (2013), which reported that over 80% of the inhabitants rely on livestock for their livelihoods. As expected, income from livestock keeping constituted a large share of respondent's total household income, accounting for about 54%. This finding corroborates previous studies, which noted that pastoralist communities derive more than 50% of their gross income and food provisions from livestock production. This is because livestock enterprises provide a wide base of potential income sources from sale of live animals, livestock products and other livestock-related activities (Opiyo et. al. 2014). Livestock also play a critical socio-cultural role among pastoral communities. This was evidenced from the fact that 39% of the respondents acquired their initial stock through inheritance from parents, while 16% and 5% acquired through bride price payment and ceremonial gifts, respectively.

Business was the second income source as approximately 15% of the respondents generated about 28% of their total income from undertaking small businesses. According to Isiolo CIDP (2013), retail trade accounted for about 15% of the self-employment especially among the urban dwellers who sold items like khat, food stuff, clothing and footwear among others. Income proportion from crop production was relatively low at 9%. This was expected since a large portion of the County is arid hence cannot support meaningful crop farming. Small-scale rain fed agriculture was undertaken by agro-pastoralists in semi-arid areas with relatively high rainfall, and the commonly grown crops include maize, beans and vegetables like kales, spinach, spring onions and tomatoes. The low crop income can also be explained by the fact that most of the respondents grow these crops majorly for subsistence, hence limited selling for income. Other sources of income noted include casual jobs, formal employment and charcoal. The low income from formal employment was highly attributed to high illiteracy levels coupled by lack of skills among the locals (Republic of Kenya, 2013).

The household mean annual total income was about Kshs 16,512. On average, this translates to Kshs 46 per day implying that most pastoral households live below the minimum poverty threshold of USD 1.9 per day as defined by the World Bank (2015). This is consistent with Isiolo CIDP (2013), which shows that over 71% of the population live below the poverty line, and this is extreme as compared to the national statistic of 45%. These trends aggravate other development challenges like infant mortality, unemployment and illiteracy, which stand at 8, 70 and 85 percent, respectively (Republic of Kenya, 2013). Therefore, there is need to develop targeted programmes geared towards addressing acute poverty especially among the pastoralists. Moreover, only a quarter of the respondents had off-farm income sources, which contribute approximately 16% to their total household income annually. Household's engagement in off-farm activities is an indicator of their income diversification strategy to mitigate against risks.

The average land size was approximately three hectares among the sampled households. Only 6% of the households had private ownership over the occupied land, 14% claimed private ownership but without formal title deeds, while majority (85%) utilized communal lands. As per the County development plan (CIDP 2013-2017), the major development challenges experienced in the County are partly attributed to weak tenure systems as it contributes to; resource-based conflicts, disincentive to long term investments, land degradation, food insecurity and extreme poverty (Republic of Kenya, 2013).

Only a third of the respondents had access to extension services within the last 12 months as indicated in Table 4. These are services respondents received outside the fodder groups. This is because Isiolo County is characterized by inadequate skilled extension personnel and resources. Inadequate access to extension services inhibits diffusion of knowledge to farmers, and this impedes agricultural productivity and growth. Majority of the respondents accessed

extension services on livestock husbandry and fodder agronomy. This is to be expected, since most of them are pastoralists and are members of fodder groups. Other training and extension support received were on crop production and entrepreneurship skills. However, most of these services were provided free of charge.

As shown in Figure 6, the different forms of extension services are majorly provided by various individual non-governmental organizations (NGOs), Isiolo county government and also through partnerships. The AAK provides more services to respondents accounting for 28%, followed by County-NGO partnerships at 21%, Isiolo County Government at 19%, and ILRI at 14%. Others included Red Cross and the SNV both providing 9%. The livestock extension services covered animal breeding, veterinary services, off-takes, marketing and insurance.

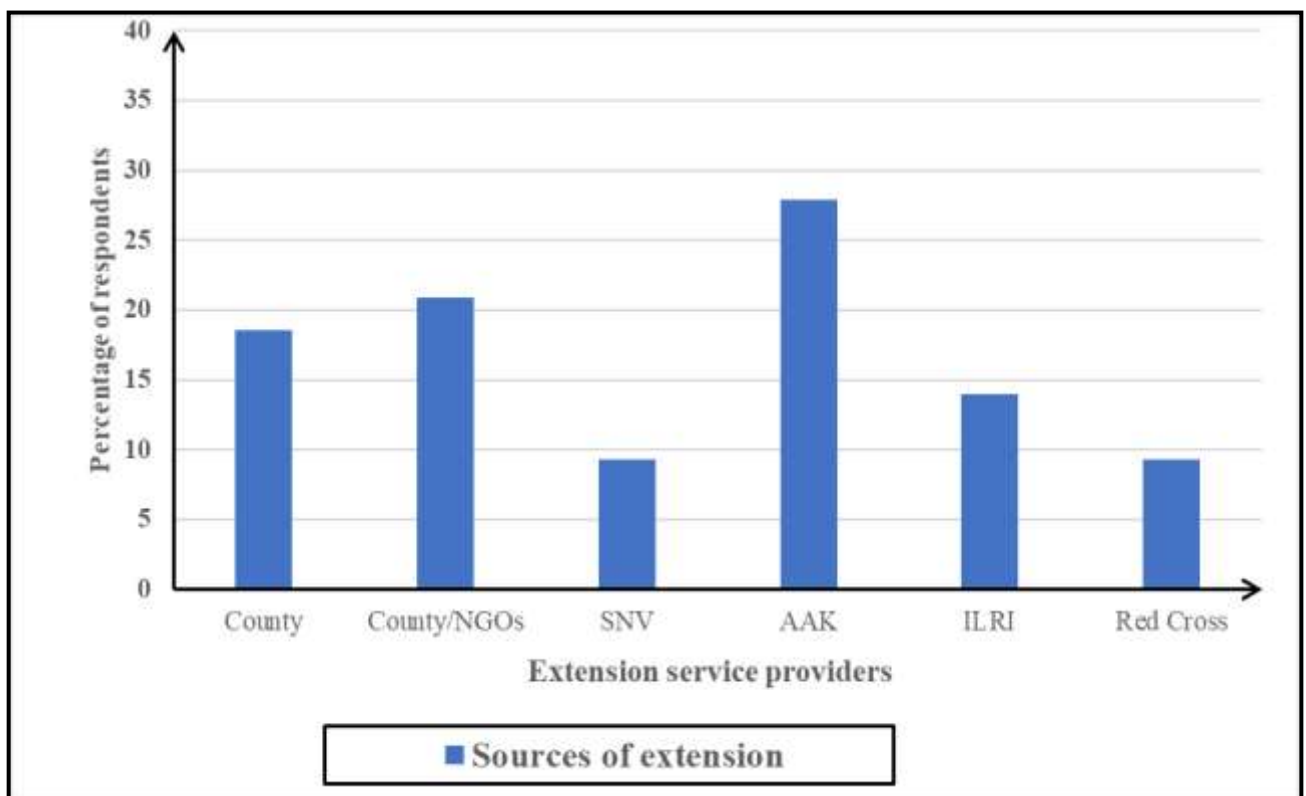


Figure 6 : Distribution of Extension Service Providers

Source: Survey data (2018).

The various channels of disseminating extension services are summarized in Figure 7. The dominant extension service delivery channel was through public seminars. This involves organizing people in one venue and various extension service providers come and train them as a group. Local Chiefs and other leaders are used to mobilize participants in advance and gather in designated areas like the Chief camps, school and market places. The pastoral households are sparsely spread over vast geographical areas that are characterized by impassable roads and poor telecommunication network coverage. This makes extension service delivery costly and tedious. As a result, public gatherings (*barazas*) are highly preferred by many service providers because of their cost effectiveness and convenience for the participants.

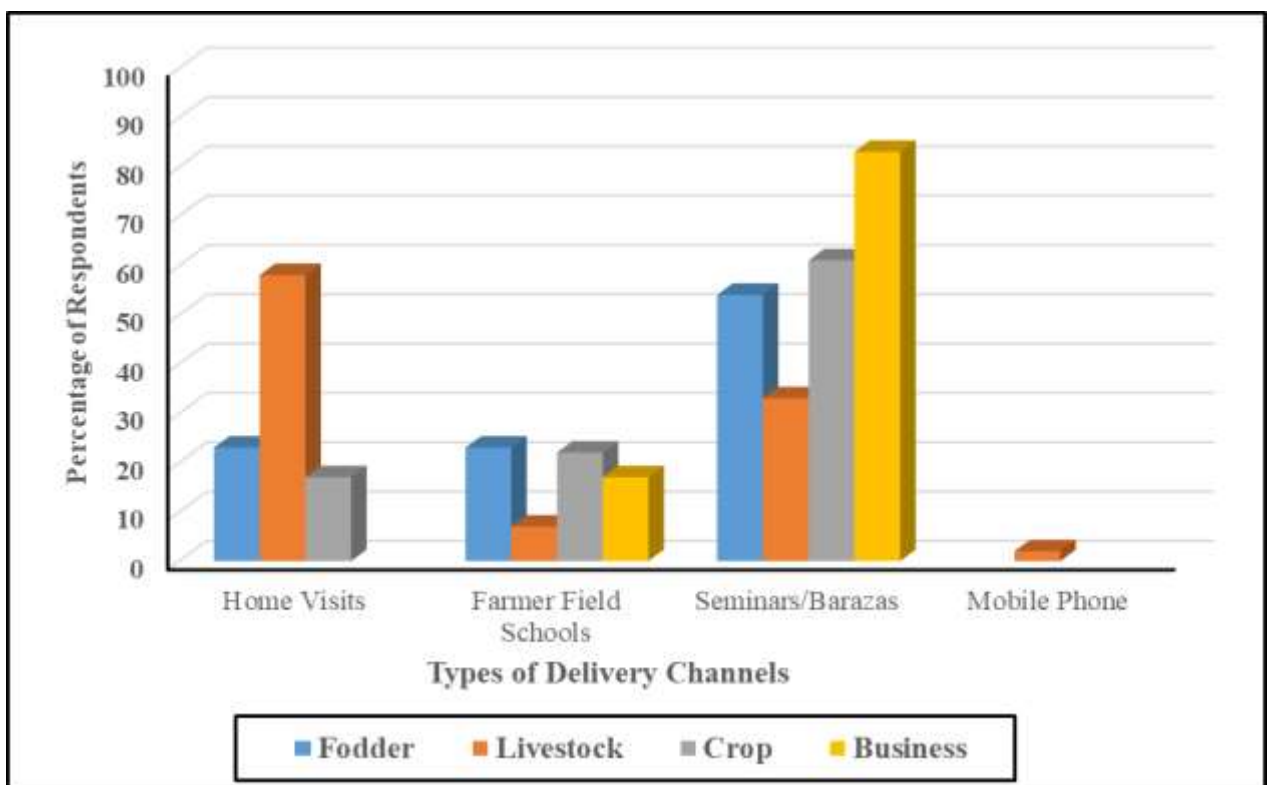


Figure 7 : Delivery Channels for Various Types of Extension Services

Source: Survey Data (2018).

Home visits are mostly used to deliver livestock extension services. This could be because pastoral households take their livestock for grazing far away from their homesteads. Service providers have to make home visits very early in the morning or at grazing areas, especially when offering veterinary services like vaccination. The training on fodder and crop agronomy are normally undertaken on-site for easy demonstration and delivery, hence home visits are most appropriate. The use of farmer field school approach is an emerging participatory channel for extension service delivery. It entails using farmer groups to train more participants in communally accepted demonstration sites and also through exchange visits to other farmer groups. Working with farmer groups is advantageous as it offers a good platform for conducting trainings, facilitates flow of information and mobilizing resources. The participatory nature of this approach enables the participants to acquire management skills and adopt self-tested and preferable technologies. Past studies have shown the effectiveness of this delivery approach in increasing productivity and incomes (Davis et al., 2010). The use of mobile phones as a dissemination approach was very low and could be attributed to the remoteness of the study area, which is characterized by limited telecommunication, network coverage and poor electricity connection. Also, most households don't own communication gadget due to high poverty.

Less than a third of the respondents had access to prior market information regarding price, demand and supply for fodder in the last one year. As illustrated in Figure 8, nearly half of them received information from other fodder producer groups in the area. A third received from NGOs while farmer-to-farmer and own-fodder group accounted for 7% and 5%, respectively. This implies that informal sources of market information dominated the study area. Only 6% of them received formal market information from the County extension workers. As noted by Otieno (2011), prior market information is critical because it could

inform respondent's decisions to buy fodder, choice of market outlets and when to buy fodder for storage.

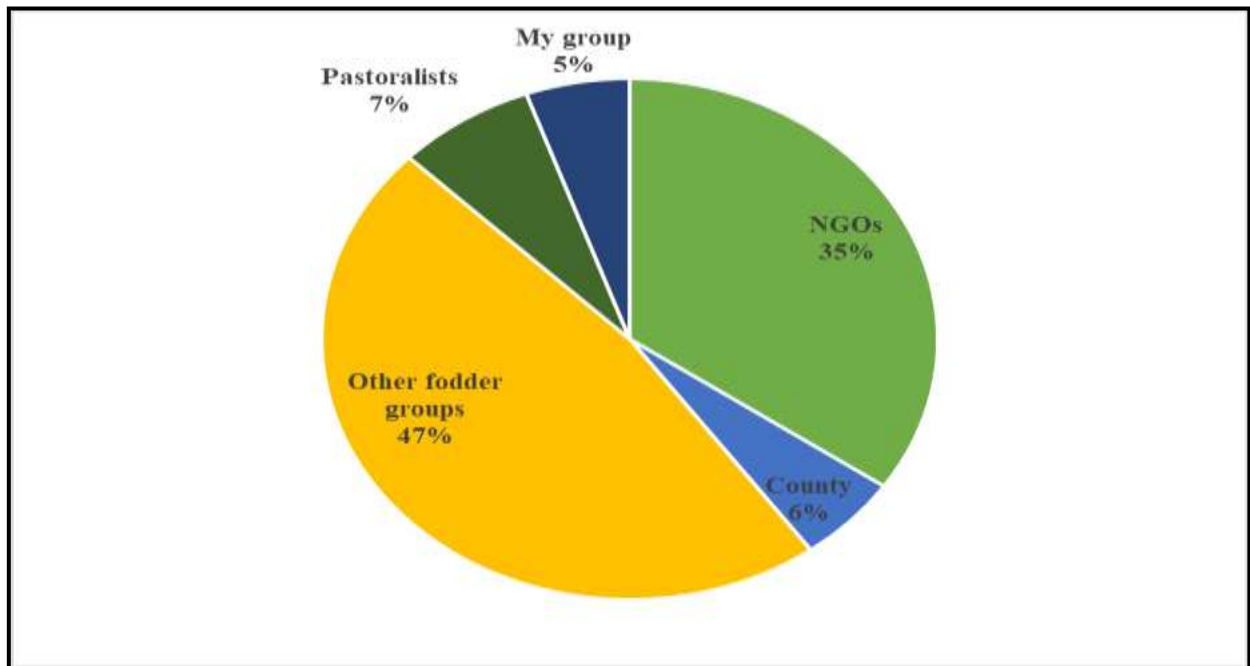


Figure 8 : Sources of Market Information

Source: Survey Data (2018).

Nearly half of the respondents had accessed credit services in the past twelve months, mainly in form of monetary loans. However, the credit facilities were only sourced from groups that mobilized funds through merry-go-rounds and offered loan services through the table banking initiative. Merry-go-round is structured as Rotating Savings and Credit Associations (ROSCAs) where members agree to contribute a fixed amount of money at each meeting for a fixed period of time, and give the whole amount to one or two members each month on a rotating schedule. On the other hand, table banking is a group funding strategy where members use the contributions from merry-go-rounds for immediate lending to one or more members either as a short or long term loan. This strategy has been widely promoted by NGOs as a financial inclusion initiative to enhance access to affordable credit to rural people

especially women and youth. It is an informal institution that mobilizes members' own resources and provides financial services (Coppock, 2006). These results indicate pastoralists' limited access to formally regulated financial services. This is because, Isiolo County has only six commercial banks, two micro-finance institutions and one village bank, but they are all located in town centers, hence not accessible to most residents in rural areas. This trend has previously partly been associated with extreme poverty and unemployment levels in Isiolo (Republic of Kenya, 2013). Lack of access to formal financial and credit services impede investments that could contribute towards resilience building. The households used the credit obtained as capital investment in various livelihood activities as shown in Figure 9.

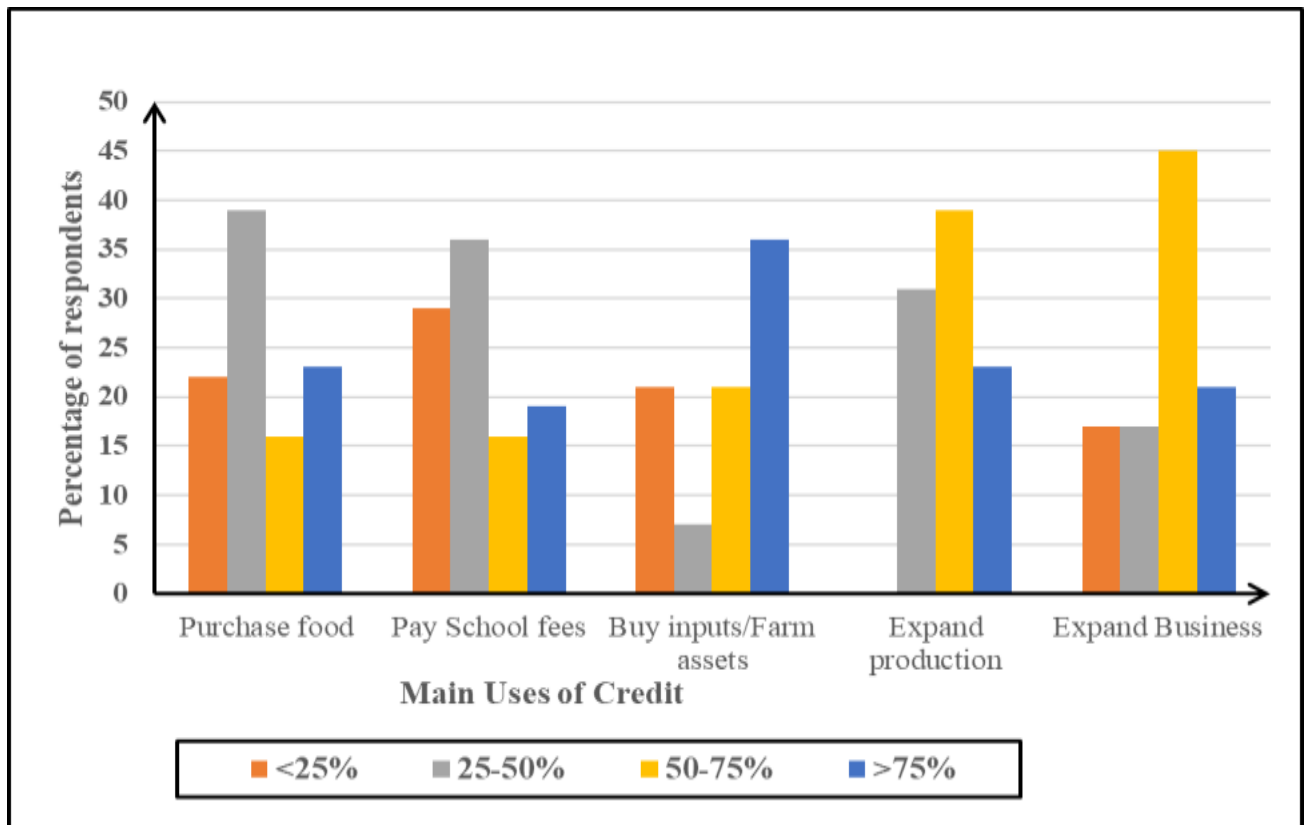


Figure 9 : Main Uses of Credit

Source: Survey Data (2018).

Majority of the respondents allocated between half to three-quarter of the credit received to expand their businesses and production as shown in Figure 9. This shows respondents' preference to invest in income generating activities that can enable them to repay the loan principal amount plus the interest accrued. Consumption expenditures such as food purchases and school fees payments were assigned relatively lower proportions. Some of the key challenges faced by respondents when accessing credit services included insufficient loan amount, high interest rates, long procedures and short repayment period. The inadequate loan amounts could be because most of the groups that offer lending services operate on a limited capital base. The insights from the FGD revealed that the loan facilities were offered at 10% interest rates and this was considered prohibitive to most applicants. The long process of getting loans from the groups was attributed to the fact that the groups had to wait for previous borrowers to repay. The respondents also acknowledged that the loan repayment period was short, thus making the loan more expensive.

Close to half of the respondents were also members of other development or social groups in the area apart from fodder groups. Women groups were the common social groups in the area with more than 80% of the respondents being members for an average duration of about 9 years. Some of the main motivations for joining women groups include; access to financial support, possibility of gaining income from group businesses as well as entrepreneurship and agribusiness skills. These findings explain why credit was mostly accessed from groups through table banking. Others also belonged to youth, mixed and religious groups. Membership to women groups offers respondents the opportunity to access funds through merry go- rounds. Its widespread existence plays a critical role in enabling the members to access markets, trainings and business skills. This concurs with the observation of past studies, which noted that access to credit and other institutional support services are the main motivation for individuals to participate in collective action (Olila 2014; Place and Kariuki,

2005). Social groups also offered support services to their members in form of cash, food and labour particularly during funerals and wedding occasions. Additionally, such groups provided members with opportunities to earn extra income by participating in joint income generating activities like livestock business, retail trade and crop/fodder production for sale. Some of the items traded include livestock, livestock products, crops, fodder and beads.

More than half of the respondents had access to early warning information regarding changes in weather conditions in the last twelve months. As presented in Figure 10, the dominant source of such information was from the traditional elders who disseminated it through home visits and in *barazas*. This concurs with the findings of Barrett et al. (2004) who noted that pastoralists in northern Kenya relied on extensive and varied traditional weather forecast methods, ranging from observing behaviour of animals and wildlife to intestine interpretation for determining possible climate outlook in the near future.

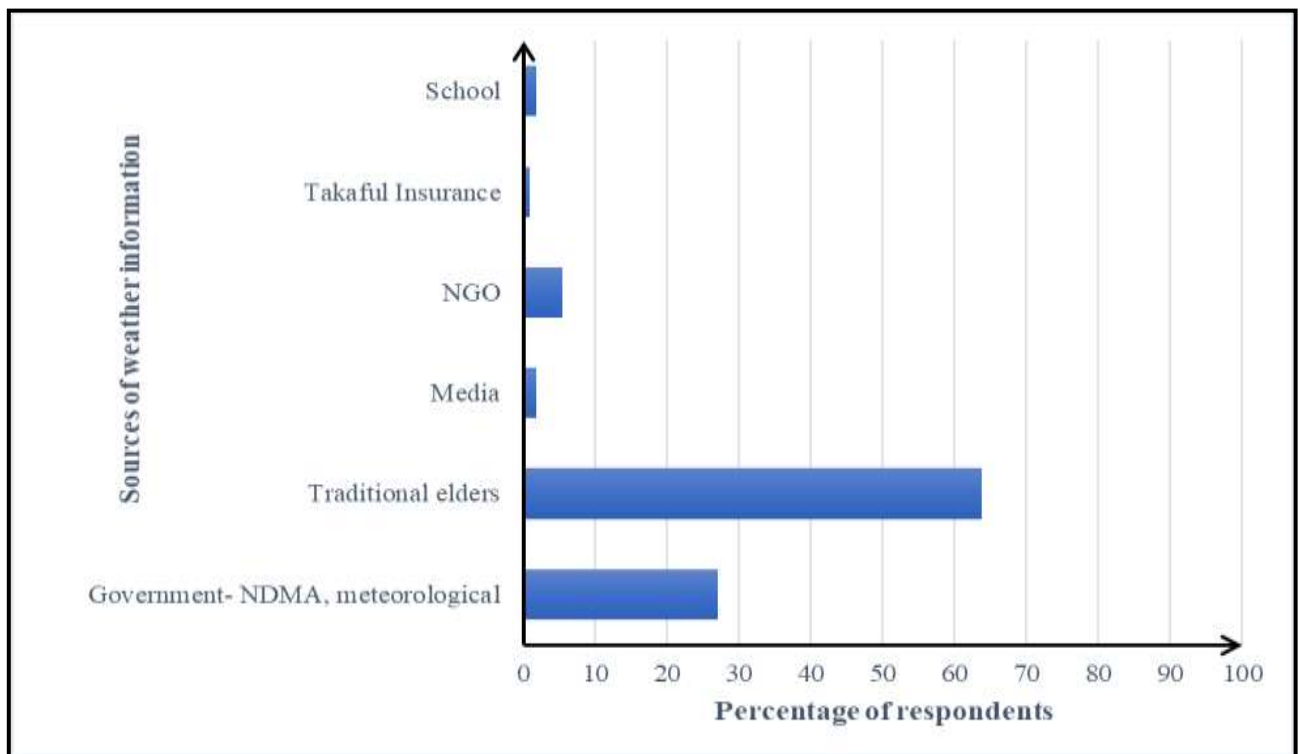


Figure 10 : Sources of Weather Information by Delivery Channels

Source: Survey Data (2018).

It also revealed that pastoralists had a high degree of confidence in the indigenous climate forecasting as opposed to the modern approaches. The government sources; the NDMA and the Metrological Department accounted for about 27% and were delivered mostly via radio and *barazas*. The NGOs like AAK and Red Cross Society of Kenya, schools and Takaful Insurance Company mostly utilized channels like public gatherings and radio. Takaful Insurance mostly offered extension on livestock insurance. Similar to Barrett et al. (2004), radio was the predominant modern media channel used to disseminate information because most of the rural people own radios. The low use of media sources (print and television) could be because most residents do not have access to televisions, poor telecommunication facilities as well as high illiteracy levels.

4.4.2 Pastoralists' Exposure to Shocks

Pastoralists' production and livelihood systems are prone to climate-induced shocks, hence they are more vulnerable. Results showed that the respondents' exposure to various shocks over the last 10 years varied. As indicated in Figure 11, almost all the respondents experienced drought-related shocks, which adversely caused massive livestock deaths, loss of household assets, cash income and crops. Over 82% of the respondents were also affected by livestock pest and diseases such as Foot and Mouth Disease (FMD) and Rift Valley Fever (RVF). Due to this, the Isiolo veterinary department imposed a ban on slaughter and consumption of livestock products for two weeks in June 2018 (during the time of survey), following an outbreak of RVF. This led to closure of all slaughterhouses and livestock markets, hence slowing economic activity and causing considerable loss of income. The ASALs are also prone to flooding. Nearly half of the respondents were affected by floods and lost their household assets. Floods occurred at least twice a year during the two rainy seasons and lasted for less than a month.

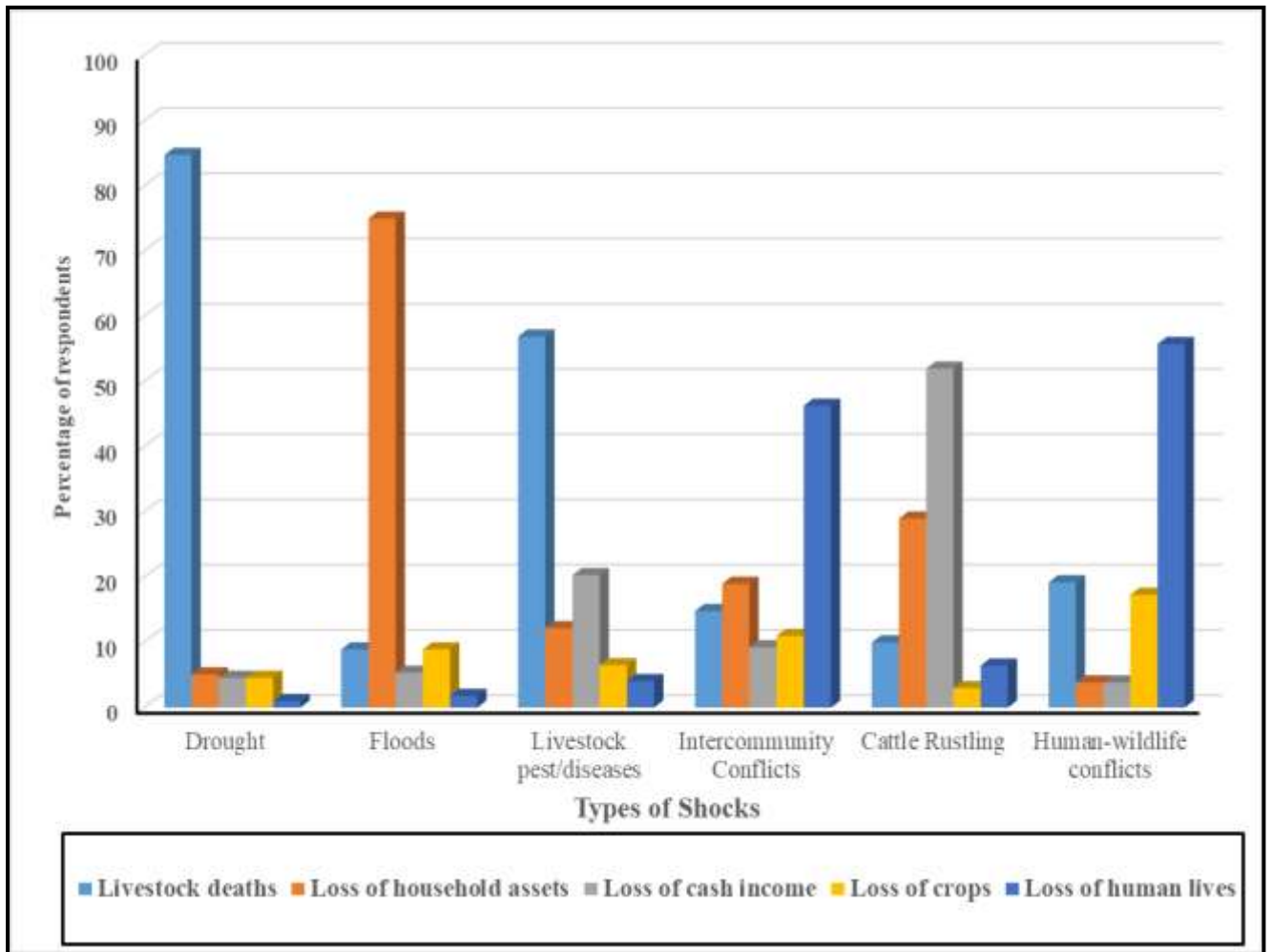


Figure 11 : Effects of Shocks on Households’ Livelihoods

Source: Survey Data (2018).

About 44% of respondents experienced intercommunity conflicts, which are fueled by pasture and water scarcity especially in dry seasons. As a result, there was high loss of human lives and household assets. Human-wildlife conflicts are also common in the sample area as reported by close to 50% of respondents. The adverse effects reported included loss of human lives and livestock – goats as they are attacked by wild animals like hyena and cheetah. Destructions of crops especially from elephants and monkeys were also reported. About 28% lost cash income and household assets as a result of cattle rustling.

Isiolo County has bimodal rainfall patterns with a long dry spell for over eight months every year. The FGD revealed that the occurrence of prolonged droughts have increased over the years with erratic rainfall patterns. More than half of the respondents (56%) acknowledged experiencing drought-related shocks at least twice in a year. The prolonged and recurrent droughts are often the root cause of these other shocks affecting pastoralists. Severe droughts results in scarce water and pasture resources, leading to deterioration of livestock body conditions and even death in extreme cases. As noted by Aklilu and Wekesa (2001), emaciated livestock are more susceptible to disease and parasitic loads. The shortage of grazing resources force pastoralist to migrate to other surrounding areas. The occurrence of cattle rustling and human-wildlife conflicts are also common in dry seasons as wildlife come near homesteads in search of food and water. On average, each household experienced about three shocks at one given time with others experiencing all at ago. This means that these shocks often occur simultaneously and when this happens, the negative effect on livelihoods and asset-base can be disastrous. Similar findings were noted in other drylands of West Pokot and Turkana Counties (Muricho et al., 2019; Opiyo et al., 2014).

4.4.3 Coping Strategies to Various Shocks

Over the years, pastoralists have adopted various coping mechanisms to reduce the negative effects of the shocks. Most of the respondents utilized migration, aid from NGOs and support from social groups to mitigate negative effects of the shocks experienced, as illustrated in Figure 12. Drought-induced effects were mostly mitigated through participation in de-stocking programs, use of food and monetary aid from NGOs and migration. During severe drought situation, the national government in partnership with NGOs usually employ de-stocking programs through emergency livestock purchase initiatives. This involves the implementing partners/organizations buying weak livestock at above market price,

slaughtering them and distributing the meat to local schools, hospitals, or poor households. Destocking enables pastoralists to liquidate some of their capital assets (livestock) through market creation for emaciated livestock. This has been noted to contribute to increased purchasing power of the affected households, thus positively impacting on their socio-economic status (Aklilu and Wekesa, 2001; Kagunyu et al., 2017).

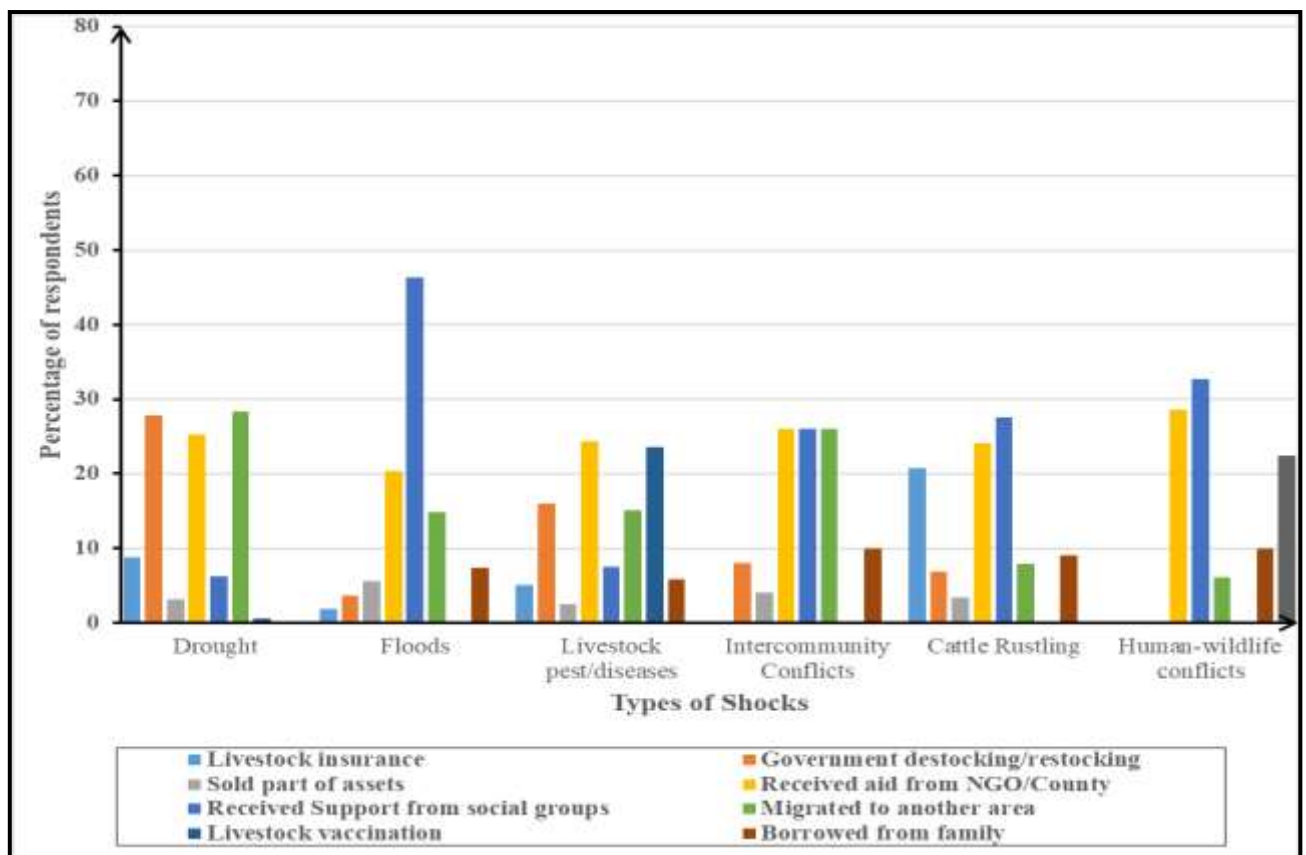


Figure 12 : Coping Strategies for Various Shocks

Source: Survey Data (2018).

Some NGOs and religious organizations also played a critical supporting role in pastoral areas where the government’s capacity and resources are constrained. Isiolo County government has established and maintained good relationship with NGOs and agencies through Partnership for Resilience and Economic Growth (PREG). The partners include AVCD-LC, WFP, REGAL AG, NDMA, and Action Aid Kenya. The support offered is

focused on enhancing livestock market access, improving productivity through promotion of drought-tolerant feeds and veterinary intervention, breeding, and improved nutrition for women and young children. The NGOs also offer humanitarian assistance in the form of cash transfers, food for asset creation, and household effects like blankets to people displaced by floods and conflicts. Provision of water support for people and livestock in dry seasons by rehabilitating existing water resources, water trucking for drilling of new boreholes, sand dams and promotion of water harvesting technologies for production. They also build capacity of pastoralists on alternative livestock feeding regimes such as feed conservation, fodder/pasture production and controlled grazing (Kagunyu et al., 2017).

Most respondents utilized livestock vaccination and NGOs' aid to mitigate shocks caused by livestock pest and diseases. The NGOs are the major players in provision of veterinary services including vaccination and control of *endo/ecto* parasites among pastoralists in Isiolo County. In addition, they train County Veterinary extension officers on how to identify/detect endemic diseases, and producers on diseases syndromic surveillance and reporting (Aklilu and Wekesa, 2001; Kutu and Wamwere-Njoroge, 2017). Migration remains an important indigenous coping strategy for pastoralists in Isiolo County to manage uncertainty and risk in arid lands. This is evident as most of the respondents migrated seasonally to other areas in order to mitigate against shocks caused by drought, livestock diseases and community conflicts. Mobility enables pastoralists to effectively utilize sparse pasture and water resources, as well as to enhance livestock resistance to diseases (Wanyoike et al., 2018; WISP, 2010). People also migrate to relatives' and friends' houses in other villages in cases of conflicts.

Social support groups also played a crucial role in mitigating the negative effects of various shocks related to floods, intercommunity conflicts, cattle rustling and human-wildlife

conflicts, as shown in Figure 13. In time of crisis, women often mobilize funds and resources through self-help groups to support the very needy people in society. As reported by Coppock et al. (2006), pastoral women's groups in northern Kenya coordinated public fund raising (*harambee*) and provided emergency support to most vulnerable groups like widows, orphans, elderly and sickly. Over time, group efforts to alleviate drought impacts have evolved as they offer co-support in form of cash, food, and payments for school fees and hospital bills. They also provide labour to construct houses for flood victims and those whose houses were burnt down during community clashes. This is consistent with Muricho et al. (2017), who noted that social groups provided support in the form of food, cash, labor and livestock to help household affected by droughts in West Pokot County. Others borrowed cash and food from family members to survive in extreme times. Some of the respondents affected by wildlife conflicts received compensation from Kenya Wildlife Service (KWS). But their response was noted to be slow while the compensation process was too procedural with little money in return.

About two-third of the respondents depend on external support ranging from trainings, money and food. Over 90% of the food aid comes from WFP which is a key incentive for participation in fodder groups. Other actors include Kenya Rapid, Red Cross Society of Kenya and national government who offer humanitarian assistance though not much. The adaptive capacity of pastoralists communities have been curtailed by demographic factors, extreme climatic conditions, limited access to institutional support services like credit and extension services as well as social services especially education, and health. Thus, they depend on external assistance from actors such as government and NGOs. This is consistent with Kagunyu et al. (2017) who noted that communities in Isiolo County are supported by government departments, NGOs and faith-based organizations during the times of calamities.

4.4.4 Factors Influencing Individual Pastoralists' Participation in Fodder Producer Groups

Descriptive statistics show that at least half of the members contributed money, ranging from Kshs 100 to 500, for group activities at least once every month. The uses of the money contributed are shown in Figure 13.

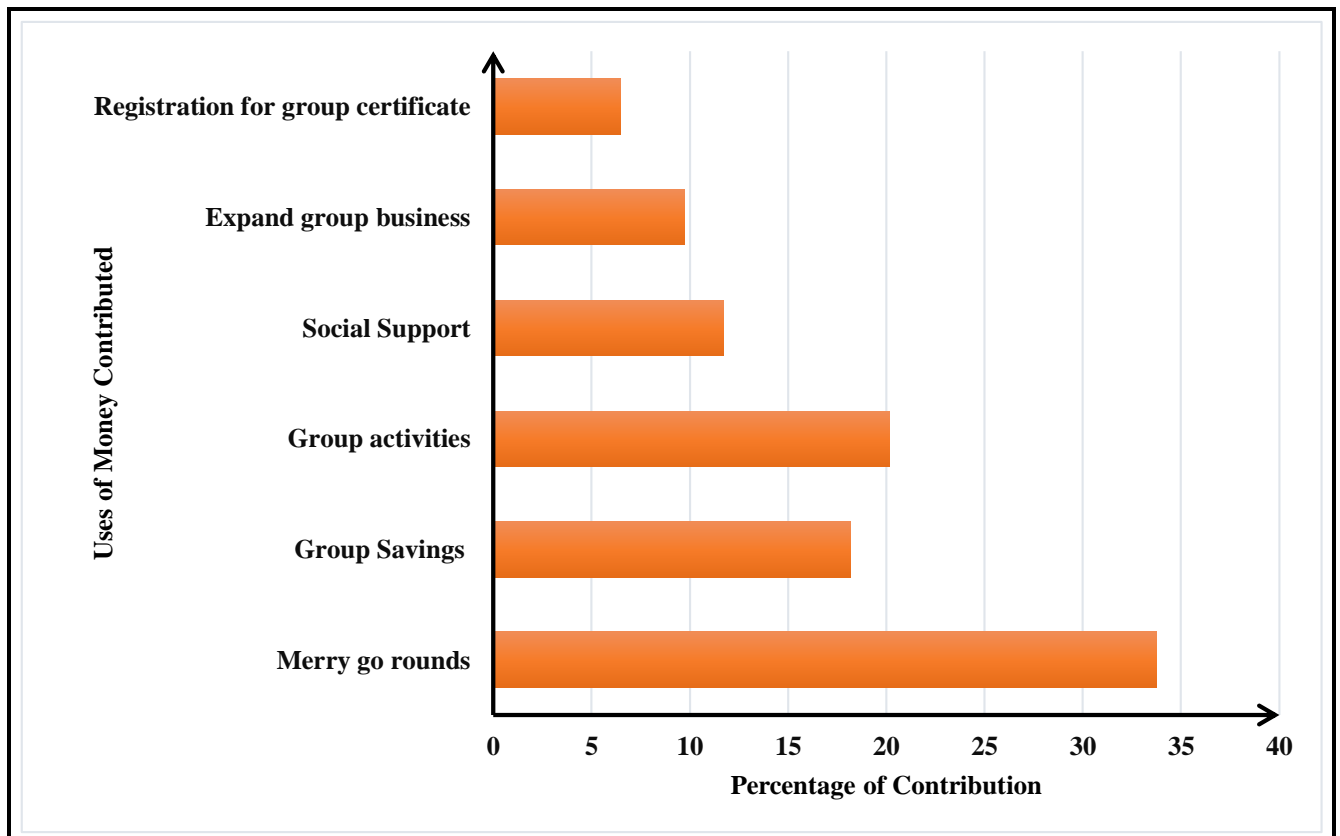


Figure 13 : Uses of Money Contributed in the Fodder Groups

Source: Survey Data (2018).

Fodder groups used a third of the capital contributed for the merry-go-round initiative. This provided the group members with a reliable source of fund to meet their immediate cash needs for food, school fees, hospital costs, child birth, weddings, funerals and restocking animals. This corroborates previous studies that found self-help groups adopting some form of savings scheme, which was sustained through monthly contributions. Part of the contributions were offered as loans to the group members (Place and Kariuki, 2005; Place et

al., 2004; Coppock et al., 2006, Lugusa, 2015). About 18% of the contributions were saved in the group bank account for future investment and as emergency funds in times of crisis.

The group apportioned a fifth of the contributions to buy inputs such as seeds, farm tools and to pay for labour used in fodder production, while around 13% was offered as social support services to the needy members in the groups. One-tenth of the money was utilized to expand the group retail business, buying livestock, beads and sugar for sale. These group activities smoothed their income between fodder planting and harvesting seasons. About 6% of the money collected was used for group certificate registration with the Ministry of Culture and Social Services. The formal registration aided the groups to access development funds like women, youth and *Uwezo* fund.

Cross tabulations between selected household assets variables, group characteristics and participation in fodder groups was done. Thereafter, independent t-tests were used to test if there was any significant difference in household assets held by contributors and non-contributors as shown in Table 5.

Table 4 : Independent t-tests on Household Assets, Group Characteristics and Group Participation

Variable	Group participation	No group participation	p-value
Average off-farms Income (Kshs)	6821.00	3577.00	0.525
Average TLU	12.17*	8.32*	0.089
Average land size (ha)	3.56	2.28	0.129
Average group age	5.20***	6.91***	0.000
Average group size	50.00***	87.00***	0.000
<i>Notes: T-test: significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$</i>			

Source: Survey Data (2018).

Results in Table 5 show noticeable differences in all the asset variables averages for those who contributed money to the group compared to those who did not contribute. It was evident that the contributors had more average off-farm income and land sizes than their counterparts. However, these differences were not statistically significant. This is perhaps because only a quarter of the respondents had off-farm income hence its influence on capital contribution could be marginal. As shown, those who contributed money for the group activities have larger TLUs compared to non-participants. The differences in average TLUs were statistically significant at 1% level of significant. Pastoralists with more livestock are considered wealthy, hence more willing to contribute.

Results also indicate that there is a statistically significant difference in the contribution behaviour of respondents across different group characteristics. The respondents who contributed to the group activities belonged to younger groups as shown by the mean of 5.2 years. This difference is statistically significant at 1%. This is plausible because members in new groups have a higher expectation of the perceived benefits offered by the group, hence would be more likely to commit themselves to the group activities. Individuals in small groups contributed capital to the groups as compared to those in large groups, and this variation was statistically significant at 1%. The possible explanation is that a large group is a potential incentive for free riding problem, hence likely to reduce members' commitment to the group pursuits.

4.4.3.2 Results of Probit Model

A binary Probit model in which capital contribution was the dependent variable was estimated. The study hypothesized individual participation in fodder group to be determined by individual-specific attributes like age, household size, transhumance distance, TLU, land size, off-farm income; group characteristics and institutional factors like access to credit,

social capital and external aid. The continuous variables were converted in the logarithm form in order to reduce outliers (Wooldridge, 2002). The estimated coefficients, marginal effects and p -values from the binary Probit model are shown in Table 6.

Table 6 : Probit Results of Determinants of Individual Pastoralist’s Participation in Fodder Group

Variables (n=201)	Coefficients		Marginal Effects
Constant	-0.011	(-1.826)	-
Log age of respondent (years)	1.194**	(-0.539)	0.228
Log of household Size (numbers)	-0.507*	(-0.292)	-0.097
Log of land size owned (ha)	0.399***	(-0.128)	0.076
Proportion of off-farm Income (%)	0.707*	(-0.396)	0.135
Log of Tropical Livestock Units (TLU)	0.0251	(-0.101)	0.005
Access to credit (%)	0.827***	(-0.291)	0.158
Reliance on external support (%)	-0.469*	(-0.262)	-0.090
Number of groups belonged to	-0.879***	(-0.302)	-0.168
Number of shocks experienced in last 10 years	0.178	(-0.122)	0.034
Log of transhumance distance	0.075	(-0.115)	0.014
Log of group age (years)	-0.946**	(-0.401)	-0.180
Log of group size (numbers)	-0.432**	(-0.170)	-0.082
Receive benefits from group	0.478*	(-0.253)	0.091

Notes: Number of observations (n) = 201, Wald Chi-square (13) = 58.260

Prob> Chi-square = 0.000, Log pseudo likelihood= -68.803, Pseudo R² = 0.349

Robust standard errors are shown in parentheses

*Significant level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Survey Data (2018).

Result showed that the Probit model explained 35% of the variations in the likelihood of member’s participation in fodder group. The estimated probability was greater than the chi-square value (Probability > Chi-square = 0.0000), suggesting that the model had a strong explanatory power, hence it offered an acceptable goodness-of-fit measure for the sample

data. Most of the key explanatory variables of interest were statistically significant at 10% or lower and the signs on most variables were as expected.

A one year increase in age of the respondent was associated with a 23% increase in their probability to contribute money for the group. A probable explanation for this is that age depicts more experience in livestock keeping, exposure to climate-induced shocks and buildup of local knowledge on its adverse effects. With more experience which is associated with age, members have a better understanding of the intricacies of fodder groups, the benefits and importance of being committed in order to mitigate some of the challenges experienced. This observation concurs with previous studies, which found age of household head to positively influence member commitment to fodder group (Adong et al., 2013; Sseguya et al., 2013). Additionally, age was positively associated with household's adoption of adaptive strategies and innovations, which in this case is fodder production, to mitigate climate variability (Hassan and Nhemachena, 2008). *This finding supports rejection of the null hypothesis that age does not affect participation in fodder group.*

Household size was found to have a negative and significant effect on a household's willingness to contribute cash to the group. The results of the marginal effect show that an additional person in the household decreases the probability of contributing cash by 10%. This is plausible because a household with more members has considerably higher expenditure on basic needs like food, medicine, shelter and clothing. Therefore, such households have less cash to spare for group activities. This is consistent with the argument advanced by Elhadi et al. (2012) and Gebremedhin et al. (2015), that household size is directly proportional to its demand for food and income to cater for other basic needs. Moreover, households with a higher dependency ratio are considered to be poorer compared to those with less dependency ratio and thus, could not afford to contribute money to the

group activities (Davis et al., 2010). *This result leads to rejection of the null hypothesis that household size does not influence participation in fodder group.*

As expected, the size of land owned was found to have a positive influence on individual participation. The marginal effects result show that a one unit increase in land size increases the probability of individual contributing cash by 8%. *This justifies rejection of null hypothesis that land size does not significantly influence individual participation.* The member's commitment could be motivated by their need to learn more technical skills and technology for fodder agronomy so that they can replicate it in their own farms. The FFA project encourages members to replicate the technology and knowledge learnt on their individual farms for maximum benefits. This was witnessed during a visit to one of the exemplary farmer who grew fodder and other food crops like legumes on his own farm. Household access to large land sizes is also a necessary condition for growing own fodder and crops, which they can sale for income to cater for food and spare some for groups. This concurs with Sseguya et al. (2013) who noted that community members with large land sizes were more likely to participate in food security groups as a means of augmenting access to resources in Uganda.

The proportion of off-farm income to total household income was significantly influenced a higher individual commitment to group activities. As shown by the marginal effects, group members with high proportion of off-farm incomes are more likely to make capital contribution to the group by about 14%. This is because such households have a better understanding of the benefits of income diversification and are thus more likely to commit to collective action. Livelihood diversification is a risk mitigation strategy adopted by pastoral households to supplement income from livestock, hence provides them with more money to spare for the group. This concurs with Ayieko et al. (2014), who noted that farmers with

more off-farm income are more likely to join groups because they can afford to pay membership fees, perform group activities and further access credit facilities. Similarly, Deressa et al. (2008) reported that non-farm income increases the likelihood of farmers to adopt climate adaptation strategies, which in this case are represented by fodder production. *This result leads to rejection of the null hypothesis that proportion of off-farm income does not influence participation in fodder group.*

The structural composition of the fodder groups in terms of group age and size was found to have a negative influence on member commitments to the fodder group. This concurs with the t-test results and the earlier discussions in Table 5. *These findings support rejection of the null hypothesis that group attributes do not affect individual commitment to fodder group.* A one unit increase in the age of the group was found to negatively influence individual participation by 18%. This could be because members have already realized the benefits expected from the group at the early periods and tend to be reluctant as their group ages. Also, as a group ages, members tend to develop diversified interests and ambitions that are different from the initial shared goals of the groups. For instance, some members graduate from the projects once they have attained the necessary knowledge and skills to start their own fodder farms, and engage in other economic ventures; some of which may compete with or act at cross-purpose with the original group's intentions. They become inactive though they are still part of the group. However, this is contrary to the finding of Ayieko et al. (2014) who noted that the duration of group existence is associated with perceived trust, stability and organization.

Entry of an additional member to the group decreases individual commitment to group activities by 8%. A possible explanation for this is that a larger group increases transaction costs arising from high communication, monitoring and enforcement costs. In addition, large

groups are faced with challenges of sharing responsibilities and benefits equitably, and decreased trust among members, which negatively affect governance; thus considered as an incentive for free rider problem that might lead to lower levels of commitment (Wollni and Fischer, 2014; Paumgarten et al., 2012).

Receiving benefits from fodder groups was found to influence individual participation by 9%. This implies that past benefits derived from the fodder group increases members' commitments to group initiatives. The benefits received were in the form of cash, fodder, enhanced access to extension, credit services as well as social supports. This is consistent with Fischer and Qaim (2014), who also observed that benefits derived from cooperatives, in the form of access to tissue culture planting materials and associated technical training, increased the commitments of banana farmers to their cooperative's shared goals in Kenya.

The institutional factors included in the model were all statistically significant in influencing group participation. Having access to credit services positively predicted individual commitment to the group. The marginal effects indicated that credit access increases the probability of members contributing to group initiatives by 16%. This is expected considering the fact that credit facilities were mainly offered by the fodder group and other development groups through the table banking initiatives. A proportion of the proceeds from fodder sales, retail and livestock business were offered as loan services to members at 10% interest rate. This facility enabled members to expand production, business and buy food thus motivation to commit to group. This finding resonates well with that of Fischer and Qaim (2012) who reported that credit access eases the cash constraints of members, hence increases money available for them to subscribe to farmer groups and make capital contributions.

Membership in social groups decreases the probability to offer cash contribution to fodder group by up to 17%. This is plausible because most of the respondents also belonged to other

developmental groups like women groups, to which they were also expected to make some form of capital contributions. Consistent with prior discussions, women groups offered more varied services like table banking to their members and had been in existence for a longer time than fodder groups. Therefore, the accumulated trust and additional benefits offered by these other social groups is likely to reduce member's commitment to fodder group. This is consistent with Wollni and Fischer (2014) who observed that an increasing number of organizational memberships lowered household's patronage to coffee cooperatives in Costa Rica.

As anticipated, the influence of reliance on external support on fodder group participation was found to be negative. This implies that access to external aid from various non-governmental organizations reduces the likelihood of capital contribution to fodder group by close to 9%. The external support received was non-monetary in the form of trainings, inputs and food incentives. This scenario could be explained by immense dependency syndrome exhibited by pastoralist communities who rely heavily on relief foods and humanitarian assistance for survival throughout the year. This means that aid is a disincentive for members to commit to group activities and hence a big threat to groups sustainability. A more sustainable approach should be adopted to enhance pastoralist's self-reliance to reverse this worrying trend. This concurs with the findings of Otieno et al. (2018), who observed that farmers with access to aid in the form of relief food from non-governmental organizations demonstrated no motivation of adopting climate change management strategies in the flood-prone areas of Western Kenya.

The TLUs, transhumance distance and number of shocks experienced were found to be positive but insignificant in influencing individual commitment to group activities. This is perhaps because over 90% of the respondents equally accessed the communal grazing

resources of pasture and water. The mean years of access and transhumance distances were uniform across the respondents in the area. The number of shocks experienced was also similar across the respondents since they are located in the same geographical conditions.

CHAPTER FIVE

5.0 AN ASSESSMENT OF THE SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS INFLUENCING PASTORALISTS' PARTICIPATION IN FODDER MARKETS

5.1 Abstract

Feed scarcity remains a perennial challenge impeding livestock production in the drylands amid increasing pressure on land and natural resources. As a result, commercial fodder production is increasingly being adopted by pastoralists as a source of both livestock feed and income. However, most previous studies on fodder mainly focused on the production dynamics, with limited attention to fodder marketing aspects and pastoralists' willingness to purchase fodder for own livestock use. This study was conducted in Isiolo County with the aim of documenting the emergence of fodder markets as well as assessing factors affecting pastoralists' decision to purchase fodder. A multistage sampling technique was used to select 201 fodder group members and data collected using a semi structured questionnaire. A Heckman step-two model was applied to identify socio-economic and institutional factors influencing pastoralist participation in fodder markets and intensity of participation. Results show that more than half of the sampled households have been buying fodder for an average duration of three years. Own fodder groups are the main source of fodder marketed. Market participation behaviour of pastoralists was significantly affected by age, gender, livestock holdings, off-farm income, shocks and access to credit, weather and market information. The intensity of market participation was significantly influenced by livestock holdings, shocks and access to weather information. The negative relationship between private land ownership and buying fodder suggests the importance of addressing land tenure issues in the ASALs in order to facilitate pastoralists' adoption of more innovative land use practices for sustainability. Additionally, results showed negative effects of pastoralists' dependence on

external support as it decreases their likelihood of buying fodder. These results underscore the importance of improving pastoralists' access to perquisite institutional support services such as credit facilities, extension services, and market information. These will strengthen household's investment in alternative livelihoods hence building their resilience.

5.2 Introduction

The rising demand for livestock feeds in the drylands has been largely driven by climate change and expanding livestock and human population, resulting into overgrazing, encroachment and fragmentation of arable rangelands (Ayele et al., 2012; Lugusa, 2015). As a result, pastoral communities in Kenya have gradually adopted fodder production as a way of drought preparedness to mitigate against livestock deaths due to starvation (SNV, 2013). In the recent years, this practice has been scaled up to commercial fodder production leading to the emergence of fodder markets in the ASAL regions. However, the degree of commercial orientation varies across different dryland Counties. For instance, Baringo County is advanced in terms of fodder production and marketing, which is demand-driven due to commercial dairy farming. Fodder production is majorly on large scale basis and mechanized, hence facilitating high level of commercialization. The fodder markets are very formalized, developed and integrated due to the large involvement of private sector players (SNV, 2013; Lugusa et al., 2016). Elsewhere, fodder enterprise and markets in Mandera, Kajiado and Makueni Counties are still developing with limited private sector participation although informal in nature (Nyangaga et al., 2009; Omollo et al., 2017). In Isiolo County, however, the fodder market is relatively small and still underdeveloped hence presents more opportunities for growth.

Moreover, there is no empirical evidence on the institutional and socio-economic factors influencing pastoralists' decisions to participate in these fodder markets and intensity of

participation. Most previous studies on fodder in the drylands have majorly focused on the production aspects and its economic viability. Consequently, little information exists on the determinants of fodder market participation behaviour and intensity of participation among the pastoralist communities. The current study aimed to fill this knowledge gap.

5.3 Methodology

In Isiolo County, fodder production and marketing is currently small-scale and majorly undertaken in groups. Thus, the current study focused on fodder producer groups under the FFA project. Ideally, it would have been plausible to study fodder market participation at the group level since production and selling is being undertaken collectively. However, there were only 20 fodder producer groups in the study area, hence not a sufficient sample size for meaningful analysis. This necessitated an analysis at the individual level by focusing on households that are members of fodder producer groups. Information was collected on whether the individual members usually buy fodder for their own livestock; thus, market participation was analyzed based on the household's decision to buy fodder from the market or not and the quantity bought. Most of the individual households were net buyers. Analysis of the factors that influence households' participation in fodder markets as net buyers is vital for: understanding the potential of fodder markets; designing carefully targeted policy interventions that promote commercially-oriented fodder production and ensuring efficient and enhanced market access for producer groups.

A total of 201 respondents were selected from the group's register using simple random sampling. Then, the group leaders and AAK field monitors assisted in mobilizing the selected members. A semi-structured questionnaire was used to gather data on the selected respondents' socio-economic characteristics and institutional factors (see Appendix 4).

5.3.1 Empirical Framework

The decision of a pastoral household to participate in commercial fodder market and the extent of participation (in terms of volumes bought) was modeled using a Heckman step-two model. The choice of this model is informed by its ability to relax Tobit's restrictive assumptions and correct for sample selection bias (Heckman, 1979). The estimation of this model involves two stages as applied in an empirical study by Vance and Buchheim (2005). The first stage is referred to as the selection equation, which defines a binary choice indicating where the household falls (decision to buy fodder or not). It is estimated using a Probit regression model to determine the likelihood that a household participated in the fodder markets. Let $B_{ifodder} = 1$ represent a household that bought fodder whereas $B_{ifodder} = 0$ is otherwise. Therefore, the first step is specified as follows:

$$B_{ifodder}^* = \beta X_i + U_i \dots\dots\dots (9)$$

$$B_{ifodder} = 1 \text{ if } B_{ifodder}^* > 0 \text{ and } B_{ifodder} = 0 \text{ if } B_{ifodder}^* \leq 0 \dots\dots\dots (10)$$

where; $B_{ifodder}^*$ is a latent variable showing household satisfaction from purchasing fodder; $B_{ifodder}$ is an indicator for market participation which takes the value of one for a household that buys fodder from the available market sources and 0 for those who do not buy, X_i defines the characteristics of the household, β is the parameter coefficients to be estimated and U_i is the error term with normal distribution. The second stage involves estimating an Ordinary Least Square (OLS) regression of the amount of fodder bought

conditional on market participation, $B_{ifodder} = 1$ against explanatory variables as shown below:

$$Y_i = X_i \beta + \varepsilon_i \dots\dots\dots (11)$$

Where; Y_i is the quantity of fodder bought measured in number of bales, X_i is a vector of independent variables that determines intensity of participation, β is a vector of coefficients and ε_i is the error term. As a result of the correlation of the error terms between Probit and OLS regression, biased estimates are generated during estimation in the second stage with $\text{corr}(u, \varepsilon)$. Therefore, an Inverse Mills Ratio (IMR) was computed from the first stage of Probit regression and is introduced to the OLS regression model with all other explanatory variables so as to correct for this bias (Komarek, 2010). Since the mills ratio is included as an independent variable, the regression model extends to:

$$E(Y_i / B_{ifodder} = 1, x_i) = \beta' x_i + \rho \sigma_\varepsilon \lambda_i \dots\dots\dots (12)$$

where x_i shows a vector of independent variables used to calculate the level of market participation after bias correction, β' is a vector of parameter coefficients to be estimated, σ_ε and σ_u represent random error terms of the outcome and selection equations respectively. The λ_i shows the IMR.

5.4 Results and Discussions

5.4.1 Distribution of Fodder Markets in Isiolo County

Approximately 58% of the sampled households bought fodder from various market sources for an average duration of three years. As shown in Figure 14, over 80% of the participants sourced fodder from their own fodder groups. This is because group members acted as the primary marketing channel for the fodder produced by their groups.

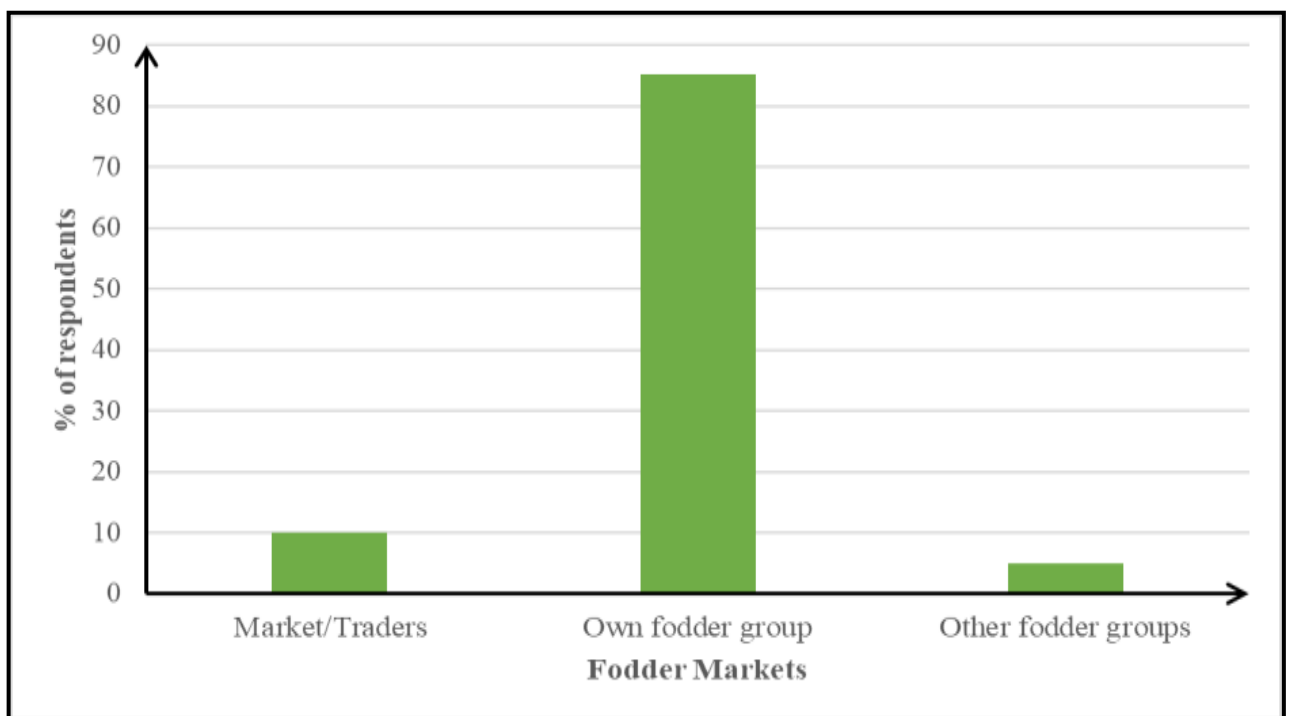


Figure 14 : Main Sources of the Fodder Marketed

Source: Survey Data (2018).

The fodder purchasing prices varied across the different market outlets though not statistically significant. The fodder groups sold to their members at a relatively lower price compared to other consumers. The low fodder price was one of the benefits enjoyed by members and it acted as an incentive for their commitment in the groups. Fodder from own groups was also preferred because of the group farm's close proximity to members'

homesteads. This implies minimum transportation cost incurred as buyers carried fodder on their shoulders. The traders in the livestock markets sourced hay from within and outside the County and sold to livestock keepers. Other fodder groups in the area were also utilized as the secondary fodder markets.

In terms of payment method, nearly 70% of the participants paid cash on the spot, 24% paid later while the rest purchased fodder on credit basis. This flexibility in payment was also an additional benefit enjoyed by members who bought fodder from their own groups. For the secondary markets, all buyers paid cash upon receipt of the fodder. Over 70% of the traded fodder was processed in the form of baled hay, while the rest was in form of freshly cut green pastures and standing pastures on farm.

5.4.2 Cross tabulations between Selected Institutional factors, Household Assets and Market Participation

A Chi-square test was used to assess associations between market participation (buying fodder or not) and selected institutional variables. Similarly, an independent t-test was done to assess if there are significant differences in asset holdings between fodder buyers and non-buyers. As shown in Table 7, the variations in behaviour of market and non-market participants are statistically significant at 1% across all factors, except for external aid. This is plausible because these factors are widely cited in literature as positive determinants of the market participation behaviour of households. The chi-square results showed significant associations between market participation and access to extension. This could be because members have realized the benefits of having constant supply of fodder through group trainings and are thus, more likely to buy fodder in preparation for dry seasons. This underlines the importance of extension services to the pastoralists' communities.

Table 7: Cross tabulations between Selected Institutional factors, Household Assets and Market Participation

Variable	Bought fodder	Did not buy fodder	Test statistic	p-value
Access to extension services (1= yes, 0= otherwise)	83.33***	16.67	Chi-square	0.000
Access to weather information (1= yes, 0= otherwise)	76.36***	23.64	Chi-square	0.000
Access to market information (1= yes, 0= otherwise)	94.74***	5.26	Chi-square	0.000
Access to credit services (1= yes, 0= otherwise)	71.26***	28.74	Chi-square	0.001
Reliance on external support (1= yes, 0= otherwise)	56.49	43.51	Chi-square	0.631
Social Capital (1= yes, 0= otherwise)	74.68***	25.32	Chi-square	0.000
Average off-farm income (Kshs)	2,670*	10,807	t-test	0.056
Average TLU	13.6***	8.2	t-test	0.004

*Notes: Statistical significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Source: Survey Data (2018).

Access to weather information enable pastoralists to plan ahead in order to mitigate livestock death due to drought periods. However, there was no statistically significant association between access to external aid and market participation behaviour. This could be because majority of the respondents had access to external aid in terms of food and trainings. Moreover, results of the independent t-tests indicate a statistically significant difference in both average off-farm income and livestock holdings between the two groups. The households with more livestock are noted to have low off-farm income and are fodder buyers. This could be because livestock keeping is labour intensive and time consuming, thus limits household's engagement in off-farm activities. On the other hand, those with less livestock have sufficient time to invest in off-farm enterprises, hence have more off-farm income. Pastoralists with large herds are expected to source for alternative feeds through buying fodder in order to complement that of natural grazing resources. Also, livestock sales provide

pastoralists with the liquidity necessary to purchase inputs such as fodder and veterinary services.

5.4.3 Factors Influencing Pastoralists' Participation in Fodder Markets

The study hypothesized that institutional factors such as access to extension, market information, weather information, credit services, tenure system, and reliance on external aid do not affect pastoralist's participation in fodder markets. Some household characteristics and asset variables were also included in the model. The continuous variables were converted in the logarithm form in order to reduce outliers (Wooldridge, 2002). The parameter estimates for the Two-step Heckman Model are presented in Table 8. Results show that ρ is positive and greater than 0.65, while *Wald chi-square* is highly significant at 1% indicating a strong correlation between the decision and intensity of market participation. The Inverse Mills Ratio (IMR/Lambda) term was positive and significant at 5% suggesting that the error terms in the selection and outcome equation are positively correlated. These results confirm that the decision to participate in markets and intensity of market participation are interrelated and modeling them as separate processes would yield misleading results. The marginal effects for the selection equation were computed for ease of interpretation.

Access to weather information (early warning signs) positively influenced pastoralist's participation in fodder markets at 5% level of significance. The marginal effect indicate that a shift from lacking access to weather information to having access increases the likelihood of a pastoralist buying fodder by 22%. *This leads to rejection of null hypothesis that access to weather information does not affect market participation.* This is plausible because a pastoralist's access to reliable early warning systems enhances their early preparedness and adoption of drought-mitigation strategies such as prior purchase and storage of livestock feeds.

Table 8 : Two-step Heckman Model Results for Fodder Market Participation

Variable	Market participation equation		Quantity of fodder bought equation	
	Coef.	dy/dx	Coef.	Std. Error
Access to weather information (1= yes; 0= no)	0.608**	0.222	-17.830**	-9.032
Land tenure (1= private; 0= communal)	-1.138***	-0.416	-17.420*	-10.430
Reliance on external support (1= yes; 0= no)	-0.910***	-0.333	8.712	-6.861
Access to market information (1= yes; 0= no)	1.635***	0.597	-	-
Access to credit (1= yes; 0= no)	0.586**	0.214	-	-
Access to extension (1= yes; 0= no)	0.261	0.095	4.829	-7.145
Sex of household head (1= female; 0= otherwise)	-0.638**	-0.233	9.811	-6.903
Log age of respondent (years)	0.908*	0.332	7.180	-11.870
Log Household Size (numbers)	-0.052	-0.019	-11.830	-7.510
Log land size owned (ha)	0.176	0.064	-0.237	-4.275
Proportion of Off farm income	-0.659*	-0.241	4.389	-12.850
Log Tropical Livestock Units (TLUs)	0.226*	0.083	13.83***	-3.607
Number of shocks experienced (in the last 10 years)	0.386***	0.141	6.694**	-2.850
Constant	-4.352**	-	-50.620	-41.620

*Notes: ***, **, * significance levels at 1, 5 and 10 percent respectively.*

N= 201 (censored observations = 85, uncensored observations = 116)

Rho = 0.692

Sigma = 32.198

Lambda = 22.280**

Wald $\chi^2(11) = 30.210$ Prob > $\chi^2 = 0.002$

Source: Survey Data (2018)

This concurs with Barrett et al. (2004), who noted that access to accurate and timely climate forecasts regarding start date for rainy season, volume of rainfall expected and end date have

a potential influence on pastoralists' mobility patterns and marketing strategies. On the other hand, access to weather information reduced the quantity of fodder bought by about 18% and this could be attributed to limited supply of fodder in the market.

The land tenure security had a negative and significant influence on both the decision and level of market participation at 1% and 10%, respectively. This implies that private land ownership reduces the likelihood of the household buying fodder by 42%. This is because secure land tenure enables households to enjoy exclusive rights to access, use, manage and withdraw benefits from their land, thus can produce adequate fodder for their livestock. On the other hand, communal land ownership discourages individual pastoralists to produce own fodder, thus forcing them to buy from the available market outlets. This is expected since Isiolo County is predominantly composed of communal lands. This finding is similar to observations in previous studies, which acknowledged insecurity of land tenure, both in terms of property ownership and resource access, as one of the key deterrent to adoption of sustainable land management practices in drylands (AU-IBAR, 2012; Muricho et al., 2017). *This result confirms rejection of the null hypothesis that land tenure security does not influence market participation.*

As hypothesized, reliance on external support negatively and significantly influenced pastoralists' market participation but was insignificant for intensity of participations. This implies that increased dependence on external aid reduces the probability of the household to participate in the fodder market as a buyer by 33%. The external aid in this case was non-monetary in the form of food incentives and inputs. Food incentive provides pastoralists with an alternative source of food particularly during drought seasons hence their reluctance in buying fodder to save their livestock. Also, those households who rely heavily on food aid usually have very low purchasing power. This concurs with Rutto et al. (2012), who noted

that access to cash relief offered pastoralists an alternative source of income to meet their basic necessities, thus reducing their likelihood of participation in small ruminants marketing in Isiolo and Marsabit Counties of Kenya. In order to reverse this trend, sustainable upscaling of the asset creation initiative is needed to enhance pastoralists' adaptive capacity and resilience to climate variability. *This result justifies rejection of null hypothesis that reliance on external support had no influence on market participation.*

Access to market information was positive and significantly associated with household participation in fodder market. Having access to market information increases the probability of respondents purchasing fodder by 60%. *This validates rejection of null hypothesis that market information had no influence on market participation.* This is plausible because these households received information related to prevailing fodder prices, demand, supply and alternative market outlets majorly from their own fodder groups. Therefore, they incurred lower transaction costs associated with information searching and transportation cost since group farms are close to their homesteads. This finding is consistent with those of previous studies, which noted that access to market information enhances households' market participation (Randela et al., 2008; Kabeto, 2014).

As expected, access to credit was statistically significant at 5% level and positively associated with pastoralist's participation in fodder market. A shift from lack of credit to credit access increases the probability of buying fodder by 21%. This is because credit access enhances the purchasing power of the pastoral households to buy inputs such as feeds, veterinary medicines and minerals for livestock production. This concurs with the findings of previous studies that found that credit access reduces transaction costs in both input and output markets, and enables farmers to purchase inputs such as land, seeds and fertilizer to expand production and subsequently market participation (Randela et al., 2008; Jalang'o et al., 2018).

This finding supports rejection of null hypothesis that credit access does not influence market participation.

The sex of the household head had a negative and significant effect on the households' market participation decisions however insignificant in the intensity of fodder market participation. This implies that being female and household head significantly reduced the likelihood of buying fodder by 23%. This is plausible because key assets and resources such as land, livestock, water and cash in the pastoral communities are generally controlled by men (Republic of Kenya, 2015). This implies that most crucial household decisions concerning production and marketing are made by men among the pastoral communities (Muricho et al., 2017). Additionally, female-headed households are generally reported to be poor with limited productive assets, hence cannot afford to buy fodder. As noted by Opiyo et al. (2014), female-headed households were less resilient mostly because of gender bias in resource allocation and control among pastoralists.

As hypothesized, the age of the respondent positively and significantly influenced the probability of market participation but insignificantly affected quantity of fodder bought. The marginal effects showed that older pastoralists had a higher probability of buying fodder for their livestock by 33%. A plausible explanation could be that older households have accumulated vast experience in livestock production and management over the years. Therefore, they tend to be more cautious and willing to purchase fodder and store in preparedness for long dry spells. This result corroborates that of Muricho et al. (2017) who observed that older household heads were more resilient to climate-induced shocks because of experience accrued over the years. Also, age influences household's access to and utilization of productive resources, which facilitates accumulation of wealth in form of

livestock over the years and thus more demand for fodder (Lugusa, 2015; Ochago et al., 2017).

Proportion of off-farm income to total income was found to have negative and significant influence on household's decision to participate in fodder markets. As indicated by the marginal effects, a unit increase in household's off-farm income reduced the likelihood of pastoralists' participation in fodder markets by 24%. Consistent with prior discussions, households with more off-farm income had low herd size hence less demand for fodder.

Consistent with prior expectation, herd size was found to have positive and significant influence on both market participation and intensity of participation by 10% and 1% respectively. Thus, a one unit increase in TLUs increase the likelihood of a household buying fodder by 8% and quantity of fodder bought by about 14%. This is because ownership of livestock provides pastoralists with the leverage to invest in purchasing fodder since the number of livestock is directly proportional to the feed demands. In addition, it is widely acknowledged that livestock serves as a capital asset to pastoralists and hence can be easily liquidated to cash in order to meet expenditure needs such as food and livestock feeds (Barrett et al., 2004).

The number of shocks experienced significantly and positively influenced household participation in fodder markets and quantity of fodder bought. The marginal effect estimate indicated that a unit increase in the number of shocks experienced increased the likelihood of buying fodder by 14% and quantity of fodder bought by 7%. This was expected considering the fact that most of the respondents were affected by several shocks occurring concurrently; hence they had suffered massive loss of livestock and livelihoods assets. Pastoralist communities often tend to keep large herds of livestock as a means of asset accumulation in order to safeguard against future shocks. However, pastoral production systems are highly

susceptible to low and variable rainfall, diseases and resource-based conflicts (Barrett, 2004). Therefore, it is only rational for the pastoralists to learn from these experiences, buy and store fodder in preparedness of drought seasons to mitigate losses. These corroborate Lugusa (2016) and Muricho et al. (2018), who observed that pastoral households who had past experience with droughts were more likely to join fodder groups in order to easily access livestock feeds.

Access to extension services had a positive sign as expected, though insignificant in influencing both market and intensity of participation. The possible explanation for this is that because only a third of the respondents had access to extension services, majority of whom acknowledged infrequent visits and communication barrier as major challenges faced. Furthermore, Isiolo County is characterized by weak extension services due to inadequate trained personnel and limited resources coupled with poor availability and distribution of inputs (Republic of Kenya, 2013). These factors bear negative influence on household access to institutional support services such as training and improved technology.

Household size and land size both have expected signs though their influence on market participation was statistically insignificant. However, their inclusion was found to improve the Heckman step-two model, indicating that their association with other explanatory variables contributes jointly to explaining pastoralists' market participation behaviour.

CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The purpose of this study was to analyze determinants of pastoralists' participation in commercial fodder value chain in Isiolo County. The Food For Asset project played a fundamental role in formation of most fodder groups undertaking fodder production. Women dominated the fodder groups. The groups have a management structure composed of a chairperson, secretary and treasurer and their day to day operations are governed by the work norm. Most groups were formally registered with the State Department in charge of Culture, Social Services and Heritage. Besides fodder sales, the groups also engaged in livestock finishing and small retail business in between the fodder planting seasons, in a bid to smoothen their income flows throughout the year.

Fodder production is generally practised on small-scale under the rain-fed system, with an average group farm size of 9.7 hectares. Fodder growing stimulated the use of dryland farming technologies such as terraces, zai-pits, semi-circular and trapezoidal bunds. The fodder groups incurred negligible costs since they received support in form of inputs, trainings and food incentives free of charge. The common grass species grown was African fork tail (*Cenchrus ciliaris*) and Maasai Love grass (*Eragrotis superba*). Some of the key production challenges reported are recurrent droughts, invasion by both livestock and wildlife, limited trainings, inadequate storage and limited farming tools.

The fodder value chain in Isiolo County is still at the early stages of development and is dominated by fodder producer groups which are the key actors in all the stages from production to consumption. However, the chain is largely supported by external actors and Isiolo County Government who provided initial inputs such as rangeland grass seeds, farming

tools and capacity building. They also supported the fodder groups in fodder marketing by creating market linkages though very minimal. The fodder marketing structure was informal and characterized by on spot cash-based transactions. The group members were the primary marketing channels while non-members such as neighboring livestock keepers, local traders and external actors like NGOs and County government formed the secondary markets. Fodder was commonly traded in the form of bailed hay. The hay and grass seeds selling prices were relatively high. Inadequate storage bans and poor market especially for grass seeds are some of the key marketing challenges cited.

The results from the individual household survey revealed that pastoralism is still the main source of livelihood in the County, with a few households engaging in off-farm activities. There are also low development indices as demonstrated by very high illiteracy level, low per capita income and limited access to institutional factors like credit and extension services. Droughts, livestock diseases and conflicts are the main shocks experienced by the respondents. The commonly utilized coping strategy was support from National and County governments, non-governmental organizations and social groups. The members' commitment to the fodder groups was assessed based on money contribution and analyzed using a binary Probit model. Results showed that individual-specific characteristics such as respondent's age, TLU, land size, off-farm income and number of shocks experienced had positive and significant influence on individual commitment to the group. The group age and size was found to have negative effects while benefits offered was a positive and significant determinant of member commitment. Credit access was a positive determinant while external aid and social capital had negative effects. Some of the benefits realized from fodder group membership include enhanced access to fodder for livestock, trainings and diversified income sources.

The study also assessed pastoralist's fodder market participation decisions using a Heckman two-step model. The results indicated existence of commercial fodder markets and fodder producer groups was the dominant market utilized. The institutional factors such as credit, market information, weather information, and communal land tenure system significantly and positively influenced pastoralist's participation in fodder markets. Intensity of market participation was determined by access to weather information, communal land tenure system, TLUs and shocks. Conversely, reliance on external aid was found to significantly reduce the likelihood of buying fodder. Moreover, household attributes such as age and herd size significantly influenced fodder market participation. However, female household heads were less likely to participate in the fodder market as buyers.

6.2 Conclusions

Generally, the results indicated that pastoralist have low development indices as revealed by low literacy level and low per capita income. In addition, their access to key institutional services such as extension, credit, market and early warning information was also limited. Credit facilities were solely sought from the informal sources like women groups indicating a big gap in terms of pastoralists' access to loans from formal financial institutions that can offer substantial credit facilities. Moreover, the results have shown the synergies and spillovers arising from the interactions of these factors as a significant determinants of market participation. For instance, stimulating access to credit is likely to enhance access to inputs, adoption of improved technology, higher production, and better market linkages. This calls for a comprehensive development and delivery of these services in order to take advantage of these interplays. The findings also revealed the importance of private tenure systems in facilitating households' adoption of adaptive strategies like fodder production on their individual farms.

Results also demonstrate the potential of fodder production and marketing as a considerable livelihood diversification strategy for the pastoralist communities. There is also great potential for out-scaling to other parts of the County. The existing value chain presents an opportunity for market expansion to take advantage of the existing high demand for fodder within Isiolo County and beyond. Additionally, the findings illustrate pastoralists' absolute reliance on external support in the form of food incentives, trainings and input provisions. Food incentives was noted to be among the main factors facilitating group operations and was found to negatively influence individual participation in fodder groups and markets. Even though the external support was a prerequisite condition for promoting fodder uptake among the pastoralists, it has negative implications on the sustainability of the groups and household's resilience in the long run.

6.3 Policy Recommendations

Based on the findings from this study, there is great need for more efforts and investment in human capital development in order to address the low development indices in the County. Over the years, Isiolo county government has been promoting rights to education through sensitization campaigns, scholarships and advocacy against early marriages and female genital mutilations. However, more concerted efforts and investment by both the County and National Governments are required in order to enhance access to and utilization of both formal and adult education especially for the pastoral women.

Provision of extension services, through organizing platforms such as fodder conferences and exhibitions for awareness creation and sharing of ideas and experiences, can play a vital role in sensitization of pastoralists on the value of fodder commercialization. This can be achieved by enhancing the capacity of County Government, in terms of both financial and human capital, to take up the Food for Asset project implementation and ensure better access to

extension services beyond the lifetime of the project. There is need to enhance post-harvest management and conservation of fodder in order to maintain its nutritive value and quality. This calls for investment in hay baling machinery and appropriate storage barns by the County government in order to support fodder commercialization. Establishing effective market linkages between producer groups and potential buyers through contract farming will enable them to take advantage of ready market opportunities within and outside Isiolo County.

There is also need by the County Government to incorporate fodder production as a priority area for livestock development in the County Integrated Development Plan. This will facilitate budgetary allocation for investment in rain water harvesting technologies hence upscaling commercial fodder production. Moreover, the County should fast track the land registration process to facilitate formal land titling. This will enhance pastoralists' adoption of more innovative land use practices for sustainability. The national government through the Ministry of Agriculture, Livestock, Fisheries and Irrigation should also direct funds for emergency response to support sufficient fodder production *ex-ante* in order to ensure stability in fodder availability.

Pastoralists' access to requisite institutional and support services as well as infrastructure developments is crucial in strengthening their access to and participation in a well-functioning markets. This will stimulate household's investment in alternative livelihoods hence building their resilience. These underscore the need by both the national and county government to prioritize investment for improving and developing infrastructure such as all weather roads, telecommunication, water, storage facilities, electricity connectivity and market facilities. These developments will not only enhance pastoralists access to markets but also improve their access to consumer goods, basic services and increase their integration into the larger market economy.

Financial services play an integral role in value chain developments. The County government should strengthen access to socially inclusive financial services by undertaking strategic partnerships with relevant financial service providers. Fodder groups should be encouraged to seek for loan facilities collectively since social capital is considered as a form of collateral. The growth in mobile banking platforms such as *M-pesa* and *M-shwari* services provide more opportunity for accessing affordable credit facilities. For instance, the fodder groups can save money in an *M-shwari* account and access credit through their phone without undergoing the rigorous process in mainstream banking. The County may also boost the groups' table-banking initiative by ensuring easy access to development funds such as women and youth funds.

Gradual reduction of pastoralists' reliance on external aid is imperative for building their resilience in the long term. This could be achieved by strengthening input market through establishing private sector driven supply chain. These include supply of grass seeds, irrigation kits, and baling equipment. Use of subsidies or vouchers can be considered to support pastoralist to acquire essential inputs instead of giving them free of charge. The less developed fodder value chain presents more employment opportunities along the chain particularly for women and youth. Improving access to extension and affordable financial services could facilitate individual pastoralists to engage in activities such as processing, baling, transporting and trading fodder in the various markets. In the long run, individuals can also replicate the knowledge and skills acquired in the fodder groups to start own fodder farms for commercial purposes.

It is also essential to support fodder groups to expand their livestock finishing and retail businesses, and even venture into new income generating activities. The use of produced fodder for livestock fattening and milk production will accelerate its commercialization.

Engaging in diversified activities will smoothen income flows throughout the year, hence enhancing pastoralists' capacity to cope with the recurrent droughts. It will also give them some level of autonomy thus reduced dependency on donors.

6.4 Contributions to Knowledge

This study contributes to the existing body of literature on transitions in pastoral production system and culture as pastoralists continue to adopt fodder production and marketing as a complimentary livelihood activity. The results also contributes towards understanding the role of collection action in commercial fodder value chain, and underscores the significant of pastoralists' commitment and active participation in interventions aimed at building their resilience. The study also builds on previous market participation studies by focusing on unconventional crop (fodder) and uniqueness of pastoralist communities.

6.5 Limitations and Suggestions for Future Research

The results of this study showed that women dominated the fodder production in Isiolo County. This calls for a more gendered analysis focusing on women's motivation for engaging in fodder and how their participation contributes to women empowerment among the pastoralist communities. The present study was constrained by data limitation; being a cross section study, it was not possible to assess the contribution of fodder to household resilience. Future research could focus on analyzing the impact of participating in fodder production on household food security and livelihood resilience by considering household data over a period of time. Also, dealing with groups raises the issue of self-selection, hence the results may not be applicable to the entire County, including those not in groups.

REFERENCES

- Adong, A., Mwaura, F., and Okoboi, G. (2013). What factors determine membership to farmer groups in Uganda? Evidence from the Uganda census of agriculture 2008/09. *Invited paper presented at the 4th International Conference of the African Association of Agricultural Economists, Hammamet, Tunisia, 22-25, September.*
- African Union (AU). (2014). Malabo declaration on accelerated agricultural growth and transformation for shared prosperity and improved livelihoods. Retrieved from: http://www.resakss.org/sites/default/files/Malabo%20Declaration%20on%20Agriculture_2014_11%2026-.pdf in 23rd January, 2018.
- Agrawal, A. (2001). Common property institutions and sustainable governance of resources. *World Development*, 29(10):1649-72.
- Agrawal, A. (2007). Forests, governance, and sustainability: Common property theory and its contributions. *International Journal of the Commons*, 1(1):111-136.
- Aklilu, Y., and Wekesa, M. (2001). Livestock and livelihoods in emergencies: lessons learned from the 1999 – 2001 emergency response in the pastoral sector in Kenya. Feinstein International Famine Centre, Tufts University, Medford, MA, USA.
- AU-IBAR. (2012). Rational use of rangelands and fodder crop development in Africa. African Union Inter-African Bureau on Animal Research, Monographic Series Number 1.
- Ayele, S., Duncan, A., Larbi, A., and Khanh, T. (2012). Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries. *Science and Public Policy*, 39(3): 333-346.
- Ayieko, M., Bett, E. Blucy, W. and Kabuage, L. (2014). Analysis of collective action: The case of indigenous chicken farmers from Makueni County, Kenya. *East African Agricultural and Forestry Journal*, 81(1): 12-17.

- Awotide, B., Awoyemi, T., and Fashogbon, A. (2015). Factors influencing smallholder farmers' participation in cooperative organization in rural Nigeria. *Journal of Economics and Sustainable Development*, 6(17): 87-96.
- Barrett, C., McPeak, J., Luseno, W., Little, P., Osterloh, S., Mahmoud, H., and Gebru, G. (2004). Pastoralist livestock marketing behaviour in northern Kenya and Southern Ethiopia: An analysis of constraints limiting off-take rates. Accessed from: <https://ssrn.com/abstract=611064> or <http://dx.doi.org/10.2139/ssrn.611064> on 20th June 2018.
- Barham, J., and Chitemi, C. (2009). Collective action initiatives to improve marketing performance: Lessons from farmer groups in Tanzania. *Food Policy*, 34(1): 53-59.
- Barry, B., Olaleye, A., Zougmore, R., and Fatondji, D. (2008). Rainwater harvesting technologies in the Sahelian zone of West Africa and the potential for out scaling. *International Water Management Institute (IWMI) Working Paper 126. Colombo, Sri Lanka.*
- Beard, V. (2005). Individual determinants of participation in community development in Indonesia. *Environment and Planning C: Government and Policy*, 23(1): 21-39.
- Burke, W. (2009). Fitting and interpreting Cragg's tobit alternative using Stata. *The Stata Journal*, 9(4): 584-592.
- Cervigni, R., and Morris, M. (Eds.). (2016). *Confronting Drought in Africa's Drylands: Opportunities for Enhancing Resilience.* World Bank Publication.
- Coppock, D., Desta, S., Wako, A., Aden, I., Gebru, G., Tezera, S., and Tedecha, C. (2006). Women's groups in arid northern Kenya: Origins, governance and roles in poverty reduction. *In Invited paper presented a Policy Research Conference on Pastoralism and Poverty Reduction in East Africa, 27-28th June.*

- Danjuma, M., and Mohammed, S. (2015). Zai Pits System: A catalyst for restoration in the dry lands. *Journal of Agriculture and Veterinary Science*, 8 (2): 1-4.
- Davis, K., Nkonya, E., Kato, E., Mekonnen, D., Odendo, M., Miiro, R., and Nkuba, J. (2010), “Impact of Farmer Field Schools on Agricultural Productivity and Poverty in Uganda”, *IFPRI Discussion Paper 00992*.
- Deressa, T., Hassan, R., Ringler, C., Alemu, T., and Yesuf, M. (2009). Determinants of farmers’ choice of adaptation methods to climate change in the Nile basin of Ethiopia. *Global Environment Change*, 19(2): 248–255.
- Elhadi, A., Nyariki, D., Wasonga, V., and Ekaya, W. (2012). Factors influencing transient poverty among agro-pastoralists in semi-arid areas of Kenya. *African Crop Science Journal*, 20(1): 113 – 122.
- Etwire, P., Dogbe1, W., Wiredu, A., Martey, E., Etwire, E., and Robert, K. (2013). Factors influencing farmer’s participation in agricultural projects: The case of the agricultural value chain mentorship project in the Northern region of Ghana. *Journal of Economics and Sustainable Development*, 4(10): 36-43.
- Faße, A., Grote, U., and Winter, E. (2009). Value chain analysis methodologies in the context of environment and trade research. *Discussion Paper Number 429. School of Economics and Management of the Hanover Leibniz University*.
- Food and Agriculture Organization of the United Nations (FAO). (2010). Guidelines on sustainable forest management in drylands of sub-Saharan Africa. *Arid Zone Forests and Forestry Working Paper Number 1*, Rome.
- Food and Agriculture Organization of the United Nations (FAO). (2018). World Livestock: Transforming the livestock sector through the Sustainable Development Goals. Rome. Accessed from: <http://www.fao.org/3/CA1201EN/ca1201en.pdf> on 6th December, 2018.

- Fischer, E., and Qaim, M. (2012). “Linking smallholders to markets: determinants and impacts of farmer collective action in Kenya.” *World Development*, 40(6): 1255-1268.
- Fischer, E., and Qaim, M. (2014). Smallholder farmers and collective action: What determines the intensity of participation? *Journal of Agricultural Economics*, 65(3): 683–702.
- Gebremedhin, B., Hoekstra, D., Tegegne, A., Shiferaw, K., and Bogale, A. (2015). Factors determining household market participation in small ruminant production in the highlands of Ethiopia. *LIVES Working Paper 2*. Nairobi, Kenya: ILRI. Accessed from: <https://hdl.handle.net/10568/65204> on 3rd February 2018.
- Greene, W. H. (2011). *Econometric analysis*. New Jersey: Prentice Hall, 7th edition.
- Grouter, C. (2001). Does social capital help the poor? A synthesis of findings from the local level institutions studies in Bolivia, Burkina Faso, and Indonesia. *World Bank Local Level Institutions Working Paper No. 10*. Washington, DC: World Bank.
- Gujarati, D. (2004). *Basic econometrics (Fourth Edition)*. New York, NY: The McGraw-Hill Companies.
- Heckman, J. (1979). Sample selection bias as a specification Error. *Econometrica*, 47: 153 – 161.
- Humanitarian Policy Group (HPG). (2009). Synthesis Paper: Pastoralism, policies and practice in the Horn of East Africa. A review of current trends. *Synthesis paper*. Accessed from: <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4315.pdf> on 20th March 2018.
- IGAD. (2015). Drought disaster resilience and sustainability initiative (IDDRSI). A programming report prepared by the platform coordination unit (PCU) during 4th IDDRSI platform steering committee meeting, Addis Ababa, Ethiopia, 25 – 26 March.

- Jalang'o, D., Otieno, D., and Oluoch-Kosura, W. (2018). Commercialization of African indigenous vegetables in Kenya. Chapter 8. (pp 36 -45). In Adamseged and Bokelmann (eds.) Value chain development for food security in the context of climate change: Perspectives and lessons from a North-South capacity building project. Verlag Dr. Köster, Berlin.
- Kabeto, A. (2014). An analysis of factors influencing participation of smallholder farmers in red bean marketing in Halaba Special District, Ethiopia. *Master thesis, University of Nairobi, Kenya.*
- Kagunyu, A., Thurair, E., and Wanjohi, J. (2017). Development agents and their role in cushioning the pastoralists of Isiolo Central Sub-County, Kenya, against negative effects of climate variability. *Pastoralism: Research, Policy and Practice*, 7(1): 1-6.
- Kaplinsky, R., and Morris, M. (2001). A handbook for value chain research. Ottawa: IDRC, Volume 113.
- Karneback, V., Wairore, J., Jirström, M., and Nyberg, G. (2015). Assessing gender roles in a changing landscape: diversified agro-pastoralism in drylands of West Pokot, Kenya. *Pastoralism: Research, Policy and Practice*, 5(1):1-8.
- Kaufmann, B., Nelson, W., Gudere, R., Canger, V., Golicha, D., Frank, M., Roba, H., Mwai, O. and Hülsebusch, C. (2012). Identifying local innovations in pastoral areas in Marsabit County, Kenya. German Institute for Tropical and Subtropical Agriculture (DITSL), Germany. Accessed from: <https://www.ditsl.org/images/articles/publications/manual.pdf> on 3rd December 2018.
- Kenya National Bureau of Statistics (KNBS). (2009). Kenya Economic Survey Report. Nairobi, Kenya.
- Kidake, B., Manyeki, J., Kubasu, D., and Mnene, W. (2016). Promotion of range pasture and fodder production among the pastoral and agro pastoral communities in Kenyan

- rangelands: Experiences and lessons learnt. *Livestock Research for Rural Development*. Accessed from: <http://www.lrrd.org/lrrd28/8/kida28151.html> On 3rd November, 2017.
- Koech, O. (2014). Comparative evaluation of six indigenous rangeland grasses for fodder production under varying soil moisture contents in Tana River County, south eastern Kenya. *PhD Thesis, University of Nairobi, Kenya*.
- Komarek, A. (2010). The determinants of banana market commercialization in Western Uganda. *African Journal of Agricultural Research*, 5(9):775-784.
- Kuria, S., Mwaura, J., Kinyua, M., Nduma, B., Okoti, M., Wamuongo, J., and Ofwona, E. (2015). Adapting dryland livestock production to meet climate change challenges in Kenya. Accessed from: <https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/54167/IDL-54167.pdf?sequence=1> on 20th November 2017.
- Kutu, A. and Wamwere-Njoroge, G. (2017). Kenya accelerated value chain development (AVCD) program - Livestock component: County project year 1 brief, Isiolo County. International Livestock Research Institute (ILRI), Nairobi, Kenya. Accessed from: <https://stormpdf.com/livestock-component-county-project-year-1-brief-avcd-program.html> on 14th January 2018.
- LAPSSET Corridor Development Authority. (2016). LAPSSET Project Report.
- Lugusa, K. (2015). Fodder production as an adaptation strategy in the drylands: A case study of producer groups in Baringo County, Kenya. *Master thesis, University of Nairobi*.
- Lugusa, K., Wasonga, O., Elhadi, Y., and Crane, T. (2016). Value chain analysis of grass seeds in the drylands of Baringo County, Kenya: A producers' perspective. *Pastoralism: Research, Policy and Practice*, 6 (1): 1-15.

- Markelova, H., Meinzen-Dick, R., Hellin, J., and Dohrn, S. (2009). Collective action for smallholder market access. *Food Policy*, 34(1):1–7.
- Martey, E., Etwire, P., Wiredu, A., and Dogbe, W. (2014). Factors influencing willingness to participate in multi-stakeholder platform by smallholder farmers in Northern Ghana: implication for research and development. *Agricultural and Food Economics*, 2(1): 1-15.
- Meinzen-Dick, R., DiGregorio, M., and McCarthy, N. (2004). Methods for studying collective action in rural development. *Agricultural Systems*, 82(3): 197-214.
- Mbogo, E. (2014). Factors influencing adoption of rain water harvesting technologies among households in Mbeere South Sub County, Kenya. *Master thesis, University of Nairobi, Kenya.*
- Meier zu Selhausen, F. (2016). What determines women's participation in collective action? Evidence from a western Ugandan coffee cooperative. *Feminist Economics*, 22(1): 130-157.
- Mnene, W. (2006). Strategies to increase success rates in natural pasture development through reseeded degraded rangelands of Kenya. *Ph.D. thesis, University of Nairobi, Kenya.*
- Mugenda, O., and Mugenda, A. (2003). Research methods: A quantitative and qualitative approach. Nairobi: ACTS press.
- Mureithi, S., Verdoodt, A., Njoka, J., Gachene, C., and Van Ranst, E. (2015). Benefits derived from rehabilitating a degraded semi-arid rangeland in communal enclosures, Kenya. *Land Degradation and Development*, 27(8):1781–1872.
- Muricho, G., Kassie, M., and Obare, G. (2015). Determinants of market participation regimes among smallholder maize producers in Kenya. *International Maize and Wheat Research Centre Discussion Paper, Number 12.*

- Muricho, D., Otieno, D., and Oluoch-Kosura, W. (2017). The role of pastoralists' innovations in managing land constraints and climate shocks in West Pokot, Kenya. *A research paper presented at the agriculture for development conference (Agri4D), Uppsala, Sweden, 20 – 21st September.*
- Muricho, D., Otieno, D., Oluoch-Kosura, W., and Jistrom, M. (2019). Building pastoralists' resilience to shocks for sustainable disaster risk mitigation: Lessons from West Pokot County, Kenya. *International Journal of Disaster Risk Reduction*, 34: 429-435.
- Mwaura, J., Koske, J., and Kiprotich, B. (2015). Assessing economic viability of pasture enterprise as adaptation strategy in dry land ecosystems-a case of Ijara, Kenya. *Journal of Economics and Sustainable Development*, 6(22): 29-45.
- Nangole, E., Lukuyu, B., Franzel, S., Kinuthia, E., Baltenweck, I. and Kirui, J. (2013). Livestock feed production and marketing in Central and North Rift Valley Regions of Kenya. Nairobi, Kenya: East Africa Dairy Development Project (EADD) report. Accessed from: <https://hdl.handle.net/10568/34450> on 14th January, 2018.
- Nato, S.M., Matofari, J.W., Bebe, B.O. and Huelsebusch, C. (2018). Effect of predisposing factors on microbial loads in camel milk along the pastoral dairy value chain in Kenya. *Pastoralism: Research, Policy and Practice*, 8(1): 1- 8.
- Ndathi, A., Muthiani, E., Ndung'u, J., Ogillo, B., Kimitei, R., Manyeki, J., and Mnene, W. (2013). Feed resources and utilization strategies in selected pastoral and agropastoral communities in Kenya. *Livestock Research for Rural Development*. Accessed from: <http://www.lrrd.org/lrrd25/12/ndat25221.htm> on 23rd January 2017.
- National Drought Management Authority (NDMA). (2017). Drought early warning bulletin for Isiolo County, December.

- Nyberg, G., Knutsson, P., Ostwald, M., Öborn, I., Wredle, E., Otieno, D., and Grönvall, A. (2015). Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. *Pastoralism: Research, Policy and Practice*, 5(1): 1-12.
- Nyangaga, J., Gebremedhin, B., Baker, D., Lukuyu, B., and Randolph, T. (2009). Market survey of fodder supporting peri-urban livestock in Mandera. Report prepared for the Enhanced Livelihoods in the Mandera Triangle and Enhanced Livelihoods in Southern Ethiopia program.
- Ochago, R., Mangheni, M., and Miiro, R. (2017). Which socio-economic factors matter in farmer group participation? Evidence from coffee pest management learning groups in Mt. elgon region, Uganda. *International Journal of Agricultural Extension*, 5(1): 23-38.
- Olila, D. (2014). Economic evaluation of factors affecting farmer participation in development groups: A case of Trans-Nzoia County, Kenya. *Journal of Agricultural Economics, Extension and Rural Development*, 2(6): 74-81.
- Olson, M. (1965). *The logic of collective action*. Cambridge, MA: Harvard University Press.
- Omollo, E., Wasonga, V., Elhadi, Y., and Mnene, W. (2017). Grass seed value chain analysis in the Southern Kenya range lands of Makueni and Kajiado counties. *A paper presented at the 5th RUFORUM Biennial Conference and African Higher Education Week, Cape Town, South Africa, 15-21 October*.
- Omollo, E., Wasonga, V., Elhadi, Y., and Mnene, W. (2018). Determinants of pastoral and agro-pastoral households' participation in fodder production in Makueni and Kajiado Counties, Kenya. *Pastoralism: Research, Policy and Practice*, 8(1): 1-10.
- Opiyo, F., Wasonga, V. and Nyangito, M. (2014). Measuring household vulnerability to climate induced stresses in pastoral rangelands of Kenya: Implications for resilience programming. *Pastoralism: Research, Policy and Practice*, 4(1):1-15.

- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Otieno, D. (2011). *Economic analysis of beef cattle farmers' technical efficiency and willingness to comply with Disease Free Zones in Kenya. PhD. thesis, Newcastle University, United Kingdom.*
- Otieno, D., Oluoch-Kosura, W., Olumeh, D., and Maroma, D. (2018). Understanding local stakeholder perspectives on climate change: The case of smallholder farmers in western Kenya. Chapter 8. (pp 95-102). In Adamseged and Bokelmann (eds.) *Value chain development for food security in the context of climate change: Perspectives and lessons from a North-South capacity building project*. Verlag Dr. Köster, Berlin.
- Ouma, E., and Abdulai, A. (2009). Contributions of Social Capital Theory in Predicting Collective Action Behaviour among Livestock Keeping Communities in Kenya. *Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, 16-22, August.*
- Paumgarten, F., Kassa, H., Zida, M., and Moeliono, M. (2012). Benefits, challenges, and enabling conditions of collective action to promote sustainable production and marketing of products from Africa's dry forests. *Review of Policy Research*, 29(2): 229-250.
- Pasteur, K. (2011). *From Vulnerability to Resilience, a framework for analysis and action to build community resilience*. Practical Action Publishing.
- Peishi, Z. (2018). How cash and food transfers and asset creation can contribute to women's empowerment: learning from Niger, Kenya and Zimbabwe. *WFP's collected papers on Gender and Cash Transfer Programmes in Humanitarian Contexts.*
- Place, F., and Kariuki, G. (2005). Initiatives for rural development through collective action: The case of household participation in group activities in the highlands of Central

- Kenya. CGIAR System wide Program on Collective Action and Property Rights. Accessed from: <https://core.ac.uk/download/pdf/6242728.pdf> on 20th February, 2018.
- Place, F., Kariuki, G., Wangila, J., Kristjanson, P., Makauki, A., and Ndubi, J. (2004). Assessing the factors underlying differences in achievements of farmer groups: methodological issues and empirical findings from the highlands of Central Kenya. *Agricultural Systems*, 82(3): 257-272.
- Prokopy, L. (2009). Determinants and benefits of household level participation in rural drinking water projects in India. *Journal of Development Studies*, 45(4), 471–495.
- Randela, R., Alemu, G., and Groenewald, A. (2008). Factors enhancing market participation by small-scale cotton farmers. *Agrekon*, 47(4): 451-469.
- Republic of Kenya. (2008). Ministry of Livestock Development Sessional Paper No. 2 on National Livestock Policy. Government printers, Nairobi, Kenya.
- Republic of Kenya. (2010). Kenya National Climate Change Response Strategy (NCCRS). Government printers, Nairobi, Kenya.
- Republic of Kenya. (2012a). Kenya Post-Disaster Needs Assessment (PDNA) 2008-2011 Drought Report. Government printers, Nairobi Kenya.
- Republic of Kenya. (2012b). Kenya Vision 2030 Development Strategy for Northern Kenya and Other Arid Lands Ministry of State, for Development of Northern Kenya and other Arid Lands. Government printers, Nairobi Kenya.
- Republic of Kenya. (2013). Isiolo County integrated development plan. 2013-2017. Government printers, Nairobi, Kenya.
- Republic of Kenya. (2015). Isiolo County Livestock Strategy and Plan of Action. Government printers, Nairobi, Kenya.
- Rutto J., Odhiambo, M., Njuguna, E., and Murithi, F. (2012). Determinants of market participation decisions in small ruminants' market by livestock keepers in Isiolo and

- Marsabit Districts, Kenya. *A paper presented at 8th Africa Farm Management Association (AFMA) Conference, Nairobi Kenya, 25-29, November.*
- Schoemaker, P. (1982). The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations. *Journal of Economic Literature*, 20(2): 529-563.
- SNV. (2013). Building Community Resilience to Drought: Results of a Baseline Study on Fodder Production and Marketing in Six Counties of Northern Kenya. A report by Alternative Finance Technologies (AFT).
- Sseguya, H., Mazur, R., Njuki, J., and Owusu, F. (2013). Determinants of participation and leadership in food security groups in Southeast Uganda: Implications for development programs and policies. *Journal of Rural and Community Development*, 8(1): 77-97.
- Stein, C., and Barron, J. (2017). Mapping actors along value chains: integrating visual network research and participatory statistics into value chain analysis. Colombo, Sri Lanka: *International Water Management Institute (IWMI), CGIAR Research Program on Water, Land and Ecosystems (WLE), WLE Research for Development (R4D) Learning Series 5.*
- Thomas, M., Wasonga, O., and Ragwa, P. (2016). Technical evaluation of drought mitigation technologies implemented under food/cash for assets project in Isiolo County. *An evaluation report submitted to FAO/WFP.*
- Train, K.E. (2009). Discrete choice methods with simulation. Cambridge university press.
- United Nations Development Programme (UNEP). (2013). Combating desertification in Kenya: Emerging lessons from empowering local communities, Nairobi.
- United Nations Convention to Combat Desertification (UNCCD). (2013). 'A Stronger UNCCD for a Land-Degradation Neutral World'. *Issue Brief, Bonn, Germany.*

- United Nations (2015). Transforming our world. The 2030 Agenda for Sustainable Development website. Accessed from: http://www.fao.org/hunger/hunger_graphics/en/ on 23rd January, 2018.
- USAID (2014). Resilience in action: Changing horizons in Ethiopia's drylands.
- USAID (2015). The Resilience and Economic Growth in the Arid Lands-Accelerated Growth (REGAL-AG) monthly report published by ACDI/VOCA.
- Vance, C., and Buchheim, S. (2005). On the application of Heckman's sample selection model to travel survey data: some practical guidelines. Proceedings of European transport and contributors' research to inform decision-making in transport-applied methods in transport planning-panel study, Strasbourg, France 18-20 September.
- Wairore, J., Mureithi, S., Wasonga, V., and Nyberg, G. (2015). Enclosing the commons: reasons for the adoption and adaptation of enclosures in the arid and semi-arid rangelands of Chepareria, Kenya. *Springer Plus*, 4(1): 1-11.
- Walker, B., and Salt, D. (2006). Resilience thinking: Sustaining ecosystems and people in a changing World. Washington, D.C: Island Press.
- Wanyoike, F., Njiru, N. Kutu, A., Chuchu, S., Wamwere-Njoroge, G. and Mtimet, N. (2018). Analysis of livestock and fodder value chains in arid and semi-arid lands in Kenya. Nairobi, Kenya: International Livestock Research Institute (ILRI). Accessed from: https://cgspace.cgiar.org/bitstream/handle/10568/91179/avcd_livestock.pdf?sequence=6&isAllowed=y on 27th April 2018.
- Watson, C. (2010). Gender issues and pastoral economic growth and development in Ethiopia. *A background note for a study of Pastoral economic growth and development in Ethiopia*.
- WISP (2010). Building climate change resilience for African livestock in sub-Saharan Africa - World Initiative for Sustainable Pastoralism (WISP): A program of IUCN - The

International Union for Conservation of Nature, Eastern and Southern Africa
Regional Office, Nairobi.

Woldu, T., Tadesse, F., and Waller, M. (2015). Women's Participation in Agricultural Cooperatives in Ethiopia. *A paper presented at the International Association of Agricultural Economics (IAAE) conference, Milan, Italy, 9-14, August.*

Wollni, M., and Fischer, E. (2014). Member deliveries in collective marketing relationships: evidence from coffee cooperatives in Costa Rica. *European Review of Agricultural Economics*, 42(2): 287-314.

World Food Program (2013). Building resilience through asset creation in Niger. Accessed from:
<https://documents.wfp.org/stellent/groups/public/documents/communications/wfp261744.pdf> on 14th January 2018.

World Food Program (WFP). (2016). Asset creation project fact sheet. Accessed from:
<https://www.wfp.org/content/wfp-kenya-factsheet-asset-creation> on 14th January 2018.

Wooldridge, J. (2002). *Econometric analysis of cross section and panel data*. Cambridge, Mass: MIT Press.

APPENDICES

Appendix 1: Variance Inflation Factors (Probit model)

Variable (Xi)	VIF	Tolerance = 1/VIF
Log group age (years)	2.02	0.50
No_Shocks	1.70	0.59
L_groupsize	1.62	0.62
L_HHSize	1.59	0.63
L_TLU	1.48	0.68
LAge	1.47	0.68
No_Groups	1.40	0.71
Receive_Cr~t	1.23	0.81
L_landsize	1.21	0.82
Proportion~m	1.18	0.85
LGraze_Dist	1.13	0.88
External_S~t	1.11	0.90
Receive_be~r	1.10	0.91
Mean VIF	1.40	

Appendix 2: Variance Inflation Factors (Heckman Step-two model)

Variable	VIF	Tolerance = 1/VIF
No_Shocks	1.76	0.57
L_HHSize	1.62	0.62
LAge	1.54	0.65
Access_Ear~g	1.52	0.66
Individual~o	1.49	0.67
L_TLU	1.48	0.68
Market_Inf~n	1.38	0.72
Proportion~m	1.29	0.78
tenure_bin~y	1.22	0.82
Receive_Cr~t	1.21	0.82
Female_R_HH	1.21	0.83
L_landsize	1.20	0.83
External_S~t	1.12	0.89
Mean VIF	1.39	

Appendix 3: Results of Hausman Test for Model Specification

Variables (Xi)	Coefficients			
	(b)- Maximum Likelihood	(B)-Two step	(b-B) Difference	sqrt(diag(V_b-V_B))-S.E
Access_Ear~g	4.850781	0.6075823	4.243199	5.283125
tenure_bin~y	-13.97401	-1.13787	-12.83614	7.672912
Individual~o	10.48786	0.26056	10.2273	5.276923
Receive_Cr~t	2.843134	0.5860403	2.257094	4.888889

Test: Ho: difference in coefficients not systematic

$$\text{Chi}^2(4) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 7.63$$

$$\text{Prob}>\text{chi}2 = 0.1059$$

The test showed no systematic difference between the estimations from the maximum likelihood and two step Heckman model. Thus, two step Heckman procedure was chosen.

Appendix 4: Household Survey Questionnaire

ANALYSIS OF DETERMINANTS OF PASTORALISTS' PARTICIPATION IN COMMERCIAL FODDER VALUE CHAIN IN ISIOLO COUNTY, KENYA (July 2018).

SECTION A: GENERAL INFORMATION

Name of Enumerator	
Date of interview	
Interview time	From..... To.....
1. Sub-County	1=Isiolo, 2=Garbatulla
2. Ward	1=Burat, 2=Bulla Pesa, 3=Oldonyiro, 4=Kinna
3. Sub location
4. Village	

SECTION B: HOUSEHOLD'S LIVELIHOOD ACTIVITIES

5. What are your major sources of Income?

Source of income	Amount of average monthly income derived in;		Proportion of income derived from it (1=None; 2=<25%; 3=25–50%; 4=50–75%; 5=>75%)
	Rainy season (Kshs.)	Dry season (Kshs.)	
Livestock Keeping			
Crop Production			
Mixed Livestock & Crop production			
Business			
Casual job/labourers			
Formal employment			
Charcoal burning			
Other.....			

6. What type of livestock you keep on your farm? Please fill in the table below;

Type of livestock kept	Breeds kept? 1=Indigenou s 2=Exotic 3=Improved	Total number of stock kept	For how many years have you practiced?	Main Purpose for keeping? 1=Food, 2=Sale, 3=Food & Sale, 4=Cultural Use e.g. dowry, prestige, 5=Store of wealth, 6=Draught, 7=Manure, 8=Other (specify)	How did you acquire initial stock? 1=Inherited, 2=Bought, 3=Received as bride price, 4=Received as gift, 5=Donations 6=Other.....
Cattle					
Sheep					
Goats					
Camels					
Donkeys					
Chicken					
Bee keeping					
Other (specify)....					
Total					

7. Which MAIN crops do you grow on your farm?

List Main Grown	Three Crop	Main Purpose 1=Food 2= Sale 3=Both	Land size under crop (Ha)	Yield in the last season (Bags/kg)	Quantity consumed(kgs)	Quantity sold (kgs)	Price per unit sold (KES)

8. Do you receive any remittances from external sources? 1=Yes, 0=No

b) If yes, please fill in the table below:

Source of remittances (Tick where applicable)	Proportion of income derived from it [1=None; 2=<25%; 3=25–50%; 4=50–75%; 5=>75%]	How often do you receive this remittances? 1=Once a month, 2=Twice a month,3=Once a year, 4=Twice a year

Family/relative		
Government cash transfers		
NGO cash transfers		
Other (specify).....		

9. How did you acquire the land you are currently using for production? Please fill in the table below:

Method of Land acquisition: 1=Bought, 2=Rented, 3=Leased, 4=Allocated by other institutions/people (specify), 5=Communal land, 6=Settlement scheme, 7=Other (Specify)	Land size owned (Ha)	Acreage under production (Ha)	Tenure system [1=Private with title deed, 2=Private without title deed, 3=Communal, 4=Other (Specify)]

10. Do you have access to communally owned grazing land and water sources during dry seasons? 1=Yes,0=No.

If yes, please fill the table below:

Resources		Location/ Area	Return Distance moved (Walking minutes)	Number of years of access	Quality/Condition of pasture [1=Very good, 2=Good, 3=Fair, 4=Poor, 5=Very poor, 6=Not sure]	Main challenge encountered (<i>tick one</i>) 1=Poor quality pasture 2=Settlement by people 3=Increased number of users 4=Conflicts with other community 5=Other (Specify)
Pasture	Livestock Grazing					
	Harvesting Grass					
Water						

SECTION C: FODDER GROUP PARTICIPATION

11. Are you aware of livelihood development projects implemented by the County Government and Non-governmental organizations in this County?1=Yes, 0= No.

If yes, please fill the table below:

Program me Target Topic <i>(Tick where applicable)</i>	Are you awa re of this initi ativ e? 1=Y es 0=N o	Implement ed by? 1=National governmen t 2=County 3=NGO(Sp ecify) 4=Universit y (Specify) 5=Other (Specify)	D o yo u pa rti ci pa te in it? 1= Ye s 0= N o	What is your role in the project? 1=Leader, 2=Donor 3=Member, 4=Non- member visitor, 5=Neighbor 6=Other (Specify)	How do you participate? 1=Attend meetings 2=Provide labour 3=Make decisions 4=Provide funds 5=Supply materials 6=(Other Specify)	Why do you participate? 1=To increase yields 2=Access to extension 3=Access to credit 4=Income diversification 5=Low cost of participation 6=Other (Specify)	Key challenge faced: 1=High cost of participation 2=Lack of information 3=Too procedural 4=Favoritism 5= Other(Specify)
Growing fodder /pasture							
Livestock marketing							
Livestock breeding							
Livestock Insurance							
Camel rearing							
Other (specify...)							

12. Do you belong to any fodder production group in your area? 1=Yes,0=No **If yes, please fill in the table below;**

What is the name of your fodder group?	For how long have you been a	How did you know about this group? 1=Neighbors, 2=Chief, 3= Other groups,	How did you join? 1=Self organization 2=Proposed by	What is your position in the group? 1=Leader, 2=Committee member 3=Ordinary member 4=Other	Do you have any personal constraint limiting your involvement in group activities?

	member of this fodder group?	4=NGOs (Specify) 5= Other (Specify)	County Government 3=Coerced by NGOs 4=Other (Specify)	(Specify)	1=Yes, 0=No If yes, Specify

13. What is the **Main** purpose/objective of your fodder group?

14. What are the activities of your fodder group? (*Please circle where applicable*)

[a. Fodder production, b. Fodder marketing, c. Training/Information access, d. Seed bulking, e. Animal fattening, f. Credit provision
g. Social supports, h. Other business (specify)

15. Does your group work with other fodder groups in your area? **1=Yes, 0=No**

16. Please rank the reasons that motivated you to join fodder production group;

Reasons	Rank [1=Highest importance 2=Average importance 3=Low importance 4=Not important]
Need of feeds for my own livestock	
Access external support from County and NGOs	
Income/profit from selling fodder	
Access inputs and extension services	
Low cost of participation	
It was the only way to access aid/assistance	
Help each other socially/social support	
Other (specify).....	

17. Do you receive any benefits from your fodder group? **1=Yes, 0=No**

b. **If yes**, in what form is the benefit? **1=Cash, 2=Fodder, 3=Both cash and fodder, 4=Other (specify).....**

c. How do you share the benefits among yourself?

d. Please rank any of these benefits received from the fodder production group in the table below;

Benefits	Please rank [1=Very important 2=Just important 3=Not important]
Increased access to fodder for my livestock	
Increased income from fodder sales	

Gain knowledge on fodder agronomy	
Access to external support (financial, technical/training)	
Access to technology/innovations in fodder production	
Social support during funerals, weddings etc.	
Other (specify).....	

SECTION D: GROUP CHARACTERISTICS

18. Do you have group officials/leaders? **1=Yes, 0=No**

b. If yes, how are they selected? (**1=Voluntary, 2=Appointed by members, 3=Appointed by NGO/external actors, 4=Elected by members, 5=Other specify**)

c. Do you take part in selecting your group officials? **1=Yes, 0=No**

d. Overall, are you satisfied with the leadership of your group? (**1=Very satisfied 2=Somewhat satisfied 3=Not satisfied**)

19. Do you normally hold group meetings? **1=Yes, 0=No (IF NO, SKIP TO QUESTION 22)**

20. As a group member, do you attend group meetings? **1=Yes, 0=No**

If yes, please fill the table below;

No. of meetings attended in the last 6 months	Walking distance to meeting venue (minutes)	Do you incur any transport expenses when attending meetings? 1=Yes, 0=No If yes, how much?	How do you know about the meetings? 1=Announced in previous meeting 2=Phone calls 3=SMS, 4=Other specify.....

b. What is your perception about these group meetings?

Perception	1=Yes, 0=No	Perception	1=Yes, 0=No
Venue is too far from home		Venue is too costly	
Venue is too noisy		Timing is inconvenient	
Venue is inconvenient for female members		There is no freedom to speak in meetings	
Venue is too insecure		There are no important issues discussed	

21. If No in (20 above), give reasons for not attending group meetings? (Please circle where applicable)

[1=Lack of communication, 2=Have no time, 3= Far from home, 4=Not interested, 5= Other.....]

22. As a member, which of the following contribution(s) do you make to your fodder group? Please fill in the table below;

Contribution	Do you contribute? [1=Yes, 0=No]	If Yes, Quantity offered	What is it used for?	Frequency/month 1=Never, 2=Once, 3=Twice, 4=Thrice
Membership fee/Cash				
Labour				
Material (inputs/equipment) Specify....				
Other (specify).....				

23. According to you, which of the following challenges does your fodder group face?

Challenges	Please rank the challenges (Tick where applicable)				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Poor leadership/governance					
Mismanagement of resources					
Inequality in sharing benefits					
High membership fees					
Gender discrimination					
Ethnic discrimination					
Lack of cooperation by members/conflicts					
Other specify.....					

24. Were you producing fodder/pasture individually before joining fodder group? 1=Yes, 0=No

b. If yes, which year did you start fodder production?

c. What is the **Main** purpose/reason for growing fodder? [1=For own livestock feeds, 2=Sale, 3=Leasing out for income, 4=Other specify.....]

d. Where did you learn about fodder production? [1=Neighbors, 2=County government, 3=Research Institution (Specify.....), 4=NGOs (Specify.....), 5= Other.....]

e. Since joining the group, by how many acres has your fodder production (a) **increased**..... (b) **Decreased**.....

© **Remained the same**..... (d) **Collapsed**.....

SECTION E: FODDER MARKET PARTICIPATION

25. As an **individual**, do you **buy** fodder for your own livestock? 1=Yes, 0=No

If yes, please fill the table below:

For how long have you been buying fodder? (Years)	In what form do you buy? 1=Freshly cut/green 2=Baled hay 3=Unbaled hay 4=Standing pasture 5=Other.....	Which is the main source of fodder that you buy? 1=Market (Specify), 2=My Fodder group 3=Other Fodder groups (Specify) 4=Traders 5=Other (Specify)	Distance to market (walking hours)	Quantity bought per month (bales)	Price per unit (Ksh.)	How do you pay for it? 1=On spot cash 2=Cash later 3=Credit 4=Contractual 5=Other.....	Do you store fodder bought? 1=Yes, 0=No	Key challenge faced (Tick one) 1=High prices 2=Low fodder supply 3=Poor fodder quality 4=Distance to market 5=Poor road conditions 6=Lack of storage facility 7=Other.....

26. Do you receive any market information e.g. on fodder prices or supply? 1=Yes, 0=No

27. If yes, from which source? 1=NGOs, 2=County, 3=Other fodder groups, 4=Other.....

SECTION F: INSTITUTIONAL SUPPORT SERVICES

28. Has your fodder group received any form of extension service(s) in the last 12 months? 1= Yes,0=No

29. As a group member, do you attend any of these extension/trainings offered to your fodder group? 1=Yes, 0=No

b. If yes, how do you participate in it? (1= Just listening, 2=Active discussions,3=Other specify.....)

30. As an individual, did you receive any extension services outside the group in the last 12 months? 1=Yes, 0=No

b. If yes, please fill in the table below;

Type of information (Tick where applicable)	Source: 1=County, 2=NGOs (specify) 3= Both NGO & University (specify), 4=University, 5=Private provider,	Delivery channel [1=Home visits, 2=Farmer Field Schools, 3=Seminars/Barazas, 4=Radio, 5=Mobile,	Terms of Provision: 1=Free, 2=Paid, 3=Other	If paid, how much,	How often in a month? 1= Once, 2=Twice 3=Thrice	Key challenge (tick one) 1=Costly, 2=Infrequent visits 3=Communication barrier 4=Distance 5-Farmers not willing

	6=Other farmers, 7=Other specify]	6=Other specify]	r.....	h? (K sh s)	4=Yearly 5=Other	to share information, 6=Other....
Fodder agronomy						
Livestock husbandry						
Crop production						
Business						
Other (Specify)-----						

31. As an individual, are you a member of any Savings and Credit institution/organization group in your area? 1=Yes,0=No

32. Did you receive any credit/loan in the last 12 months? 1= Yes, 0=No

(IF NO, SKIP TO QUE. 32b.)

b. If yes, please fill in the table below;

Source of credit (Tick where applicable)	Forms of credit 1=Monetary loans 2=Inputs e.g. seeds	Amount/Quantity received (Kshs.)	Indicate Proportion for each use where applicable: (1=None; 2=<25%; 3=25-50%; 4=50-75%; 5=>75%)					Challenges faced (Tick one) [1=Lack of collateral, 2=High interest, 3=Procedural 4=Not available, 5=Other... ..]
			Buy food	Pay school fees	Buy farm inputs/assets specify..... ...	Expand production	Expand business	
Table banking/ Merry go rounds								

Mobile money (Specify).....								
Relatives/Friends								
NGOs (Specify.....)								
Microfinance institution specify								
Formal Bank (Specify.....)								
Other Specify.....								

b. If no (in 32 above), what is the reason why you cannot access credit facilities?

33. Did you receive any external support /aid in the last 12 months? 1=Yes,0=No

If yes, please provide the following information:

Type of support/Aid (Tick where applicable)	Source of support 1=National government 2=County 3=NGOs (Specify) 4=University (Specify) 5=Other Specify.....	How often in a month? 1=Once 2=Twice 3=Yearly 4=Other.....	Did it benefit you? 1=Yes 0=No	Key challenge Faced (tick one) 1=Insufficient, 2=Not timely, 3=Not fairly distributed 4=Not appropriate 5=Other specify.....
Financial/Cash				
Food items				
Inputs Provision (seeds, tools)				
Trainings & extensions				
Other (specify.....)				

34. Do you also belong to other developmental/social group(s) in your area apart from fodder group? 1= Yes, 0=No

If yes, please fill the table below;

Type of group (Tick where)	Duration of membership	Position held	Do you attend	Activities or services provided by group	Reason for joining
-------------------------------	------------------------	---------------	---------------	--	--------------------

<i>applicable</i>)	(years)	1=Leader 2=Committee 3=Member	their meetings? 1=Yes 0=No		
Women					
Men					
Youth					
Mixed group					
Communal grazing/water					
Religious group					
Other (specify)					

35. Do you normally receive any information (early warning signs) regarding changes in weather conditions? Please the table below;

Access 1=Yes, 0=No	Source 1=Government-NDMA, metrological 2=NGOs (Specify) 3=Traditional elders, 4=Other...	Channel 1=Radio 2=Mobile, 3=Extension workers, 4=Barazas,5=Chief/Elders 5=Other....	Terms of Access 1=Free, 2=Paid for	Perception 1=Timely, 2=Accurate 3=Reliable, 4=Useful 5= Not Useful	Key Challenge 1=Not timely, 2=Unreliable 3=Not available, 4=Other...

36. What kind of shocks did you experience during the last 10 years and how did you cope with them? Please fill the table below (Tick all that apply)

Type of shock (Tick where applicable)	Did you Experience this shock in the last 10 years? 1 = Yes 0 = No	Duration of the Shock 1=Less than a month 2=One month 3=More than one month	Frequency in the last 1 year (number of times it occurred) 1=Once 2=Twice 3=Thrice 4=Other	What are adverse effects of this shock? 1=Livestock death 2=Loss of household assets 3=Loss of cash income 4=Loss of crops 5=Loss of human lives 6=Other.....	How did you manage this shock? 1=Livestock Insurance 2=Government/County destocking/restocking program 3=Sold part of assets 4=Borrowed from family 5=Received aid from NGO/County 6=Received Support from
--	--	--	--	---	--

		4=A year			social groups 7=Migrated to another area 8=Other.....
Drought					
Floods					
Livestock diseases/crop/pests					
Inter-community conflicts					
Cattle rustling					
Human-Wildlife conflicts					
Other specify.....					

SECTION G: PERCEPTIONS ON FODDER GROUP IMPACTS ON DEVELOPMENT INDICATORS

37. According to your opinion, to what extent do you think your participation in the fodder group has improved or deteriorated your access to these services? Please fill in the table below;

Services	Opinion; 1=Improved 2=Deteriorated	Please indicate to what extent you think it has improved or deteriorated;				
		Much better	Somewhat better	Remained the same	Somewhat worse	Much worse
Access to Institutional Support Services:						
Extension Services/Trainings						
Market information (prices, demand, supply)						
Prices for livestock products e.g. milk, meat,						
Volume/Quantity of livestock commodities in the markets						
Credit/Loan facilities						
Social networks (social capital)						
Food Security of the Household:						
Average number of meals per day						
Number of days people lack food						

Number of people who lack food							
Household income/Assets							
Access to Basic Services:							
Health services and knowledge							
Nutrition knowledge and skills							
Formal Education	For adult group members						
	For their children						
Access to feeds and water for livestock							
Livestock management/good husbandry							
Socio-cultural acceptance of fodder growing							
Women involvement in livelihood projects							
Reliance on external assistance/aid							
Cohesion/Unity among community members							
Inter-community/clan/border relations/ conflicts							

SECTION H: FUTURE PROSPECTS

38. Do you have plans of establishing your own fodder plot in the near future? **1=Yes, 0=No**

a) **If yes**, why?

b) **If no**, why not?

c) What kind of support do you require/need? (*Circle all applicable*)

[a. Capacity building, b. Infrastructure development, c. Security, d. Input access, e. Credit access, f. Other (specify).....]

SECTION I: HOUSEHOLD DEMOGRAPHICS (*Circle where applicable*)

39. Ethnic affiliation (1=Borana, 2=Samburu, 3= Meru, 4=Somali 5=Others Specify.....)		44. Gender (1= Male, 0=Female)	
40. Religion (1= Christian, 2=Muslim, 3=Traditional 4=Other.....)		45. Age (years):	
41. Marital Status (1=Single, 2= Married 3=Widowed/divorced/separated)		46. Years of Schooling:.....	
42. Relationship to household head? (1= HH head, 2=Spouse, 3=Son/Daughter, 4= other (Specify.....))		47. Number of children below five years of age:	
43. Household Size	No of Male:	No of Female:	48. Number of children completed primary education

THANK YOU!!!

Appendix 5: Fodder Group Leader Survey Questionnaire

SECTION A: GENERAL INFORMATION

Name of Enumerator	
Date of interview	
Interview time	From..... To.....
39. Sub-County	1=Isiolo, 2=Garbatulla
40. Ward	1=Burat, 2=Bulla Pesa, 3=Oldonyiro, 4=Kinna
41. Sub location
42. Village	

SECTION J: GROUP STRUCTURE

49. Please provide the following information about your fodder group in the table below;

Name of group	How was group formed? 1=Self initiation 2= Neighbor motivation 3=NGO/County facilitation 4=Partnership Self/County/ NGO 5=Other.....	Which year was it formed ?	Is the group registered formally by ministry of culture & social services? 1=Yes 0=No.	Is the group actively producing fodder currently? 1=Yes 0=No.	Total No. of members at inception/starting		Total No. of members now (2018)	
					Male	Female	Male	Female

50. Do you have group officials/leaders? 1=Yes, 0=No

- b. If yes, how are they selected? (1=Voluntary, 2=Appointed by members, 3=Appointed by NGO/external actors, 4=Elected by members, 5=Other specify.....)
- c. How are decisions made in your group? (1= Imposed by politicians, 2= Imposed by donors/NGOs, 3=By leader's only 4=Leaders, but ask for approval from members, 5=By members' consensus, 6=Other (specify).....)

51. Do you normally hold group meetings? 1=Yes, 0=No

- b. If yes, how many times do you meet in a month? (1= Once, 2=Twice, 3=Thrice, 4=Never)
- c. Where do you normally hold the meeting (location)?

d. Do you record minutes of the meetings? **1=Yes, 0=No**

52. Do you have rules for joining or leaving the fodder group? **1=Yes, 0=No**

b. If yes, what is the process if a member wants to **join or exit** the group?

.....

c. Are there members who have exited the group since its inception or beginning? **1=Yes, 0=No**

d. If yes, what are the reasons for exiting? (*Please circle where applicable*)

[a. Moved to another fodder group, b. Misunderstanding with members, c. Forced to exit by other members, d. Not interested anymore, e. Other specify.....]

SECTION K: GROUP FODDER AND GRASS SEED PRODUCTION

53. Please fill in table below;

Which year did your group start fodder production?	Where did your group learn about fodder production? 1=Neighbors 2=County government 3=Research Institution (Specify) 4=NGOs (Specify) 5= Other.....	Main Purpose/Reason: 1=For own livestock feeds 2= Sale 3= Both feeds & Income 4=Leasing out for income 5= Other specify.....	Group Farm size (Ha)	Species grown (List them)	Quantity of fodder produced per season (Bales)		Quantity of Seeds produced per season(Kgs)	
					Rainy season	Dry season	Rainy season	Dry season

54. Which agronomic practices do you apply in fodder or grass seed production, and in which month(s) do you undertake these practices?

Activities (Tick where applicable)	Do you undertake? 1=Yes, 0=No	How do you do it? (Method used)	Which month(s) of the year	How many times in a year
Land preparation		(1= Clear land & plough, 2= Clear land but do not plough)		
Reseeding		(1=Broadcast on prepared land, 2=Oversaw on unprepared land, 3=Enclose land for natural regeneration Planting)		
Weeding		(1=Do not weed, 2=Uproot weeds rarely, 3=Uproot frequently)		

Harvesting		(1=By hand, 2=Use harvesting tools)		
Baling		(1= Do not bail, 2=Use hand baling tool, 3=Use tractor)		

55. How did you acquire the group farm you are currently using for fodder production? Please fill in the table below:

Method of Land acquisition 1=Bought, 2=Rented, 3=Leased, 4=Allocated by other Institutions/People (Specify), 5=Communal land, 6=Settlement scheme, 7=Other (Specify)	If bought, how much and source of money?	If leased/rented, how much per season and for how long?	Acreage under fodder production (Ha)	Tenure system [1=Private with title deed, 2= Private without title deed, 3=Communal, 4=Other (specify)]

56. Which type of labour do you use for the following activities in fodder production? Please fill the table below:

Activities (Tick where applicable)	Type/Source 1=Group 2=Hired 3=Both	Gender 1=Male 2=Female 3=Both	Age 1=Youth (18-30 years) 2=Adults (>30 years) 3=All	No. of group labor used	Quantity used if hired (man days)	Price per Unit/per day if hired (Kshs)
Land preparation						
Planting						
Weeding						
Pasture security						
Seed harvesting						
Fodder harvesting						
Baling						
Storage						
Transporting to market						

57. Do you use any inputs in fodder production? 1= Yes, 0=No.

b. If yes, where did your group acquire the inputs used in production last season? Please fill in the table below:

Input Type	Which specific input do you use? (Tick where applicable)	Source of input 1=Market Specify 2=County government 3=University(Specify) 4=NGOs(Specify) 5=Other....	Form of acquisition 1=Bought 2=Given 3=Hired 4=Borrowed 5=Other....	Quantity purchased/Hired	Price per unit hired/purchased	Quantity Given	Key challenge (Tick one) 1= Poor quality seeds 2=Costly/Expensive 3= Not available 4= Other specify.....

Grass seeds (variety)							
Fertilizer	1-Organic/manure 2-Inorganic						
Ploughing tools	1-Hand tools, 2-Tractor 3-Animal traction						
Fencing materials	1-Barbed wire, 2-Thorns/fence, 3-Other (specify)						
Harvesting tools	1-By hand, 2-Machine/Tool						
Baling equipment	1-Hand tool, 2-Machine						
Other specify.....							

58. Do you irrigate your fodder? **1=Yes, 0=No.**

b. If yes, where do you get water for irrigation during last season?

c. Do you pay for the water? **1=Yes..... 0=No....., if yes**, how much?

d. If no, why don't you irrigate your fodder?

59. Do you use any technology or innovation in fodder production and harvesting? **1=Yes, 0=No**

b. If yes, Please fill in the table below:

Type of technology/Innovation	Please list the specific technology used e.g. Zai Pits, semi-circular bans	Source [1=Government 2=County 3=Research Institution (Specify) 4=NGOs (Specify) 5=University (Specify) 6=Other Specify	Duration of use (years)	Benefits from technology use (Please list them)	Key Challenges faced (please list them)
Water harvesting					

60. Does your group normally store fodder and grass seeds produced? **1=Yes, 0=No**
- b. **If yes**, where do you normally store? (**1= On Trees.**, **2= Group fodder store**, **3= In group farm**, **4=Other specify.....**)
- c. In what form do you store? (**1=Green/standing pasture**, **2=Baled hay**, **3=Unbaled hay**)
- d. Why do you store? (**1= Future consumption**, **2=Future sale**, **3=Other specify.....**)
61. Is your group engage in animal fattening business using the produced fodder? **1=Yes, 0=No**

If yes, please fill in the table below;

Type of animal	Number of animals grazing	Fattening period (months)	Acreage grazed	Source of animal (1=Group, 2=Purchased)	Price if purchased (Kshs)	Selling Price (Kshs)
Cattle						
Goat						
Sheep						

62. What are the **Major Challenges** that you faced in your fodder and grass seed production last season?

Challenges	Please rank the challenges (<i>Tick where applicable</i>)				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Lack technical skills on fodder agronomy					
Inadequate inputs Specify (a. seeds, b. tools, c. equipment, etc.)					
Poor quality seeds					
Low volumes of fodder produced					
Droughts/rain failure					
Illegal grazing on group farm/theft					
Lack of storage facilities					
Other (specify).....					

SECTION L: GROUP FODDER MARKET PARTICIPATION

63. As fodder group, do you **sell** fodder and/or grass seeds you produce? **1=Yes, 0=No (IF NO, SKIP TP QUE 66)**

b. If yes, please fill in the table below;

Products	For how long have you been selling fodder (Years)	In which main market?	Distance to market (walking hours)	Mode of transport 1=On foot 2=Donkey 3=Motorbike 4=Car/Pick up 5=Other.....	Do you receive any market information e.g. on fodder prices? 1=Yes, 0=No	If yes, from which source? 1=NGOs 2=County 3=Other fodder groups, 4=Other.....	Channel: 1=Home visits 2=Seminars/barazas 3=Mobile/Radio 4=Other.....
Fodder							
Grass seeds							

64. What quantities of grass seeds and fodder did you sell to these markets and at what price? Please fill in the table below:

Source of market (Tick where applicable)	Do you sell to each listed market source? 1=Yes 0=No	Fodder				Grass Seeds		
		Quantity Sold to each source (Bales)	Price per unit for each source (Kshs.)	In what form do you sell? 1=Freshly cut/green 2=Baled hay 3=Unbaled hay 4=Standing pasture 5=Other.....	Selling arrangements 1=On spot cash 2=Cash later 3=Credit 4=Contractual 5=Other.....	Quantity Sold to each source (Kgs.)	Price per unit for each source (Kshs.)	Selling arrangements 1=On spot cash 2=Cash later 3=Credit 4=Contractual 5=Other.....
Group members								
Neighbors								
Traders								
NGOs Specify.....								
County government								
Traders from other counties								
Other specify.....								

65. What are the Major Challenges/Problems faced in your fodder and grass seed marketing last season?

Challenges	Please rank the challenges (Tick where applicable)				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Lack of market & market information					

Low prices					
Not enough volumes of fodder to sell					
Distance to market					
Poor road conditions					
Lack of transport means					
Lack of storage facilities					
Other (specify).....					

66. If **NO** (in 63 above), what is the **MAIN** reasons for not selling fodder? (*Circle where applicable*)

[1=Own livestock use, 2=Not enough surplus to sell, 3=Distance to market, 4=Lack of transport, 5= Poor roads, 6=Lack of buyers, 7=Low prices, 8=Other, specify.....]

67. Does your group keep records on fodder and grass seed production and marketing? 1=Yes, 0=No

b. If No, why not?

68. Does your group lease out group farm to other people for grazing? 1=Yes, 0=No

b. If yes, please fill in the table below;

Type of animal	Acreage leased (farm size in hectares)	No. of animals grazing	Duration of leasing (Months)	Leasing price/month/animal	Total amount (Kshs)
Cattle					
Goat					
Sheep					
Donkey					

SECTION M: INSTITUTIONAL SUPPORT SERVICES

69. Has your **fodder group** received any form of extension service(s)/trainings in the last 12 months? 1= Yes, 0=No

b. If yes, what kind of information and from which sources? Please fill in the table below:

Type of information (<i>Tick where applicable</i>)	Provider of information: 1=County, 2=NGOs (Specify) 3=Both	Delivery channel [1= Farmer field schools, 2=Seminars/Barazas,	Terms of Provision: 1=Free, 2=Paid,	If paid for, how much? (Kshs)	How often in a month? 1=Once 2=Twice	Key challenge (tick one) 1=Costly, 2=Infrequent visits

	County & NGOs 4=University (Specify),5=Private provider 6=Other farmers, 7= Other Specify]	3=Group Farm Visits 4=Radio, 5=Mobile, 6=Other specify]	3=Other.....		3=Thrice 4=Other.....	3=Communication barrier 4=Distance 5-Farmers not willing to share information, 6=Other....
Fodder production						
Livestock husbandry						
Crop production						
Business						
Other (Specify)-----						

70. Has your fodder group received any credit/loan facilities in the last 12 months for fodder production? 1=Yes, 0=No

b.If yes, please provide the following information:

Source of credit (Tick where applicable)	Forms of credit 1=Monetary loans 2=Inputs e.g. seeds	Amount received (Kshs.)	Use [1=Buy farm inputs, 2= Expand fodder production, 3=Buy group assets (specify), 4 =Other specify.....]	Key Challenge (tick one) [1=Lack of collateral, 2=High interest, 3=Procedural 4=Not available, 5 =Other.....]
Formal Bank (Specify.....)				
Micro finance institution (Specify.....)				
Merry go rounds/Table banking				
NGOs (Specify.....)				
Group members contribution				
Other Specify.....				

71. Has your fodder group receive any external support/assistance to improve fodder business in the last 12 months? 1=Yes, 0=No

b. If yes, please provide the following information:

Type of support (Tick where applicable)	Source of support 1=County 2=NGOs (Specify) 3=University (Specify)	How often in a month? 1=Once, 2=Twice, 3=Yearly,	Did it benefit you? 1=Yes 0=No	Key challenge Faced (tick one) 1=Insufficient, 2=Not timely, 3=Not fairly distributed 4=Not appropriate

	4=Other Specify.....	4=Other.....		5=Other specify.....
Inputs Provision (seeds, tools)				
Trainings & extensions				
Infrastructure (a. Storage bans, b. markets, c. roads)				
Financial/Cash				
Food items				
Other (specify)				

FUTURE PROSPECTS

72. What is the future plan (s) of your fodder group? Please list them.....

b.What kind of support do you require/need? *Circle all applicable*

[a. Capacity building, b. Infrastructure development, c. Security, d. Input access, e. Credit access, f. Other (specify).....]

SECTION N: LEADER DEMOGRAPHICS (*Circle where applicable*)

44. Ethnic affiliation (1=Borana, 2=Samburu, 3= Meru, 4=Somali 5=Others Specify.....)		49. Gender (1= Male, 0=Female)	
45. Religion (1= Christian, 2=Muslim, 3=Traditional 4=Other.....)		50. Age (years):	
46. Marital Status (1=Single, 2= Married 3=Widowed/divorced/separated)		51. Years of Schooling:.....	
47. Relationship to household head? (1= HH head, 2=Spouse, 3=Son/Daughter, 4= other (Specify.....))		52. Number of children below five years of age:	
48. Household Size	No of Male:	No of Female:	53. Number of children completed primary education

THANK YOU!!!

Appendix 6: Checklist for Focus Group Discussion on Fodder Production and Marketing in Isiolo County

SECTION A: LOCATION INFORMATION

Sub-County.....

Ward.....

Village.....

Fodder Producer Groups

1. Historical perspective of pastoral livelihood transitions over 5-year blocs of time from 1988 – 2018 in terms of livestock, migration, markets, land use, culture, human capital, governance institution and infrastructure development.
 - Challenges and opportunities that come with these transitions as well as its impacts on livelihoods.
2. Historical evolution of fodder producer groups and the driving forces over 5 years, resultant outputs and its impact on livelihoods in those areas
3. Groups' leadership, management and its main/other activities of fodder and groups?
4. Cost of group participation (Contributions in terms of membership fee, time, money, labour and mechanisms)
5. Fodder production and marketing: Grass variety, volumes produced/sold per season, market outlet and prices, costs incurred.
6. Any role played by external actors e.g. County, NGO etc.
7. Benefits received from fodder groups and sharing mechanisms
8. Challenges faced and possible their management strategies
9. Opinion(s) about fodder production as a business (cultural perspectives)
10. Future plans for the groups

Appendix 7: Checklist for KIIs on Fodder Production and Marketing in Isiolo County

a) County Government Official (Min. of Agric. And Livestock)

1. Specific role of county government regarding fodder production
2. Any initiatives/projects undertaken to support fodder production and marketing?
(Infrastructure, technical)
3. Who are the key players in the fodder value chain, production-marketing-consumption?
4. Challenges, opportunities and possible strategies to improve fodder production and marketing
5. Opinion about fodder production as a business, its economically viability and uptake by pastoral communities.

b) Technical Supporters/Advisors (NGOs: ILRI, Action Aid)

1. Specific roles of NGO in fodder production and marketing
2. Which services do you offer to fodder group?
3. Do you think fodder production has benefited the producers and how?
4. Challenge encountered so far, opportunities and possible strategies to improve fodder production and marketing
5. Opinion on fodder uptake by pastoral communities