

**A SOCIO-ECONOMIC ANALYSIS OF THE ROLE OF INDIGENOUS KNOWLEDGE  
AND EXTERNAL INTERVENTIONS IN PASTORALISTS' LIVELIHOOD  
RESILIENCE IN WEST POKOT COUNTY, KENYA**

**BY**

**DEBORAH NAMAYI MURICHO**

**A56/83704/2015**

**A Thesis Submitted in Partial Fulfillment of the Award of the Degree of Master of Science  
in Agricultural and Applied Economics  
Department of Agriculture Economics  
Faculty of Agriculture  
University of Nairobi  
October, 2018**

**Declaration**

This thesis is my original work and has not been presented for the award of a degree in any other institution.

Deborah Namayi Muricho  
Reg. No. A56/83704/2015

Signature.....Date.....

**Approval**

This thesis has been submitted with our approval as supervisors.

Dr. David Jakinda Otieno

Department of Agricultural Economics, University of Nairobi, Kenya

Signature.....Date.....

Prof. Willis Oluoch-Kosura

Department of Agricultural Economics, University of Nairobi, Kenya

Signature.....Date.....

Prof. Magnus Jirstrom

Department of Human Geography, Lund University, Sweden

Signature.....Date.....

The following papers have been written from this thesis.

### **Journal Paper**

**Muricho, D.N.**, Otieno D.J and Oluoch-Kosura W. (2018) “The Role of Pastoralists’ Indigenous Knowledge and Practices in Reducing Household Food Insecurity in West Pokot, Kenya.’’ Journal paper published in the Journal of Development and Agricultural Economics (JDAE) <https://doi.org/10.5897/JDAE2017.0871>

### **Conference Papers**

**Muricho, D.N.**, Otieno, D.J., Oluoch-Kosura, W. and Jistrom, M. (2018). **Strengthening Participation in Markets: an opportunity to Build Pastoralists’ Resilience in West Pokot County, Kenya.** An oral paper accepted for presentation at the 5<sup>th</sup> Adaptation Futures Conference in Capetown, South Africa, 17<sup>th</sup> – 22<sup>th</sup> June 2018.

**Muricho, D.N.**, Otieno, D.J., Oluoch-Kosura, W. and Jistrom, M. (2018). **Factors building pastoralists resilience to shocks: Evidence from West Pokot County, Kenya.** A poster paper accepted for presentation at the 30<sup>th</sup> International Conference of Agricultural Economists (ICAE) in Vancouver, Canada, 28<sup>th</sup> July – 02<sup>nd</sup> August 2018.

**Muricho, D.N.**, Otieno, D.J., Oluoch-Kosura, W. and Jirstrom, M. (2018). The role of pastoralists’ tenure security in sustainable land management: Evidence from West Pokot, Kenya. Conference paper presented at the 19<sup>th</sup> Annual World Bank Conference on Land and Poverty in Washington D.C., USA from 19<sup>th</sup> to 23<sup>rd</sup> March 2018.

**Muricho, D.N.**, Otieno, D.J. and Oluoch-Kosura, W. (2017). “Enhancing pastoralists’ resilience to climate change induced shocks; the role of indigenous knowledge in West Pokot, Kenya.’ Poster presented during the 6<sup>th</sup> National Science Week of the Kenya National Commission for Science, Technology and Innovation, NACOSTI ON 22<sup>nd</sup> -26<sup>th</sup> May 2017.

**Muricho, D.N.**, Otieno, D.J. and Oluoch-Kosura, W. (2017). “Building pastoralists’ resilience: Strengthening participation in markets and local governance institutions in West Pokot, Kenya.”Conference Paper presented at the 18<sup>th</sup> Annual World Bank Conference on Land and Poverty in Washington D.C on 20<sup>th</sup> – 24<sup>th</sup> March 2017. Available at [https://www.conftool.com/landandpoverty2017/index.php?page=browseSessions&print=yes&cols=6&doprint=yes&form\\_session=391&mode=table&presentations=show](https://www.conftool.com/landandpoverty2017/index.php?page=browseSessions&print=yes&cols=6&doprint=yes&form_session=391&mode=table&presentations=show)

### **Acknowledgement**

I give thanks to Jehovah God, for granting me the gift of life and good health to be able to complete this study. I appreciate my advisors Dr. David Jakinda Otieno, Prof. Willis Oluoch-Kosura and Prof. Magnus Jirstrom for their guidance, readiness to help, timely feedback, and moral support. My gratitude also goes to the Government of Kenya and the Africa Economic Research Consortium (AERC) for awarding me a scholarship to pursue a master's degree in Agricultural and Applied Economics at the University of Nairobi and the Land, Livestock and Livelihood (Triple L) project ([www.triplel.se](http://www.triplel.se)) for partially funding the research work.

I am grateful for the perseverance and support of the data collection team comprising Peter Waboya, Mary Kavuu and Naomi Juma. I also acknowledge the respondents and field guides in West Pokot for their cooperation and hospitality during data collection. Finally, I wish to thank fellow colleagues and lecturers from the University of Nairobi and at the shared facility at University of Pretoria for their invaluable input towards this research thesis and their moral support. May God bless you all abundantly.

## **Dedication**

I dedicate this thesis to mum Cellestyne Naliaka, nephew Russell, my grandparents Francis Simiyu and Rose Nasike for your unwavering love, support and care that molded me into the person I am today. I cannot thank you enough.

## Table of Contents

Declaration .....	i
Acknowledgement .....	iii
Dedication .....	iv
Table of Contents .....	v
LIST OF TABLES .....	viii
LIST OF FIGURES .....	ix
LIST OF APPENDICES .....	x
ABSTRACT .....	xi
LIST OF ABBREVIATIONS .....	xii
CHAPTER ONE .....	1
1.1 Introduction .....	1
1.1.1 Livestock in the context of pastoralists' livelihoods .....	1
1.1.2 Trends in the Resilience of Pastoral Livelihoods .....	4
1.2 Statement of the Research Problem .....	6
1.3 Objectives of the study .....	8
1.4 Research Hypotheses .....	8
1.5 Justification .....	9
1.6 Organization of the thesis .....	10
CHAPTER TWO .....	11
2.0 LITERATURE REVIEW .....	11
2.1 Overview of Pastoral Livelihoods and Emerging Trends .....	11
2.2 Emerging Trends in Livestock Marketing .....	12
2.3 The Resilience Concept .....	13
2.4 A Review of Previous Studies on Indigenous Knowledge, External Interventions and Resilience .....	15

2.5 Conceptual Framework .....	18
2.6 Theoretical Framework .....	20
2.7 Study Area.....	21
CHAPTER THREE .....	26
Characterization of Pastoralists’ Livelihoods, Shocks and Coping Strategies .....	26
3.1 Introduction .....	27
3.2 Objectives and Methodology .....	28
3.3 Characterization of households by demographic and socio-economic attributes .....	31
3.2 Pastoralists’ Exposure to Shocks and Coping Strategies .....	34
CHAPTER FOUR.....	39
4.0 Pastoralists’ Indigenous Knowledge and Uptake of External Interventions and their Role in Helping Households Manage Shocks .....	39
4.1 Introduction .....	40
4.2 Objective and Methodology .....	41
4.3 Indigenous knowledge and practices among the pastoralists’ community .....	42
4.4 Conclusions and Policy Implications .....	53
CHAPTER FIVE .....	55
5.1 Introduction .....	55
5.2 Objective and Methodology .....	57
5.3 Measurement of Household Resilience to Shocks .....	57
5.3.1 DFID/TANGO Resilience Conceptual Framework .....	58
5.3.2 Tufts Livelihoods Change Over Time (LCOT) Model .....	58
5.3.3 OXFAM and ACCRA .....	58
5.3.4 FAO Resilience Index Measurement and Analysis (RIMA) Conceptual Framework .	59
5.4 Factors that Enhance Household Resilience to shocks .....	66

5.4.1 Household Demographic Characteristics .....	69
5.4.2 Effect of Proximity to Basic Services on Resilience .....	71
5.4.3 Institutional Factors Affecting Household Resilience .....	72
5.4.3 Effect of Indigenous Knowledge, Innovations and Practices on Resilience .....	75
5.4.4 Effect of External Interventions on Resilience .....	76
5.5 Conclusion and Policy Implications .....	78
CHAPTER SIX .....	80
6.0 SUMMARY, CONCLUSION AND IMPLICATIONS TO POLICY .....	80
6.1 Summary .....	80
6.2 Conclusion and Implications to Policy .....	81
6.3 Contribution to Knowledge .....	83
6.4 Suggestions for Further Research .....	84
6.0 References .....	85
Appendices .....	93

## LIST OF TABLES

Table 1: Livestock population and percentage off-take in Kenya .....	2
Table 2: A Historical perspective of pastoral livelihoods changes from 1980 to 2016 .....	29
Table 3: Sample Respondents' Characteristics .....	31
Table 4: Indigenous Knowledge and Practices .....	43
Table 5: Pastoralists' Uptake of Intervensionist Programmes .....	50
Table 6: Factor Loadings of Variables used in PCA.....	61
Table 7: Ordered Probit Results on Determinants of Household Resilience .....	69

## LIST OF FIGURES

Figure 1: Vegetation condition index for West Pokot County.....	3
Figure 2: Rainfall amount in West Pokot County as at April 2017 .....	4
Figure 3: A Framework for Understanding Pastoralists’ Resilience in West Pokot .....	19
Figure 4: Illustration of the Study Sites .....	22
Figure 5: Respondents’ Livelihood Activities .....	33
Figure 6: Effects of Shocks on Households .....	35
Figure 7: Coping Mechanisms for Shocks .....	36
Figure 8: Household Resilience Categories .....	65
Figure 9: Challenges in Various Market Channels .....	72

**LIST OF APPENDICES**

Appendix 1: Questionnaire for Focus Group Discussion ..... 93

Appendix 2: Key Informant Interviews ..... 1

Appendix 3: Household Interview Questionnaire..... 3

## ABSTRACT

Pastoralists face many shocks, which increase their vulnerability to food insecurity and poverty. In West Pokot county of Kenya, such shocks include prolonged seasons of drought that leads to acute shortage of forage resulting to fluctuations in milk and meat production and ultimately loss of livestock. The surging population growth forces human encroachment into shared grazing grounds leading to diminishing pasture availability. To counter these effects, pastoralists have been known to use their own indigenous knowledge which for a long time has enabled them to thrive in the harsh environment. Also, in recent years the county government of West Pokot together with other development partners has put in place interventionist programmes aimed at building pastoralists' livelihood resilience. However, the extent to which these efforts contribute to resilience has not been comprehensively documented. This study assessed the effect of pastoralists' own indigenous knowledge and the external interventions on household resilience to shocks. Primary survey data was collected through a combination of methods comprising a focus group discussion, key informant interviews and a household survey on 191 households. The Principal Component Analysis (PCA) method was used to compute household resilience index to shocks. An ordered probit regression model with 3 resilience categories was used to analyze the effect of indigenous knowledge and external interventions on household resilience. Results showed that most respondents derived over 75% of their food and income needs from livestock. Drought and livestock diseases were the most prevalent shocks. The average resilience index was 0.41. Regression results showed that indigenous practices such as ethno-veterinary practices and grazing on postharvest crop residues as well as external intervention programmes such as enclosing land, bee keeping, stocking improved breeds and institutional support in form of credit and extension services had a positive and significant effect on building household resilience to shocks. These results suggest the need to incorporate the indigenous practices in the external interventions together with more institutional support to help pastoralists overcome shocks.

**Key words:** Pastoralists, Shocks, Indigenous Knowledge, External interventions, Livelihood Resilience.

## **LIST OF ABBREVIATIONS**

ALRMP	Arid Lands Resource Management Project
ASAL	Arid and Semi Arid Land
CAADP	Comprehensive African Agriculture Development Programme
CABESI	Camels Bees Silk
CCDP	Combined County Development Plan
CIDP	County Integrated Development Plan
CTA	Technical Centre for Agricultural and Rural Cooperation
DFID	Department for International Development (UK)
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
IK	Indigenous Knowledge
IFAD	International Fund for Agricultural Development
IIR	International Institute for Rural Reconstruction
IPCC	Inter-governmental Panel on Climate Change
KALRO	Kenya Agricultural and Livestock Research Organization
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
KVDA	Kerio Valley Development Authority
MT	Metric Tonne
NDMA	National Drought Management Authority
NGO	Non-Government Organization
ODI	Overseas Development Institute
PCA	Principal Component Analysis
SID	Society for International Development
SHOATS	Sheep and Goats
TLU	Tropical Livestock Unit
WISP	World Initiative for Sustainable Pastoralism

## **CHAPTER ONE**

### **1.1 Introduction**

#### **1.1.1 Livestock in the context of pastoralists' livelihoods**

Livestock production supports the sustenance of many people's livelihoods in Africa in diverse ways. The livestock enterprises serve as means to an end for people who depend on the livestock for food and non-food uses such as draught power, source of fertilizer, medium of exchange and store of wealth (Steinfeld, 2010). Livestock also play important social and cultural purposes in Africa such as means of dowry payment, tokens of appreciation during celebrations and as a measure of prestige. Further, a considerable share of livestock owners prefer holding their assets in form of livestock rather than in monetary form that require a formal banking system, which is not usually accessible especially for remote farmers (World Initiative for Sustainable Pastoralism, (WISP, 2010).

In Kenya, the livestock sector accounts for over 40% of the total agricultural gross domestic product (GDP). Estimates by the Kenya Institute for Public Policy Research and Analysis (KIPPRA, 2015) also show that the sector employs at least 50% of total agricultural labor in pasture cultivation, herding, manufacture of commercial feeds and other inputs, processing and marketing of livestock products.

Domestic livestock production contributes over 70% of the local requirements for meat, milk, dairy products and other livestock products (Aklilu, 2008). The 2009 census by the Kenya National Bureau of Statistics (KNBS) shows that cattle, sheep and goats are the most important source of red meat in Kenya and accounts for over 70% of the total ruminant take-off (Table 1).

**Table 1: Livestock population and percentage off-take in Kenya**

	<i>ASAL</i>	<i>Highlands</i>	<i>Total</i>	<i>% off take</i>
Indigenous cattle	12,155,974	N/A	N/A	6 -14
Exotic cattle	N/A	5,311,800	17,467,774	N/A
Sheep	14,954,925	2,174,681	17,129,606	4-10
Goats	25,250,865	2,489,288	27,740,153	4-10
Camels	2,968,670	2441	2,971,111	1-3

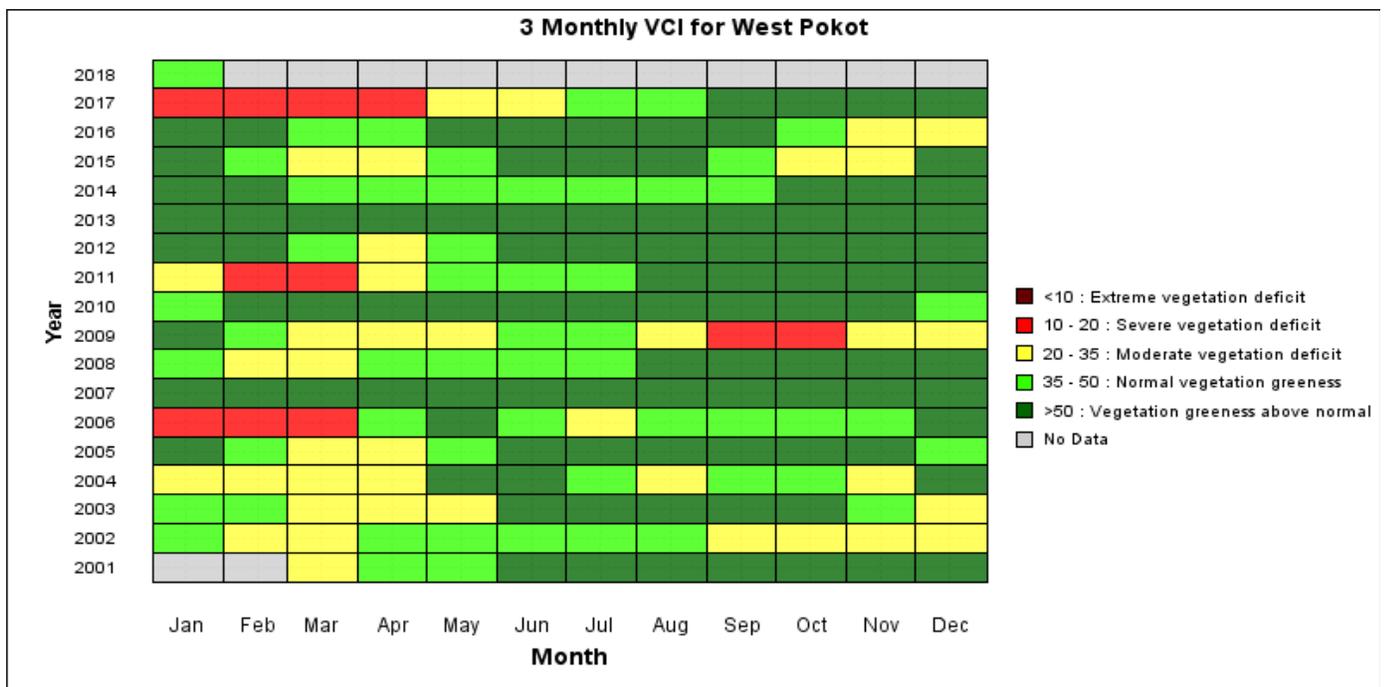
Source: KNBS (2009).

More than half of the total livestock population in Kenya is found in the arid and semi arid lands (ASALs) and are reared by over 80% of the ASAL inhabitants who derive over 90% of their livelihoods from livestock. Such households who depend almost entirely on livestock are considered to be pastoralists (WISP, 2010).

Pastoralism, as a livelihood means enables the people who practice it to meet their food and income needs from livestock (WISP, 2010). It is widely recognized that besides being a cultural way of life, pastoralism is an adaptive mechanism to harsh ecological systems that can hardly support rain-fed crop farming (Barrow et al., 2007). Pastoralism in Kenya is mainly practiced by the communities living in the ASALs such as West Pokot where it employs over 90% of the population both directly and indirectly. Pastoralism generates about Kshs 2 billion (about USD\$20 million) annually for the people of West Pokot (Combined County Development Plan, CCDP 2013). Livestock for a long time has been used by the people of West Pokot culturally as a means to pay bride price, fines, gifts and ceremonial food in cultural feasts.

Pastoralism throughout the world faces multiple challenges such as loss of grazing grounds due to encroachment by human beings and climate change related shocks (Little and McPeak, 2014). The Intergovernmental Panel on Climate Change (IPCC, 2014) predicted greater impacts of climate changes such as global warming in Africa than anywhere in the world. Pastoralists, especially those in the ASALs, are among the worst hit by vagaries of climate change (Thornton

et al., 2008). As a result, disasters such as droughts and conflicts have been on the rise especially in the Horn of Africa and humanitarian aid is needed in such instances to avert the crisis (Little and McPeak, 2014). Vegetation condition index (VCI) is one of the indicators monitored to measure climatic changes such as an impending drought. Figure 1 below shows the VCI statistics for West Pokot County over the last 17 years. A vegetation deficit occurs as a result of rain cessation, resulting in a moderate drought situation that may result in a severe drought if the trend persists. Recent reports and news bulletins from the National Droughts Management Authority (NDMA) showed that the vegetation deficit got worse from late 2016 in the area and by April 2017, the VCI index was below 15 implying drought for pastoralists.

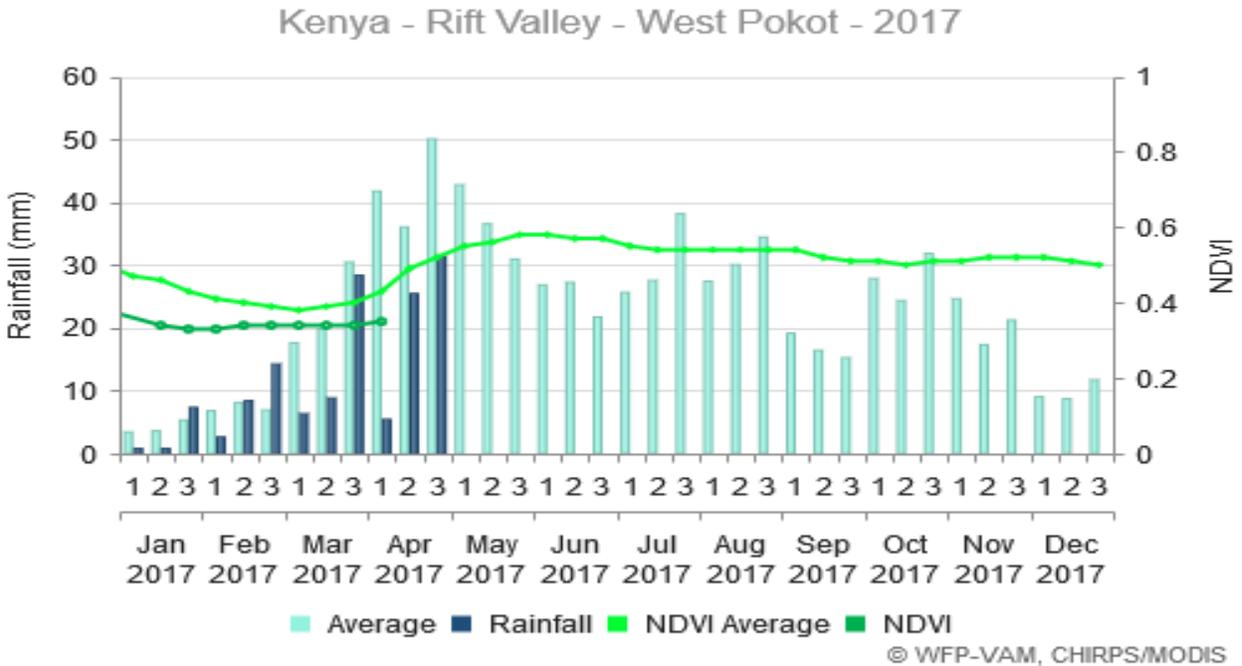


**Figure 1: Vegetation condition index for West Pokot County**

Source: NDMA (2018).

Figure 2 below shows a sharp decline in rainfall amounts received from January to March 2017 with the actual normalized difference vegetation index being below the usual average. This

resulted to deterioration and death of livestock, reduced milk production and consumption and food insecurity in many households (NDMA, 2017).



**Figure 2: Rainfall amount in West Pokot County as at April 2017**

Source: NDMA (2017).

### 1.1.2 Trends in the Resilience of Pastoral Livelihoods

Pastoralists have employed a number of mechanisms that enable them thrive well in the ASALs that can hardly support other forms of livelihood. One of the emerging adaptation strategies is organized seasonal transhumant movements in search of pasture and water in open access resources. Transhumant movement enables pastoralists to escape droughts and disease-infested areas (Flintan, 2012 and Turner et al., 2014). Pastoralists mainly stock indigenous breeds of livestock that can move long distances and do well with little water and pasture (WISP, 2010 and Little and McPeak, 2014).

Pastoralists are custodians of indigenous knowledge, which enables them to make a living in the harsh environment (Emery, 2000). Studies have shown that pastoralists' indigenous knowledge manifests itself in practices such as diversifying herds by stocking both grazing and browsing species, group herding to minimize risk of cattle rustling, naming of animals for identification and to control inbreeding, setting up of traditional institutions that control access to and use of communal pastures and use of traditional tree species that have curative benefits for livestock (Dinucci and Fre 2003; WISP 2010; Selemani et al 2012; Little and McPeak, 2014).

However, there are various challenges including recurrent droughts that undermine pastoralists' livelihood resilience. During extremely dry spells, large herds of livestock (cattle, camels, goats and sheep) are often lost due to acute shortage of pasture and water. This increases pastoralists' vulnerability and perpetually traps them in poverty (Carter et al., 2015 and FAO, 2012). Another emerging challenge is the loss of key pastoral resources of natural pastures as population pressure pushes people to encroach into grazing lands for settlement and institutional changes such as land fragmentation for urbanization and commercial farming, occasioned by imbalance in the allocation of property rights (Cotula, 2007).

Another concern in the pastoralists' domain is political marginalization (Markakis, 2004). Because they are found far away from cities and towns and their niche has often been characterized by low economic activities, there has largely been low investment in infrastructure and most pastoral areas record low indices of access to basic services such as health and education (Little and McPeak, 2014). As a result of spatial marginalization, pastoralists seldom feature as a priority stakeholder group in the planning horizon of the political class and policy makers.

Building resilience, that is the ability to cope with shocks while maintaining stability in asset endowment, has considerable potential for sustainable development. Coping strategies are important in the recovery process after a shock as they may either help a household escape the poverty trap or fall even deeper into destitution and misery. Thus, pastoralists need to be supported in order to realize the sense of inclusivity in development and poverty reduction.

The FAO (2012) observes that one sustainable approach to building pastoralists' resilience is by livelihood diversification, which may take the form of agro- pastoralism and herd diversification. Antle (2009) noted that a household with diversified livelihood activities has a better capacity to cope with shocks. Also, supporting and incorporating pastoralists' indigenous knowledge into livelihood strategies and intervention measures can contribute to local empowerment and sustainable development (Dinuucci and Fre, 2003; Alan 2000). In the Kenya national livestock policy (Republic of Kenya, 2008), the government together with other stakeholders pledged to support pastoralism and agro-pastoralism while encouraging diversification of the pastoral economy to hedge pastoralists' livelihoods against vulnerability to droughts, floods and conflicts. This is through irrigation to make more land arable, breeding programmes to improve the livestock quality, free primary education and better access to basic services such as health, water and sanitation. The extent to which these interventions contribute to people's livelihood resilience needs to be understood so as to guide investments in similar initiatives.

## **1.2 Statement of the Research Problem**

West Pokot County in Kenya has been facing recurrent and prolonged droughts. During such spells, acute pasture and water shortages lead to deterioration of livestock conditions and thus cause a vicious cycle of seasonal fluctuations in milk and meat production. The early warning bulletin by the National droughts management authority (NDMA, 2016) showed that by December 2016, the county had a record VCI of 22.87 against the recommended index of at least

35, indicating a moderate vegetation deficit. The arid regions had a much lower index of 13.62, indicating a severe vegetation deficit. This trend worsened and by March 2017, the county had a record low VCI of 15.57. This had negative implications on the pastoral community. An undisclosed number of livestock deaths were reported. Drought comes with the challenge of water unavailability and households have to travel an average of 4 kilometers to get water (NDMA, 2017).

Additionally, population growth, resource competition and institutional changes such as defined property rights on land ownership have significantly reduced land accessibility for grazing. Former grazing areas have been fragmented and allocated for cultivation and settlement. This hampers transhumant movement, which is crucial for survival and thus causing pressure on the pastoral system (CIDP, 2013). These changes render the pastoral farmers vulnerable to food insecurity and make it hard for them to break from the viscous cycle of poverty.

The promulgation of the new constitution in Kenya in 2010 gave rise to devolved governments where the primary focus is to decentralize resource allocation to priority development matters at the local community level rather than holding the resources at the national level (CIDP, 2013; Orina-Nyamwamu, 2010). In West Pokot, investment of resources has been prioritized to transform the pastoral production system from cultural and subsistence focus to more market-oriented enterprises. In this regard, West Pokot County priority areas include improving the breeding stock, pasture production, utilization and conservation, livestock vaccination, value addition of milk, livestock disease eradication, construction of coolers and milk processing plants, establishment of pastoral training centers, market infrastructure development and an export abattoir at Nasukuta in Chepareria (CIDP, 2013). International organizations such as the Food and Agriculture Organization of the United Nations (FAO) and non-government

organizations (NGO's) such as Kerio Valley Development Authority (KVDA) and Action Aid have partnered with the county government to provide interventions aimed at building resilience. These include fruit growing, bee keeping and camel rearing. However, the extent to which pastoralists have taken up these opportunities and the effect on their resilience has not been documented.

Incorporating indigenous knowledge in external interventions has the potential of producing desirable results in improving households' resilience to shocks. However, indigenous knowledge and practices of the people of West Pokot and their effect on building resilience has not been empirically documented. This study therefore sought to analyze the role of indigenous knowledge and external interventions in building pastoralists' resilience to drought and related shocks.

### **1.3 Objectives of the study**

The purpose of this study was to assess the contribution of indigenous knowledge and external interventions through the county government and other stakeholders in building pastoralists' resilience to drought and other related shocks in West Pokot County. The specific objectives of the study were to:

- Characterize pastoralists' livelihood strategies, shocks experienced and coping approaches
- Assess the pastoralists' indigenous knowledge and uptake of external interventions
- Analyze effects of indigenous knowledge and external interventions on household resilience to shocks

### **1.4 Research Hypotheses**

The following hypotheses were tested:

- There is no significant difference in livelihood strategies, shocks and coping approaches among different households
- External interventions and indigenous practices do not have any significant effect on household resilience to shocks

### **1.5 Justification**

The first, second and thirteenth sustainable development goals of the United Nations Development Programme (UNDP) are geared towards eliminating poverty and hunger and building resilience towards climate change. People in drought prone areas are vulnerable and thus unable to meet basic needs for safe lives on earth. There is therefore a critical need for resilience policies that support climate change adaptation and stabilize livelihoods. Understanding resilience indices and determinants in West Pokot is seen as a useful contribution towards achieving the above development goals.

The 2014 Malabo declaration on African agriculture and CAADP emphasize African governments' commitment to accelerating agricultural growth and transformation for shared prosperity and improved livelihoods. The sixth goal in the declaration is to enhance resilience in livelihoods and production systems to climate variability and other shocks. This study provides insights for different stakeholders to understand the challenges faced by pastoralists, their own efforts to overcome them and the necessary support they need. This will help in the formulation of more sustainable policies that will enhance pastoralists' resilience and lead to the attainment of this goal.

There is a general cultural change in many pastoralist societies. These changes include population growth, urbanization, livelihood diversification, global economic integration and cultural changes. As hypothesized in the evolutionary theory of land rights (Cotula, 2007), these

changes act as push factors to individualization and commercialization of land rights and the erosion of customary institutions. As a result, pastoralism is becoming more sedentary and even incorporating other livelihood options such as farming. This is a major change in production systems and there is still a knowledge gap in management especially for the livestock-based agro-pastoral systems. By comparing resilience indices across households, vulnerable households can learn from more resilient households on their management practices that make them cope better with shocks. This knowledge is useful to the people of West Pokot during this livelihood transition process (Verdoot et al., 2010).

### **1.6 Organization of the thesis**

This thesis is organized in six chapters. The research issue and objectives of the study have been explained in Chapter one. Chapter two provides a review of the relevant literature, while the methods, results and key conclusions are discussed in Chapters three, four and five, which are presented in paper format focusing on each specific objective. The final Chapter (six) summarizes the main findings, policy implications and offers some suggestions for further research.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Overview of Pastoral Livelihoods and Emerging Trends

Pastoralism depends on the use of natural forage; mainly pastures and shrubs. Availability of grazing land dictates the herd movements. Pastoralism could either be nomadic with random movements with the herd or transhumance where there are seasonal movements following predetermined routes. Herd diversity is an important feature of traditional pastoral systems where pastoralists keep different types of herds that do well under different climatic conditions. This production system accounts for over 70% of total livestock production in Africa (WISP, 2010).

There are major transformations going on in the pastoral systems in Africa. Pastoral communities that were initially nomadic now have less transhumance movements and are likely to own homesteads. This is due to high population density, leading to loss of key pastoral resources of natural pastures as people encroach into grazing lands for settlement and institutional changes such as clearly defined property rights, individualization of land tenure and the acquisition of formal education, which erodes local customs and practices (Cotula, 2007).

Thornton et al. (2008) noted that this transition from nomadic to agropastoralism will continue even in the years to come and could be viewed as a challenge or opportunity in different pastoralists' domains. The extent of sedentarization varies in different contexts and environments. In West Pokot too, there is a livelihood transition and a more settled agropastoralism system is becoming more prevalent than nomadic pastoralism (Nyberg et al., 2015). Previous studies in West Pokot have shown an increasing trend in sedentarization especially in the semi-arid regions of the county where pastoralism is incorporated with other livelihood activities such as trade and crop farming (Geutjes and Knutsson 2014; Gronvall 2015).

This transition presents challenges such as restriction of livestock mobility that is important to pastoralists' livestock survival (Flintan, 2012), erodes traditional livelihoods, cultures and values. On the other hand, new opportunities emerge, for instance increased demand for livestock products as a result of population growth and urbanization and thus need for external interventions to strengthen local knowledge in managing livestock, coping with shocks and seizing emerging opportunities within the new sedentary frontier.

## **2.2 Emerging Trends in Livestock Marketing**

The demand for livestock products for consumption rises with purchasing power. The effect of increased income on consumption is greatest among lower and middle-income populations (Aklilu, 2008). With increased market integration as well as emergence of new marketing channels in Sub Saharan Africa (SSA), demand for livestock and its products, especially meat is expected to rise from the current average of 5 tonnes to at least 13 tonnes by the year 2025 (Delgado, 2003 and Shibia et al., 2016). Bett et al. (2012) noted an increase in per capita meat consumption in Kenya, with beef being the most preferred meat and projected an annual per capita consumption of 40kg by the year 2050. The rising demand is supposed to induce competitiveness of livestock producers and production systems in order to meet the market supply requirements (Delgado, 2003).

It is estimated that on average, Kenyans have an annual per capita consumption of 15kg of red meat, making the annual consumption to be approximately 600,000 metric tones (MT). The mean is higher in major towns of Nairobi, Mombasa and Kisumu, accounting for over 17% of the total consumption (Shibia et al., 2016). Nairobi County has the highest per capita annual consumption of over 20 kg of red meat and has a population of over 3 million, making it an important domestic market for meat. Approximately 27,839 cattle, 71,555 sheep and goats, and 685

camels are needed to meet this demand. Animals supplied to Nairobi come from the ASALs, West Pokot being one of the biggest suppliers. However, because of a shortfall in supply, about 30% of the livestock is imported from Ethiopia, Somalia, Tanzania and Uganda (Farmer and Mbwika, 2012). The existing high demand of livestock is an opportunity to the supplying counties to market more quantity and thus earn more as long as they meet the quality requirements.

The domestic market can be categorized into low, medium and high end market. The low-end market comprises the highest share of the meat market. The middle segment of the market butcheries are found in the medium-income residential areas and are mainly patronized by the medium-income group while the high-end market is characterized by high-quality meat from well-finished animals mainly from ranches and by choice-cuts that are priced differently. High-income consumers are more likely to buy value added beef such as choice-cuts and beef sausages than middle-and low-income consumers, and are more likely to purchase meat from high-end markets such as supermarkets and high-end butcheries (Farmer and Mbwika, 2012).

### **2.3 The Resilience Concept**

According to Walker et al. (2004), resilience is the ability of a system to withstand shocks and reorganize while undergoing change so as to still return to its original function and stabilize. Walker and Salt (2006) further noted that in as much as changes occur, they are easily ignored or resisted and this increases vulnerability and even makes people to forego emerging opportunities. As a result, options become limited. However, a resilient system is able to organize itself in a way that makes it adapt and capitalize on the opportunities arising from emerging changes (Carpenter et al., 2001).

Carter et al. (2012) and Ellis (2000) noted that a vulnerable household has a few buffers against contingencies and in case of disasters such as drought, crop failure, famine, sickness or social

shocks, the household becomes worse off. This situation coupled with poverty, powerlessness, physical weakness and isolation (*'clusters of disadvantage'*) further interlock and cause a deprivation trap or viscous cycle of poverty. For them to come out of this deprivation trap, the process that leads them to deprivation needs to be slowed down, halted and turned to a resilient pathway.

Adaptability on the other hand is the capacity to fit in changed circumstances influenced by learning, combining experiences, knowledge and adjusting accordingly, while maintaining stability (Berkes et al., 2003; Walker et al., 2004). This ability enhances livelihood opportunities and builds assets and capabilities for the current and future generations, thus creating sustainable livelihoods. This enables households to cope with shocks in their domains and may lead them to explore innovative ways of overcoming the challenges experienced.

Agricultural adaptation is crucial as it enables farmers counter the effects of shocks in a system (Antle, 2009). In livestock production, previous studies suggest that adaptive strategies such as stocking improved breeds, enclosing grazing land, growing and conserving fodder crops help to improve livestock productivity in the wake of shocks. Butt (2010) noted that fencing or enclosing land for grazing reduced distance walked by livestock. By having livestock feed available, households with enclosures record low transhumant movement and increases time available for grazing since they only graze within the enclosed systems (Geutjes and Knutsson, 2014). Reduced movement enables livestock to gain marketable weight fast and increase milk productivity as less energy is spent in walking.

WISP (2010) found out that pastoralists can cope with droughts by use of emergency fodder, pasture enclosures, destocking weak livestock and herd diversification as well as keeping locally

adapted breeds. Turner et al. (2014) and FAO (2012) noted that transhumant movements enable pastoralists to effectively respond to changing pasture availability patterns. Transhumant movement enables pastoralists to avoid shocks since livestock is moved before the onset of droughts or outbreak of diseases (Flintan, 2012). Local knowledge guides these migratory patterns. The same view is shared by Nori and Davies (2007) who conclude that besides being a means of livelihood, pastoralism is an adaptive mechanism to the ASALs.

Indigenous knowledge (IK) is the knowhow possessed by local people that enables them to make decisions and live in a given environment (Gorjestani, 2004). This knowledge meets the needs of the local people and is very creative and often static. Pastoralists utilize IK in livestock production and ethno-veterinary. Practical application of IK can be in form of seasonal migration, herd diversification, traditional methods of pasture conservation and treatment of livestock diseases (Dinucci and Fre, 2003). Supporting pastoralists' IK and making it part of development projects intended to build resilience can enhance their participation and thus make development projects more sustainable (Selemani et al. 2012; Alan, 2012).

#### **2.4 A Review of Previous Studies on Indigenous Knowledge, External Interventions and Resilience**

Various studies have documented IK and practices in the various contexts. Dinucci and Fre (2003) describe the indigenous practices such as herd naming, identification and ethno-veterinary practices among the *Beni Amer* pastoralists' community in Eritrea. Selemani et al. (2013) describe indigenous institutions in managing *ngitili*, communally-owned grazing land such as collective maintenance of the land and penalty on those violating the rules of access. Abate (2016) describe how indigenous knowledge guide seasonal transhumant movement, leading to effective management of Ethiopian rangelands. The current study contributes to this body of knowledge by assessing the effect of these practices on household resilience.

Previous studies have shown that proper farming practices enable farmers adapt to climate-related risks. Farmers come up with these practices themselves or adopt them through supporting external interventions. Mulwa et al. (2015) assessed the effects of early planting, growing drought-, disease- and pest-tolerant varieties, water and soil conservation and crop diversification in mitigating climate-related risks in Malawi. The study found that the farm characteristics such as soil fertility, access to credit and dissemination of climate-related information motivate farmers to adopt several adaptation practices. Other authors (Huang et al., 2015 and Maguza-Tembo et al., 2016) also noted that proper farm practices help in mitigating climate-related shocks.

Robinson (2009) found that the Gabra pastoralist community in Kenya adapt to shocks such as drought by stocking resilient animal breeds, seasonal mobility, herd diversification and storing some pastures for use in dry season. However, he noted that there were new challenges such as human population growth and global climate change that were posing a vulnerability threat and at that moment the community was dependent on food aid. Other studies (Alinovi et al., 2010; Opiyo et al., 2014 and Ngigi et al., 2015) similarly show that many pastoral livelihoods are less resilient to shocks compared to other livelihoods. There is an urgent need to take steps that would rebuild their resilience.

Efforts made to build resilience bolster households' ability to absorb, adapt and recover from the negative impacts of shocks such as natural disasters, conflicts and economic instability. This helps in protecting livelihoods and supports economic and social development. Resilience building stabilizes livelihoods and reduces humanitarian emergency response to recurrent shocks that often affect millions of vulnerable households (Pain and Levine, 2012).

Several studies have attempted to measure resilience. Keil et al. (2008) used a reduction in expenditure for basic necessities as a proxy for resilience after the El Nino Southern Oscillation (ENSO) drought in Indonesia. Using Principal Component Analysis (PCA), underlying variables that aggregate consumption were computed. Resilient households had smaller variation in consumption indices before and after the drought than vulnerable households. Alinovi et al. (2008) and (2010) used PCA with assets, income, access to food, adaptive capacity and access to basic services as components for analysis to assess resilience to food insecurity in Palestine and Kenya respectively. These components are outlined in the FAO resilience measurement framework (FAO RIMA-II, 2016). Each component had sub-components - for assets, tropical livestock units (TLUs) and land owned were measured, for income and food access, income and expenditures, expenditure on food and diet diversity were considered. Access to health, education, water, electricity and security were analyzed and income diversity, level of education, dependency ratio and other coping strategies were considered for adaptive capacity. Households with more income and assets were more connected and had better access to food and basic services and in turn had a higher resilience index than the counterpart households. In Alinovi et al. (2010), the study population was categorized into livelihood groups. It was noted that pastoralists had the lowest resilience index.

Other studies have adopted the approach of Alinovi et al. (2010) to measure resilience using other indicators and stratifying the study population into livelihood groups for comparison. Ciani and Romano (2013) applied this approach to measure the resilience of rural households affected by Hurricane Mitch in Nicaragua in 1999. Mulat and Negussie (2010) studied Ethiopian households' resilience to food insecurity. The study used the PCA method to estimate household

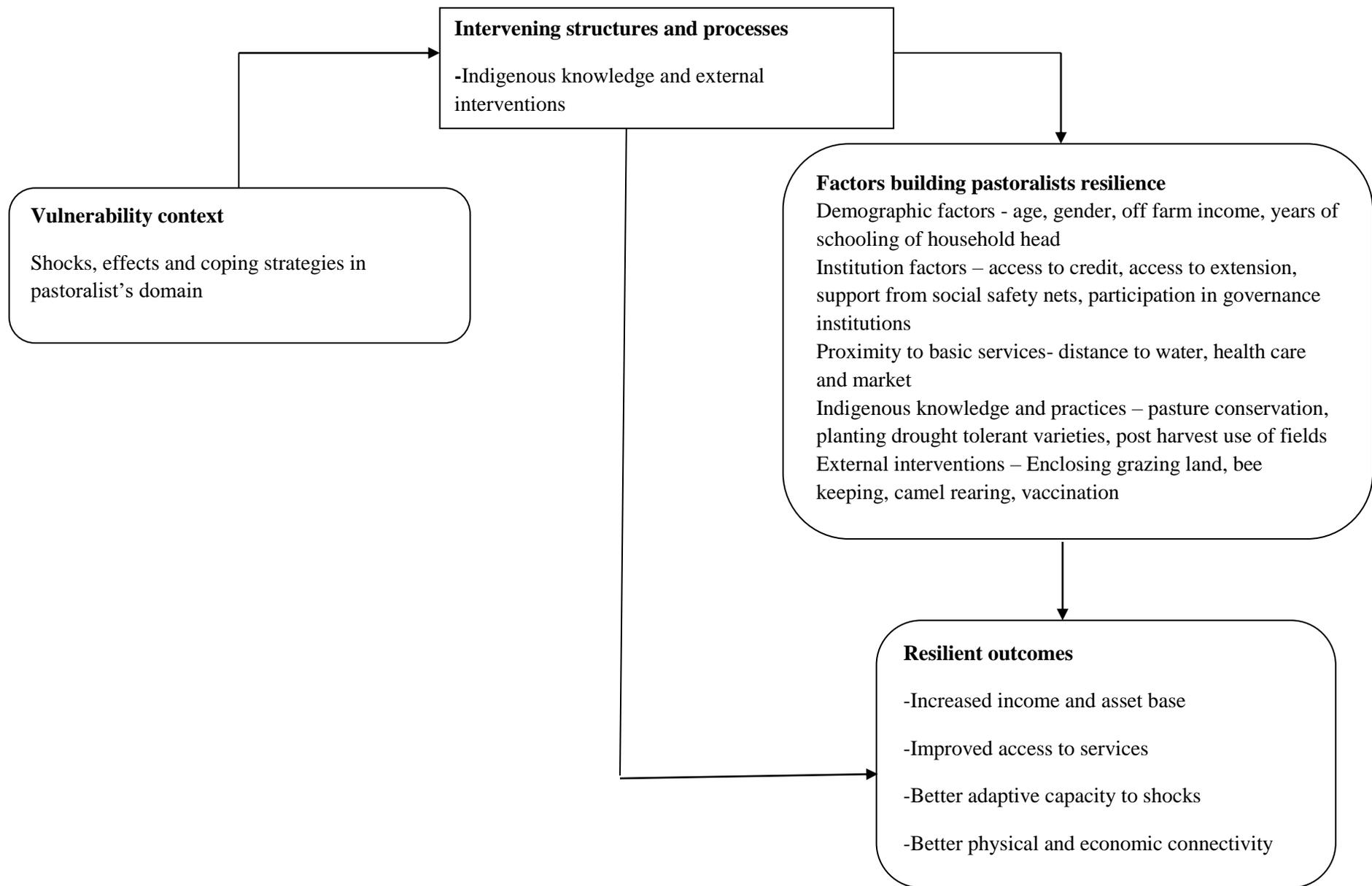
resilience scores, with the key variables being grain held in stock, in-kind precautionary savings, investment in child education and participation in mutual aid association. It was reported that Ethiopia's sustainable resilience to food insecurity was positively and significantly correlated with land under cultivation, ownership of oxen, milking cows and transport animals, use of improved technologies and membership in traditional saving groups.

The present study contributes to the literature by assessing how pastoralists' IK and the external intervention programmes contribute to their resilience.

## **2.5 Conceptual Framework**

As shown in Figure 3, this study is underpinned by the sustainable livelihood framework (DFID, 1999). Pastoralists' vulnerability is evidenced from the shocks they experience such as droughts and livestock diseases (FAO, 2012). These shocks result in losses in form of livestock death and quality deterioration. The structures and processes are embodied in the formal and informal institutions that enable or inhibit the resilience of individuals, households and communities.

Being custodians of indigenous knowledge, pastoralists manage to cope with these shocks in ways such as seasonal migration, herd splitting and livestock feed supplementation. However, external interventions are required to boost pastoralists' own coping mechanisms. These include investments by the county government and other NGO's towards the pastoralist sector in fodder production and conservation, improving breeding stock, promoting establishment of enclosures, camel rearing, bee keeping and growing fruits. This study considered the role of intervening structures and processes brought about by pastoralists own IK and external interventions in building pastoralists resilience.



**Figure 3: A Framework for Understanding Pastoralists' Resilience in West Pokot**

Source: Adapted from DFID Sustainable Livelihood Framework (1999) .

Pastoralists' adaptation through own IK and external interventions has the potential of transforming their production from subsistence to more market-oriented system, raise income and welfare (WISP, 2010). Pastoralists' own IK and external interventions brought about by the devolved county government together with other partners are the intervening structures. Resilience is measured by proxy variables such as income, assets and access to basic services, physical and economic connectivity and adaptive capacity (FAO – RIMA, 2016). These outcomes are used to compute the resilience index of each household.

After constructing the resilience index, the effects of demographic factors, institutional factors, household proximity to basic services, indigenous practices and the external intervention practices on the resilience index were estimated.

## **2.6 Theoretical Framework**

This study is based on the theory of induced innovation which was first hypothesized by Hicks (1932). He proposed that a change in prices of factors of production is sufficient to spur an innovation of any kind meant to economize the use of the factor that becomes expensive. More improvements and modifications have since been made to the theory. Hayami and Ruttan (1985) hypothesized that innovations and development of new technologies are spurred (induced) by a change in resource endowments so that the technology helps in substituting a relatively abundant factor of production for a relatively scarce one. The fundamental insight of this theory is that investment in innovation in agriculture is a function of change that enters into the farm's production function. Worthwhile to note, is that innovations in agriculture do not evolve with respect to climatic conditions alone; non-climatic factors, such as economic and political environment, have significant implications for innovation and adaptation to new agricultural practices.

On the agriculture-climate change nexus, Rodima-Taylor et al. (2012) noted that farmer innovations that are needed to respond to potential threats of climate are a function of change. Such changes include heat stress to both crops and livestock, which alter normal crops and livestock development. These changes therefore trigger institutional innovation to reinforce adaptation through research and development. Farmers will also seek new knowledge to overcome these new changes in their domains. Rodima-Taylor et al. (2012) noted that climate change motivates farmers to innovate and to eventually adapt to a new frontier.

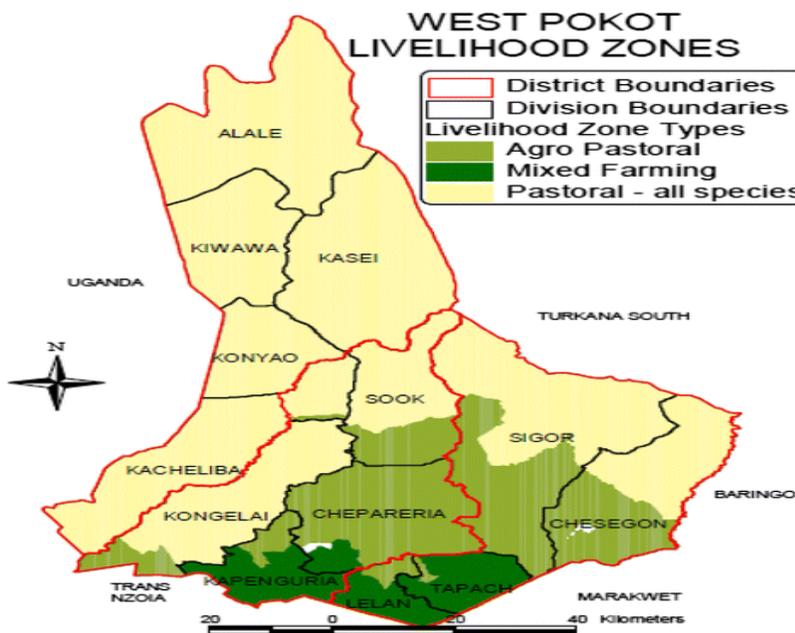
Carter (2009) criticized the theory of induced innovation by arguing that changes in resource prices alone are not sufficient to spur innovation. Factors such as risk and the inelastic nature of supply of agricultural factors of production hinder innovations meant to respond to resource scarcity and needs. Chhetri (2011) concurred that public action can indeed spur induced innovation through research funding and diffusion of agriculture technology. Following the induced innovation theory, the present study sought to assess if shocks in West Pokot county have motivated pastoralists to seek new coping strategies such as use of own IK and external interventions.

## **2.7 Study Area**

The study was conducted in Chepareria, Kongelai and Kacheliba livelihood zones in West Pokot County, Kenya. It covers an area of 9,169.4 km<sup>2</sup>. According to Kenya's 2009 census, the county has an estimated population of 512,690 persons. Rainfall varies from 400mm to 1,500mm per annum while temperatures range from 10 °C to 30 °C. Communities in West Pokot County practice agro-pastoralism, combining mixed farming with nomadic pastoralism. Over 90% of the population relies on pastoralism for food and income.

West Pokot residents have relatively high levels of under-development; the county indices on poverty, illiteracy and other welfare indicators are worse than the national's average and the recommended levels. For example, food poverty is nearly 70%, illiteracy is 60% and infant mortality is almost 13% against the national average of 50%, 40% and 5%, respectively. At least 60% of the population in West Pokot County can't meet their annual food requirements and thus efforts are needed to halt and reverse this trend (CIDP, 2013).

Chepareria has a semi-arid climate and thus supports agro-pastoralism, while Kongelai and Kacheliba have arid climate and thus the major livelihood activity is nomadic pastoralism (Figure 4). Livestock plays an important role in Pokot households. Over 90% of the population in West Pokot County depends on livestock directly and/or indirectly to meet their needs including provision of food and income needs, besides their cultural importance such as payment of bride price and gifts (CIDP, 2013).



**Figure 4: Illustration of the Study Sites**

Source: CIDP (2013).

## 2.8 Sampling and Data Collection

Data was collected on shocks, coping mechanisms, indigenous knowledge and external interventions using a combination of methods namely; a focus group discussion (FGD) key informant consultations and individual household survey on 191 households. The data collection was done from December 2016 to February 2017. Participants of the FGD were pastoralists with over 20 years experience who provided information on the changes and challenges the community has been undergoing. Youth pastoralists (7) and an officer from the county extension department were also included in the FGD. Semi-structured checklists and questionnaire were used to conduct the FGD, key informant interviews and individual household survey. Of the 22 participants in the FGD, 6 were women.

Household survey data was collected from 191 respondents. Two stage sampling procedure was employed. In the first stage, sampling was purposively done to capture the arid and semi-arid locations for a livelihood comparison between the two areas within West Pokot, Kenya. In the second stage, the villages and households within the locations were randomly selected. A total of 19 sublocations were studied across the locations. These were Asilong, Chepareria, Chepkopegh, Kacheliba, Kipkomo, Kitelakapel, Kolopot, Kongelai, Korrelach, Lateg, Nakuyen, Orolwo, Pertum, Riwo, SLA, Suam and Ywalateke. The sample size was calculated as follows:

$$n = \frac{p(1-p)Z^2}{E^2}$$

.....(1)

Where  $n$  is the sample size being determined,  $p$  is the proportion of the population in the determined study areas that would be available to participate in the interview,  $Z$  is the confidence interval and  $E$  is the margin of error.

Since  $p$  is unknown (especially in the study sites where most households' decision makers had moved with their livestock to other areas during the time of the study),  $p$  value is set at 0.50 as this would give an optimum sample size, with  $Z$  being 1.96 and  $E$  0.07 (Anderson et al., 2007).

This gives an optimum sample size of 196 as follows:

$$= \frac{0.5(1-0.5)1.96^2}{0.07^2} = 196$$

.....(2)

The sample size of 196 is closer to that used in related previous studies such as Selemani et al. (2012), Ghorbani et al. (2013), Ngigi et al. (2015) and Abate (2016).

Due to time and financial resource constraints, the survey fell short of 5 respondents and only 191 households were interviewed. Data on households' demographic characteristics, indigenous knowledge and practices and external interventionist practices were captured. The household survey was conducted through face-to-face interviews. This is a better method compared to telephone or email because it allows for clarification of matters by both the interviewer and the respondent and thus provides the chance to obtain more accurate data (Bateman et al., 2002). The interviews were conducted with the help of 3 well-trained enumerators and field guides who assisted with the translation of the local language. Household heads, their spouses or household

members over 18 years old who had lived in the household for at least 1 year and were familiar with the daily household activities were interviewed.

In the subsequent chapters (3, 4 and 5), the data is analyzed and presented in research paper format corresponding with the specific objectives of the study. Data was analysed using SPSS version 20, STATA version 14 and Microsoft Excel softwares.

## **CHAPTER THREE**

### **Characterization of Pastoralists' Livelihoods, Shocks and Coping Strategies**

#### **Abstract**

At least 1/3 of the earth's surface is under drylands. Over 80% of Kenya's land surface is categorized as Arid and Semi-Arid Lands, (ASALs), where the main economic activity is livestock keeping through pastoralism. In Kenya, pastoralism account for over 70% of total livestock production. However, the ASALs are very vulnerable to climate shocks especially droughts. Climate change is a major concern for the livestock subsector particularly from ASALs areas that are greatly impacted by climatic events. The objective of this paper was to characterize the pastoralists' livelihoods, the shocks experienced and the coping strategies employed to overcome the effects of these shocks. Data from FGD, Key Informant Interviews and 191 households was qualitatively analysed. The socio demographic characteristics showed that most households had low income levels and low indices of human capital development through formal education. Droughts, livestock diseases and market shocks were the main shocks affecting peoples' livelihoods. Though households utilize their savings and assets to cope with shocks, external interventions become necessary. This necessitate investment in human capital development through formal education, and creating an enabling environment for on and off farm investments that will raise household incomes as well as other interventions that will build a production system that is resilient to shocks.

Key words: Pastoralists livelihoods, Shocks, Coping strategies

### **3.1 Introduction**

Over 40% of the land surface on earth is categorized as drylands or ASAL's (Bastin et al., 2017). The main economic activity in SSA's rangelands is pastoralism, which supports over 25 million people to meet income and food needs (WISP, 2010). Pastoralists derive over 50% of their food and income needs from livestock. Pastoralism is characterized by extensive grazing and transhumant movement across the rangelands they occupy (IIR and CTA, 2013). Transhumant movement enables pastoralists to access grazing areas available during dry season, avoid areas infested by diseases and parasites and conflict-prone areas, access minerals and herbs that provide ethno-veterinary properties to livestock (Flintan, 2012; Little and McPeak, 2014). In Kenya, pastoralism is the main livelihood activity for over 80% of the ASAL's population. According to the West Pokot County development plan (CIDP, 2013), at least 90% of the population has strong cultural attachment to pastoralism as a way of life, besides enabling them to meet their food and income needs.

Many rangelands face challenges posed by a combination of environmental and socio-economic factors, such as population increase, climate change, landscape fragmentation, resource conflicts and urbanization (Cotula, 2007). These challenges have multiple consequences such as individualization and commercialization of land rights and the erosion of customary institutions of rangeland governance that was openly accessed for grazing. Climate change brings with it vagaries such as prolonged seasons of drought, erratic rains and increased prevalence of livestock diseases (Little and McPeak, 2014). These challenges and shocks undermine pastoralists' resilience and threaten the survival of pastoralism and thus measures required to build pastoralists' resilience need to be considered in policy making processes.

Several studies have documented pastoralists' exposure to shocks (Tesso et al., 2012; Opiyo et al., 2014 and Ngigi et al., 2015). The most common shocks that pastoralists are exposed to are droughts, livestock diseases and loss of grazing resources. Different shocks affect households differently and call for different coping mechanisms. There is little evidence in literature on the effects of and how households cope with each shock. This paper contributes to this body of knowledge by isolating effects of shocks and how households cope with each particular shock.

### **3.2 Objectives and Methodology**

The objective of this paper was to assess the demographic and socio economic characteristics of households, their exposure to shocks and their coping strategies in West Pokot County, Kenya. Data from the focus group discussion, Key informant interviews and individual household interviews was qualitatively analyzed. The focus group discussion and key informant interviews provided data on the historical trends on the transitions in the drylands, occurrence of shocks and how pastoralists cope with them. The findings are summarized in table 2 below.

**Table 2: A Historical perspective of pastoral livelihoods changes from 1980 to 2016**

	Livestock	Migration	Markets	Governance Institutions	Land use	Culture
Main changes from 1980 – 2016	<ul style="list-style-type: none"> <li>Adoption of improved breeds such as Sahiwal dual purpose cow, gala goats and doper sheep</li> <li>More prevalence of cattle diseases than before</li> <li>Rise in conflicts among pastoral communities</li> </ul>	<ul style="list-style-type: none"> <li>In Kapenguria, Sigor and Ortum, there has been an influx of people.</li> <li>Reduced transhumant movements</li> </ul>	<ul style="list-style-type: none"> <li>Expansion of the Chepareria Livestock market.</li> <li>New buyers from distant markets e.g. Nairobi</li> <li>New markets for maize, onions and fruits</li> </ul>	<ul style="list-style-type: none"> <li>Increased number of both government and non government organizations – FAO, Peace and Conflict Resolution organizations and Community-based Organizations</li> <li>Devolved governance</li> <li>Increased number of community based organizations supporting women</li> </ul>	<ul style="list-style-type: none"> <li>Increased number of settlers around Kapenguria, Ortum and Sigor necessitates the construction of rental houses</li> <li>Crop production at Weiwei and Kongelai.</li> </ul>	<ul style="list-style-type: none"> <li>Gradual shift from nomadic to agro-pastoralism</li> <li>Reduction of female genital mutilation (FGM) practice</li> </ul>
Key drivers of change	<ul style="list-style-type: none"> <li>Increased demand for milk necessitates improved breeds.</li> <li>Poor maintenance of existing cattle dips</li> <li>Increased incidences of drought reducing pasture availability</li> </ul>	<ul style="list-style-type: none"> <li>New businesses opening up such as banks.</li> <li>Boundary demarcation and settlement of people in communally accessed pasture grounds</li> </ul>	<ul style="list-style-type: none"> <li>Increased number of livestock buyers</li> <li>Advocacy/promotion of fruit production by FAO, VI-Agro forestry and West Pokot County government</li> </ul>	<ul style="list-style-type: none"> <li>New Country constitution that gave rise to devolved governance –</li> <li>Ease of service provision such as extension in community groups</li> </ul>	<ul style="list-style-type: none"> <li>Population increase across business centres</li> <li>Investment in irrigation by the national government, National Cereals &amp; Produce Board and Kerio Valley Development Authority</li> </ul>	<ul style="list-style-type: none"> <li>Migration and settlement in former transhumant paths</li> <li>Free Primary Education</li> <li>Enforcement of anti FGM legislation</li> </ul>

Source: Survey Data (2017)

As shown in table 2, the major change in livelihood activities in West Pokot is a transition from pure nomadic to a less transhumant pastoral system. Recent studies in West Pokot ( Nyberg et al. 2015; Verdoot et al. 2010) made similar observations. However, this transition is more prevalent in highland regions of West Pokot; Kapenguria, Lelan, Chepareria and Sigor as opposed to the extremely dry areas of Alale and Masol. A change in herd composition too has been noted over the years where the pastoralists incorporate improved Sahiwal cattle, Gala goats and Dopper sheep in their herds. These breeds offer double advantage; they are well adapted to the harsh ecological zone of West Pokot and yield better than the traditional Zebu cattle and local goats and sheep (WISP, 2010). However, incidences of livestock diseases have been on the increase. This is largely attributed to climate variability as some diseases are more prevalent during extremely dry periods and others during heavy rains. Similarly, the IPCC (2014) noted that as a result of global climate change, plant and animal diseases are expected to prevail more than it was before.

As expected from the induced innovation theory (Hayami and Ruttan, 1971), expansion of business centres in West Pokot has created demand for residential units since rental returns are higher than farm proceeds. Elsewhere in Weiwei, farmers under the Lord Aggrey irrigation scheme benefit from being Kenya Seed Company's maize seed out-growers. Farmers in Sigor and Lomut are also benefiting from a project by the Food and Agriculture Organization of the United Nations (FAO) that is promoting pawpaw, mangoes and water melon fruits production by offering seeds and extension services at a low cost.

A major culture change observed in the area is the reduction of incidences of female genital mutilation (FGM). This is due to the enforcement of anti-FGM regulations, and awareness campaigns to stop the practice. The compulsory free primary education program has also played

a role in stopping FGM and promoting a more sedentary lifestyle as children have to attend school. Other drivers of change are the devolved county government that has brought services closer to the people and emerging markets for livestock and its products.

### 3.3 Characterization of households by demographic and socio-economic attributes

As shown in Table 2, most (82%) of the respondents were male. This is because in many pastoral communities, men make important household decisions on production and marketing (Markakis, 2004). Also, according to the Pokot culture, women are more reserved and skeptical to talk to strangers especially on livestock matters.

**Table 3: Sample Respondents' Characteristics**

<i>Variable</i>	<i>Data category</i>			<i>t-statistic</i>
	<i>Arid area n= 104</i>	<i>Semi-arid area n= 87</i>	<i>Pooled sample n=191</i>	
Average age (years)	45.7	47.0	46.2 (10.88)	0.8170
Gender of respondents (Percentage male respondents)	80	83	82	0.3953
Average number of years of completed formal education	3.9	6.4	5.0 (4.3)	3.9654**
Number of household members (average)			5.1(4.3)	
Average dependency ratio	0.60	0.55	0.58 (0.008)	2.6698**
Average household total annual income (Kshs)	119014.0	167034.0	139143.9 (136205.00)	2.4435**
Average per capita annual income (Kshs)	16109.0	23093.0	19290.4 (17033.23)	2.8757**
Average years of practicing pastoralism	15.7	11.7	13.9(9.48)	
Average land size (acres)	3.4	4.3	3.8 (3.76)	1.6201
Possession of title deed	10.0	63.0	35.0	9.0840**
Average Tropical Livestock units (TLUs)	15.8	8.5	12.5 (10.43)	5.1870**
Planned transhumant migration (% yes)	82.0	10.0	71.0	13.9049**
Households accessing communally owned pasture grounds (% yes)	89.0	9.0	52.0	19.0870**
Average transhumance distance ( kilometers)	29.1	5.5	18.4 (15.4)	16.1578**

Notes:\*\* and \* represent significant difference between the arid and semi arid areas at 5% and 10%, respectively.

Following WISP (2010), the TLU equivalents for various livestock were considered as: cattle = 1, camels = 1, donkeys = 0.8, goats and sheep = 0.2 and poultry = 0.04.

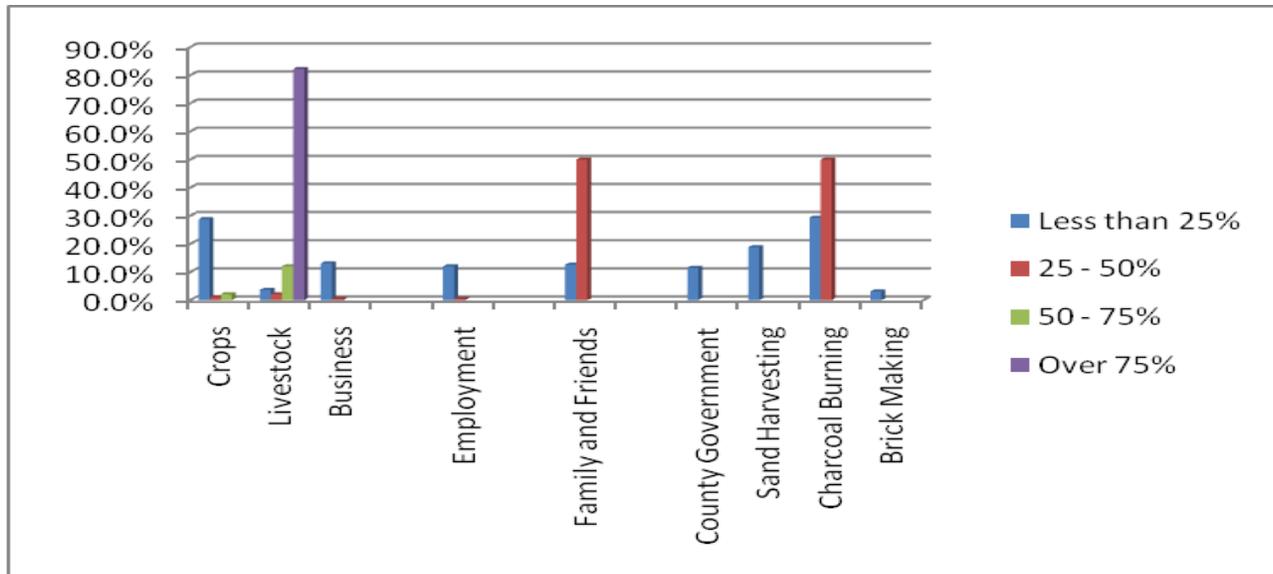
1 USD\$ was equivalent to Kenya Shillings (Kshs) 100 at the time of the study.

Source: Survey Data (2017).

The average experience of households in pastoralism was 13 years. From a mean age of 43 years, this implies that most households began practicing pastoralism at least when they were adults. This is consistent with the definition of pastoralism as a way of life for the people (WISP, 2010). The mean tropical livestock unit (TLU) in this study was about 12 units. However, respondents in the more arid region had a higher average of over 15 TLUs compared to those in the semi-arid region who have an average of 8 TLUs. This difference can be attributed to the livelihood diversity of the agro-pastoralists in the semi-arid region whereby besides livestock, their land can be used for growing crops and thus the need to reduce herd sizes (Geutjes and Knutsson, 2014). On the other hand, pastoralists in the arid areas make good use of extensive grazing on their land, which cannot support other agricultural activities and keep huge herds to cushion themselves against shocks such as droughts and diseases (Dinuucci and Fre, 2003).

The average number of years of schooling was 5 years implying that most of the household heads did not complete primary school education which takes 8 years. This is consistent with the observation by the Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID), that over 50% of residents in West Pokot County had no formal education (KNBS and SID, 2013). This implies that pastoral households are less endowed with formally trained human capital, and this may have negative implications on livestock production and marketing; use of rudimentary skills may lead to sub-optimal returns. The dependency ratio measures the ratio of economically active people to the total household population. The dependency ratio in the sampled population was 0.58. This can be attributed to the overall population structure of the county whereby over 50% of the population is between 0 - 14 years (KNBS and SID, 2013) and thus not economically active.

Figure 5 below shows the various livelihood activities that the pastoralist households in West Pokot engage in.



**Figure 5: Respondents' Livelihood Activities**

Source: Survey Data (2017).

Over 80% of the respondents derive more than three quarters of their food and income from livestock. This finding concurs with those by other authors who noted that pastoralists derive most of their food and income needs from livestock (Alinovi et al., 2010; Opiyo et.al, 2014; Little and McPeak, 2014). Over 79% of the respondents acknowledged that besides food and sale, livestock especially cattle play an important cultural role. This is evidenced from over 50% of the respondents who acquired their initial stock as payment of bride price, ceremonial gifts and inheritance from parents. In the semi-arid areas, agro-pastoralism is practiced with over 80% of the respondents growing maize, 58% growing beans, 42% growing sorghum and 14.7% growing mangoes, in addition to livestock keeping. Other sources of income included burning and selling charcoal, remittances received from the county government for the elderly and remittances received from family members working off farm.

The household average annual per capita income is slightly over Kshs 19,000. On average this translates to Kshs 53 per day which is approximately half a dollar. This implies that most

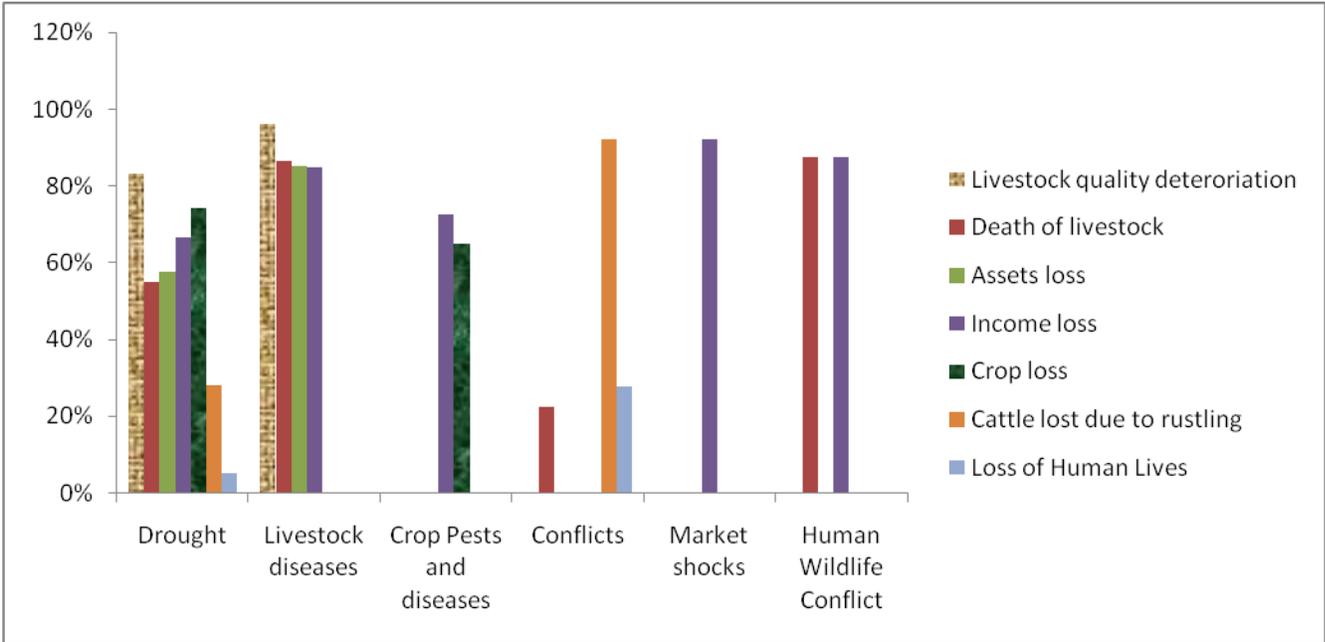
pastoralist households live below the poverty threshold defined by the World Bank (2015) of USD 1.90 per day. This is consistent with the county development plan that over 70% of the population is poor and cannot meet their basic food and income needs. This implies negatively on other development indicators. For instance, infant mortality is about 13% and literacy level slightly above 50% against the nation's average of 5% and 60%, respectively (CIDP, 2013). This necessitates the urgency for external interventions to reverse this trend.

Land in the arid areas is mostly communally owned with only about 10% of the respondents having private ownership compared to over 60% of respondents in the semi-arid area who even have title deeds as proof of land ownership. Over 80% of the respondents from arid areas had access to communally shared pasture grounds compared to less than 10% from the semi-arid lands. This shows that pastoralism in the semi-arid area is more sedentary than in the arid areas. These findings concur with Geutjes and Knutsson, (2014) who attribute this sedentarization to private land ownership in the semi-arid region. The average transhumant distance is 37 kilometers. Respondents from the arid region moved the most with an average of about 60 kilometers compared to about 10 kilometers by those in the semi-arid areas. Turner et al. (2014) noted that pastoralists can move up to an average of 50 kilometres in transhumance. This enables them to explore new water and pasture grounds.

### **3.2 Pastoralists' Exposure to Shocks and Coping Strategies**

Shocks undermine pastoralists' livelihood resilience. Almost all respondents were affected by drought-related shocks and 96% were affected by livestock diseases, with the most common diseases being Newcastle Disease in poultry and Foot and Mouth Disease (FMD) in cattle. Nearly 60% were affected by market shocks and 42% were affected by crop pests and diseases. Most crop losses were incurred post-harvest due to weevil attack on stored maize and crop

failure due to erratic rains. About one third of respondents were affected by conflicts with the neighboring communities over water and pasture. In the arid regions, over 20% of the respondents' livestock were attacked by wild animals, while 8% of the respondents experienced death of a household member. Some shocks occur concurrently. Some 87% of the households noted that most livestock diseases occur during dry seasons and 2% reported that their livestock got diseases during outward migrations. About 11% indicated that intercommunity conflicts over water and pastures heightened during dry seasons. These conflicts result in cattle rustling and loss of human lives. Opiyo et al. (2014) similarly noted that resource conflicts are high in dry seasons among the Turkana pastoralists in Kenya and these conflicts have multiple negative effects on households as shown in Figure 6.



**Figure 6: Effects of Shocks on Households**

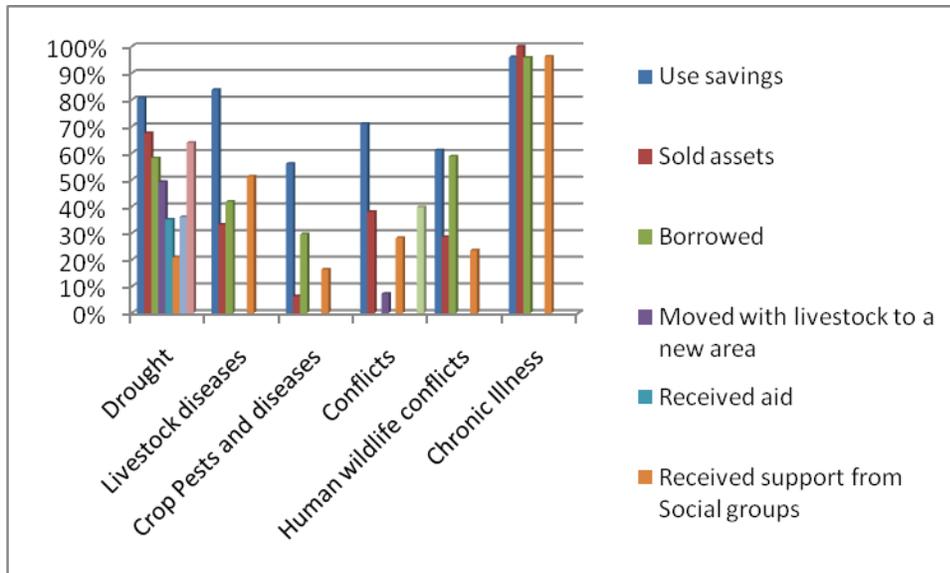
Source: Survey Data (2017).

Drought brings about many negative effects. Due to the unavailability of pasture and water, livestock become emaciated and the quality of their products deteriorates (FAO, 2102). In

extreme cases, the livestock die. Livestock are important assets to pastoralists' households and quality deterioration or worse still, death becomes a huge blow to livelihoods of the affected households. Erratic rains and droughts are the major causes of crop failure to agro-pastoralists.

Market shocks experienced were mainly attributed to price and output fluctuations. It was noted that during seasons of surplus, prices of commodities such as milk, maize and mangoes fell and due to the perishable nature of these commodities, the households had no option except selling at very low prices. Cattle traders also complained of middlemen offering very low prices for their livestock. Similar observations have been noted in other pastoral communities (IIR and CTA, 2013). Most households in the arid areas complained of frequent attacks of their livestock by wild dogs and hyenas on their livestock during transhumance.

Households cope with the shocks through different strategies (*Figure 7*).



**Figure 7: Coping Mechanisms for Shocks**

Source: Survey Data (2017).

For most shocks, households utilize their savings and assets to smoothen their consumption patterns. However, if by doing so, the household depletes or has its assets drop below a minimum threshold, the household falls into a deprivation trap and may need external interventions to disentangle itself off the trap (Carter, et al., 2005). Less endowed households resort to borrowing and even sending part of their family members to stay with other relatives and friends during drought when the family cannot meet its food needs. Further, planned transhumant migration helps pastoralists to get water and pasture that enables their livestock to survive during drought (WISP, 2010). Due to food scarcity, some households resort to use of edible wild fruit and tree leaves to meet their food needs. Humanitarian assistance in form of food aid becomes important to these households during such times. Support from social groups is also important as it helps households to cope when a family member is chronically ill and when one's livestock are affected by diseases. This support comes in form of food, cash, labor, livestock treatment and even helping a household to restock in the event of loss of the entire herd.

Most households accessing shared water and pasture grounds had agreed to a conflict resolution mechanism that helped in mitigating cattle rustling. Respondents from the arid region who shared pasture grounds with the Karamoja of Uganda had an accord that for each livestock stolen, the culprit had to return it and pay a hefty fine of four more. This had contributed to a reduction of incidences of conflicts between the two pastoralist communities, albeit at a small scale but could be enhanced for greater conflict resolution.

### **3.4 Conclusion and Implications**

This paper assessed the demographic and socio-economic characteristics, exposure to shocks and coping strategies of pastoralists in West Pokot County. The results revealed low indices of

human development manifested by limited formal schooling and low per capita income. The main shocks noted were droughts, livestock diseases and market shocks. It was noted that although households utilise their savings and assets to cope with shocks, external interventions are still necessary, especially for less-endowed households.

These findings call for investment in human capital development through formal education. Such investments should consider the nature of pastoralists' mobility especially in the arid areas. For example, establishment of boarding primary schools and school feeding programme can provide an incentive for pastoralists to take more of their children to school than sending them to other family members in the event of food scarcity.

There is also the need for both on- and off-farm investment incentives that will help raise households' per capita income. This can be implemented through infrastructure development that will open up pastoral areas to markets and investment in value addition of livestock products. Such infrastructure include transport and communication that will help link pastoralists to markets.

To be able to gain from market participation, pastoralists need to enhance the quality and quantity of the livestock produced. Measures such as fodder conservation to smoothen grazing in times of drought, vaccination to prevent diseases and incorporation of breeds that can survive the harsh environment but still yield more output can help to improve the quality and quantity of livestock produced. External interventions to encourage pastoralists' own investment in these measures can help to build resilience to shocks.

## CHAPTER FOUR

### 4.0 Pastoralists' Indigenous Knowledge and Uptake of External Interventions and their Role in Helping Households Manage Shocks

#### Abstract

Pastoralists are stewards of and users of indigenous knowledge and practices, through which they are able to make a living in the harsh arid and semi-arid lands (ASALs). However, recurrent shocks occasioned by unpredictable vagaries of nature undermine pastoralists' efforts towards sustainable survival. In recent decades, researchers and development practitioners have explored strategies to manage shocks in the ASALs especially through introduction of modern scientific approaches and interventions; for instance promotion of exotic livestock breeds, but these interventions have not yielded desired results. Recognizing the need for context-specific locally-acceptable and adaptable solutions to pastoralists' challenges, the study sought to understand the indigenous knowledge and practices and the various external interventions and how they both help pastoralists cope with shocks in West Pokot County, Kenya. Data was collected from key informants' interviews, focus group discussion (FGD) and individual surveys of 191 households. Results demonstrate the value attached to traditional customs, local animal breeds, guided migratory patterns and sustainable human-environment interactions in adapting to the harsh environment shocks such as droughts and livestock diseases. External interventions that promote fruit growing, bee keeping, camel rearing, livestock vaccination, enclosures and fodder growing help in diversifying livelihoods, availing livestock feed even during droughts and preventing livestock diseases. These together with local practices enable households cope with shocks better. We recommend documentation of indigenous knowledge and practices, and their integration in long-term programs and plans aimed at building resilience in pastoralist systems.

**Key words:** Pastoralists, Indigenous Knowledge, Local Practices

#### **4.1 Introduction**

The uniqueness of pastoralists' social, cultural and economic conditions from other sections of the national community qualifies them to be identified as Indigenous People (Emery, 2000). As a result of managing rangelands for livestock production, pastoralists have acquired vital knowledge, which enables them to manage resources within the rangelands and earn a living (Mapinduzi et al., 2003). This knowledge is herein referred to as Indigenous Knowledge (IK), which is the insight possessed by indigenous people that enables them to make a living in a given environment (Woytek, 1998; Dinucci and Fre, 2003). This knowledge is well adapted to the requirements of local people and conditions and is unique to a particular culture and society. It regulates customs and traditions, and is useful for local decision making in agriculture, resource management and other activities. Contrary to the conventional perception of many practitioners that IK is old fashioned and archaic, it is creative and incorporates external influence and inside innovations and thus is always dynamic.

The IK is different from formal knowledge generated by research institutions or private firms. Formal knowledge is written and easily shared across people, cultures and generations, while IK is tacit and engrafted in practices and experiences (Emery, 2000). It is worthwhile to note that IK is more experiential than theoretical and is learnt through repetition. Moreover, IK is exchanged orally by demonstration through apprentices, parents to children or neighbor to neighbor. This is only possible where both the provider of IK and the recipient speak similar language and share cultural practices than across cultures.

Over the last few decades, there has been considerable erosion of IK and practices among many indigenous communities (Oba, 2009). Due to the erroneous perception that IK is old fashioned and archaic, it has been disregarded by many practitioners. However, recent studies (Oba, 2009; Selemani et al., 2013; Abate, 2016) have shown that IK in most communities is innovative and

actually help in reducing and mitigating risks. There is therefore a need to preserve IK, its valuable skills and problem-solving strategies along modern technologies. This requires a clear understanding of the critical role that IK plays in the overall process of sustainable development (Gorjestani, 2004).

Recent occurrences of droughts and other related shocks such as livestock diseases and inter-community conflicts, however, undermine pastoralists' resilience to food security. Previous studies highlight the need for integrating IK with scientific knowledge in the development of a common understanding of pastoralists' livelihoods (Angassa and Oba, 2007; Abate, 2016). Mutual understanding between local communities and external practitioners will go along way in identifying best development solutions and innovations to address challenges such as food insecurity.

Because of heavy reliance on livestock to meet food and income needs, shocks such as drought and livestock diseases increase pastoralists' vulnerability (Opiyo et al., 2014; Ngigi et al., 2015). Most previous studies have focused on assessing the role of IK in pastoralists' rangeland management (Mapinduzi et al., 2003; Oba, 2009; Oba, 2012; Selemani et al., 2012, Abate, 2016). Elsewhere, Dinnucci and Fre (2003) studied the role of IK in livestock management among pastoralists in Eritrea. There is a striking knowledge gap regarding the role of IK and various external interventions by the county government together with other development partners in helping pastoralists cope with shocks. The present study bridges this gap in knowledge by documenting the IK and the external interventions and how they help pastoralists manage shocks among the pastoralist community of West Pokot County, Kenya.

#### **4.2 Objective and Methodology**

The objective of this paper was to find out the local indigenous knowledge and practices and the external interventions and the extent to which households apply them to manage effects of shocks. From the review of literature, key informant interviews, focus group discussions and household surveys, indigenous practices were identified. Individual household data was analyzed on their local practices and uptake of external interventions. Data was analyzed qualitatively. The findings are summarized in tables 4 and 5 below.

#### **4.3 Indigenous knowledge and practices among the pastoralists' community**

Table 4 below shows the different indigenous practices used by pastoralist households in both arid and semi-arid locations to cope with the shocks in West Pokot.

**Table 4: Indigenous Knowledge and Practices**

<i>Indigenous Knowledge and Practices</i>	<i>Proportion of respondents applying the strategy (%)</i>			
	<i>Arid area (N=104)</i>	<i>Semi-arid area (N=87)</i>	<i>Pooled sample (N=191)</i>	<i>Proprtion test statistic</i>
Planned transhumant migration	82.0	10.0	49.2	13.90**
Herd splitting	75.0	22.0	50.8	8.58**
Increasing herd size during rainy seasons	68.0	51.0	60.2	2.5162*
Altering composition of grazers and browsers in the herd	100.0	82.0	91.6	4.82**
Stocking female-dominated herds	99.0	93.0	96.3	2.19**
Grazing at night	90.0	20.0	58.1	14.06**
Grazing in groups/merging of herds	92.0	21.0	59.7	14.56**
Traditional pasture conservation	23.0	66.0	42.4	6.50**
Use of browse trees	100.0	83.0	92.1	4.63**
Use of wild herbs to treat livestock diseases	94.0	83.0	89.5	2.34*
Use of wild fruits as food	79.0	46.0	63.9	4.98**
Traditional bee keeping	34.0	10.0	22.5	4.19**
Post-harvest use of fields for grazing	86.0	96.0	90.6	2.61*
Planting drought-tolerant crop varieties	49.0	50.0	49.7	0.21
Use of naturally-occurring salt	93.0	68.0	81.7	4.77**
Rotational grazing	84.0	71.0	78.0	2.07*
Penalty imposed on violation of communal grazing land	88.0	18.0	56.0	13.22**
Naming of livestock	98.0	70.0	85.3	5.88**
Livestock identification by body nomenclature	94.0	64.0	80.6	5.58**
Branding of livestock	95.0	67.0	82.7	5.32**
Coincide calving to wet season	13.0	51.0	29.8	6.26**
Moving livestock to higher grounds during wet seasons	67.0	37.0	53.4	4.39**
Controlled burning of pasture to control pests and diseases	43.0	26.0	35.6	2.44**

Note: \*\* and \*significant difference between the arid and semi-arid areas at 5% and 10%, respectively.

Source: Survey Data (2017).

Planned transhumant migration enables pastoralists to adapt to changing vegetation patterns in their environment. Transhumance allows herders to access seasonally available resources such as wet season pastures or dry season forests and evade seasonal stresses such as parasites and disease outbreaks. Other studies such as Turner et al. (2014) have shown that planned transhumant migration enables pastoralists to escape shocks such as droughts. Herders take the livestock to the shared grazing area (*ka' tich*) before the onset of droughts and they return at the start of rains. Splitting part of the herd into smaller groups and moving some of them to new areas prevents overgrazing. Calves and lactating cows are left as the other part of the herd is moved. This reduces competition for limited pasture resources and thus ensuring the in-calf, calves and lactating cows, which cannot walk long distances thrive. A similar observation was noted in a study of pastoralists' indigeneous knowledge in Eritrea by Dinucci and Fre (2003).

Regarding the herd composition, increasing herd size in wet seasons helps to cushion against losses during dry periods. Altering herd composition between grazers and browsers also allows pastoralists to make use of varying quality and amount of vegetation available at different times (WISP, 2010). During wet seasons, grass is plenty and thus they usually stock more of grazers (cows and sheep). In the dry seasons however, grass is scarce and thus browsers like goats and camels thrive well on available trees and shrubs than the grazers. Female-dominated herds offset the long calving periods, a characteristic of the indigeneous cattle and thus ensure stable milk production. This is because milk is an important part of the pastoralists' dietary requirement (Little et al., 2010; Farmer and Mwika, 2012). During drought seasons, herders graze their cattle at night to escape the intense heat at day time. The herders graze their livestock in groups so as to provide security to each other in the event of attacks by cattle raiders or even wild animals. During the day, both the livestock and herders rest under sheds close to water points. This

limited movement during the day enables livestock to optimally utilize the little food available and thus survive in the wake of intense drought. Similarly, Butt (2010) noted that reduced livestock movement generally increases livestock productivity.

In seasons of surplus forage, pasture and crop residues, and stover are conserved for use during the lean period. Harvested maize, millet and sorghum residues and grass is cut, dried and stored on top of trees and will be released in small amounts for livestock use until the wet season. As shown in Table 3, pastoralists from semi-arid areas are more likely to conserve pastures since they have incorporated crop production and thus have more crop residues to store. Also they are more sedentary, with less transhumant movement (average return distance of 10 kilometres) compared to 50 kilometres for their counterparts in the arid areas.

Browse trees and shrubs that are locally adapted to harsh climate serve as both livestock and human food. This ensures livestock productivity including milk yield does not fall drastically during drought period and thus making households more food secure. The respondents mentioned that besides serving as livestock feed, these trees and other shrubs possess ethno-medicinal properties to both humans and livestock. Other indigenous trees such as the tamarind tree (locally known in the different villages as *orolwo/arol*, *oron/ara* and *k'nyotwo/k'nyat*) that thrive well produce edible fruits for human consumption. Tamarind and honey are used for traditional food preservation. Meat cuts are smoked then stored in a mixture of honey and tamarind juice. This reduces bacterial activity and the meat can last for as long as a year in good condition. This food is important especially in days of scarcity and for herders who are usually in transit for long periods. Small amounts of honey are also eaten directly as food as well as for other purposes such as making traditional beer (*mayek*) and for treatment of wounds.

Honey is produced in traditional log hives that are hung under shady trees especially along river banks and other quiet places. Bees have a preference for the traditional log hives made from indigenous trees (locally known as *mokong'wo* and *koral*). The logs from the trees are made hollow and the inside of the hollow log burnt. These indigenous trees produce an appealing smell when burnt that attracts bees to the hive. Due to increased demand for quality honey, households have become creative with the traditional log hive. The hive is partitioned into two compartments to separate the queen from worker bees thus keeping the honey clean as in the modern hives such as the Kenya Top Bar Hive, but the few respondents having them mentioned that the bees still prefer the traditional log hives over the modern types.

Agro-pastoralists make good use of their farms after harvesting crops. Livestock are allowed to graze and feed on the crop residues. At the same time, livestock drop dung as they graze, which is useful in enhancing soil fertility. Pastoralists who do not grow any crops make arrangements with those who do, sometimes as far as in the neighbouring Trans Nzoia county. The farmers allow the pastoralists to graze cattle on their farm in exchange for milk or a goat as a gift. In a few instances, conflicts arise between the farmers and the pastoralists. Some farmers argue that as the livestock graze on their fields, soils are compacted and thus become hard to cultivate. Others feel that livestock dung propagates weeds on their fields.

Relatively older key informants and participants in the FGD recalled that in the previous years, drought-tolerant crops such as sorghum, millet and cassava were mostly grown. The literature shows that such crops enhance household food security as well as ability to cope with the vagaries of weather (Mulwa et al., 2015). However, in the present study it was noted that with increased demand for maize and its products, many farmers in West Pokot have abandoned the traditional drought-tolerant crops for maize whose yields are generally low; an average of 4 bags

per acre in the arid areas and 8 bags in the semi-arid areas. Such low harvest compared to other counties that record an average of 15 bags per acre, cannot sustain an average household until the next harvest season and thus many households who plant maize still cannot meet their annual food requirements.

Natural salt sources (*ngeny*) are important especially to pastoralists in the arid areas. Livestock are taken at least once a week to *ngeny* whose rocks are rich in minerals. Some respondents mentioned that this salt reduces livestock diarrhoea, which is a symptom of many livestock diseases. However, most of them also reported that livestock pick up foot and mouth disease - FMD (*ngorion*), from this source and many have lost part of their herds in this process. Household who could not afford to buy livestock salt and relied on '*ngeny*' exclusively were the most affected.

The practice of rotational grazing allows grass and forage to rejuvenate. Transhumant movement is key to rotational grazing (Turner et al., 2014). More sedentary households divide their grazing land into enclosures in which animals are grazed in a rotational manner. Grass and other pasture species can be grown on these enclosures. This ensures there is enough livestock feed to last through subsequent seasons.

Across most pastoral communities, there are traditional laws that govern the access and use of communal grazing lands (*ka'tich*). As in the study area, Selemani et al. (2012) noted that in Tanzania, the communal grazing land is only accessed during dry seasons. Grazers and browsers are separated at the shared grounds due to different feed requirements. Theft is not allowed. Herders violating any of these rules are penalised. Anyone found guilty of stealing is required to return the stolen animal and a fine of four more animals is imposed.

Livestock identification practices play a crucial role at the *ka'tich* because all livestock from different herders graze together. Cattle are named according to their skin color and shape of their horns. For example a bull, red in color will be named *parer* and a female cow of the same color is named *cheparer*. Only promising female cows with good mothering ability, that is high milk productivity and adaptability to local conditions of less pasture, water and harsh terrain are named. Their subsequent progeny displaying similar traits will also be named. Bulls are also named later, usually a year after their birth. They are closely observed for desirable traits such as their weight, adaptability and their being stalwart to household members but aggressive to strangers. This is also true among Eritrean pastoralists (Dinucci and Fre, 2003). Named cattle become the nucleus of the herd. They are rarely sold or slaughtered as they are expected to pass these good traits to the next generation. This ensures high productivity and in turn household food security. All livestock are branded immediately after birth. The most common method of branding is by notching of the ears (*ighata yitin*). The design is unique to each family and clan and thus makes it easy to identify livestock especially when herded as a group. Herders try their best to prevent inbreeding between closely related livestock. They also calculate seasons and prefer livestock especially cattle to conceive at particular times so that calving down dates are during the rainy season when there is plenty of pasture. This will ensure both the cow and calf thrive.

Pastoralists possess and use a wide array of ethno-veterinary practices. They know herbs and trees that can be used to treat different livestock diseases. This also reduces milk quality deterioration and possible transmission of foodborne diseases such as brucellosis to humans. Besides this, preventive mechanisms are also put in place. Some households mentioned that the transhumance pattern is such that at the start of the rainy season, livestock are moved to higher

grounds with proper drainage and thus reducing incidence of diseases such as contagious caprine and bovine pleuropneumonia (*lokoi*). Livestock kraals are constructed in gently sloping areas to allow for proper drainage. Another practice mentioned is the controlled burning of grass pasture. This helps in reducing ticks prevalence because as the grass is burnt, the tick eggs and larva are destroyed. The fresh grass that emerges after the burn (*psikor*) is perceived to have more nutritional benefits to the livestock.

These practices have enabled pastoralists in West Pokot to continue thriving amidst shocks previously discussed. However, with changing climate and other factors, the intensity of shocks continue to magnify and thus necessitate external interventions to augment local knowledge. The county government of West Pokot together with other partners promote programmes that are aimed at building household resilience (CCDP, 2013). These include growing fruits in partnership with FAO and KVDA, bee keeping together with KVDA and Camels, Bees and Silk Organization, CABESI and camel rearing in partnership with Action Aid. Other interventions run by the county government are livestock vaccination campaigns and improving livestock breed. The VI agroforestry together with Triple L project have been training farmers on establishing enclosures on grazing land and planting fodder trees to help rehabilitate degraded landscape. These activities present opportunities for livelihood diversification, providing alternative income and thus build resilience. Table 5 below shows the percentage uptake of these interventionist programmes by pastoralists.

**Table 5: Pastoralists' Uptake of Interventionist Programmes**

<i>Intervention programme</i>	<i>Percentage Frequency</i>			<i>t-statistic</i>
	<i>Arid population N= 104</i>	<i>Semi arid population N= 87</i>	<i>Pooled population N=191</i>	
Vaccination campaigns	60.0	76.0	67.0	2.4017**
Establishing enclosures on land	30.0	92.0	58.0	11.0741**
Improving breeding herd	4.0	48.0	24.0	8.3137**
Camel rearing	10.0	0	5.0	3.0263**
Bee keeping	34.0	9.0	22.5	4.1915**
Growing fruits	14.0	24.0	19.0	1.7139*
Growing fodder	5.0	42.0	22.0	6.8771**

Note: \*\* and \*significant difference between the arid and semi-arid areas at 5% and 10%, respectively%.

Source: Survey Data (2017).

In order to prevent the spread of livestock diseases such as FMD and the resultant mass death, the county government periodically runs vaccination campaigns. This is important because livestock diseases and the subsequent losses incurred is the greatest shock affecting most households. At a subsidized cost of Ksh 10 (USD 0.1) per livestock head, pastoralists get their herds vaccinated. This reduces incidences of livestock diseases and the resultant losses in the event of death, saves on incidental veterinary drug purchases and ensure quality livestock is produced and marketed and thus build resilience (IIR and CTA, 2013).

More sedentary households divide their grazing land into enclosures in which animals are allowed to graze rotationally. Grass and other pasture species can be grown on these enclosures. This ensures there is enough livestock feed to last through all seasons. Nyberg et al. (2015) noted that enclosures in West Pokot county has helped in reclaiming degraded land. Since transhumant movement is reducing significantly in most pastoralist communities, enclosures provide an opportunity for intensifying livestock production on the available land. Butt (2010) noted that livestock that moved less distance utilized feed better as they needed less energy and thus gain

the needed marketable weight fast and even produce more milk. Proper intensification increases production and assures pastoralists of more food and revenues (IIR and CTA, 2013).

Another emerging trend among pastoralists in the highland region is stocking improved livestock breed. Little and McPeak (2014) noted that this is an emerging response to climate-related challenges. These breeds are more marketable as they take a shorter time to mature and their meat is more tender. Nearly 10% of the respondents stocked improved Sahiwal cattle breeds, 8% cross cattle breed, 15% Gala goat breed, 3% cross goat breed, 16% Dopper sheep breed, and 3% cross sheep breed. The main challenge noted with these breeds is that unlike the indigenous ones, they are more susceptible to diseases and cannot move long distances. As a result, very few respondents in the arid areas stocked them.

Incorporating camels is increasingly becoming important in many pastoralist communities. Kagunyu and Wanjohi (2015) noted that pastoralists in northern Kenya are increasing the number of camels in their herds because of their adaptability and few deaths during drought compared to cattle. Being browsers, camels are able to survive on shrubs in drought times when pastures dry up. Similarly, WISP (2010) noted that incorporating camels to herd helps pastoralists adapt themselves to climate-related shocks and thus aptly build their resilience. This is a viable intervention for the arid areas where land is largely communally-owned and thus there is plenty of space and browse plant species for the camels.

Bee keeping is another viable intervention in the arid areas. Over 90% of the respondents keeping bees were from the arid areas. The indigenous trees that produce nectar and used to produce log hives that bees prefer are found in the arid areas. In the past, bees were left in the wild and honey was collected only during hunger emergencies (WISP, 2010). However, with the

intervention of the county government, CABESI self-help group and the KVDA, it was noted that over 22% of respondents in were involved in bee keeping. CABESI self-help group helps in value addition and marketing of honey and thus the honey producers earn more revenues, building their resilience.

Afforestation and fruit growing contributes positively to resilience. The most common marketable fruit grown was mango. The arid and semi-arid climate makes mangoes thrive well and have a sweet taste. The fruits are consumed locally and some sold, thus enabling household earns extra revenue. The KVDA and FAO seedling stations propagate various tree species and sell them at a subsidized price of Kshs 100 (1 USD) per seedling to the pastoralists. This amount is quite expensive for most households who have an average daily income of about half a dollar. Apart from the fruit trees, the other trees have multiple uses. Fodder trees such as Lucerne and Caliandra complement livestock feed enhancing quality. Caliandra species has nitrogen fixing properties that improve soil fertility and enhance crop productivity. These measures possibly help to build resilience.

Fodder growing is an emerging enterprise in many pastoralist communities. This is because pasture is perceived to grow naturally in open access grazing grounds. However, constraints on communal land and increasing sedentarization reduce free movement of livestock and less natural pasture is available for livestock. This has made many pastoralists to consider growing fodder to ensure smooth availability of pasture. Fodder is mainly grown on land boundaries and land that is less likely to be used for production of other crops. The livestock research centre in Chepareria has grown different types of fodder grasses on demonstration fields and avails various pasture seeds to the pastoralists.

There is a significant difference between pastoralists in the arid and semi-arid areas in the uptake of enclosures, stocking improved breeds and growing fodder. This difference could be attributed to difference in land tenure regime. Farmers who practice them would want exclusive land rights in order to reap the benefits that accrue from them. Also, some initial investment costs such as purchasing tree seedlings as well as labor and management is required and thus tenure security is vital before applying the practices. The improved livestock breeds cannot do well in the arid areas since they cannot move long distances in search of water and pasture. This explains the low adoption of these practices in the arid areas where most land is still communally-owned with no exclusive ownership rights. Similarly, Geutjes and Knutsson (2014) noted that pastoralists in semi-arid areas were able to undertake various on-farm investments due to the private/individualized tenure which was perceived to be more secure.

#### **4.4 Conclusions and Policy Implications**

This study assessed pastoralists' IK and various external interventions and the role they play in helping pastoralists cope with shocks. Understanding IK is vital in reaching out to pastoralists because it is an important asset that they possess and use to make a living. Pastoralists' value their own IK and this forms an important pedestal for interventionists to learn and appreciate pastoralists own coping mechanisms and thus contribute to the body of knowledge.

Of importance is that these practices, *inter alia* have the potential of helping pastoralists cope with shocks such as drought, livestock diseases and intercommunity conflicts. The various external interventions help pastoralists diversify their on-farm livelihood activities, an important aspect of building resilience to shocks.

These findings form a basis for further research on how best these practices can be incorporated in development programmes. There is also the need for documentation of IK and practices and

how they can be applied in other areas. This will ensure that these valuable practices are handed over to future generations and thus reduce the threat of their extinction.

Planned transhumant migration enables pastoralists to escape shocks and thus reduces the effect of these shocks on food security. There is need for more inclusive rights on land to allow for this movement especially in the arid areas. Traditional institutions regarding access to and use of communally-owned land need to be strengthened through recognition of communal land rights bestowed on communities. This can provide an incentive for pastoralists to manage communal land better. There is also need to address the issue of intellectual property rights to communities who are stewards of IK.

## CHAPTER FIVE

### 5.0 Effects of Indigenous Knowledge, Practices and External Interventions on Household Resilience to Shocks

#### Abstract

Pastoralism is the main livelihood activity in the arid and semi arid areas. Most pastoralists' households are adversely affected by climate-change shocks such as droughts and livestock diseases. These shocks lead to deterioration of livestock quality and even mass death of herds. This leaves pastoralists households vulnerable as they derive most of their food and income needs from livestock, necessitating emergency disaster response and the need to build their long term adaptive capacity. In most cases however, investments only focus on reducing risks when disaster strike and not in building long term adaptation strategies. In order to build long term pastoralists adaptive capacity, there is need to understand local or indigenous practices and external interventions that work so that investments can be channeled towards them. This study analyzed factors that build household resilience among the pastoralists of West Pokot County in Kenya. The household resilience index was constructed using Principal Component Analysis, PCA. An ordered probit regression was used to analyze the effect of socio-demographic, institutional factors and adaptive practices on households' resilience. It was noted that years of schooling, household income, access to credit and extension and adaptive practices such as post harvest use of field crops for grazing, enclosures, stocking improved breeds, bee keeping, ethno-veterinary practices and afforestation have a positive and significant effect in building household resilience to shocks. There is therefore the need to direct investment to bolster pastoralists own efforts in this regard to realize the attainment of more resilient households.

Key words: Shocks, Vulnerability, Resilience, Pastoralists

#### 5.1 Introduction

Resilience was originally introduced by Holling (1973) as a concept to help understand the capacity of ecosystems with alternative attractors to persist in the original state subject to perturbations. Walker et al. (2004) define resilience as the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same

function, structure and feedbacks, and therefore identity, that is, the capacity to change in order to maintain the same identity. Further, Walker and Salt (2006) consider resilience to be the ability of a system to absorb disturbances and still retain its basic function and structure. They also noted that in as much as changes occur, they are easily ignored or resisted and this increases vulnerability and even foregoing emerging opportunities. As a result, options become limited. Thus, a resilient system has capability for self-organization and adaptability to changing conditions (Carpenter et al., 2001).

According to Chambers and Conway (1992), a sustainable livelihood is one which can cope and recover from shocks and stress while maintaining and enhancing its capabilities and assets and provide sustainable livelihood opportunities for the next generation. This is achieved by a household having enough buffers against contingencies such as drought, crop failure, famine or sickness and being able to adapt fast to new changes and shocks. Adaptability is the capacity of actors to influence resilience by learning, combining experiences and knowledge, adjust its responses to changing internal processes and continue developing with the current stability (Berkes et al., 2003; Walker et al., 2004). Building resilience is an important step in attaining sustainable development as it enables households thrive in the wake of shocks and even reduce expenditure in disaster risk reduction.

The challenges experienced in many ASALs reduce pastoralists' resilience. One major change is the loss of grazing land as a result of urbanization and population growth. This has resulted to land degradation due to overgrazing and heightened conflicts with other communities over access rights to the little remaining grazing parcels (Verdoodt et al., 2010; Little and McPeak, 2014). The already bleak situation is worsened by the negative effects of climate change- related shocks such as droughts. With little or no access to water and pasture, many pastoralists lose part

of their herds during drought periods (WISP, 2010; IIR and CTA, 2013). Loss of livestock, which is the main source of food and income plunges households down the vulnerability path and may take a long time to recover and ‘bounce back’ to normal *ex ante* condition.

Many studies have been done to ascertain pastoralists’ vulnerability and resilience to shocks (Tesso et al., 2012; Opiyo et al., 2014; Ngigi et al., 2015). Alinovi et al (2010) constructed resilience indices of different livelihood groups, among them pastoralists. In their analysis, pastoralists recorded the lowest index compared to entrepreneurs, agro-pastoralists, small and large scale farmers. Most of the studies that were reviewed documented pastoralists’ exposure to shocks and their response mechanisms without providing empirical evidence on resilience-building strategies and their outcomes on households. This study fills this knowledge gap by assessing the effects of pastoralists’ own IK and external interventions in building their resilience.

## **5.2 Objective and Methodology**

The objective of this paper was to analyze the effects of indigenous and local knowledge and practices and external interventions on household resilience to shocks. Primary household data from 191 households was qualitatively and quantitatively analyzed. The framework for quantitative analysis is discussed below.

## **5.3 Measurement of Household Resilience to Shocks**

Resilience concept is of interest to many agencies and organizations because it has been seen to provide a new perspective on how to effectively plan for and analyze the effects of shocks and stressors that threaten the well-being of vulnerable populations. As a result, many organizations have conceptualized resilience in different ways. These include;

### **5.3.1 DFID/TANGO Resilience Conceptual Framework**

This framework describes resilience in four elements, the context, disturbance, the capacity to deal with disturbance and reaction to disturbance (Constas et al., 2014). It seeks to answer the following questions; whose resilience, resilience to what and how the system responds to the disturbance. The DFID's framework approaches resilience primarily from a disaster risk reduction perspective.

### **5.3.2 Tufts Livelihoods Change Over Time (LCOT) Model**

This model is based on a livelihood cycle framework. It involves understanding the shocks common to a system or the targeted population and the effect of these shocks to the different stages of the livelihood cycle such as the effect of a shock on assets and production decisions (Constas et al., 2014).

The LCOT conceptual model captures static livelihood outcomes such as food security, health status, and education level, which are typically measured in a fairly linear manner, as well as more complex outcomes based on dynamic interactions between livelihood strategies, policies and programmes, and institutions, which can enhance or limit household responses. Such information is then used to identify who is most vulnerable to what types of shocks. Rather than collect the large amount of data required to directly measure various parts of the livelihoods cycle, a model is used to estimate relationships between initial asset levels, variables at different stages of the livelihood cycle, and outcome measures of household resilience.

### **5.3.3 OXFAM and ACCRA**

This approach focuses on the adaptive capacity that determines household and community resilience. This capacity is measured based on characteristics without the consideration of shock. Five dimensions are considered key to resilience; livelihood viability, innovation potential,

contingency resources and support access, integrity of natural and built environment, and social and institutional capability.

Though Oxfam views these five dimensions as critical to household resilience, the specific characteristics determining resilience and adaptation in a particular context vary widely. Defining a set of resilient characteristics has the advantage of being adapted to different geographical settings, cultures and environments. Identifying a set of characteristics as a proxy for resilience tends to be case-specific and cannot be easily generalized.

Another significant limitation to the characteristics-based approach is that it does not address whether the characteristics identified are actually relevant when different shocks occur. As Bene et al. (2012) explains, resilience is not a static state but rather a process, therefore its determinants keep on changing as the social, economic and environmental landscapes within which households and communities operate also change.

### **5.3.4 FAO Resilience Index Measurement and Analysis (RIMA) Conceptual Framework**

The FAO model builds on the other frameworks by explaining the interaction between shocks and their effects on households, with resilience accounting for the difference in outcomes between two similar households exposed to the same shock. Resilience is the outcome of the coping and long-term mitigating strategies adopted by the pastoralists. According to FAO (2016) this outcome being latent is measured in terms of income and food access, assets, access to basic services, agricultural production technology, social safety nets, economic activity and adaptive capacity. This can be expressed as (Equation 3):

$$R=f(IFA, ABS, AA, NAA, APT, SSN, AC EC) \dots\dots\dots(3)$$

where R = resilience; IFA = income and food access; ABS = access to basic services; AA = agricultural assets; NAA = non-agricultural assets; APT = agricultural practice and technology;

SSN = social safety nets; sensitivity; AC = adaptive capacity and EC = Economic Connectivity (FAO, 2016).

This study adopted the FAO approach and built on its flexibility to be adopted in different real life cases and in this study, pastoralist’s resilience to climate and other related shocks. The Principal Component Analysis (PCA) method was applied to generate resilience indices for each household. The PCA approach has been used by previous studies to generate the weights for the variables included in resilience index (Keil et al., 2008; Browne et al., 2015; Mulat and Negussie 2010). The chosen variables should be consistent with the assumptions of PCA that variables should have at least an interval level of measurement and should be linearly related to one another. The Bartlett’s test of sphericity and Kaiser-Meyer Olkin (KMO) measure of sampling adequacy were used to test variables’ suitability for PCA. The scores generated using PCA were used to determine the indicator weights for the variables. Once the indicator weights have been estimated and the index of resilience constructed, the index is applied to the individual households and a score for each household is calculated (Equation 4):

$$A_j = f_1 \times (a_{j1} - a_1) / (s_1) + \dots + f_N \times (a_{jN} - a_N) / (s_N) \dots \dots \dots (4).$$

where  $A_j$  is the resilience score for household  $j$ ,  $f_1$  is the component loading generated by PCA for the first variable,  $a_{j1}$  is the  $j$ th households value for the first variable, and  $a_1$  and  $s_1$  are the mean and standard deviation, respectively, of the first variable over all the households (Browne et al., 2014).

This can be summarized as;  $R = \sum_j w_j F_j \dots \dots \dots (5)$

where the resilience index is a weighted sum of the factors. Table 6 below shows the variables that were used in the PCA and their factor loadings.

**Table 6: Factor Loadings of Variables used in PCA**

<i>Variable</i>	<i>Factor score</i>
<b>Income</b>	
Log of total income (Farm and off farm income)	0.3767
<b>Food security</b>	
Number of months that the household was unable to meet food requirements	-0.3363
<b>Assets</b>	
Log of value of farm implements	0.3370
Log of value of tropical livestock units	0.2879
Log of value of land	0.3362
<b>Access to basic services – Health</b>	
Health expenditure	0.3084
<b>Agricultural Practice and Technology</b>	
Count number of sustainable practices- agro forestry, terracing, enclosures, drought tolerant crops, pasture conservation and use of organic manure	0.3213
<b>Adaptive Capacity</b>	
Dependency ratio	-0.2378
Proportion of losses incurred during shocks to total income	-0.3142
Increase savings to cushion against shocks	0.2863
Chi square = 1110.236, Degrees of Freedom= 45, <i>P- value</i> =0.000	
H <sub>0</sub> – Variables are not intercorrelated	
Kaiser-Meyer Olkin, KMO measure of sampling adequacy = 0.908	

Source: Survey Data (2017).

The Bartlett's score of Sphericity has a *p-value* of 0.000 which is highly significant at 5%. Thus, the null hypothesis is rejected since the variables are intercorrelated and this justifies the use of PCA. The KMO statistic is above the recommended minimum of 0.70 and thus unbiased inference can be drawn from the indices constructed using these variables.

The variable explaining the index the most is total income with a factor value of 0.3767. Income is an aspect of livelihood, showing a household's capacity to earn a living. It comprises income derived from selling livestock, other farm products and income from formal and informal employment. A diverse income stream cushions the household against drought-related shocks. It enhances other resilience indicators since cash income can be converted into assets. Income also enables households to access basic services such as healthcare and food, all which explain resilience (Ciani and Romano, 2013).

The FAO (2016) defines a status of food security to be existing when all people at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs. There are four important components of food security: availability, access, stability and utilization. Food availability is determined by food production and stock level. Access to food is determined by disposable income and food prices. Stability is determined by weather, political and economic conditions. Utilization is determined by dietary diversity, energy and nutrient intake. Failure to meet food and dietary requirements leads to a situation of food insecurity.

Food security in this study was explained by the number of months in a year that the household could not meet its' annual food requirement. Over 53% of the respondents could not meet their annual food requirements. Half of the respondents cited poor harvest and 45.7% attributed it to high food prices. The average number of meals per day was 1.5. About 74% of the respondents cope with food shortage by borrowing, about 60% by feeding on edible wild fruits and tree leaves and 20% received food aid from government and non government institutions. Other studies (Alinovi et al., 2010, Ciani and Romano, 2013) used number of meals and expenditure on food to explain food security. However, these indicators vary across households. For example, a household producing most of its food and livestock on the farm may have a lower expenditure

for food items but may not necessarily mean that it is not food secure. This study overcomes this obstacle by using the number of months in a year a household is unable to meet its food requirement over the last 12 months. As expected, more months of food insecurity makes a household less resilient and this explains the negative factor coefficient of -0.3363.

Assets are a key element of a livelihood. They give a household the opportunity to have something tradable; something to build an activity upon. By employing assets, households raise both their on- and off-farm incomes (FAO, 2016). This in turn, has a positive outcome on the households' resilience. Consistent with observation of other studies (for example, Alinovi et al., 2010; Ciani and Romano, 2013) the assets used in this analysis, value of farm implements, value of land and value of the TLUs have positive factor values on the resilience index (0.3370, 0.3362 and 0.2879, respectively). Unlike previous studies, this study incorporated TLUs because of the importance of livestock in pastoralists' households.

Alinovi et al. (2010) and Ciani and Romano (2013) used distance to the nearest healthcare, water source and school as indicators of access to basic services. Access to basic services such as health, schools, and extension offices increases access to vital information and awareness creation in case of need. Isolated households are more vulnerable to shocks and are less likely to be accessed in times of need and because of this; these variables are treated as explanatory determinants of resilience (see section 5.3) in this study. Health expenditure was used to compute factor variable for access to basic services. It had a positive factor value of 0.3084. More resilient households spend more on health because they can travel to better equipped hospitals.

Agricultural adaptation and production technology is crucial as it enables farmers counter the effects of shocks in a system (Antle, 2009). Proper practices such as afforestation, use of terraces

and livestock enclosures have positive influence on the household resilience. Alinovi et al. (2010) noted that more resilient households use more advanced agricultural technologies. In this analysis, the count number of sustainable agricultural practices of a household was used to compute the factor score of 0.3231. The individual practices are treated as explanatory variables of resilience.

Ciani and Romano (2013) and Alinovi et al. (2010) used household education, number of household members employed and other sources of income to explain adaptive capacity. Education level improves the decisions made both on- and off-farm. Similarly, with a good education, one can secure formal employment and thus earn off-farm income. Dependency ratio is the proportion of economically inactive to the total household population. They include children not yet in school, students, elderly and the sick. A household with a high dependency ratio has few economically active members who have to meet the needs of all the other people in the household. This reduces savings and puts great pressure on economic resources of the household (Ellis, 2000).

In this study, adaptive capacity was explained using dependency ratio, proportion of losses incurred during shocks and savings. As expected, higher dependency ratios imply negatively on the household resilience index and that explains the negative factor score of -0.2378.

As in Carter et al. (2005), a household that loses most of its assets during a shock becomes more vulnerable to subsequent shocks. This may lead the household to be entangled in a poverty trap, which requires lots of external interventions. This explains the negative factor value of -0.3142 for share of income and assets lost during shocks in this analysis. Savings was a dummy variable measured in terms of whether the household sets apart some income and assets to be

used in the event of shocks. This has a positive effect on the household resilience index (factor value of 0.2863).

Income and monetary value of assets was taken in the logarithm form in order to reduce the range of variables and thus reduce outliers (Wooldridge, 2002). Following FAO (2016), the resilience scores were re-scaled to range from 0 to 1. The average household resilience index for the entire sample was found to be 0.4095. On a scale of 0 to 1, this is below average. Other studies also found that pastoralists had the lowest resilience scores (Ciani and Romano, 2013; Alinovi et al., 2010) compared to other livelihood groups. This is attributed to the shocks that affect their main source of livelihood, livestock. These shocks in turn affect their assets and access to basic services thus lowering their resilience index. Figure 8 below shows the distribution of the resilience indices. Nearly half of the respondents in this study had an index ranging from 0 to 0.33, at least 30% an index between 0.34 and 0.66 and about 20% had an index between 0.67 and 0.99.

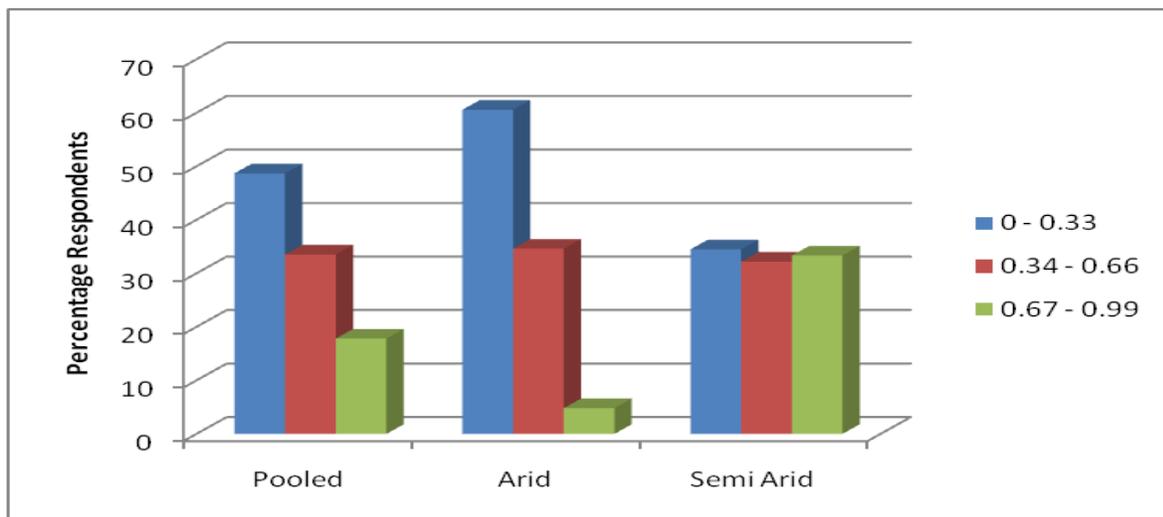


Figure 8: Household Resilience Categories

Source: Survey Data (2017).

There is a significant difference of resilience across respondents in the arid and semi-arid areas in West Pokot County. The average index of respondents in the semi-arid locations is 0.50 while that for those in arid locations is 0.33. Almost 60% of the respondents in the arid areas have an index ranging between 0 – 0.33. Geutjes and Wernerson (2014) noted that in the semi-arid locations there is livelihood diversification due to a more favorable climate, which in turn contributes to building resilience.

**5.4 Factors that Enhance Household Resilience to shocks**

After computing the resilience index, most studies describe the distribution of the index across the study population (Ciani and Romano, 2013; Alinovi et al., 2010). However, few studies have employed quantitative methods to measure the effects of various factors on resilience. After computing the vulnerability index among households in Turkana County Kenya, Opiyo et al. (2014) used an ordered probit with 3 vulnerability categories to estimate the probability of a household belonging to any of the three categories. Similarly, Tesso et al. (2012) used an ordered probit to measure the number of years a household took to return to its original state after a shock. This current study builds on this body of knowledge by employing an ordered probit model with 3 categories of resilience and includes demographic factors, pastoralists’ own indigenous knowledge and external interventions as the independent variables.

The ordered probit is derived from the latent variable model (Equation 6).

$$y^* = \beta_1 + \beta_2x_2 + \dots \beta_kx_k + \epsilon \dots\dots\dots(6)$$

Equation (6) can be reduced to equation (7) below:

$$= x_i\beta + \epsilon \dots\dots\dots(7)$$

Where  $\epsilon$  is an error term, which follows standard normal distribution, with a normalized variance equal to 1.

$$\epsilon \sim N(0,1)$$

.....(8)

The model does not contain a constant. The model defines  $J$  threshold parameters,  $\alpha$  whereby  $\alpha_1 < \alpha_2 < \dots < \alpha_j$

The latent variable  $y^*$  is not observable but we can observe the resilience categories according to the following:

$$y = 1 \text{ if } \alpha_1 < y^* \leq \alpha_2$$

$$y = 2 \text{ if } \alpha_2 < y^* \leq \alpha_3$$

(

$$y = J \text{ if } \alpha_j < y^*$$

.....(9)

In this study, the dependent variable  $y^*$  is the household resilience index. The probability of a household belonging in any of the three resilience categories given the independent variables can be specified as follows:

$$= \Pr(y = 1 \text{ given } x) = \Pr(x\beta + \epsilon \leq \alpha_1)$$

$$= \Pr(\epsilon \leq \alpha_1 - x\beta)$$

$$= \Phi(\alpha_1 - x\beta)$$

.....(10)

$$\Pr(y = 2 \text{ given } x) = \Pr(\alpha_1 < x\beta + \epsilon \leq \alpha_2)$$

$$\begin{aligned}
&= \Pr (\epsilon > \alpha_1 - x\beta, \epsilon \leq \alpha_2 - x\beta) \\
&= [1 - \Phi (\alpha_1 - x\beta)] - \Phi (x\beta - \alpha_2) \\
&= 1 - [1 - \Phi (x\beta - \alpha_1)] - \Phi (x\beta - \alpha_2) \\
&= \Phi (x\beta - \alpha_1) - \Phi (x\beta - \alpha_2)
\end{aligned}$$

$$\begin{aligned}
\Pr (y = 3 \text{ given } x) &= \Pr (x\beta + \epsilon \leq \alpha_2) \\
&= \Pr (\epsilon \leq \alpha_2 - x\beta) \\
&= 1 - \Phi (\alpha_2 - x\beta) \dots \dots \dots (11)
\end{aligned}$$

The sum of the three probabilities is equal to 1. Table 7 below shows the results of the ordered probit model

**Table 7: Ordered Probit Results on Determinants of Household Resilience**

Variable	Coefficient	Marginal Effects		
		Prob (Y=1)	Prob (Y=2)	Prob (Y=3)
Age	0.027 (0.127)	-0.001	-0.001	0.003
Gender (1= Male headed household)	-1.467** (0.681)	0.079**	0.064	-0.144**
Years of schooling of the household head	0.154**(0.067)	-0.008**	-0.006**	0.015**
Title ownership of land owned	0.783 (0.630)	-0.043	-0.034	0.077
Proportion of off -farm income of total income	3.585**(1.298)	-0.195**	-0.157*	0.352**
Distance to water source	-0.005 (0.213)	0.0002	0.0002	-0.0005
Distance to the market	0.076 (0.066)	-0.0041	-0.0033	0.0074
Distance to the health centre	0.033 (0.032)	-0.0018	-0.0014	0.0032
Access to extension advice	3.512** (0.873)	-0.191**	-0.154*	0.345**
Access to credit	0.365**(0.160)	-0.019**	-0.016**	0.036**
Access to social safety support	-1.049*(0.584)	0.057	0.046	-0.103*
Participation in governance institutions	0.680 (0.582)	-0.037	-0.029	0.067
Livestock vaccination	0.780 (0.772)	-0.042	-0.034	0.077
Pasture conservation	0.313 (0.468)	-0.017	-0.013	0.031
Planting drought tolerant crop varieties	1.262 (0.155)	-0.069	-0.055	0.124
Post-harvest use of crop fields	2.531**(0.858)	-0.138**	-0.111	0.249
Ethno-veterinary treatment of livestock	1.404**(0.535)	-0.076**	-0.062**	0.138**
Enclosing grazing land	3.162**(0.838)	-0.172**	-0.138**	0.311**
Agro forestry	0.659*(0.385)	-0.036*	-0.029	0.065*
Stocking improved livestock breeds	1.754**(0.505)	-0.095**	-0.077**	0.172**
Incorporating camels in the herd	0.522 (0.587)	-0.028	-0.22	0.051
Bee Keeping	0.762*(0.438)	-0.415*	-0.033	0.075

Notes:  
 $\alpha_1 = 14.298(2.398)$ ;  $\alpha_2 = 20.498 (2.947)$ ; Wald Chi-Square (22) = 79.55  
Log Pseudo-likelihood = -30.538; Pseudo  $R^2 = 0.7256$ . Robust standard errors are in brackets.  
\*\* p-value significant at 5%, \* p-value significant at 10%.  
Marginal effects were calculated as a discrete change from 0 to 1 for dummy variables and at means for continuous variables

Source: Survey Data (2017).

#### 5.4.1 Household Demographic Characteristics

The demographic characteristics included in this study are age, gender, years of schooling of the household head and proportion of off farm income to total income, a proxy variable to off-farm diversification. It was noted that households headed by older members were more resilient than those headed by younger counterparts. This could be attributed to the vast production experience they have accumulated over the years. Similarly, Mulwa et al. (2015) noted that in Malawi, older

farmers adapted better to climate risks due to the farming experience they have accumulated over time.

In this study, male-headed households were found to be less resilient compared to female-headed households. The probability of male-headed households having a resilience index ranging from 0 - 0.33 and 0.34 – 0.66 is 7.9% and 6.4%, respectively. On the other hand, the probability of female-headed households having a resilience index ranging between 0.67 - 0.99 is 14.4%. This is unlike previous studies (Opiyo et al., 2014; Tesso et al., 2012) that noted that female-headed households are less resilient largely due to bias in resource allocation and decision making that leans towards males in most pastoral communities. IIR and CTA (2013) noted that there have been emerging trends such as increased demand in milk and poultry commodities, which are largely managed by women, presenting an opportunity for women pastoralists to benefit. Besides, female-headed households are more sedentary and are more likely to adopt alternative livelihood practices that build their resilience.

Formal education augments local knowledge leading to better decisions and thus have a positive and significant effect on the household resilience. Similar findings were noted by Tesso et al. (2012) in analyzing household vulnerability to climate shocks in Ethiopia. They found that more educated household heads were better decision makers in the event of shocks and were able to recover fast. In this analysis, an increase in the number of years of schooling by 1 reduces the probability of the household having a resilience index ranging 0 – 0.33 by 0.8%, 0.34 to 0.66 by 0.6% but increases the probability of a household having an index ranging between 0.67 – 0.99 by 1.5%.

Livelihood diversification through off-farm activities has a positive impact on household resilience. As noted by Ellis (2000), diversified livelihoods spread risks so that in the event of a shock from one activity, the others offset the effects of the shock making the household resilient. In this analysis, households augmenting farm income with off-farm income reduce the probability of having a resilience index ranging 0 – 0.33 by 19.5%, 0.34 to 0.66 by 15.7% but increases the probability of a household having an index ranging between 0.67 – 0.99 by 35.2%.

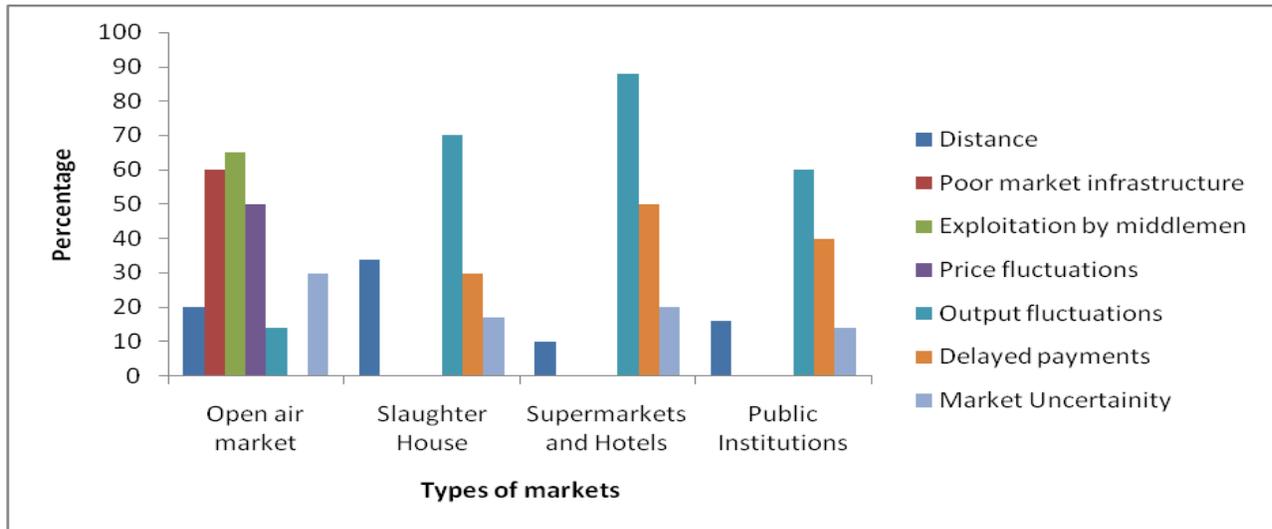
#### **5.4.2 Effect of Proximity to Basic Services on Resilience**

Markakis (2004) noted that most pastoralists generally live in areas geographically distant from national capitals and regions where economic activity is concentrated. Their domain is characterized with poor road infrastructure and poor access to basic services such as water, education and healthcare. This isolation reduces pastoralists' resilience. In this analysis, the effect of household distance to their sources of water, their most used market and health facility on resilience were assessed.

Distance moved to households' water source had an overall negative effect on resilience. Herders moved an average 32 kilometers during the dry season in search of water and pasture (Table 2). Animals trekking such a long distance become weak and are more likely to lose weight and thus fetch low revenues when marketed (IIR and CTA, 2013). This movement predisposes pastoralists to other shocks such as conflicts with other communities and attack by wild animals thus further undermining their resilience.

In this study, households who sold to more distant markets were more resilient than households who sold to nearby markets. These distant markets include slaughter houses and institutions such as hotels, schools and hospitals. Households selling to these markets need to meet the high quality and quantity requirements but in turn earn more revenues (IIR and CTA, 2013). The most

marketing channel used by pastoralists is the open air markets which are nearby, an average distance of 10 kilometres. However, as seen in Figure 8 below, with it comes exploitation by middlemen leading to low returns which further undermine resilience.



**Figure 9: Challenges in Various Market Channels**

Source: Survey Data (2017).

Unlike previous studies on resilience whereby the distance to health facilities had a negative effect on household resilience (Ciani and Romano, 2013) the present study found out that more resilient households travelled to distant health care facilities that are better equipped. As noted earlier (see section 5.2), the health expenditure had a positive factor loading implying more resilient households spend more on health. This complements the findings herein that these households are in a better position to travel to better equipped hospitals that could be far away.

### 5.4.3 Institutional Factors Affecting Household Resilience

Land tenure security influences the application of practices that build resilience such as enclosing grazing land, conserving pasture, planting trees and growing fodder. This is because farmers who practice them would want exclusive land rights in order to reap the benefits that

accrue from their investments. Also, some initial investment costs such as purchasing tree seedlings as well as labor and management is required and thus tenure security is vital before applying the practices. This explains the low adoption of these practices in the arid areas where most land is still communally-owned with no exclusive ownership rights. Similarly, other studies (WISP, 2010; IIR and CTA, 2013) noted that lack of tenure security is one of the main hindrances to pastoralists' innovations.

Access to extension training and advice has a positive influence in building household resilience. Extension advice raises pastoralists' awareness on issues that affect pastoralists such as climate related shocks and land constraints and ways through which the shocks can be mitigated and thus have a positive effect on household resilience. Other studies such as Mulwa et al. (2015) and Maguza – Tembo et al. (2016) also found that extension advice augments local knowledge and facilitates adoption of various farm management practices. In the present study, over one-third of the respondents received extension advice through radio, 40% through county extension workers and about 27% from fellow pastoralists. Extension advice reduces the probability of a household having an index ranging from 0 – 0.33 by 19.1%, 0.34 to 0.66 by 15.4% but increases the probability of a household having an index ranging between 0.67 – 0.99 by 34.5%.

In this study, access to credit was found to have a positive effect on household resilience. Over 40% of those having access to credit got it from table banking groups. The most cited group was a savings and internal lending community popularly known as *SILC* which is a table banking model introduced by the County Department of Gender and Social Services to enhance the culture of saving, borrowing and investment. About a third had access to credit from formal banks and micro finance institutions, 5% from family, friends and relatives and 5% through mobile money platforms. Credit access helps in making available the capital needed to undertake

investments and thus facilitate the application of innovative practices. Mulwa et al. (2015) noted that access to credit had a positive influence on many farm practices such as water and soil conservation practices besides planting drought-tolerant crop varieties. In this analysis, a household accessing credit reduces its probability of having an index ranging between 0 – 0.33 by 1.9%, 0.34 to 0.66 by 1.6% but increases the probability of a household having an index ranging between 0.67 – 0.99 by 3.6%.

Social safety nets help cushion households in the event of shocks. Such support can be from family, friends and relatives, group members, county and national government and non government organizations. In this analysis, social safety nets had a negative overall effect on household resilience unlike in other studies (Alinovi et al., 2010; Ciani and Romano, 2013). Most households received support from family, friends and relatives in form of cash and the most cited use of this cash was to buy food. This shows that these households are non-resilient and need to smooth their consumption by the support received. The marginal effects show that households receiving such kind of support are more likely to have an index ranging from 0 – 0.33 and 0.34 – 0.66 by a probability of 5.7% and 4.6% respectively. However, a *t-test* on household resilience among those receiving support from NGO's and group members showed a positive difference (0.45 versus 0.38 for group support and 0.43 versus 0.38 for support from NGOs). This is because the support is received in forms of inputs such as bee hives, tree seedlings and marketing of honey. Such kind of support eventually builds resilience. Support from group members and NGO's was mainly in form of labor and inputs respectively. This support helps to increase productivity, raise incomes and thus build resilience.

Pastoralists' participation in governance institutions contributes positively to their resilience. This gives pastoralists an avenue where they can air their concerns and collaborate with other

partners in prioritizing development projects that aim at building their resilience. This is important because for a long time pastoralists across many countries have been ignored by policy makers (Markakis, 2004). The most common governance institutions were those at the community level. This is because of their proximity and thus members are at ease to meet and interact with others.

#### **5.4.3 Effect of Indigenous Knowledge, Innovations and Practices on Resilience**

In this study, traditional pasture conservation, planting indigineous drought tolerant crop varieties and ethno-veterinary treatment of livestock were analyzed to asses their influence on household resilience.

Forage, pasture and crop residues are traditionally conserved for use during the dry season. Harvested maize, millet and sorgum residues and grass are cut, dried and stored on top of trees and released in small amounts for livestock feeding the onset of a rainy season when pasture will again be abundant until coming of the wet season. Feed availability helps to maintain the livestock's body condition, which when sold earn higher revenues thus stabilizing household income. Fluctuations in milk production is reduced with the available feed, which enhances food security at the household level and thus build resilience.

Post-harvest use of crop fields for grazing helps to augment locally available livestock pasture and feed which can be scarce in supply especially during the dry season. Where crops are harvested at the onset of a sry season, livestock are allowed to feed on the crop residues. This is a short term strategy in solving pasture scarcity. Households doing so have a 24.9% likelihood of having a higher index ranging from 0.67 to 0.99.

Drought tolerant crops such as millet, sorghum and cassava thrive well despite the erratic rains that the county receives and thus households planting them improve their food sufficiency.

Mulwa et al. (2015) similarly noted that among other strategies, planting drought-tolerant crop varieties in Malawi enabled farmers to cope with the vagaries of weather. Also, surplus produce is sold thus earning the household income and hence contribute positively to the overall resilience.

Ethno-veterinary knowledge and practice play an important role in livestock treatment, thus averting effects related to shocks due to livestock diseases. This is important since most pastoralists live far of modern veterinary and pharmaceuticals and may not have access to modern treatment (IIR and CTA, 2013). From this study, households employing etho-veterinary practices increase the probability of having a resilience index ranging from 0.67 – 0.99 by 13.8%.

#### **5.4.4 Effect of External Interventions on Resilience**

The county government of West Pokot together with other partners promote programmes that are aimed at building household resilience (CCDP, 2013; CIDP, 2013). These include growing fruits in partnership with FAO and KVDA, bee keeping together with KVDA and CABESI and camel rearing in partnership with Action Aid. Other interventions run by the county government are livestock vaccination campaigns and improving livestock breed. These activities present opportunities for livelihood diversification, providing alternative income and augment household food requirement thus building resilience. In this study, the effects of livestock vaccination, enclosing grazing land, growing fruits, stocking improved breeds, bee keeping and incorporating camels in the herd on households' resilience were assessed.

The county government periodically runs livestock vaccination campaigns. This is important because as seen in Figure 2 in this study, livestock diseases and the losses incurred are the greatest shocks affecting most households. Vaccination is a disease preventive measure and

reduces the likelihood of livestock disease outbreaks that usually result in mass death of livestock. This cushions pastoralists of the losses that they would incur and instead, build their resilience.

Enclosures ensure that there is enough livestock feed to last through all seasons. Nyberg et al, (2015) noted that besides making livestock feed available, enclosures in West Pokot county has helped in reclaiming degraded land. Since common access grazing resources is reducing significantly in most pastoralist communities, enclosures provide an opportunity for intensifying livestock production on the available land. Proper intensification increases production and assures more food and revenues (IIR and CTA, 2013). The marginal effects show that enclosing grazing land increases the probability of a household having a resilience index ranging between 0.67 – 0.99 by 31.1%.

Another emerging trend supported by the County government among pastoralists in the semi-arid region is stocking improved livestock breed. These breeds are more marketable as they take a shorter time to mature and their meat is more tender (IIR and CTA, 2013). Nearly 10% of the respondents stocked improved Sahiwal cattle breeds, 8% cross cattle breed, 15% gala goat breed, 3% cross goat breed, 16% dopper sheep breed, and 3% cross sheep breed. The inability of these breeds to walk for long distances in search of water and pastures makes it hard for them to survive in the arid areas. As a result, very few respondents in the arid areas stocked them. For those with these stocks, the study showed that they were more likely to have a higher resilience index ranging between 0.67 – 0.99 by 17.2%.

Another form of livelihood diversification is bee keeping or apiculture. Bee keeping requires very little initial capital and bee hives occupy less space compared to cattle. Besides, bee keeping

is not labor intensive since bees forage on their own. Honey produced complements domestic food and surplus quantities can be sold earning households income. Bee keeping households increase their probability of having a resilience index ranging between 0.67 – 0.99 by 7.5%.

Planting trees through afforestation and agro forestry has multiple benefits. Trees slow down soil erosion and thus can help restore degraded land, trees provide fuel wood, fodder trees provide livestock feed and fruit trees provide food and surplus fruits can be sold earning households extra income. Tree planting can be combined with bee keeping since tree shades and flowers provide excellent shelter and food for bees. Households planting trees and growing fruits increase their probability of having a higher resilience index between 0.67 – 0.99 by 6.5%.

### **5.5 Conclusion and Policy Implications**

This paper assessed the effect of pastoralists own IK and external interventions on household resilience to shocks. The analysis from PCA showed that on a scale of 0 to 1, the pastoralists had an index below average of 0.41 with respondents from the semi-arid region having a higher index than those in the arid areas. Both IK and practices and external interventions had a significant effect on building household resilience. Female-headed households, number of years of formal schooling, access to credit, extension, off farm income, pastoralists ethno veterinary practices, afforestation, enclosing grazing land, bee keeping and fruit growing had a positive and significant effect on resilience. The findings showed that camel rearing and bee keeping are viable interventions to build resilience in the arid areas.

There is the need to document and learn indigenous practices of the various communities of indigenous people because these practices build their resilience. External interventions designed to build resilience should not undermine local practices but instead synergize them. Incorporating

pastoralists' IK in external interventions such as development projects will produce better results in building resilience as the projects would be more readily acceptable by the local people.

## **CHAPTER SIX**

### **6.0 SUMMARY, CONCLUSION AND IMPLICATIONS TO POLICY**

#### **6.1 Summary**

Building pastoralists resilience to shocks is an important aspect in achieving sustainable livelihoods. The recent developments across many ASALs of SSA predispose pastoralists to shocks. Open access pasture and water resources are increasingly becoming scarce and transhumant movement is becoming more difficult with increasing population and human encroachment on grazing resources. Together with climate-related shocks, most pastoralist households find themselves entangled in the vulnerability trap.

Indigenous knowledge has enabled pastoralists to manage livestock production in the ASALs. However, as the effects of the challenges they experience intensify, external interventions are needed in order to bolster their own efforts to make a living.

This study analyzed the effects of pastoralists own IK and external interventions in building resilience to shocks. The specific objectives were to: characterize pastoralists' livelihood strategies, shocks experienced and coping approaches; assess the pastoralists' indigenous knowledge and participation in external interventions and to analyze the effects of indigenous knowledge and external interventions on household resilience to shocks. The PCA method was used to compute the household resilience index. An ordered probit regression models were also applied in data analysis.

The first paper assessed the shocks encountered by pastoralists, their coping strategies and the effects of own mechanisms and external interventions in building their resilience. Results showed that the most prevalent shocks across all households were drought and livestock diseases and households utilize their savings and assets in coping with them. Less-endowed households resorted to borrowing, relied on support from friends and food aid. The paper suggested the need for external interventions in strengthening pastoralists own efforts in building resilience.

The second paper analyzed the effects of IK and external interventions in helping households manage shocks. Findings showed that both Indigenous Knowledge and practices and external interventions are important in helping households manage shocks. This forms a learning blue print for external interventions that bolster IK in managing shocks.

The final paper assessed the effects of IK and external interventions on household resilience. Household resilience was constructed using PCA and rescaled to range from 0 being the least resilient household to 1 being the most resilient household. An ordered probit with three resilience index categories ranging 0 – 0.33, 0.34 – 0.66 and 0.67 – 0.99 was used to estimate the effect of IK and external interventions in building resilience. The results showed indigenous practices such as etho veterinary and post-harvest use of crop fields for grazing had positive and significant effects on building resilience. On external interventions, enclosing grazing land, agroforestry and bee keeping have a significant and positive effect on building household resilience.

## **6.2 Conclusion and Implications to Policy**

These results show that the efforts put in place by the county government and other partners are yielding fruits as they are building pastoralists resilience. However, these efforts need to be intensified so that more people can benefit. This study has isolated the viability of bee keeping

and camel rearing in the arid areas. These need to be strengthened since respondents from the semi-arid areas are the least resilient. The inclusion of pastoralists especially at the county and national government platforms is still low. This calls for a more bottom up approach in reaching out to pastoralists.

Tenure security is a major contributor of the application of resilience building practices. Innovating households need to have exclusive rights over the benefits that accrue from the practices. Where applicable, tenure rights need to be bestowed upon individuals to drive the innovation process. In line with K'onyango (2017), there is need to recognize and implement the communal land act of 2016 so that the communities entitled to such land can manage it innovatively. This will also safeguard pastoralists' transhumant corridors since migration is an important survival mechanism for pastoralists. This calls for further research on how benefits and costs of innovations can be inclusively shared among users of communally owned land.

Institutional support in the forms of credit and extension need to be strengthened in the pastoralists' area. As shown in the results, households having access to formal credit and extension advice were more resilient as they are provided with the knowhow and the needed capital to undertake resilience building investments. Providers of such services need to put into consideration the uniqueness of pastoralists' livelihoods such as dependence on livestock for income and seasonal mobility. Considering this will help them design credit products and extension services that best suit the pastoralists. Formal credit can be embedded with livestock insurance to cushion both the lender and the pastoralists in the event of catastrophic loss of livestock. Extension programmes and campaigns such as livestock vaccination can be implemented during seasons when pastoralists are more likely to be settled so that many households can benefit.

Making markets work for pastoralists is an important aspect in building resilience. A combination of IK, practices and external interventions has the potential of increasing pastoralists' livestock productivity so that they have a marketable surplus. For them to gain financially from this surplus, markets need to work efficiently. This can be achieved through investment in infrastructure such as transport, communication and livestock holding grounds in the markets. There is also the need to reduce price and production risks and uncertainty. This can be achieved through pastoralists' context – specific risk management tools such as index- based livestock insurance and emergency livestock take off before the onset of droughts. This calls for policy objectives that support public and private partnerships to support such investments aimed at building pastoralists' resilience.

### **6.3 Contribution to Knowledge**

This study contributes to the scarce quantitative studies involving pastoralists' resilience to shocks. It analyzes resilience at the household level and thus an important viewpoint in understanding household dynamics. The study contributed to the FAO's quantitative framework of measuring resilience to come up with the index by overcoming the obstacle of quantifying food security as the number of months in a year that a household is unable to meet its food requirements as opposed to food expenditure. Additionally, a quantitative analysis was done to understand the effects of IK and external interventions in building resilience. The findings show that both IK and external interventions contribute to resilience building. The study identifies bee keeping and camel rearing as the most viable interventions in the arid areas. This is because of the harsh climatic and environmental conditions that prevail in the arid areas.

#### **6.4 Suggestions for Further Research**

The findings herein that female respondents are more resilient calls for further gendered analysis on a fairly distributed sample because the study had more male respondents than females thus the findings are not conclusive. Being a cross section study, this study could not isolate the impact of factors studied on household resilience. If the households can be observed over a period of time, the impact of these interventions can be estimated. The study also looked at the households' practices in the broadest sense. Further research can narrow down on the intensification of each particular practice and the effect on household resilience. Finally, research should be done on how best pastoralists' own indigenous knowledge can be incorporated in external interventions.

## 6.0 References

- Abate, T., 2016. Indigenous Ecological Knowledge and Pastoralist Perception on Rangeland Management and Degradation in Guji Zone of South Ethiopia. *Consilience: Journal of Sustainable Development*, 15(1), pp.192-218.N
- African Union (2014). Malabo Declaration on accelerated agricultural growth and transformation for shared prosperity and improved livelihoods. *Malabo, 26–27 June 2014—Decisions, Declarations, and Resolution of the Assembly of the Union Twenty-Third Ordinary Session*.
- Aklilu, Y. (2008). Livestock marketing in Kenya and Ethiopia: a review of policies and practice. *Feinstein International Center, Addis Ababa*, 38.
- Alan, R. (2000). Integrating Indigenous Knowledge in Project Planning and Implementation. A partnership publication of the International Labor Organization, the World Bank, the Canadian Onternational Development Agency and Kivu Nature.
- Alinovi, L., D’Errico, M., Mane, E., and Romano, D. (2010). Livelihoods strategies and household resilience to food insecurity: An empirical analysis to Kenya. In *conference organized by the European Report of Development, Dakar, Senegal, June* (pp. 28-30).
- Alinovi, L., Mane, E., and Romano, D. (2008). Towards the measurement of household resilience to food insecurity: applying a model to Palestinian household data. *Sibrian R.(ed.), Deriving Food Security Information From National Household Budget Surveys*, 137-52.
- Anderson, D., Sweeny, D. and Williams, T. (2007). *Statistics for Business and Economics*. 11th edition, South-Western, Cengage Learning, USA.
- Antle, J.M., 2009.*Agriculture and the Food System Adaptation to Climate Change*. RFF report on Adaptation: An Initiative of the Climate Policy Program, Resources for the Future.
- Barrow, E., Davies, J., Berhe, S., Matiru, V., Mohamed, N., Olenasha, W., and Rugadya, M. (2007). Pastoralists as shrewd managers of risk and resilience in the Horn of Africa. *IUCN Eastern Africa Regional Office Policy Brief*, (1).

- Bastin, J. F., Berrahmouni, N., Grainger, A., Maniatis, D., Mollicone, D., Moore, R. and Aloui, K. (2017). The extent of forest in dryland biomes. *Science Journal*, 356(6338), 635-638.
- Bateman, I. J., R. T. Carson, M. Hanemann, N. Hanley, T. Hett, M. Jones-Lee, G. Loomes, E. Ozdemiroglu, D. W. Pearce, R. Sugden, and Swanson, J. (2002), *Economic Valuation with Stated Preference Techniques, A manual, Department for Transport, ISBN 1-84376-852-6, Edward Elgar, Cheltenham.*
- Béné, C., Wood, R. G., Newsham, A., and Davies, M. (2012). Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. *IDS Working Papers*, 2012(405), 1-61.
- Berkes, F., Colding, J., and Folke, C. (Eds.). (2008). *navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press.
- Browne, M., Ortmann, G. F., and Hendricks, S. L. (2014). Household food security monitoring and evaluation using a resilience indicator: an application of categorical principal component analysis and simple sum of assets in five African countries. *Agrekon*, 53(2), 25-46.
- Butt, B. (2010). Seasonal space-time dynamics of cattle behavior and mobility among Maasai pastoralists in semi-arid Kenya. *Journal of Arid Environments*, 74(3), 403-413.
- Carter, M. R. (2009). Inducing innovation: risk instruments for solving the conundrum of rural finance. *Population and natural resources*.
- Carter, M. R., Little, P. D., Mogue, T., Negatu, W., and Ababa, A. (2005). The long-term impacts of short-term shocks: Poverty traps and environmental disasters in Ethiopia and Honduras. *Basis Brief*, 28.
- Chhetri, N. (2011). Induced innovation: a conceptual approach in understanding agricultural adaptation to climate change.
- Combined County Livestock Development Plan for Turkana, West Pokot, Samburu and Baringo CCDP 2013-2017. <http://www.reliefweb.int/> CCDP 2013-2017. Accessed 12<sup>th</sup> May 2016.
- Constas, M., Frankenberger, T., Hoddinott, J., Mock, N., Romano, D., Béné, C., and Maxwell, D. (2014). A common analytical model for resilience measurement: causal framework

and methodological options. *Food Security Information Network Resilience Measurement Technical Working Group*.

Cotula, L(ed) 2007. Changes in Customary Land Tenure Systems in Africa. ISBN: 978-1-84369-657-5

County Government of West Pokot, 2013. First county integrated development plan 2013 –2017. [http://www.westpokot.go.ke/images/downloads/ CIDP final draft](http://www.westpokot.go.ke/images/downloads/CIDP_final_draft). Accessed 2<sup>nd</sup> May 2016

Davies, J., Niamir-Fuller, M., Kerven, C., and Bauer, K. (2013). Extensive livestock production in transition. *Livestock in a Changing Landscape, Volume 1: Drivers, Consequences, and Responses*, 285.

Delgado, C. L. 2003. “Rising consumption of meat and milk in developing countries has created a new food revolution.” *Journal of Nutrition* vol. 133, no. 11, pp. 3907S–3910S.

DFID (2010). Pastoralism Information Notes. Series of Pastoralism Information Notes prepared for DFID by John Morton of the Natural Resources Institute, University of Greenwich.

Dinucci, A., and Fre, Z. (2003). Understanding the indigenous knowledge and information systems of pastoralists in Eritrea. *Communication for Development Case Study (FAO)*.

Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford university press. 4-12

Emery, A.R (2000). Integrating Indigenous Knowledge in Project Planning and Implementation. A partnership publication of the International Labor Organization, the World Bank, the Canadian International Development Agency, and Kivu Nature

DFID (1999b) Sustainable Livelihoods and Poverty Elimination. London: Department for International Development

- FAO (2005). *Kenya Livestock Sector Brief*. Rome, Italy, FAO Livestock Information, Sector Analysis and Policy Branch (AGAL).
- FAO (2012) Pastoralism in sub-Saharan Africa; Know its advantages, Understand its challenges, Act for its sustainability. Food sovereignty brief no 5.
- FAO RIMA II 2016. Resilience Index Measurement and Analysis – II. *Analysing Resilience for better targeting and action*.
- Farmer, E., and Mbwika, J. (2012). End market analysis of Kenyan livestock and meat: a desk study. *Rep. no. MicroREPORT, 184*. Project under USAID
- Flintan, F. 2012. Protecting Livestock Mobility Routes: Lessons Learnt. Learn Initiative 2012 brief.
- Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., and Rockstrom, J. (2010). Resilience thinking: integrating resilience, adaptability and transformability. *Ecology and Society 15(4): 20*. [online] URL: <http://www.ecologyandsociety.org/vol15/iss4/art20>.
- Gorjestani, N. (2004). Indigenous knowledge for development. *Protecting AND Promoting Traditional Knowledge: Systems, National Experiences AND International Dimensions*, 265.
- Geutjes and Knutsson, 2014. Coping with climate change variability in West Pokot, Kenya: The influences of land use on responses to climate variability by pastoralists and agro pastoralist communities in arid and semi arid areas of West Pokot Kenya. Master thesis in global studies, University of Gothenburg.
- Gronvall Antonio (2015) Transition from nomadic pastoralism to livestock based agro-pastoralism - The case of animal husbandry in West Pokot, Kenya
- Hayami, Y., and Ruttan, V. W. (1971). Induced innovation and agricultural development. *Staff Papers Series, 71(1)*.
- Hensher, D. A., Rose, J. M. and Greene, W. H. (2005), *Applied Choice Analysis: A Primer*,
- Huang, J., Wang, Y., and Wang, J. (2015). Farmers' Adaptation to Extreme Weather Events through Farm Management and Its Impacts on the Mean and Risk of Rice Yield in China. *American Journal of Agricultural Economics, 97(2)*, 602-617.

- IFAD. 2009. *Livestock and climate change*. Draft thematic paper. January 12–13, 2009. Rome, Italy.
- Intergovernmental Panel on Climate Change, IPCC (2014). *Climate Change 2014—Impacts, Adaptation and Vulnerability: Regional Aspects*. Cambridge University Press.
- IIR and CTA, (2013). Moving herds, moving markets: making markets work for African pastoralists. International Institute of Rural Reconstruction, Nairobi and the Technical Centre for Agricultural and Rural Cooperation, Wageningen, Netherlands
- Israel, Glenn D. 1992. Sampling the Evidence of Extension Program Impact. Program Evaluation and Organizational Development, IFAS, University of Florida. PEOD-5. October.
- Kagunyu, A., and Wanjohi, J. (2014). Camel rearing replacing cattle production among the Borana community in Isiolo County of Northern Kenya, as climate variability bites. *Pastoralism Journal*, 4(13), 1-5. doi:10.1186/s13570-014-0013-6
- Keil, A., Zeller, M., Wida, A., Sanim, B., and Birner, R. (2008). What determines farmers' resilience towards ENSO-related drought? An empirical assessment in Central Sulawesi, Indonesia. *Climatic Change*, 86(3-4), 291-307.
- Kenya Institute of Public Policy and Research, KIPPRA 2015. *Empowering youth through productive and decent employment*.
- Kenya National Bureau of Statistics (KNBS) 2009. *Economic Survey 2009*. Nairobi, Kenya
- KNBS and SID (2013). Exploring Kenya's inequality: Pulling apart or pooling together? West Pokot County Report. Kenya National Bureau of Statistics and Society for International Development. ISBN-978-9966-029-18-8.
- Konyango, C.O.(2017). Land use planning and communal land tenure reforms in pastoral areas: the experience of Kenya. National Land Commission of Kenya. Paper presented at the 2017 World Bank conference on Land and Poverty, Washington D.C
- Little, P. D., and McPeak, J. G. (2014). Resilience and pastoralism in Africa South of the Sahara. *Resilience for food and nutrition security*, 75.
- Markakis, J. (2004). *Pastoralism on the Margin* (pp. 2-37). London: Minority Rights Group International.

- Mulat and Negussie, 2010. Household Resilience to Food Insecurity in Ethiopia: Panel Data Evidence, FAO-ESA, *mimeo*.
- Maguza- Tembo, F, Mangison, J, Edris, K.A and Kenamu, E (2016). Determinants of adoption of multiple climate adaptation strategies in southern Malawi: An ordered probit analysis. *Journal of Development and Agriculture Economics* Vol 9 (1) PP 1-7, DOI: 10.5897/JDAE 2016-0753.
- Mulwa, C., Marenya, P., Rahut, D., and Kassie, M. (2015). ) Response to Climate Risks among Smallholder Farmers in Malawi: A Multivariate Probit Assessment of the Role of Information, Household Demographics and Farm Characteristics. Adoption Pathways project discussion paper 3 February 2015.
- National Drought Management Authority, NDMA 2016. Drought early warning bulletin for West Pokot County for April 2016.
- Ngigi, M., Mueller, U., and Birner, R. (2015). The role of livestock portfolios and group-based approaches for building resilience in the face of accelerating climate change: An asset-based panel data analysis from rural Kenya. *Available at SSRN 2676574*. , ZEF-Discussion Papers on Development Policy No. 205, Center for Development Research, Bonn, October 2015.
- Nori, M., and Davies, J. (2007). Change of Wind or Wind of Change? Report on the conference on Climate Change, Adaptation and Pastoralism, organized by the World Initiative for Sustainable Pastoralism. Available online at; <http://www.iucn.org/wisp/resources/?2339>.
- Nyariki, D. M., Makau, B. F., Ekaya, W. N., and Gathuma, J. M. (2005). Guidelines for emergency livestock off-take handbook. Arid Lands Resource Management Project (ALRMP), Agricultural Research Foundation (AGREF), Nairobi, Kenya.
- Nyberg, G., Knutsson, P., Ostwald, M., Öborn, I., Wredle, E., Otieno, D. J. and Grönvall, A. (2015). Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. *Pastoralism*, 5(1), *Pastoralism: Research, Policy and Practice (2015)* 5:25 DOI 10.1186/s13570-015-0044-7.

- Opiyo, F., Wasonga, O.V. and Nyangito, M.M (2014). Measuring household vulnerability to climate induced stresses in pastoral rangelands of Kenya: Implications for resilience programming. *Pastoralism: Research, Policy and Practice*, 2014 4:10.
- Orina-Nyamwamu, C. (2010). From a centralized system to a devolved system of governments: Past, present and future dynamics. In *FES Conference on State of Implementation of the Constitution since 2010*.
- Overseas Development Institute (2006) “Saving Lives through Livelihoods: critical gaps in the response to the drought in the Greater Horn of Africa” HPG Briefing Note, ODI, London. Online <http://www.odi.org.uk/resources/download/1381.pdf> Swift
- Pain, A. and Levine, S. (2012). A conceptual analysis of livelihoods and resilience: addressing the insecurity of agency’. Working Paper, Humanitarian Policy Group (HPG), Overseas Development Institute (ODI), London. ISBN: 978-1-909464-00-1.
- Republic of Kenya (2008). Ministry of Livestock Development Session Paper no. 2 of 2008 on National Livestock Policy. November 2008.
- Rodima-Taylor, D., Olwig, M. F., and Chhetri, N. (2012). Adaptation as innovation, innovation as adaptation: An institutional approach to climate change. *Applied Geography*, 33, 107-111.
- Selemani, I. S., Eik, L. O., Aring, T., Mtengeti, E., and Mushi, D. (2012). The role of indigenous knowledge and perceptions of pastoral communities on traditional grazing management in north-western Tanzania. *African Journal of Agricultural Research*, 7(40), 5537-5547.
- Shibia, M., Rahman, S., and Chidmi, B. (2017). Consumer demand for meat in Kenya: an examination of the linear approximate almost ideal demand system. *Available online with updates at <http://ageconsearch.umn.edu>*.
- Solesbury, W. (2003). *Sustainable livelihoods: A case study of the evolution of DFID policy*. London: Overseas Development Institute.
- Steinfeld, H., Mooney, H. A., Schneider, F., and Neville, L. E. (Eds.). (2013). *Livestock in a changing landscape, Volume 1: Drivers, consequences, and responses*. Island Press.
- Tesso, G. Emanu, B. and Mengistu K. (2012). Analysis of vulnerability and resilience to climate change induced shocks in North Shewa, Ethiopia. *Journal of Agricultural Sciences* vol 3 No6 871-888 (2012). Online at <http://dx.doi.org/10.4236/as/2012.36106>

- Thornton, P. K., Steeg, J., Notenbaert, A. M. O., and Herrero, M. (2008). The livestock-climate-poverty nexus: A discussion paper on ILRI research in relation to climate change.
- Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge university press. PP 100-130
- Turner, M. D., McPeak, J. G., and Ayantunde, A. (2014). The role of livestock mobility in the livelihood strategies of rural peoples in semi-arid West Africa. *Human Ecology*, 42(2), 231-247.
- Verdoodt, A., Mureithi, S. M., and Van Ranst, E. (2010). Impacts of management and enclosure age on recovery of the herbaceous rangeland vegetation in semi-arid Kenya. *Journal of Arid Environments*, 74(9), 1066-1073.
- Walker, B., and Salt, D. (2012). *Resilience thinking: sustaining ecosystems and people in a changing world*. Island Press.
- Walker, B., Holling, C. S., Carpenter, S. R., and Kinzig, A. (2004). Resilience, adaptability and transformability in social--ecological systems. *Ecology and society*, 9(2), 5.
- 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, March 2010
- Woytek, R. (1998). *Indigenous knowledge for development: A framework for action*
- Wooldridge, JM (2005). *Introductory econometrics: A modern approach*.

## Appendices

### Appendix 1: Questionnaire for Focus Group Discussion

#### **Theme: Understanding livelihood shocks and Resilience Mechanisms in West Pokot**

##### **Introduction**

This Focus Group Discussion intends to provide useful insights in shocks experienced and coping strategies in West Pokot and the necessary support needed. The information obtained will only be used to inform policy decisions.

**Location**.....

**Ward**.....

**Date**.....

##### **Questions for Discussion:**

1. What are the 5 main shocks that affect people's lives and survival in this area?
  - a. Last 5 – 10 years
  - b. Current situation
  - c. Expected trends 5 years from now
2. How have these shocks affected welfare?
  - a. Health
  - b. Food Security
  - c. Education
  - d. Peace and Unity
3. What has been done at the following levels to enable people cope better with these shocks?
  - a. Individuals
  - b. Community groups
  - c. County government
  - d. Development partners and NGO's
4. What else needs to be done now and in the future to enable people deal better with these shocks?
5.
  - a. In the last 5 years, what market opportunities have emerged in this area?
  - b. Where have they emerged?
  - c. How have they been used?
  - d. What challenges are being encountered in the use of these markets?
  - e. What needs to be done now and in the future to address these challenges?

## Appendix 2: Key Informant Interviews

### Theme – Historical Perspective on Livestock Production in West Pokot

1. What changes have been experienced in the community over the years from 1980 to date. Please fill the table below:

Time Period	Livestock breeds	Average Number per Household	Yields	Shocks Encountered 1 Drought 2 Disease 3 Cattle rustling 4 Other..	Frequency	Coping strategies	Migration and settlement	Markets	Governance Institutions	Land use	Culture	Drivers of change
1980-1990												
1990's												
2000-2010												
2010- date												

2. What is the effect of these changes in welfare? Please fill the table below:

Changes	Effect on Yields	Income	Access to basic services 1 Health 2 Education 3 Extension 4 other	Food security 1 availability	Assets 1 land	Cultural practices

				<b>2 distribution</b> <b>3 Access</b>	<b>2 livestock</b> <b>3 houses</b> <b>4 Other</b>	

## Appendix 3: Household Interview Questionnaire



UNIVERSITY OF NAIROBI

**Pastoralists' Livelihood Activities, Participation in Markets & Governance Institutions for Resilience Building in West Pokot, Kenya**

**Household Survey Questionnaire, February 2017**

### ***Respondent***

In this survey, household head, spouse or older family members above 18 years old, familiar with and involved in decision-making on household livelihood activities will be interviewed. Only households that rear **at least one type of livestock** will be interviewed.

### ***Purpose of this Survey***

The reason for conducting this field survey is to get some insights on livestock production, marketing, shocks to the pastoral system, how pastoralists cope up with the shocks and what support is needed to build their livelihood resilience. Your voluntary participation in answering questions on these issues is highly appreciated. Your responses together with those from over 200 other households in other parts of West Pokot will be analyzed and the findings will be used to inform policy makers on better strategies for improving pastoral livelihoods in West Pokot County. All the information obtained will be treated with utmost confidentiality and will only be used for the purpose of this survey. This interview will take approximately **ONE hour** to complete. I request your permission to start now.

For any further clarification, please contact Deborah Muricho 0720840902.

SECTION A : GENERAL INFORMATION

1) Enumerator's name: ..... 2) Date of interview (dd-mm-yyyy):.....

3) Sub county.....4) Ward .....

5) Sub -location.....6) Village.....

7) Household Number.....

**SECTION B: FARM ENTERPRISE**

8. What type of crops and livestock do you keep on your farm? Please fill the tables below;

***i. Livestock***

Livestock	Breeds kept	Numbers	Number of years Practiced	Main purpose/reason for engaging in this enterprise 1-Food 2- Sale 3- Draught 4- Cultural use e.g. dowry payment, status symbol etc. 5-Manure 6-Store of wealth	How initial stock was acquired 1-Bought 2- Inherited 3-Received as bride price 4- Received as gift 5- Other.....	Land size allocated for this enterprise – housing, pasture development/grazing etc (acres)
Cattle						
Sheep						
Goats						
Camels						
Donkeys						
Chicken						
Bee keeping (hives)						

***ii. Crops***

Three main crops grown	Land size grown (acres)	Yield in the last season (kg)	Main purpose 1 – Food 2- Sale 3-both food and sale

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

<b>Method of Land acquisition</b>	<b>Land size owned (acres)</b>	<b>Tenure system</b> 1. Private with title deed 2. Private without title deed 3. Communal 4. Other.....
1. Allocated by clan		
2. Inherited from parents		
3. Bought		
4. Rented		
5. Leased		
6. Received as gift from an institution/other people		
7. Settlement scheme		
Other.....		

10. Do you have access to communally owned grazing land and water sources? 1. Yes 2. No

If yes, please fill table below:

<b>Location and Return Distance moved</b>	<b>Pasture</b>	<b>Water</b>	<b>Number of years of access</b>	<b>Challenges encountered</b> 1-Settlement by people 2- Increased number of users 3- Conflict with other community 4 -Other.....
Dry Season				
Wet Season				

## SECTION C: EXPOSURE TO SHOCKS AND COPING STRATEGIES

11. What kind of shocks did you experience during the last 12 months and how did you cope with them? Please fill the table below (Tick all that apply)

Type of Shock	Did you Experience this shock in the last 5 years? 1 = Yes; 2 = No	Duration of the Shock (1-Less than a week 2-Two weeks 3-One month 4- More than one month)	Frequency in the last 12 months (number of times it occurred)	Value of loss in monetary terms (Kshs)	Main effects ( <u>Rank them in order of severity</u> ) 1 Quality deterioration of livestock 2 Loss of livestock due to death 3 Loss of household assets 4 Loss of cash income 5 Loss of crops 6 Loss of livestock through rustling 7 Loss of human lives 8 Other.....	What did you do to manage this shock? (rank them in the order in which they were applied) 1 Used up Savings 2 Sold part of assets 3 Borrowed 4Migrated to another area 5 Received aid from NGO/County 6 Received Support from social groups 7 Sent children to other family members 8 Fed on wild fruits and tree leaves 9 Other.....	What initiatives have/are you putting in place to manage this shock better in future? (rank them in the order of your preference) 1 On-farm livelihood diversification 2 Off-farm livelihood diversification 3 Adopting new farming practices e.g. drought tolerant crops; new livestock breeds; conservation agriculture etc. 4 Increased Savings 5 Moved to Another area 6 Joined some peace Initiative for conflict resolution 7 Took an Insurance policy 8 Other.....
Droughts							
Livestock diseases							
Crop pests and diseases							
Conflict with							

neighboring Communities							
Chronic Illness of a household member							
Market Shocks- Market closure, Low Prices							
Fire outbreak							
Human wildlife conflict							
Death of family member							

12. Are there shocks that occur concurrently? Describe.....

.....

13. In your opinion, which **ONE** of the above shocks had the greatest effect on your household livelihood stability?

.....

Please fill the table below on how you relied on various social safety nets to manage the main shock:

Type of safety net	Did you receive support from this source? 1 = Yes; 0 = No	Type of support received 1 = cash 2 = inputs 3 = labor 4 = evacuation 5 = food 6 = other....	What proportion of the losses did this support enable you to manage? 1) Up to 25% 2) 25% - 50% 3) 50% - 75% 4) More than 75%
Family members/relatives			
Friends			
Group members			
NGOs – including religious organizations			
National government programmes			
County government programmes			

14. Which livestock and crop practices have you put in place to cushion you against future shocks? Please fill table below:

Livestock Practices	Do you Practice (1-Yes 2-No)	Crop Practices	Do you Practice (1-Yes 2-No)

1. Herd diversification (grazers, browsers and different ages)		1.Crop diversification (Specify combinations)	
2.Improved breeds (Sahiwal cattle, gala goats, doper sheep,camels etc)		2. Planting drought tolerant varieties – Specify	
3.Enclosures for livestock grazing		3.Irrigation	

4. Conserving pasture (Specify method)		4. Took up crop insurance	
5. Vaccination		5. Soil conservation – afforestation; gabions; terracing; minimum tillage; organic manure	
6. Took up livestock insurance		6. intensification and use of chemical fertilizer	

15. Have you ever changed your livestock breed type and composition? 1- Yes 2- No. If yes, please fill the table below

<b>Livestock Type</b>	<b>Initial breed</b>	<b>Current breed</b>	<b>Motive for change 1-More drought tolerant 2-More disease tolerant 3- Yields more milk 4- Takes short time to mature 5- Other.....</b>	<b>Challenges with this breed 1-Needs more feed 2- More susceptible to diseases 3-Other.....</b>
Cattle				
Goats				
Sheep				
Chicken				
Other				

16. Do you have an insurance policy covering your livestock and/ or crops in the event of loss? 1-Yes, 2- No. If Yes please fill the table below

<b>Policy Type</b>	<b>Provider</b> 1-Banks 2-Insurance company(specify) 3-Other.....	<b>Amount of premium paid</b>	<b>Mode of premium payment</b> 1-Weekly 2-Monthly 3-Annually 4-Other.....	<b>Extent of the insurance cover</b> 1-In the event of livestock death 2-In the event of crop failure 3- In the event of perils such as fire.....	<b>Challenges</b> 1-High premiums 2-Lack of information 3-Policy is not comprehensive 4-Other
Livestock					
Crops					
Both livestock and crops					
Other.....					

17. If the household does not have an insurance policy why have you not taken up any of them? 1-Lack of information 2- Premiums are too high 3- Other.....

18. Would you be willing to continue paying for an insurance policy that will compensate you in the event of livestock death or crop failure?  
1- Yes, 2- No)

SECTION D: INDIGINEOUS KNOWLEDGE AND PRACTICES

19. Which of the following traditional practices in livestock management do you practice on your farm?

<b>Indigenous Practices</b>	<b>Do you practice 1-Yes, 2- No</b>	<b>How long have you practiced it in the last 5 years (Months)</b>	<b>Why do you prefer doing it (1-Cheaper 2-Convenient 3- Appropriate</b>	<b>Challenges 1-Insecurity 2-Lack of cooperation 3-Depletion of natural resources 4-Other</b>
<b>Herd size management</b>				
Herd splitting during drought				
Increasing size during rainy seasons				
Stocking both grazers and browsers				
Female dominated herds				
<b>Grazing</b>				
Night grazing				
Group herding				
Use of browse tree species				
Post harvest use of fields				
Use of naturally occurring salts				
<b>Access and use of communal resources</b>				
Limit herd size per household				
Rotational access				
Penalizing violators				
<b>Control breeding</b>				
Naming				
Branding				
Body nomenclature				
Coincide calving with wet season				
<b>Ethno-veterinary</b>				
Move livestock to higher grounds in wet seasons				
Controlled burning of pasture to reduce parasites				
Use of wild herbs to treat diseases				
Use of natural occurring salt				

**SECTION E: PARTICIPATION IN GOVERNANCE INSTITUTIONS**

20. Do you belong in any of the following governance institutions? Please fill the table below:

<b>Institution Type</b>	<b>Participation</b> 1 Yes 2 No	<b>Role:</b> 1 Member 2 Leader 3 Sponsor 4 Other	<b>Number of Meetings Attended In last 12 months</b>	<b>Services provided by the group</b> 1 Provide credit 2 Share information 3 Receive aid 4 Receive extension training 5 Link to market 6 Security 7 Environment conservation 8 Political committee	<b>Key challenges</b> 1 Lack of Communication 2 Mismanagement of resources 3 Poor leadership 4 Lack of commitment by other members 5 High membership fees 6 Gender bias 7 Ethnic discrimination 8 Political interference 9 Other.....
1. Community level groups (Specify)					
2. County government committees (Specify)					
3. National level Programmes (Specify)					

21. Are you aware of livelihood development projects implemented by the County Government and Nongovernmental organizations 1. Yes 2. No. If yes, please fill the table below:

<b>Programme</b>	<b>Are you aware of this initiative? 1 = Yes; 0 = No</b>	<b>Implemented by 1-County government 2- NGO (Specify) 3- Both</b>	<b>Do you participate in it? 1-Yes 0-No</b>	<b>Motivation 1-To increase yields, 2-Access to extension 3-Access to credit, 4-Ready market for output 5-Low cost of participation</b>	<b>Outcome</b>	<b>Before Participation</b>	<b>After Participation</b>	<b>Challenges Encountered 1-High costs 2-Too procedural 3-Other.... 4-Favoritism 5-Lack of information 6-Other....</b>
1.Growing fodder and pastures					Milk (litres per cow)			
2.Improving livestock breed					Crop yields			
3. Enclosures					Livestock value sold in the market			
4.Artificial insemination					Herd size			
5. Vaccination					Frequency of diseases			
6.Growing fruit					Monetary value of losses during drought			
7.Bee keeping								
8. Camel rearing								
9. Other								

**SECTION F: (i) MARKET PARTICIPATION**

22. Please fill the table below if you have participated in the following markets during the last 12 months:

<b>Product</b>	<b>Participati on</b> 1-Yes 2-No	<b>Market type</b> 1-Open air market 2-Slaughter house 3-Supermarket 4- Schools/colleges 5-Hospitals 6-Prisons 7-Cereals board 8-Religious institution e.g. church, orphanage etc 9-Other..	<b>Distance To market (Km)</b>	<b>Frequen cy of particip ation</b>	<b>Quantity Bought</b>	<b>Buying Price Per unit</b>	<b>Quantity Sold</b>	<b>Selling Price Per unit</b>	<b>Gender participation</b> 1=% men 2=% women	<b>Challenges</b> 1- Distance to market 2-Poor market infrastructure 3-Exploitation by middlemen 4-Price fluctuations 5-Output fluctuations 6-High levies
Cattle										
Goats										
Sheep										
Chicken										
Milk (Litres)										
Hides										
Land (acres)										
Hay/Fodder										
-Maize -Beans -Onions -Green grams -Mangoes -Papaws -Melon										

Information										
-------------	--	--	--	--	--	--	--	--	--	--

Construction										
Credit										
Construction										

**ii); OFF TAKE RATES**

23. Besides sales, please indicate your livestock off- take in the table below:

<b>Livestock Type</b>	<b>Breed</b>	<b>Numbers consumed at home</b>	<b>Number given as gift</b>	<b>Number lost due to theft</b>	<b>Number lost due to disease and drought</b>

24. Do you sell any milk from your livestock? 1. Yes, 2. No. If yes, Please fill the table below:

<b>Numbers of litres sold (Per day)</b>	<b>Price(per unit) (Per day)</b>	<b>Litres sold in Wet season (Per day)</b>	<b>Litres sold in Dry season (Per day)</b>	<b>Amount consumed in Wet Seasons (Per day)</b>	<b>Amount consumed in Dry Seasons (Per day)</b>

25. In which months of the year do you receive high prices in the market? Please fill in the table below:

<b>Commodity</b>	<b>Months in the year when prices are highest</b>	<b>How do you prepare to benefit from the high market prices 1-Target harvest to coincide with these months, 2-Stock breeds to be sold when market prices are good, 3-Store harvest 4-Other.....</b>
Cattle		
Goats		
Sheep		
Chicken		

Milk		
Maize		
Beans		
Onions		

**26. Other Output**

How much do you produce of these? Please fill the table below;

Type	Quantity Produced	Used at farm	Quantity sold	Sale Price
Hides and Skin				
Manure				
Other				

**27. How much cost did you incur last year in the production of crops and livestock? Please fill the table below:**

Input Item	Quantities	Cost price per unit	Total cost
Feeds			
Salt			
Drugs and vaccines			
Acaricides			
Fertilizer			
Seeds			
Plough land			
Land rent			
Pesticides and herbicides			
Other.....			
Total cost			

**28. Who does the following livestock practices on the farm? Please fill the table below;**

Management Activities	1- Adult males(>18 years) 2- Adult females (>18 years) 3- Children (10-18 years) 4- Children (below 10 years) 5- Elderly (above 65 years)	Source 1-Family. 2-Hired 3-Other.....	Number of people involved per week	Wages per week paid to men	Wages Per week paid to women
Milking					
Herding					

Watering					
----------	--	--	--	--	--

Calf management					
Salt supplementation					
Vaccination and treatment					
Ploughing					
Planting					
Weeding					
Harvesting					
Storage					
Marketing					
Cattle, sheep & goats					
Milk					
Chicken & eggs					
Crops					

**SECTION F: RESILIENCE OUTCOMES**

**a. Food Access**

29. What is the average number of meals consumed in a day in your family?.....

30. How much does your household spend in buying food items per month?...Kshs.....

31. Were there any months, in the past 12 months, in which you did not have enough food to meet your family's needs?

1. Yes

2. No

If yes, in which months did the family experience inadequate food supplies? Please fill the table below;

	Mar 16	April 16	May 16	June 16	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb17
Record 1=Yes 0=N0												
Extent of food insecurity 1-missed food for one day, 2-missed food for two days 3- missed food for a week												
Average number of meals your household had in a day												

32. What was the cause of this inadequate food supply?

1. Low supply in the market 2. High prices 3. Poor harvest 4. Other.....

33. What coping strategies did your family undertake during months of inadequate food supply?  
 1. Borrow from neighbours, family and friends 2. Fed on wild fruits and tree leaves 3. Did nothing 4. Other.....

**b. Assets owned by the household**

34. Which of the following assets does this household own? Fill the table below:

	<b>Asset Item</b>	<b>Number owned</b>	<b>Estimated value of the asset</b>
<b>1</b>	Farm implements- hand hoes, panga, ploughs, etc		
<b>2</b>	Carts and Wheelbarrows		
<b>3</b>	Spray Pumps, irrigation pumps, irrigation pipes		
<b>4</b>	Water tank, borehole		
<b>5</b>	Mobile phones, radios and TV		
<b>6</b>	Bicycle, motorcycle and vehicle		
<b>7</b>	Residential house		
<b>8</b>	Buildings for rent		
<b>9</b>	Livestock owned (TLU)		
<b>10</b>	Land size owned		
<b>11</b>	Shares and Stocks		
<b>12</b>	Others		

**c. Access to Early Warning Information**

47. Do you normally receive any early information regarding changes in weather conditions? Please the table below;

<b>Source</b>	<b>Access 1-Yes 2-No</b>	<b>Terms of access 1-Free</b>	<b>Perception; 1-Timely, 2-Accurate 3-Reliable, 4-Useful</b>	<b>Challenges 1-Costly, 2-Not timely</b>	<b>What other information should be included in the early warning system 1-Disease outbreaks</b>
---------------	------------------------------	-----------------------------------	--	--	--

		<b>2-Paid for</b>		<b>3-Unreliable, 4-Other</b>	<b>2-Price changes, 3-Onset and end of rainy season</b>
Radio					
Television					

Mobile phone					
Social media					
Internet					
Print media					
Other...					

**Access to Savings and Credit**

54. Are you a member of any Savings and Credit institution/organization group?      1. Yes .....                      2    No.....  
 If yes, which type?

a. SACCO b. Table banking c. Merry go round d. Formal bank e. Mobile money (Specify).....

55. Can you access credit from any of the sources if you needed it?    1. Yes .....                      2    No.....

56. Have you received any credit in the last 12 months? If yes, fill the table below:

<b>Source</b>	<b>Amount Received</b>	<b>Amount Received Vs Amount applied (1=25%, 2=50% 3=75%,4=100%)</b>	<b>Use (1=Buy farm inputs, 2.=Expand business, 3=Pay school fees, 4=Buy assets, 5=Buy food</b>	<b>Proportion of loan already repaid (1= 25%, 2=50% 3=75%, 4=100%)</b>	<b>Challenges to credit access credit (1= Lack of collateral, 2 =High interest, 3 =Procedural 4 =Other.....)</b>
Formal Bank					
Micro finance institution					
SACCO					
Community groups					
Relatives/friends					

Mobile Money (specify)					
---------------------------	--	--	--	--	--

57. If the household doesn't have access to credit, what is the reason why you cannot access credit facilities?

1. No need 2. Not aware 3. Lack of enough collateral to secure a facility 4. High interests 5. Too procedural. 6. Other.....

**e. Access to Basic services**

58. In the last 12 months have you been able to have access to the following:

<b>Service</b>	<b>Did you get this service 1 Yes 0 No</b>	<b>Distance</b>	<b>Expenditure In Kes</b>	<b>Challenges (1 Distance 2 Expensive 3 Poor services 4 No personnel 5 Poor quality)</b>
Health service Mobile clinic, Dispensary, Sub county Hospital, County Hospital Private Hospital				
Water Tap, Borehole, Stream River				
Lighting Electricity Solar panel Solar lamps Lantern lamps				

58. In the last 12 months have you been able to have access any form of extension services? If so, please fill table below:

<b>Provider</b>	<b>Channel:</b>	<b>Terms of provision</b>	<b>Challenges</b>	<b>What can be done</b>
<b>1- Private</b> <b>2- County government</b> <b>3- Farmer to farmer</b> <b>4-Credit linked extension</b> <b>5-Outgrower</b> <b>6-Agro dealer</b>	<b>1 Home visits</b> <b>2 Phone</b> <b>3 Field school</b> <b>4 Other.....</b>	<b>1 Free</b> <b>2 Paid for</b> <b>3 Other.....</b>	<b>1-Costly 2- Infrequent visits</b> <b>3- Communication barrier</b> <b>4- Distance</b> <b>5-Farmers not willing to share information</b>	<b>1-Reduce costs</b> <b>2-Train more contact farmers</b> <b>3-Establish field schools</b> <b>4- Other.....</b>

<b>7- Church</b>			<b>6- Other.....</b>	
<b>8- Other.....</b>				

**f. Income**

59. Non Livestock Farm Income Activities (in the last 12 months)

<b>Enterprise</b>	<b>Amount harvested</b>	<b>Amount consumed</b>	<b>Amount fed to livestock</b>	<b>Amount sold (units)</b>	<b>Price per unit</b>
Maize (bags)					
Beans (bags)					
Onions (Kgs)					
Green grams (Kgs)					
Honey (Kgs)					

**Income Activities**

60. What are your major sources of income?

<b>Income source</b>	<b>Amount Derived</b>	<b>Proportion of income derived from it</b>  (1=none; 2=<25%; 3 = 25-50%;4=50-75%; 5=>75%)	<b>Number of male adults involved</b>	<b>Number of female adults involved</b>
Crops – (list 3 main ones)				

Livestock – (list 3 main ones)				
Business				
Employment				
Investment Income				
Artisan				

Remittances from family or friends				
Remittance from county government				
Gold mining				
Sand harvesting				
Charcoal Burning				
Brick Making				
Other.....				

### SECTION G: FUTURE SCENARIO

61. What other enterprise would you want to engage or continue in the next 5 years? Please fill the table below:

<b>Enterprise</b> (1- Livestock, 2-Crops, 3- Business, Rent, etc 4- Other.....)	<b>Motivation</b> (1-More profitable, 2-Less time consuming, 3-Resource availability 4- Reduced interest rates 5-Other.....)	<b>Needed Support;</b> (1-Capacity building 2- Institution framework, 3-Reduce bureaucracy 4- Infrastructure development, 5- Security 6- Reduce taxes 7-Other.....)

### SECTION H: DEMOGRAPHIC CHARACTERISTICS

	Gender of Household Head (1= Male, 2= Female)
	Age of Household head (years)
	Marital status(1= Single, 2= Married 3= Widowed/divorced/separated)
	Years of schooling of Household head.....
	Number of males-----
	Number of females.....
	Number of people who have lived in this household for the last 4 months.....

**SECTION I: EMPLOYMENT AND EDUCATION**

		Aged below 15 years	Aged 15-35 years	Aged 36-65 years	Above 65 years
	Number of Household members				
	<b><u>Labor disaggregation</u></b>				
	Working on-farm only				
	Working off-farm only				
	Working both off & on-farm				
	<b><u>Education (Quality of human capital)</u></b>				
	Completed Primary education; male = female =				
	Completed Secondary education male = female =				
	Completed Tertiary education male = female =				
	Completed University education male = female =				
	Dropped out at primary male = female =				
	Dropped out at secondary school male = female =				

**THANK YOU!**