FACTORS INFLUENCING MULTI-STAKEHOLDER LINKAGES FOR INNOVATIVE AGRICULTURAL DEVELOPMENT IN THE GADAM SORGHUM GROWING SEMI-ARID AREAS OF KITUI, MACHAKOS AND MAKUENI COUNTIES, KENYA

JUSTUS MUTETI KAVOI

A Thesis Submitted to the Board of Post Graduate Studies in Partial Fulfilment of the Requirements for the Award of the Degree of Doctor of Philosophy in Agricultural Extension of Egerton University

EGERTON UNIVERSITY

NOVEMBER, 2014

DECLARATION AND RECOMMENDATION

Declaration

I declare that this Thesis is my original work and has not been published or submitted to this or any University for the award of a degree.

Signature _____   Date _____

Justus Muteti Kavoi

Reg. No. ED12/0324/11

Recommendation

This thesis has been submitted with our approval as University supervisors.

Signed _____   Date _____

Prof. John Gowland Mwangi

Professor of Agricultural Education and Extension

Department of Agricultural Education and Extension, Egerton University

Signed _____   Date _____

Dr. Geoffrey Mbuthia Kamau

Principal Research Officer

Adaptive Research Programme, Kenya Agricultural Research Institute, Nairobi

DEDICATION

To my beloved wife Jane Ndumi, my children Emmanuel Ngumbau, Magdalene Mutanu and Vatillas Mbuvi, my mother Monica Nthengo for their support, understanding and encouragement in the entire period of my study and to my late father Gideon Kavoi who never lived to see me graduate.

ACKNOWLEDGEMENTS

ABSTRACT

Smallholder farmers in Kenya's semi-arid areas of Kitui, Machakos and Makueni Counties experience food insecurity due to challenges of low, erratic and poorly distributed rainfall and poor infrastructure. To address these challenges, leaders in the region have seen the need to involve local actors in sustainable development activities. Poor performance of Multi-Stakeholder Linkages for Innovative Agricultural Development (MSLIAD) in development initiatives in the region inhibits farmers' ability to increase farm productivity and household income. Analysis and documentation of the information on the factors responsible for the poor performance of MSLIAD initiatives were inadequately understood and poorly documented. A study to determine the factors influencing MSLIAD in the semi-arid areas of the three Counties was carried out. A pilot study involving 30 respondents was done in Kambu location, Kibwezi Sub-County to determine the Cronbach alpha (α) reliability coefficient of data collection instruments. A Cronbach alpha (α) reliability coefficient of 0.86 was obtained, which was above the minimum 0.70 threshold for acceptable reliability in social sciences. The researcher adopted a Working Research Design within the agricultural innovation systems (AIS) framework. Structured Key Informant (KIs) interviews (34 respondents), Focus Group Discussions (FGDs) (55 respondents) and Face-to-Face interviews involving 165 respondents were used to collect data. The study used a total of 254 respondents. Data were analysed using the Statistical Package for Social Sciences (SPSS) software versions 12.0 and 17.0. The unit of analysis was an individual respondent for Household and Key informant interviews and a group for FGDs. Main study data gave a Cronbach alpha (α) reliability coefficient of 0.87, which was well above the minimum of 0.70 threshold for acceptable reliability in social sciences. Study findings showed relatively weak linkages among development partners (weak linkages were significantly higher than strong linkages (($\chi^2 = 76.07$, df = 2, $p = 0.001$); breach of contracts (breach of contracts was significantly higher than distorted farm-gate and market prices ($\chi^2 = 59.49$, df = 2, $p = 0.001$); undefined networking and mistrust among development partners. The researcher concluded that key stakeholders supported joint MSLIAD initiatives; strong linkages were needed for defining the existing relationships and networks and improving trust among stakeholders. Agricultural innovation systems (AIS) presented a useful framework for analysing technological, economic and institutional change in agriculture. The researcher recommends that stakeholders working in the target area should take advantage of the prevailing stakeholders' support to MSLIAD initiatives to accelerate agricultural development; Policy formulation process should embrace an all inclusive formulation to achieve a positive and sustainable policy impact on the productivity of the agricultural sector; Stakeholders should promote use of AIS and formation of PPP-based linkages to improve agricultural productivity in the target area sustainably.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS AND ACRONYMS

AEZ	Agro-Ecological Zones
AIS	Agricultural Innovation Systems
ANT	Actor-Network Theory
APVC	Agricultural Product Value Chain
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
CBOs	Community-Based Organizations
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (International Centre for Tropical Agriculture)
CIMMYT	International Maize and Wheat Improvement Centre
CIGs	Common Interest Groups
CODA	Cotton Development Authority
CSOs	Civil Society Organizations
CRAC	Centre Research Advisory Committee
FAA	Focal Area Approach
FAO	Food and Agriculture Organization
FDA	Focal Development Approach
FBOs	Faith-Based Organizations
FFFs	Farmer Field Schools
FGDs	Focus Group Discussions
FM	Frequency Modulation
GDP	Gross Domestic Product
ICIPE	International Centre for Insect Physiology and Ecology
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
ICTs	Information and communications technologies
IS	Innovation Systems
ISF	Innovation Systems Framework
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KI	Key Informant
KIs	Key Informants

LM3	Lower Midland 3
LM4	Lower Midland 4
LM5	Lower Midland 5
MASL	Metres Above Sea Level
MDGs	Millennium Development Goals
MoA	Ministry of Agriculture
MSLIAD	Multi-Stakeholder Linkages for Innovative Agricultural Development
MT	Metric Tonnes
NALEP	National Agriculture and Livestock Extension Programme
NASEP	National Agricultural Sector Extension Policy
NEPAD	New Economic Partnership for African Development
NGOs	Non-Governmental Organizations
PM&E	Participatory Monitoring and Evaluation
PPPs	Public-Private-Partnerships
SAPs	Structural Adjustment Programmes
SMART	Standardized Monitoring and Assessment of Relief and Transitions
SPSS	Statistical Package for Social Sciences
UM2	Upper Midland 2
UM3	Upper Midland 3
UM4	Upper Midland 4

CHAPTER ONE
INTRODUCTION

1.1   Background of the Study

Resource-poor smallholder farmers in developing countries of the world, particularly in Sub-Saharan Africa continue to face food insecurity and low household income amid respective governments' efforts to address the situation (Maeda, Pellikka, Clark & Siljander, 2011; Moebius-Clune, Es, Idowu, Schindelbeck, Kimetu, Ngoze, Lehmann & Kinyangi, 2011). The quest for sustainable food security and household income has remained a major challenge among the resource-poor smallholder farmers in Sub-Saharan African (Maeda *et al*., 2011). Some of the challenges are caused by low, erratic and poorly distributed rainfall and increasing scarcity of available resources (Maeda *et al*., 2011; Moebius-Clune *et al*., 2011). Demographic trends and rising energy costs may worsen the situation (Le Gal, Dugué, Faure & Novak, 2011). This is particularly so for the smallholder farmers in the semi-arid areas of lower Eastern Kenya region (Bett, Ouma & De Groote, 2010; Ouma, Odendo, Bett, De Groote, Mugo, Mutinda, Gethi, Njoka, Ajanga & Shuma, 2011; Western, Groom & Worden, 2009). The Kenya Government has developed strategies and policies for raising household income for 75% of the 9.2 million persons engaged in farming in the semi-arid regions. This is achievable by increasing farm productivity in line with the New Economic Partnerships for Africa's Development (NEPAD) and the Millennium Development Goals (MDG) (Encyclopaedia of the Nations, 2011; Kabubo-Mariara, 2009; Omwami & Omwami, 2010). The importance of Multi-Stakeholder Linkages for Innovative Agricultural Development (MSLIAD) was emphasized during the 15th Annual International Sustainable Development Research Conference held in Netherlands in 2009 (Esders, 2009). Additionally, MSLIAD has been observed to offer an important new approach that has the potential to drive innovation, improve governance and raise living standards of millions of people (World Economic Forum, 2005).

The agricultural sector, which is the mainstay of Kenya's economy contributes about 51% of Gross Domestic Product (GDP) directly and indirectly and accounts for 65% of Kenya's total exports (Ministry of Agriculture, 2012). The sector generates 60% of

total foreign exchange earnings and provides over 18% of formal employment and over 60% of informal employment in the rural areas. Additionally, the sector employs 62% of the total population of about 40 million people (Kenya National Bureau of Statistics, 2010). This translates to 24.8 million people, 80% of who derive their livelihoods from subsistence farming. However, the returns from agriculture, which influence household income, depend on a farmer's ownership of assets and capacity to produce and market goods and services efficiently (Freidberg & Goldstein, 2011; Rao & Qaim, 2010). This is evident in the semi-arid areas of Kitui, Machakos and Makueni Counties, a region characterised by poor infrastructure; low, erratic and poorly distributed rainfall; food insecurity and low household income (Karanja, Kavoi & Mutuku, 2011).

Agricultural development stakeholders in the target area who include researchers, extension agents, civil society groups and farmers have been making efforts through MSLIAD to develop, validate and promote improved technologies and innovations for wider adoption in the region (Kavoi, Mwangi & Kamau, 2013a). For instance, these stakeholders through MSLIAD have been playing a major role during the Annual KARI Centre Research Advisory Committee (CRAC) which are meetings held to review on-going research projects and to discuss new research proposals for funding (Arithi & Wafula, 2010). The stakeholders have also been participating in respective Sub-County development and agricultural committees as well as in Sub-County stakeholder fora. In the semi-arid areas of Kitui, Machakos and Makueni Counties, the stakeholders have in the past implemented several initiatives which include Public-Private-Partnership (PPP) initiatives aimed at commercializing cotton (*Gossypium hirsutum*), sunflower (*Helianthus annus* L), castor (*Ricinus communis* L), dairy goat production, Gadam sorghum and cassava, among others (Kavoi *et al.*, 2013a). The PPP development initiatives were made to promote the dissemination of improved technologies and innovations that enable the smallholder farmers in the region to increase and stabilize farm-gate and market prices of their agricultural products.

To complement MSLIAD development initiatives in the Gadam sorghum growing semi-arid areas of Kitui, Machakos and Makueni Counties and other parts of the country, both farmer-led innovations and researcher-led technologies have been developed. Such innovations include improved finger millet produced through raising

finger millet seedlings in nurseries in Machakos County and reducing soil acidity through use of lime in Kakamega Siaya and Ugenya Sub-Counties (Kavoi, Kamau, Kirigua, Masila & Wanja, 2010b; Makete & Mbakaya, 2010). However, the intermediary organizations that provide knowledge to producers and other users of agricultural information have not adequately taken up the available technologies already developed and validated by research scientists (Alene & Coulibaly, 2009; Maina & Mwangi, 2011; Mwirigi, Makenzi & Ochola, 2009). Hence the wide gap between what is available with the suppliers of improved technologies and innovations and what the potential users of the technology have. Appropriate intermediary agencies and mechanisms are therefore required to bridge the gap in order to ensure improved adoption of the technologies and innovations (Rajalahti, 2009). Past performance of MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties, has been less than satisfactory and has led to minimal adoption and use of available improved technologies and innovations.

According to the MoA's National Agribusiness Strategy (2012), smallholder subsistence farms whose average size ranges between 0.2 and 3 hectares (Ha) account for more than two thirds of Kenya's marketed agricultural produce. However, use of improved technologies such as certified seeds, fertilizers, pesticides and machinery among the smallholder farmers is relatively low. Moreover, low adoption of improved technologies developed by scientists is related to appropriateness of the technologies with production resources such as land, labour, and capital, among others (Quisumbing & Pandolfelli, 2009). One therefore needs to consider the experience and needs of the target population (Ouma *et al.*, 2011). The role of relative advantage as an adoption driver, and the importance of profit for most resource-poor farmers influence adoption of technologies and innovations as well as agricultural productivity (Wilson, Bunn & Savage, 2010).

In the last two decades, the agricultural sector has increasingly become information-dependent. Furthermore, the farming communities require a wide range of scientific and technical information for effective decision-making (Ali & Kumar, 2011; Sivakami & Karthikeyan, 2009). The concepts of innovations and innovation systems have increasingly become common in the agricultural and rural development spheres (Anandajayasekeram & Gebremedhin, 2009). Such concepts have emerged as a result

of the limitations of linear models of knowledge and technology transfer. They have also emerged due to the inadequacy of previous participatory approaches at farm and community levels to sustainably improve the livelihoods of smallholder farmers (Triomphe *et al.*, 2013; ASARECA,[1] 2010a). Triomphe *et al.* (2013) observed that in terms of policy, stimulating innovation and improving the efficiency of innovation systems is recognized as a priority. Consequently, there is need to understand the complexity of MSLIAD processes in knowledge generation and use among smallholder farmers.

Both knowledge and information can contribute significantly to the acceleration of agricultural development. They can enhance adoption of improved agricultural technologies and farm productivity, which may include pre- and post-harvest management practices and marketing (Ali & Kumar, 2011). Improving access of information on new innovations and markets especially for resource-poor farmers improves their farm productivity (Murage, Obare, Chianu, Amudavi, Pikett & Khan, 2011). It also improves household income while contributing to other pressing family needs such as health and education. Stakeholders' access of information on available technologies and innovations is a key building block for improving farmers' performance and the capacity to achieve the set objectives on time (Hashemi & Hedjazi, 2011). A study by Okoko *et al.* (2008) shows that, smallholder farmers in southwest Kenya and in common with other Sub-Saharan African countries face weak linkages. As crop production losses increase with increase in yields, the need for effective pre- and post-harvest management as a tool for increasing farm productivity becomes more urgent. Past studies done in Uganda and Kenya show that farmers can innovate to suit their situations (Hawkins *et al.*, 2009; Kamau & Almekinders, 2009). The use of such innovations has shown positive results. However, documentation of such farmer-led innovations is inadequate or rare (Hashemi, Hossein & Damalas, 2009).

Smallholder farmers in the semi-arid areas of Kitui, Machakos and Makueni Counties, like small-holder farmers in other African countries continue to face limited access to agricultural services, weak markets links and limited resources such as certified seed.

---

[1] = Association for Strengthening Agricultural Research in Eastern and Central Africa

They also face weak collaborative linkages between public extension staff and other service providers (Ministry of Agriculture, 2012a). Additionally, development agencies in Kenya's semi-arid regions promote different approaches such as electronic platforms to share indigenous knowledge and to train para-extensionists who complement extension agents (Murage *et al*., 2011). This is done with limited understanding of how MSLIAD can assist resource-poor farmers move out of poverty (Glasbergen, 2010). Although there is evidence of high rates of returns from the use of improved technologies, it is not clear why agricultural research-based technologies have not translated into rapid agricultural growth and poverty reduction (Alene & Coulibaly, 2009; Wang'ombe & van Dijk, 2013). The complexity of information and knowledge processes on the promotion and adoption of improved technologies and innovations calls for stakeholders involved in MSLIAD initiatives to seek for valuable knowledge beyond their own boundaries (Faria, Lima & Santos, 2010).

Technological innovations developed through Multi-stakeholder processes generally drive the agricultural sector's profitability, productivity and sustainability in developing countries (Sneddon, Soutar & Mazzarol, 2011). Meaningful innovative agricultural development particularly in the semi-arid areas require joint efforts of innovative entrepreneurs, researchers and extension agents in the development, promotion and diffusion of improved technologies for wider adoption (Kavoi *et al*., 2013a). Resource-poor smallholder farmers in the semi-arid areas of Kitui, Machakos and Makueni Counties of Kenya operate in an environment constrained by poor infrastructure, low, erratic and poorly distributed rainfall (Karanja *et al*., 2011). These challenges have made it necessary to involve farmers in sustainable development activities through MSLIAD. The focus of this study was to determine and analyse the factors responsible for the current status of MSLIAD performance in the promotion and diffusion of improved technologies and innovation for improved innovative agricultural development in the semi-arid areas of Kitui, Machakos and Makueni Counties.

1.2   Statement of the Problem

Extension agents have in the past used MSLIAD initiatives such as public-private-partnership (PPP) to promote the diffusion and adoption of improved technologies and

innovations in the Gadam sorghum growing semi-arid areas of Kitui, Machakos and Makueni Counties. However, their success has been less than optimal. This problem has been compounded by the inadequate understanding of the cause(s) of the limited success. Moreover, there has been poor documentation of the factors responsible for the less than optimal performance of MSLIAD development initiatives. Additionally, information on the role(s) of different stakeholders and the existing networks within which the MSLIAD operate is limited. This study therefore sought to contribute towards providing the missing information. Such information would help to explain the current status of the performance of the MSLIAD in semi-arid areas of Kitui, Machakos and Makueni Counties of Kenya with a view to influencing policy on the current MSLIAD status.

1.3   Purpose of the Study

The purpose of this study was to determine the factors influencing MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties with a view to provide evidence-based policy recommendations for enhanced MSLIAD performance in the three Counties.

1.4   Objectives of the Study

The objectives of the study were to: -

a) Determine the different stakeholders and their roles in MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties.

b) Establish the existing relationships and networks within which MSLIAD operate in the semi-arid areas of Kitui, Machakos and Makueni Counties.

c) Identify the factors responsible for the current status of MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties.

d) Determine stakeholders' perceptions and suggestions for improving MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties.

e) Identify recommendations that have contributed to policy formulation in the past for development, promotion and diffusion of improved technologies and innovations in the semi-arid areas of Kitui, Machakos and Makueni Counties.

1.5   Research Questions of the Study

This study was guided by the following research questions: -

a) Who are the stakeholders and what are their roles in MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties?

b) What are the existing relationships and networks within which MSLIAD operate in the semi-arid areas of Kitui, Machakos and Makueni Counties?

c) What are the factors responsible for the current status of MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties?

d) What are stakeholders' perceptions and suggestions that can improve MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties?

e) What are the recommendations that have contributed to policy formulation in the past for development, promotion and diffusion of improved technologies and innovations in the semi-arid areas of Kitui, Machakos and Makueni Counties?

1.6   Significance of the Study

The study presents information on the factors responsible for the current status of MSLIAD. This information is likely to help all the stakeholders in identifying areas within their operations which need to be addressed. The information is also likely to assist stakeholders involved in MSLIAD to effectively plan, monitor and evaluate their performance. This would in turn lead to higher and sustainable farm productivity, household income and food security in the target area. The information would also help stakeholders, namely, policy makers, policy implementers, development partners and farmers to know how to improve the status of MSLIAD.

1.7   Scope of the Study

The study was carried out in six purposively selected Sub-Counties in the semi-arid areas of Kitui, Machakos and Makueni Counties. It involved Key Informants and smallholder farmers involved in the inception and awareness creation meetings and training workshops of the Gadam PPP commercialization initiative. Study variables included attitude, perceptions, education level and the capacity of the respondents to partner as these may influence MSLIAD current status. The study adopted the socio-demographic factors as moderating variables. These included respondents' socio-economic and socio-demographic factors (age and education level) and prevailing government policies. The study was undertaken within the concepts and theories that explain how innovation systems, actors' networks theory and boundaries concept relate in influencing the performance of MSLIAD joint development initiatives.

1.8   Assumptions of the Study

The study assumed that: -

a) Sampled respondents were involved in the initial farmer sensitization and training workshops organised to promote and commercialize Gadam sorghum production in Kitui, Machakos and Makueni Counties.

b) Apart from being involved in the Gadam sorghum commercialization initiative, sampled farmers were previously involved in past PPP initiatives in the target area.

c) There would be minimal attrition cases in the sample size.

1.9   Limitations of the Study

Limitations of this study are that:-

a) The study was conducted only in the areas where commercialization of Gadam sorghum MSLIAD PPP initiative had been carried out.

b) The study involved only farmers who participated in the commercialization of Gadam sorghum MSLIAD PPP initiative.

c) The selected respondents could have included some farmers who might have dropped out of the commercialization of Gadam sorghum MSLIAD PPP initiative and might have given limited information on study questions.

d) Recommendations therefore can only be generalised to the respondents in the study target area.

1.10   Definitions of Terms Used in the Study

Several terminologies have been used in the context of the study topic. These include:-

Actor-Network Theory: Latour (2005) defines actor-network theory (ANT) as the systematic way to consider the infrastructure surrounding technological achievements. The ANT encompasses boundary objects and boundary actors. This theory assigns agency to both human and non-human actors, for example artefacts. The theory is more interested in the infrastructure of actor-networks, how they are formed and how they can fall apart. Since MSLIAD initiatives involve several stakeholders in carrying out their activities in the semi-arid areas of Kitui, Machakos and Makueni Counties, it was important to study the dynamics and or processes within and across the different stakeholder networks. This definition was adopted and used in this study.

Agricultural Innovation Systems: Klerkx, Aarts and Leeuwis (2010) defined Agricultural innovation systems (AIS) as a framework for analysing technological, economical and institutional change in agriculture. The AIS framework entails the main actors, for instance, technology and innovation providers, users of technologies and or innovation, the intermediaries and the actors who bring about the interaction among them. This definition was adopted and used in this study.

Agricultural Product Value chain: Narrod, Roy, Okello, Avendaño, Rich and Thorat (2009) defines agricultural product value chain as a sequence of target-oriented combinations of production factors that create a marketable product or service from its conception to the end consumer, for example, the horticultural high value crops supply chain. This definition was adopted and used in this study to explain the various actors involved in Gadam sorghum value chain.

Boundary Actors:

Boundary actors (brokers) are defined as members of multiple groups and or communities capable of making effective flexible connections and coordination between the two or more communities (Coenen & López, 2010; Kimble, Greiner & Goglio-Primard, 2010). This definition was adopted and used in this study.

Boundary Objects:

Coenen and López (2010) and Kimble *et al.* (2010) define boundary objects as technologies and or innovations linking different stakeholders' interests. This definition was adopted and used in this study.

Group Dynamics: The Oxford Dictionary of Sports Science and Medicine defines group dynamics as the system of behaviours and psychological processes occurring within a social group (*intra*-group dynamics), or between social groups (*inter*-group dynamics). Dynamics refer to the change-producing force that produces activity or change in any situation or sphere of existence and or personal relationships. This could be the relationships of power between the people in a group. Clear understanding of group dynamics is crucial because it contributes to the understanding of decision-making behaviour, conflict of interests within and cross different groups, emergence and popularity of new ideas and technologies. The fore-going definition was adopted and used in this study.

Innovation: Researchers, Anandajayasekeram and Gebremedhin (2009); Love, Roper, and Bryson (2011) and Spielman, Ekboir, Davis and Ochieng (2008), have defined innovation as anything old and used in a new way or new that is successfully introduced into an economic or social process with a commercial application of new knowledge. Innovation has also been defined as a process of doing something that may follow a sequence of events in an institution or an organization (Spielman *et al.*, 2008). These two definitions were adopted and used in this study.

Innovation Platforms: Kimberley (2011) defines innovation platforms as the "spaces" that enable individuals and organizations to come together to address specific process issues of mutual concern and interest. They facilitate dialogue between the concerned stakeholders and provide a place for them to state their needs and requirements. This study adopted and used this definition to define the existing platforms in the target area.

Innovation Systems: Innovation systems are groups of organisations and individuals who interact and are involved in the generation, diffusion and adaptation, and use of knowledge of socio-economic significance, and the institutional context that governs

the way these interactions and processes take place (Spielman, Ekboir & Davis, 2009). This study adopted this definition in describing the innovation systems found in the study area.

Innovative: This has been defined as ground-breaking, pioneering, inventive, novel (English Thesaurus Dictionary, 2012). It means doing something in a modern or new way, from the usual way. This definition was adopted and used in this study to define and describe the nature of existing innovative agricultural development in the study area.

Innovative Agricultural Development: Esders (2009) and Tenywa *et al.* (2011) have defined innovative agricultural development as that development which results from the use of new ways and or technologies and innovations with a view to improving farm productivity, household income and the living standards of the smallholder farmers. Innovative agricultural development brings different stakeholder, groups or actors into constructive engagement, dialogue and decision making to help improve situations that affect them. It helps the stakeholders to draw the attention of government staff, policy makers and the farming community to think and work together. These definitions were adopted and used in this study.

Instruments: Ditsa and Al Kobaisi (2009) define instruments as tools for data collection and or the means by which something is done. In this study, instruments were the tools and or means through which data were collected. Instruments used in this study included a key informant in-depth interview check-list focus group discussion guiding check-list, a semi-structured questionnaire for individual household survey and a self-administered structured questionnaire.

Linkages: Giuliani & Arza (2009) defined linkages as the connections, relationships, partnerships and or associations between different partners, institutions and or stakeholders which have been established to share and or transfer information and resources among and or across the stakeholders involved. In this study, these refer to the linkages that exist between agro-dealers, farmers and other stakeholders in the agro-inputs supply chain (Maina & Mwangi, 2011). This definition was adopted and used in the respective areas in the study.

Multi-Stakeholder Linkages for Innovative Agricultural Development (MSLIAD): A stakeholder is any person, group or organization who affects and or is affected by a decision of an organization (Wilson *et al.*, 2010). The MSLIAD have been defined as the processes relating to the setting up and facilitating long term processes that bring different actors into constructive engagement, dialogue and decision making (Esders (2009; Tenywa *et al.*, 2011). The MSLIAD aim to involve stakeholders in improving situations that affect them, while at the same time getting government staff, policy makers, community representatives, scientists, business people and Civil Society Organizations (Community-Based Organizations, faith-Based Organizations and Non-governmental organizations -NGOs) representatives to think and work together. These definitions were adopted and used as the operational definitions in this study.

Partnerships: Poulton and Macartney (2011) and Wilson *et al.* (2010), define partnership as a "cooperation of some sort of durability between public and private actors in which they jointly develop products and services and share the risks, costs and resources which are connected with such products and services". Poulton and Macartney (2011) further defined partnerships as the "reciprocal obligations and mutual accountability, voluntary or contractual relationships; the sharing of investment and reputation risks, and joint responsibility for the design and execution of a project and or an activity". The definition by Poulton and Macartney (2011) was adopted in this study.

Systems: Anandajayasekeram and Gebremedhin (2009) define a system as a collection of related elements that must function in a coordinated manner to achieve the desired results. Systems have also been defined by the English Language Thesaurus dictionary (2012) as the structures, coordination, arrangement or an approach of doing something. This study adopted these definitions to describe the existing agricultural innovation systems within which MSLIAD are engaged in implementation of activities in the semi-arid areas of Kitui, Machakos and Makueni Counties.

CHAPTER TWO
LITERATURE REVIEW

2.1   Introduction

Literature review was carried out in the context of multi-stakeholder linkages for innovative agricultural development (MSLIAD) under the following sub-titles: The Paradigm of Agricultural Extension Delivery Approaches and Drivers of Change in Technology Dissemination and Adoption; Linkages between Research, Policy and Practice; Sustainable Multi-Stakeholder Linkages; Roles and Relationships between Different Agricultural Extension Service Providers; The Case of Public-Private-Partnerships; Agricultural Research and Involvement of Different Stakeholders in Agricultural Extension Service Provision; The Role of Agricultural Innovation Systems in Agricultural Development; Networks of Practice and Innovation Platforms; Entrepreneurial Innovation; Theoretical Framework; and The Conceptual Framework. Literature review enabled the researcher to establish what has been done, the existing gaps and what the study did to address the identified gaps. The chapter further outlines the importance of casual and behavioural change with regard to the drivers of technological, social, political and psychological change. The researcher concludes the chapter by outlining the theoretical and conceptual framework that guided the study.

2.2   The Paradigm of Agricultural Extension Delivery Approaches and Drivers of Change in Technology Dissemination and Adoption

Over the years, different approaches have been used in extension service provision in the world, and particularly in Sub-Saharan Africa (Vanloqueren & Baret, 2009). This raises questions as to "how does a paradigm emerge in the first place and how was it "preferred" to others?" One also needs to know how agricultural extension delivery approaches and methods have been evolving over the years and how these have affected the dissemination and adoption of agricultural technologies and innovations. Understanding past and current technology dissemination approaches and the changes associated with the paradigm shifts are vital (Vanloqueren & Baret, 2009). According to Dolata (2009) paradigm shifts can be based on two interrelated influencing factors, first, the sectoral specific transformative capacity of new technologies themselves. This refers to the technologies' substantial or incremental impact on socio-economic

and institutional change in a given sectoral system; secondly, the sectoral adaptability of socio-economic structures, institutions, and actors confronted with the opportunities presented by new technologies. The former enables the identification of the technology-based pressure to change and adjust to fit in the system. The latter assists in the discernment and or sensitivity of the distinct social patterns of anticipating and adopting this technology-based pressure for change (Dolata, 2009).

The trend in paradigm shift has been for the introduction and promotion of top-down approach with its own set of principles and guidelines by the respective proponents over a few years followed by promotion of yet another approach in the agricultural sector development (Hashemi & Hedjazi, 2011). Such approaches fall into three broad methodological categories: Linear – Top-down approach in technology transfer; farming systems approach and farmer participatory research approach. Within these broad categories were different methodologies, namely, whole farm management in the 1950s to 1970s; farmers training centres and participatory methodologies in the 1980s. Other methodologies include the shifting focal extension and farmer field schools (Davis, Nkonya, Kato, Mekonnen, Odendo, Miiro, & Nkuba, 2011). In the recent years, the focal development approach (FDA) which emphasises the agricultural product value chain concept has been used in extension service provision by public extension staff (MoA, 2009). Thus, through the National Agricultural and Livestock Extension Programme (NALEP), the FDA provides a framework for interaction of interdependent sectors in project implementation. Presently, agricultural information desks have been established in Sub-County agricultural offices to disseminate agricultural technologies and innovations using the concept of the agricultural product value chain (APVC) (Narrod *et al.*, 2009).

Information on factors responsible for shifting paradigms in technology and innovation promotion and diffusion approaches, which explain how the paradigm shifts occur, is globally available. But this information is either lacking or inadequate in the semi-arid areas of Kitui, Machakos and Makueni Counties leading to a knowledge gap that is yet to be filled as observed by Anandajayasekeram and Gebremedhin (2009). New development projects are often introduced by different agencies that have their own preferences attached to such projects in terms of the mode of implementation, the reporting format and target community. Leys and Vanclay (2011) argues that the

earlier technology transfer approaches and methods were unsuitable for resource-poor farmers in the third world countries' complex, diverse and risk-prone agriculture. Little focus, they say, has been given to the development of institutional frameworks for implementation and evaluation of emerging technology dissemination approaches and methods – a situation that exists in the semi-arid areas of Kitui, Machakos and Makueni Counties.

2.3   Linkages between Research, Policy and Practice

Although governments globally have recognized the need to involve local actors in sustainable development (Leys & Vanclay, 2011), sustainable development has remained elusive for many African countries and poverty remains a major challenge (United Nations (UN), 2011). Failure by most countries in Sub-Saharan Africa to benefit from the opportunities of globalization has further worsened the situation. Globalization and climate change have combined with civil strife, inequality and weak governance as drivers of food insecurity to expose the ever-increasing numbers of people to severe hunger (ASARECA, 2011). A major bottleneck to the development of the African continent is declining agricultural productivity (Nyagumbo & Rurinda, 2011). In recent years, agriculture has received attention from governments, investors and other partners after decades of neglect. However, such attention should support and create strong linkages that link smallholders to productive value chains (Byerlee& Bernstein, 2013; ASARECA, 2013). The new economic partnership for African development (NEPAD) has recognized partnerships among African countries themselves and between them and the international community as key elements of a shared and common vision to eradicate poverty (UN, 2011). Adoption of innovations that enhance or maintain land productivity sustainably becomes crucial in achieving the much desired food security to feed the increasing population, (ASARECA, 2010b).

Leaders can use research to manage development projects. They can also use research to guide them in making the right choices when developing pro-poor policies that lead to socio-economic development of a nation (Mwangi, 2011). ASARECA (2010a) noted that, for research to be relevant, it must focus on people's cultural, social and economic aspirations. Research must also take into account the values and realities that are entrenched in national policies and clearly focus on the practical usefulness of

technologies and innovations developed for practice. Moreover, a government agency responsible for the development of a particular commodity or a business entity can initiate linkages that would link research, policy and practice (UN, 2011). However, the goal of practical usefulness of research can remain indefinable without strong linkages between research, policy and practice. These are the key elements necessary for reducing the time gap between scientific findings and their translation into commercial application, especially among the resource-poor smallholder farmers in the semi-arid areas of lower Eastern Kenya (Mwangi, 2011).

Policies are statements of organizational objectives and expectations that reflect the social values and needs of the masses (Byerlee & Bernstein, 2013; Sycamnias, 2010). Researchers Giuliani and Arza (2009) define linkages as the interactions between organizations which allow exchange and or transfer of information, resources or power. Linkages may be formed for joint research or they may be needed for transferring the developed technologies and innovations; Linkages may also be formal and institutionally recognized or informal and temporarily and used to enhance consensus building and people's understanding on relevant integrated decision-making (Giuliani & Arza, 2009). Linkages have been observed to minimize duplication of efforts and delay the process of project planning and implementation continuum (Mwangi, 2011). Arza and López (2011) noted that in developing countries, linkages between different actors are more related to the provision of specific services as opposed to research or entrepreneurship. However, lack of motivation to participate, coupled with inadequate understanding of the benefits derived from linkages may weaken the linkages.

Stronger linkages can be achieved through creation of an enabling environment that promotes product specialization among producers (farming community) and processors (value addition) (Buchanan, Brouwer, Klerkx, Schaap, Brouwer & Le Borgne, 2013; Food and Agriculture Organization, 2011). Local communities should be encouraged and appropriately supported through the entire process of project development, implementation and ultimately adapt and adjust policies according to their constraints and opportunities for realization of a successful policy reform agenda (ASARECA, 2010b). As noted by researchers Buttoud, Kouplevatskaya-Buttoud, Slee and Weiss (2011), a strategy therefore is needed to promote social and policy learning

among different stakeholders in order to address contradiction between policies and markets in technology and innovation development.

Policy makers have over the last decade been searching for a suitable blend between the public and private sector roles to enhance agricultural productivity in Sub-Saharan Africa (Spielman, Byerlee, Alemu & Kelemework, 2010). Additionally, a study by Quisumbing and Pandolfelli (2009) showed that African households are complex and heterogeneous. They further noted that complex gender roles are embedded in both agricultural and non-agricultural production systems. Furthermore, policies, institutions, markets and information as well as the external environment greatly influence any particular farming system (Steeg, Verburg, Baltenweck & Staal, 2010). This implies that the respective roles of the major actors in research, policy and practice need to be well focused and clearly defined (FAO, 2011). Moreover, direct government participation, for instance, in sponsoring agribusiness linkages have been observed to slow down the growth of such sectors or sub-sectors of the economy due to state bureaucracy (FAO, 2011).

In liberalized markets and the changing world economic order, where there is heavy government control in farm-agribusiness linkages, such sub-sectors are likely to perform poorly (FAO, 2011). Thus, there is need for governments to be sensitive to changing economic climates. There is also the need for such governments to limit their presence in policy and regulatory work (UN, 2011). A study by FAO (2011) observed thst, farmers' organizations such as producer co-operatives, associations and agricultural lobby groups are beneficial to the commercialization of agriculture and agribusiness development due to their organised bargaining power unlike the case of individual resource-challenged smallholder farmer. However, the same study observed that in the smallholder systems, farmers are at the weak end of the economic exchange system and as individuals, they need to develop strategies that enhance their marketing and market power that can help them move out of poverty Thus, policies intended to enhance people's lives and should therefore express and embody the needs and values of the targeted society. Moreover, within the agricultural practices in particular, gender and household organisation simultaneously influence and determine the nature of human values (ASARECA, 2010b). Consequently, implementation of policy reforms

should therefore ensure that the process does not disrupt production, processing, marketing functions and or delivery of services (Ministry of Agriculture, 2005).

The effectiveness of linkages between research, policy and practice can be based on the knowledge of stakeholders' functions, accessibility, relevance, urgency and timeliness of service delivery. It can also be based on the end-users' perceptions on their performance in achieving the intended goals over time, the mandate and representatives in their formulation and the legitimacy of the concerned stakeholders (Arza & López, 2011; Mwangi, 2011). Poor leadership as well as lack of openness (poor transparency) and weak representation (involving junior representatives) of policy makers in most policy-formulation meetings have also been noted to contribute to weak linkages. Junior representatives in such meetings cannot make certain decisions thus dragging the policy-formulation process.

Researchers, extension agents, civil society groups and farmers have been involved in MSLIAD development initiatives to improve agricultural production and household income in the semi-arid areas of Kitui, Machakos and Makueni Counties. The initiatives have been carried out through the development, validation and promotion of improved technologies and innovations for wider adoption in the region (Kavoi *et al*., 2013a). Based on their mandate, availability and easy accessibility by farmers for consultations and their genuine commitment to socio-economic development, extension service providers are ideal for educating communities on how to make decisions on capital flow and use of technology in production and value addition of farm produce (Mwangi, 2012).

2.4 Sustainable Multi-Stakeholder Linkages within and across Organization, Jurisdiction and Sectoral Boundaries

Sustainable MSLIAD involve both benefits and costs associated with MSLIAD initiatives (Giuliani & Arza, 2009). Researchers, Gill (2009) and Prager and Freese (2009) in their studies observed that, for MSLIAD to be sustainable, factors that influence them need to be clearly defined and addressed. These researchers noted that factors that could partly influence the performance of MSLIAD initiatives include interest, transparency and inputs or resources needed from all the partners involved. These could also include room for initiating participatory process in the issue(s) that

brings the partners together and the resulting benefits from such initiatives. However, lack of documented evidence on the factors influencing the performance of MSLIAD joint initiatives in the semi-arid areas of Kitui, Machakos and Makueni Counties presents yet another knowledge gap. Actors in a potential partnership represent different ways of knowing what is created by the boundaries that they must traverse in order to work together (Morse, 2010). Such boundaries include organizational, jurisdiction and sectoral, as well as boundaries created by worldviews and life experiences (Morse, 2010). Room for creation of new opportunities can be created once actors work together across boundaries and integrate differences into shared understanding and common purposes.

A common interest in the issue at hand can bring multi-stakeholders partners together to actively participate in different MSLIAD initiatives (Prager & Freese, 2009). Such interest acts as the driver that brings and binds the different stakeholders together. To sustain it, transparency on the use of allocated inputs and resources as well as the benefits accruing from the initiatives has to prevail (Prager & Freese, 2009). However, Giuliani and Arza (2009) argued that, although linkages between different stakeholders may exist, some linkages may be beneficial to all the stakeholders while others may not. Apparently, weak linkages among different stakeholders involved in MSLIAD initiatives in semi-arid areas of Kitui, Machakos and Makueni seem to exist (Kavoi, Karanja, Wafula, Kisilu & Arithi, 2011; Poulton & Macartney, 2011). Thus, an understanding of the current status of MSLIAD development initiatives in semi-arid areas of Kitui, Machakos and Makueni is crucial for the realization of improved farm productivity and food security in the region.

2.5   Roles and Relationships between Different Agricultural Extension Service Providers

Technology and innovation promotion and diffusion approaches observed in the last two decades have been observed to involve different extension service providers amid inadequately defined and documented role(s) and relationships of different stakeholders (Kavoi *et al.*, 2013a). However, according to the MoA's National Agricultural Sector Extension Policy (NASEP) (2012a), in a pluralistic extension system, partnership, collaboration and networking are important aspects among the

structural adjustment programmes (SAPs). Input suppliers, agro-processors, marketing agents, financial institutions, farmer organizations, research and training institutions, administrative and regulatory agencies are among the potential collaborators and or partners who complement extension service provision. Little formal collaboration among the SAPs has led to lack of synergy and duplication of efforts. Additionally, weak collaboration between public extension staff and other service providers has resulted in poor access to extension support services by extension clients (MoA, 2012a).

Generally, the desire for partnership especially in extension service provision is there but translating this desire into visible actions remains a challenge. For instance, different NGOs visit farmers at different times without coordinating their activities to avoid duplication of effort or unnecessary wastage of available scarce resources. The gap in coordination of activities is a major challenge. Finding and having a consensus on the person or institution to coordinate other stakeholders is another challenge. Proper sharing of available resources is yet another challenge. A clear identification of stakeholders and their role(s) in the MSLIAD is important because one partner's failure, as Narrod et *al.* (2009) observed, is likely to affect the performance of other stakeholders. Poulton and Macartney (2011) recommends, for instance, that if the state extension service provision fails, innovative ways should be sought to bring the private sector on board.

A continual decline in government financial support for agricultural extension combined with a growing concern for sustainability and equity has resulted in the need for participatory methods to replace the top-down approaches (Trauger, Sachs, Barbercheck, Kiernan & Findeis, 2008). To address this situation, the MoA has in recent years used the FDA approach which initiates, facilitates and promotes grassroots institutions formations that help the communities to generate and implement projects. In FDA, common interest groups (CIGs) which are groups of farmers with an interest in an enterprise are formed to develop and implement activities around the priority issues or challenges within the enterprise (MoA, 2009).

2.6   Public-Private-Partnerships

Public-Private-Partnerships (PPPs) are both multidisciplinary and contrasting (Giuliani & Arza, 2009). They are known to impact on society positively especially where resources for research are inadequate (Kavoi *et al.*, 2011). They minimise transaction costs on contracting, coordinating and enforcing relationships between different stakeholders as well as costs associated with forming and sustaining relationships (Kavoi *et al.*, 2013a; Oreszczyn, Lane, & Carr, 2010). To address this, contributions from all the stakeholders towards the achievement of a common goal should therefore be taken into consideration (Mahoney & Morel, 2006).

Researchers Ali and Kumar (2011), Arza and López (2011) and Gill (2009) noted that, respective governments (India, Argentina and Australia) upon realising the importance of advanced and real-time information and knowledge for the farming communities, have made concerted efforts to explore innovative information delivery mechanisms. Thus, knowledge and information on improved agricultural technologies and practices are a public good and agricultural extension services are one of the most common means of dissemination. Although a similarity exists between the inter-organizational relationships in both the public and the private sector setting, there is, however, less research done on them (Cäker & Siverbo, 2011). Hence the need for a thorough understanding of the transformation of extension services in view of the new challenges that require innovations and new technical knowledge (Labarthe, 2009).

Agricultural setup in many parts of Africa has been viewed as a struggle between market and state failure as evidenced by the disappointment of the private sector's response to agricultural market liberalization (Poulton & Macartney, 2011). Over the past decade, a search by policy makers for an appropriate mix (blend) of public-private sector roles for sustainable increased agricultural production and marketing has been carried out (Spielman, Byerlee, Alemu, & Kelemework, 2010). However, Poulton and Macartney (2011) further argue that the major emphasis has been to get the state out of agricultural marketing activity in the Sub-Saharan Africa. A search for a more active role for the state that goes beyond the creation of an enabling environment toward encouraging market development is emphasised.

2.7 Agricultural Research and Involvement of Different Stakeholders in Agricultural Extension Service Provision

Agricultural research holds a great potential for achieving sustainable agricultural production by raising agricultural productivity and reducing poverty (Alene & Coulibaly, 2009). Nyagumbo and Rurinda (2011) and Alene and Coulibaly (2009) noted that despite considerable advances in agricultural technology development, declining agricultural productivity among smallholder farmers in Africa remains a major bottleneck to the continent's development. They also observed that while there is great theoretical literature on the role of agricultural research and technology in agricultural growth and poverty alleviation, there is limited empirical evidence establishing the links between agricultural research, productivity growth, and poverty. There is also limited empirical evidence to suggest that agricultural sector reforms have been successfully adapted to the specific context of Sub-Saharan Africa including Kenya's semi-arid areas of Kitui, Machakos and Makueni Counties. Linkages between public research organizations and other service and product providing agencies seem much more related to the provision of specific services rather than to research or entrepreneurship (Arza & López, 2011; Nyagumbo & Rurinda, 2011).

The semi-arid areas of Kitui, Machakos and Makueni Counties require deliberate efforts to create effective linkages between technological arrangements, people and social-organizational arrangements as observed by Klerkx and Leeuwis (2008a). Public extension services have over the years been centralised, hierarchical and unresponsive to the diverse needs facing resource-poor farmers in these Counties. Poulton and Macartney (2011) suggest that contracting private extension service providers could possibly increase responsiveness. However, this would call for the establishment of a mechanism that enables farmers to express their preferences across competing service providers. Research has great potential in raising agricultural productivity, particularly among small-holder farmers, reducing poverty and ensuring sustainable development (Alene & Coulibaly, 2009; Nyagumbo & Rurinda, 2011).

2.8   The Role of Agricultural Innovation Systems in Agricultural Development

Technological innovation is a key driver of the agricultural sector's profitability, productivity and sustainability (Sneddon, Soutar & Mazzarol, 2011). Researchers Klerkx, Aarts and Leeuwis (2010) noted an increased thinking and application of agricultural innovation systems (AIS) as a framework for analysing technological, economical and institutional change in agriculture. The AIS framework entails the main actors, for instance, technology and innovation providers, users of technologies and or innovation, the intermediaries and the actors who bring about the interaction among them. All actors are influenced by the agricultural policy context and the overall informal institutions, attitudes and practices that either support or hinder innovative processes (Rajalahti, 2009). Accordingly, coordinated support to agricultural research, extension and education is therefore crucial in promoting innovations, fostering innovation partnerships and linkages that go beyond APVC in agricultural development. In the AIS approach, innovation is considered as a result of a process of networking and interactive learning among a heterogeneous set of actors. In this setup, agricultural professionals play a vital role in helping to create and develop innovations (Wheeler, 2008). However, in the semi-arid areas of Kitui, Machakos and Makueni Counties, the innovation networks are not clearly defined and stable and the networks' membership and composition may change over time. This could possibly be due to other peripheral actors who are involved in the institutional environment within which the existing networks operate.

Agricultural education, research and extension systems can contribute substantially to enhancing agricultural production, growth and poverty alleviation (Spielman *et al*., 2009). However, such contribution seems to fall short of meeting the expectations of the MSLIAD initiatives made to increase agricultural production in the semi-arid areas of Kitui, Machakos and Makueni Counties. Spielman *et al*. (2009) suggested that, there is need for more innovative and less linear approaches to exploiting new opportunities and overcoming production constraints. More importantly, an innovation system framework shifts the analytical emphasis from a conventional linear model of knowledge and technology transfer (researcher-extension agent-farmer) to a more complex, process-based system approach. Additionally, the agricultural sector's growth and development as noted by Faria *et al*. (2010) is influenced by complex

interactions among the PPP actors. This is coupled with rapidly changing market and policy regimes that affect knowledge and information flows, technological opportunities and innovation processes that are evident in the semi-arid areas of Kitui, Machakos and Makueni Counties.

Technology and innovation adoption is greatly influenced by farmer characteristics and circumstances under which the farmer operates. It is also influenced by the innovation's relative advantage over the existing practice (Greiner, Patterson & Miller, 2009). The space for innovation is entrenched in and constituted by the dynamics between social-cultural, biophysical, economic, political and legal subsystems (Schut, Paassen, Leeuwis, Bos, Leonardo & Lerner, 2011). Thus, innovation is not a linear process. Instead it emphasizes that organizations do not innovate in isolation but in the context of a system. Innovation is therefore seen as a process of creating and managing effective linkages between different subsystems (Klerkx & Leeuwis, 2008a). Klerkx and Leeuwis (2008a) further observed that, from the innovation systems perspective, production and exchange of knowledge are not the only prerequisites for innovation. Several additional factors such as policy, legislation, infrastructure, funding and market development play a key role (Freidberg & Goldstein, 2011).

2.9   Networks of Practice and Innovation Platforms

An improved and validated technology and economic innovation create a win-win situation while maintaining and improving economic competitiveness and securing environmental sustainability (Coenen & López, 2010). Although innovation platforms and intermediaries help entrepreneurs cope with emerging agricultural challenges such as the articulation of the multi-stakeholders' innovation needs, they need a flexible attitude and process skills in the navigation of their dynamics (Buchanan, Brouwer, Klerkx, Schaap, Brouwer & Le Borgne, 2013). They also need a broad range of tasks that relate to problem solving, learning and group development processes (Paassen, Klerkx, Adu-Acheampong, Adjei-Nsiah, Ouologuem, Zannou, Vissoh, Soumano, Dembele & Traore, 2013).

In many developing countries, the agricultural sector is being organised along demand-driven production chains in both local and global competitive markets (Klerkx &

Leeuwis, 2008b). Poorly functioning agricultural value chains in Sub-Saharan Africa can be effectively improved through PPP-based linkages. These linkages should be used to strengthen stakeholders' individual and collective capacities to innovate and improve organizational cultures and behaviours. Buttoud, Kouplevatskaya-Buttoud, Slee and Weiss (2011) recommends promotion of multi-stakeholders' social and policy learning process, which is inherently interactive. In this process, individuals, organizations and societies must have the ability to improve on what they are currently doing. This draws attention to three key elements of innovation systems: the importance of strengthening individual and collective capabilities to innovate; improving organizational cultures and behaviours in support of such capabilities; and nurturing networks and linkages with other innovation agents (Spielman *et al.*, 2008) – a situation that needs to be addressed in MSLIAD initiatives in Kitui, Machakos and Makueni Counties.

Agricultural innovation platforms require deliberate efforts to create effective linkages between technological arrangements, people and the social-organizational arrangements for them to effectively deliver their services (Oreszczyn *et al.*, 2010). Farmers do not earn high incomes because their innovations and practices are mostly organised and accumulated through experience and are usually applied in isolation (Lwoga, Ngulube, & Stilwell, 2010). Thus, such innovations end up not being fully utilised for agricultural development purposes. Although diverse groups with different organizational allegiances comprise the local farming communities, development of appropriate approaches to tap isolated information, experiences and skills for sustainable agricultural development is crucial. New technology and innovation approaches that make better use of knowledge among smallholder farmers are needed to achieve innovative agricultural and rural development (Friis-Hansen & Duveskog, 2011). Such approaches should provide the smallholder farmers with a stronger demand voice for negotiating power besides extension advisory services.

Although the idea of a support network may assume voluntary network membership, it does not mean members' interests align, instead innovation networks are scenes of negotiation (Klerkx *et al.*, 2010). The introduction and performance of an innovation therefore requires an integrated assessment of an innovation systems approach. Supporting innovation processes or analysing space for innovation requires analysis

across all the sub-systems in order to provide an integrated and holistic understanding of the innovation systems. However, Glasbergen (2010) observed that, networking ought to be seen as a continuous process in which the interacting agents create emergent properties, qualities and patterns of behaviour. This could possibly suggest that, for MSLIAD initiatives to overcome a collective action problem, stakeholders' strengths should be combined with the identity of the network while keeping single identities of stakeholders at bay.

2.10   Entrepreneurial Innovation

Policy makers support innovation and entrepreneurship since it creates economic value and is critical to a country's economic development (Colwell & Narayanan, 2010). However, in balancing between the objective of sustainable development and the rules of the market governing entrepreneurship, public policies and market mechanisms act both as drivers of, and barriers to innovation (Buttoud *et al.*, 2011). Buttoud *et al.* (2011) argues that, to overcome the contradiction between policies and markets in innovation development, leaders should put in place a strategy that enables the promotion of social and policy learning between multi-stakeholders.

Ardent crusaders for free markets argue for some restrictions on the actions of enterprising and ambitious entrepreneurs. But Colwell and Narayanan (2010) argue that, encouraging and constraining entrepreneurial activity requires a special kind of foresight that takes into account the entire institutional context in which the entrepreneur operates. Understanding entrepreneurial innovation as an inherently social, interactive learning process would then form the defining feature of the systems approach to innovation (Coenen & López, 2010). Thus, the ability of individuals, stakeholders, for instance, those involved in MSLIAD processes in the semi-arid areas of Kitui, Machakos and Makueni Counties, organizations and societies to improve on what they are currently doing forms the basis for any development (Spielman *et al.*, 2009).

2.11   Theoretical Framework

The overarching concept of innovation systems encompasses the innovation systems framework which can be used to study the agricultural innovation systems (AIS) in an area. The innovation systems framework and the boundaries concept therefore guided this study because the two show the factors that influence processes and reactions among and between different actors (Ditsa & Al Kobaisi, 2009). Social science studies using innovations diffusion theoretical frameworks have provided useful insights that explain the behavioural reactions of individuals to technology and innovation (Ditsa & Al Kobaisi, 2009). Innovation systems framework indicates that, although the link between innovation and knowledge sharing has been widely recognised, knowledge sharing can be challenging (Coenen & López, 2010). Owing to the challenges in information sharing, a clear understanding on innovation and knowledge sharing across boundaries is critical (Kimble, Grenier & Goglio-Primard, 2010). Knowledge within a group is reflected by a particular group's own norms and concern (Garcia-Retamero, Müller, Catena & Maldonado, 2009; Klerkx *et al.*, 2010). Kimble *et al.* (2010) argued that, although information exchange has its own difficulties, whether the stimulus is from within or outside a certain group, it is unlikely that such a group can produce innovative ideas on its own. As such, existing farmer self help groups in the semi-arid areas of Kitui, Machakos and Makueni Counties will need a stimulus of fresh information from outside.

Boundaries concepts emphasize that, in order to distinguish endogenous (systems' own) drivers of innovation from the external drivers (outside the system), the boundary objects and brokers should be clearly defined (Coenen & López, 2010; Kimble *et al.*, 2010). Kimble *et al.* (2010) define boundary objects as technologies and or innovations linking different stakeholders' interests. In this study, for instance, improved technologies and innovations that have been promoted through joint development initiatives in the target area were examples of boundary objects. Boundary actors (brokers) are defined as members of multiple groups and or communities capable of making effective flexible connections and coordination between the groups or communities (Coenen & López, 2010; Kimble *et al.*, 2010). In the study area, boundary actors referred to members of farmer self-help groups who belonged to more than one group. Innovation systems boundaries can be physical projects/ documents or

sets of rules that allow groups to remain stable. Different stakeholders working without interaction between them would not benefit from the experiences and new information and knowledge acquired through such interactions.

Although flexible boundary objects allow coordination of programmes and processes to bring about transformation, coordination of such programmes and processes can be costly especially when different actors with divergent perceptions portray vested interests in determining how things should be done (Garcia-Retamero *et al*., 2009). Perceptions held by different stakeholders in the study area calls for identifying the existing boundary objects and boundary brokers (actors) and how they relate with each other to influence the innovation systems and knowledge-sharing. It is vital to understand the interplay between boundary objects and brokers (actors) since institutional politics and related factors could influence MSLIAD (Kimble *et al*., 2010). Understanding the interests and needs of different stakeholders involved in MSLIAD initiatives is critical to the sustainability of innovative agricultural development in the target area.

To determine factors responsible for the current MSIAD status, this study used innovation systems framework (ISF) and ANT to understand the real situations that farmers face in implementing new technologies and innovations (Oreszczyn *et al*., 2010). It also involved the use of actor-network theory (ANT) concepts. Although the ISF has not yet been extensively applied in agricultural systems, it provided an opportunity to explore complex relationships among diverse actors, social, technological, economic institutions and opportunities in the study area. The ANT argues that nothing takes place in isolation. However, although ANT assumes that all actors are equal, no accommodation for power imbalances can be made (Latour, 2005).

But, Hildebrand and Shriver (2010) argued that, behaviour change interventions are most effective when they are theoretically based and compatible with cultural and or behavioural characteristics of particular group. The use of ISF and ANT in the study contributed to the understanding of how different actors relate, and possibly influence MSLIAD joint development initiatives in the promotion and diffusion of improved technologies and innovations. This enhanced the generation of recommendations for policy.

2.12   The Conceptual Framework

The current MSLIAD status could be improved by analysing and establishing the MSLIAD current status. The researcher identified and used four phases to explore and explain the current status, existing gaps and or opportunities, perceptions and suggestions, and recommendations from different partners that could contribute in improving the performance of MSLIAD in the target area (Figure 1). In phase one, stakeholders and their roles in the target area were identified using innovation systems framework and innovation platform concepts. Boundaries concept was used in the second phase established the existing relationships and networks between different stakeholders in the target area. In the third phase, existing opportunities that can be used to improve the performance of MSLIAD were identified using boundaries concept. In the fourth phase, recommendations for improving policy formulation for promoting extension communication for enhanced stakeholders' participation in MSLIAD initiatives were established

1. Current status
☞ Who are the stakeholders involved in MSLIAD joint initiatives in the study area?
☞ What are their roles in MSLIAD in the study area? (Innovation systems framework and Innovation platform concepts)

4. Recommendations
☞ What suggestions can contribute to policy formulation to promote extension communication for enhanced stakeholders' participation in MSLIAD initiatives in the target area? Enhanced participation in technology and innovations development, promotion for diffusion and adoption.

2. Existing gaps
☞ What are the existing relationships between different stakeholders?
☞ Are there networks within which MSLIAD operate in the study area?
☞ Are any opportunities in the existing networks within which MSLIAD operate? (Boundaries concept)

3. Opportunities
☞ What are the stakeholders' perceptions on how to improve the performance of MSLIAD joint PPP initiatives in the target area?
☞ What are the suggestions that could improve the current MSLIAD status in the target area (Boundaries concept)

Figure 1. Phases in analysing MSLIAD processes in semi-arid areas of Kitui, Machakos and Makueni Counties

Four sets of assumptions were used to guide in conceptualizing and executing the study. These were the essence of the phenomenon under study (ontology), epistemology (the grounds of knowledge), the human nature (relationship between human beings and the environment) and the study methodology (Ditsa & Al Kobaisi, 2009). The study expected that, effective MSLIAD should provide feedback mechanism to reflect on the past and the current performance of MSLIAD joint development initiatives in innovative agricultural development. Studies on the performance of MSLIAD have shown that the MSLIAD effectiveness can be partly improved through the establishment and analysis of a well defined structure of the current status. This showed the stakeholders involved, their role(s); the existing gaps within the MSLIAD operational area, available opportunities, stakeholders' perceptions; and suggestions and recommendations for improving the MSLIAD effectiveness in the target area.

This study addressed MSLIAD organizational diversity and complexity as they relate to inter-agency collaboration with other sectors (Garrigos, Oliver & Hidalgo, 2009). This was made to provide an in-depth understanding of such concepts like the Agricultural Product Value Chains (APVCs) (Cäker & Siverbo, 2011; Poulton & Macartney, 2011; Unluer, 2011). The researcher used concepts and approaches from IS and relevant concepts from ANT as well as the boundaries concepts to produce and communicate research results that carry weight in policy arena. It is anticipated the study provides that missing information needed for evidence-based recommendations that are likely to contribute to policy formulation and implementation (Chen & Guan, 2011; Coenen & López, 2010).

Although the institutional environment for improved technology and innovation dissemination and diffusion in semi-arid areas of lower Eastern Kenya is challenging, opportunities for increased promotion and diffusion of improved technologies and innovations exist. Both public and private development partners are expanding to support agricultural production in the semi-arid areas of Kitui, Machakos and Makueni Counties (Kavoi *et al.*, 2010b). These development partners are getting more involved in both technology and innovation validation and promotion, for instance, improved variety testing and support in input and output market development (Bett, *et al.*, 2010). In the private sector, improved technology and innovation diffusion approaches are not

well developed but are slowly improving both in terms of input supply and marketing (Spielman & Grebmer, 2004; Spielman *et al.*, 2009). Establishing effective MSLIAD should take into account the implications of the emerging information on existing government policies with regard to the provision of research, extension services and farm inputs.

Past studies (Bett *et al.* (2010) and Karanja *et al.* (2011) show that MSLIAD initiatives involving different actors exist in the semi-arid areas of Kitui, Machakos and Makueni Counties. These formed the basis for determining the factors that could influence the current status of MSLIAD. It was critical to contextualise past and on-going MSLIAD operational strategies, roles and relationships existing between different stakeholders. Perceptions (views or opinions), attitude (mind-set), education and capacity to partner through resources (time, funds and manpower) may contribute to the current status of MSLIAD. Innovation systems framework concepts were used to analyse and explain the current MSLIAD status, whereas relevant concepts from the ANT were used to explain the infrastructures within which MSLIAD initiatives are established and what can make them fall (Klerkx *et al.*, 2010). This required adequate understanding and characterization of semi-arid agriculture, including the emerging trends and opportunities. Using the MSLIAD boundaries concepts and IST, available opportunities were determined and recommendations made to improve the current MSLIAD status (Kimble *et al.*, 2010).

Smallholder farmers involved in MSLIAD initiatives in the semi-arid areas of Kitui, Machakos and Makueni Counties work together through their organised farmer self help groups in the production and marketing of their farm produce and sourcing of farm inputs (Kavoi *et al.*, 2011). Although middlemen have persistently interfered with prevailing farm-gate and market prices, smallholder resource-poor farmers also network in information-sharing and sourcing for new information through boundary actors as a way of benefiting all the group members. Teamwork, networking and sharing of information can build strong linkages. Teamwork, networking and the number of participating partners could be determined through existing MSLIAD initiatives such as the PPP on Gadam sorghum commercialization. In this study, the moderating variables (existing policies, Socio-economic and Political factors) were held constant since they affect everybody (Figure 2).

Independent Variables	Moderating Variables	Dependent Variables
Factors influencing MSLIAD in the target area: a) Linkages (Relationships and Networking). b) Attitude (mind-set). c) Information sharing among stakeholders. d) Competition among development partners.	a) Prevailing Policies b) Socio-economic and socio-demographic factors (Age, education level)	Performance of MSLIAD initiatives: Measurable indicators: a) Technology and innovations adoption. b) Team-work in project planning and implementation c) Communication mechanism. d) Feedback mechanism.

Figure 2. Conceptual framework for analysing the existing MSLIAD in semi-arid areas of Kitui, Machakos and Makueni Counties

CHAPTER THREE
METHODOLOGY

3.1   Introduction

This chapter outlines the methodology used to carry out the study. Information in this chapter is presented under the following sub-topics: Research design, location of the study, target population, sampling procedures and sample size, instrumentation, data collection and data analysis. The researcher concludes the chapter by presenting a summary of data analysis.

3.2   Research Design

A research design is used to obtain answers to the research questions (Ditsa & Al Kobaisi, 2009). In this qualitative study, the researcher used a Working (also known as Emergent) Research Design (Cavallo, 2000; Spring, Stevenson & Selviaridis, 2007). An emergent research design is a research design that provides for active participation of both the researcher and the respondents (Martin, 2008). The design involves an on-going process that is iterative in nature with purposeful choices made during the entire period of the study (Wright, 2009). It refers to a flexible design in which a detailed framework emerges of how the researcher uses emerging issues that are related to the study during interactions with one category of respondents to probe further during interactions in the subsequent category(s) of respondents. Working (Emergent) Design enables the researcher to be flexible and to make necessary adjustments as the study progresses (Wiersma & Jurs, 2009; Whitten, 2011). This naturalistic and holistic participative research design takes the interests of both the researcher and the respondents into account using, for instance, ANT, ISF and boundaries concepts to triangulate the collected data. The design requires the researcher to adopt an open mind as he or she engages the respondents in discussions.

The design was adopted because it presents a powerful tool to analyse and sensibly document the realities of interpreted study findings and understanding of research as an experience in a situation, for instance smallholder farming, that is complex, relatively poorly controlled and generally "messy" (Martin, 2008; Wright, 2009). The researcher used the design because it enabled him to use concepts of innovation

systems, actors' network theory and MSLIAD' boundaries to collect both qualitative and quantitative data. Under this emergent research design, the researcher used Key Informants (KIs) structured interviews, Focus Group Discussions (FGDs), Face-to-Face Interviews and self-administered questionnaire to collect data based on the objectives of the study as recommended by Wiersma and Jurs (2009) and Whitten (2011).

As an illustration on the use of emergent research design, researchers Bakioğlu and Kurnaz (2008) and Keus, Vries, Gooszen and Laarhoven (2010) used Face-to-Face interviews and FGDs to collect qualitative data on respondents' perceptions, comments, suggestions and understanding on the issues raised by the researchers. Bakioğlu and Kurnaz (2008) did not examine interviewees' academic works for quality. They also did not include their definition of quality of research or determine any quality criteria pertaining to research, but instead preferred to have these defined by the respondents with their own expressions (Ditsa & Al Kobaisi, 2009). In this study, the researcher used an Emergent Research Design within the agricultural innovation systems (AIS) framework to collect both qualitative and quantitative data from KIs and respondents of FGDs by allowing the respondents to define issues relating to the focus area of the study. This allowed the researcher to combine respondents' expressions with observations made during data collection that related to the required information for answering the respective guiding research questions of the study, hence the choice for the Working Research Design.

Qualitative data collected included respondents' perceptions on group leadership composition and performance; any existing relationships with other development agents in the area; any benefits from associating with other development partners; how their group links to other partners; if the respondents were involved in development and promotion of technologies and innovation(s); how they accessed improved technologies and innovation; perceptions on extension agents' performance in extension service and product provision; comments and suggestions on improving the performance of existing MSLIAD joint development initiatives and partnership linkages in the area. The data formed the basis for understanding and determining how existing MSLIAD joint initiatives have been performing (Ditsa & Al Kobaisi, 2009). It further helped in identifying gaps that needed to be addressed by the study.

Key informant interviews were carried out on selected public officers (MoA and Provincial administration), opinion leaders, farm input suppliers and civil society organization working in the target area. Information from KI played a very crucial role in identifying the areas that needed in-depth probing in both FGDs and Face-to-Face interviews (Whitten, 2011). To triangulate qualitative data collected from KIs, a self-administered structured questionnaire was issued to each KI respondent with clear instructions on how to fill in their expressed opinions. Filled-in self administered questionnaires were handed over later in the day or later in the week.

The study addressed the MSLIAD organizational diversity and complexity as observed by Garrigos *et al*. (2009). These related to inter-agency collaboration with other sectors, for instance, the agricultural and information technology to provide an in-depth understanding of APVCs (Cäker & Siverbo, 2011; Poulton & Macartney, 2011; Unluer, 2011). Patterns and inter-relationships such as similarities in responses from different respondents to the same questions that were identified using qualitative data were further explored through data triangulation during Face-to-Face individual interviews. To produce and communicate research results that carry weight in policy arena for the targeted beneficiaries in study area, the study used frameworks from innovation systems. This enabled the study findings provide that missing information necessary in supporting evidence-based recommendations and thus contribute to policy formulation and implementation (Chen & Guan, 2011; Coenen & López, 2010).

3.3   Location of the Study

The study was carried out in selected sites in the Gadam sorghum growing semi-arid areas of Kitui, Machakos and Makueni Counties in lower Eastern Kenya region. Specifically, the selected study sites in Kitui County were located in Ngomeni and Kyuso Divisions of Kyuso Sub-County and Migwani and Nguutani Divisions of Migwani Sub-County. In Machakos County, the sites were located in Kalama and Central Divisions of Machakos Sub-County and in Masii and Yathui Divisions of Mwala Sub-County. Study sites in Makueni County were located in Wote and Kalawa Divisions of Makueni Sub-County and Kathonzweni and Kithuki Divisions of Kathonzweni Sub-County (Figure 3).
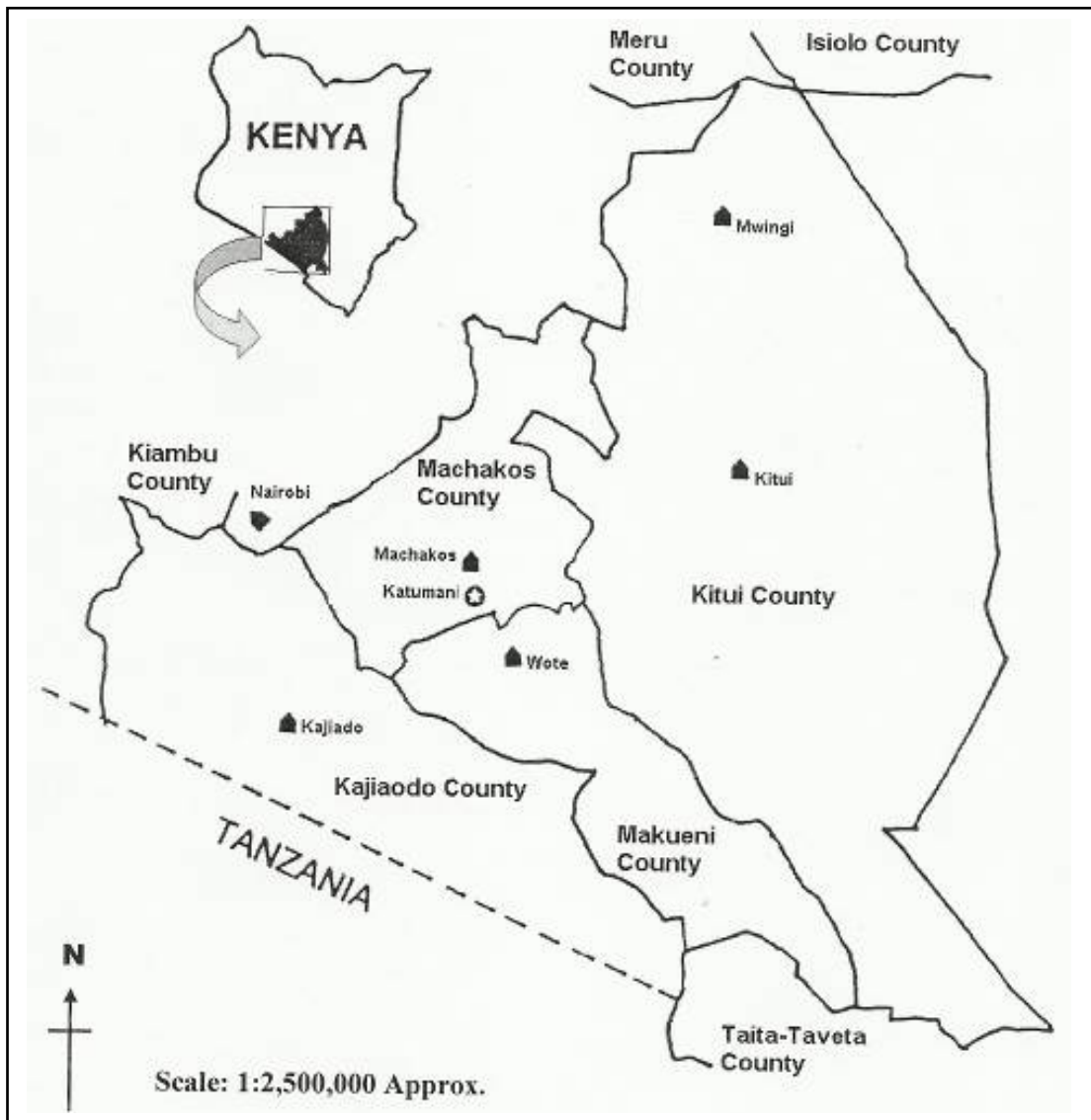
Figure 3. Study location map showing Kitui, Machakos and Makueni Counties
        Source: Adapted from Arithi and Wafula (2010).

3.4   Target Population

The target population comprised 521 households in Kitui County, 391 households in Machakos County and 259 households in Makueni County, giving a total of 1,171 households. These households were involved in the initial farmer training when the PPP initiative was implemented in 2009. The inhabitants in these Counties largely rely on subsistence mixed farming (crops and livestock production). The average farm size is about 1.2 to 2 hectares, with some below and above this range, under freehold land ownership (Kavoi *et al.*, 2010a; MoA, 2012b). Their livelihood is mainly on crop production, sporadic charcoal burning (though prohibited), sand harvesting, brick-

making, minimal off-farm income generating activities and remittances from working relatives (Ouma *et al.*, 2011). Agricultural production in the target area is mostly done by women as men engage in off-farm activities where they provide casual labour or permanent employment in neighbouring farms (Davis *et al.*, 2011; Kavoi *et al.*, 2010a).

3.4.1 Characteristics of the Target Area and Past Public-Private partnership Development Initiatives

The inhabitants of the Gadam sorghum growing semi-arid areas of Kitui, Machakos and Makueni Counties mainly rely on subsistence farming. They often dispose off their farm produce soon after harvest to avert huge yield losses due to storage pests (Ouma *et al.*, 2011). Additionally, over the years, due to erratic and poorly distributed rainfall, crop failure is frequent in the region, thus creating need for provision of famine relief to the area residents. It is in this same region where past PPP initiatives have been promoted for dissemination and wider adoption as cash crops. Such PPP initiatives included cotton in early 1980s, sunflower in early 1980s, castor in early 1990s and recently Gadam sorghum grain production for the brewing industry (East African Malting limited (EAML), a subsidiary of the East African Breweries limited (EABL)) in 2008-2009.

In mid 1970s and early 1980s, both cotton and sunflower PPP joint promotion initiatives were carried out in the semi-arid areas of Kitui, Machakos and Makueni Counties with a view to improving household income and food security. These initiatives involved different stakeholders including the MoA (extension service provision), researchers (improved technologies development and provision), provincial administration (farming community mobilization and security provision) and the private sector - farm-input suppliers, transporters (provision of farm inputs and transport of farm produce). Smallholder farmers in the region were sensitized and trained on the production and value addition of sunflower where the manual seed pressing machines were introduced in selected centres within the production areas. Production and marketing of cotton progressed well in the first few years of implementation. Furthermore, there were no rigorous and or spirited Government policies targeting sunflower production since 1996. This followed abandonment of

sunflower production since it was of little value to the farmers (Daily Nation Newspaper, October 4ᵗʰ 2010).

Although cotton output was on a general upward trend since independence, rising to an all time high of 39,300 metric tonnes (MT) in 1984/85, unfavourable trade and environmental factors reversed the growth trend to a low of 11,000MT in 1999 (Cotton Development Authority (CODA), 2014). Unstable producer prices, delayed payments to farmers and competition with food crops as well as alternative cash crops in the target area were the major factors attributed to decline in cotton production. Additionally, influx of cheap second-hand clothes and high cost of production contributed to low cotton production (*The EastAfrican*" Business Newspaper, November 24, 2012). The continued drop in cotton production in subsequent years led to closure of the ginneries in Makueni County due to insufficient supply of cotton from the area. Other technical factors which contributed to the closure of the ginneries included: low utilization capacities of the ginneries due to low cotton supply; poor market infrastructure; and lack of ready cash for timely buying of cotton and farmers' payment (CODA, 2014). Table 1 shows Kenya's cotton production and growth in the last 15 years.

Table 1

National Annual Cotton Production and Growth in Kenya, 1999-2013

Market Year	Production[2]	Percent Growth Rate
1999	30	0.00
2000	20	-33.33
2001	20	0.00
2002	20	0.00
2003	20	0.00
2004	20	0.00
2005	20	0.00
2006	46	130.00
2007	38	-17.39
2008	46	21.05
2009	23	-50.00
2010	49	113.04
2011	32	-34.69
2012	30	-6.25
2013	28	-6.67

Source: Adapted from United States Department of Agriculture (2014): Kenya cotton
production by year

During KI interviews and FGDs, respondents indicated that efforts made to revive the production of cotton in the region have not been significantly successful. They further observed that poor and unsustainable market structure remains a major challenge to successfully promote and commercialize cotton in the region.

Between mid 1980s and early 1990s, promotion and commercialization of castor beans in the same region was carried out. Joint efforts were made to sensitize and train farmers on how to commercially produce castor beans. According to information gathered during KI interviews and FGDs, free seed was given to both individual and organised farmer groups following sensitization and training workshops. As was the case with cotton and sunflower, different stakeholders were involved in the castor beans promotion for production and commercialization. However, due to lack of readily available and reliable market for the castor beans in the semi-arid areas of

---

[2] = Production in 1000 480 lb. Bales

lower Eastern Kenya, improved and sustainable castor beans production in the region has not been realised. Moreover, improved castor seed varieties developed in 1990s are yet to be officially released for commercial production in the semi-arid areas of Kitui, Machakos and Makueni Counties (KARI-Katumani Research Centre Annual Report, 2011). Further probing during FGDs on the production and marketing of castor beans in the region indicated that castor beans production has greatly diminished in the target area.

To explore and determine the factors influencing the current status of MSLAID performance in the target area, the researcher used the Gadam sorghum MSLIAD PPP joint initiative as a case study. He linked and related his questions to other past MSLIAD joint PPP initiatives (Cotton, Sunflower and castor) that have been implemented in the region.

3.4.1.1 Commercialization of Gadam Sorghum in the Target Area

The overall objective of the Gadam sorghum PPP initiative was to promote the production and commercialisation of Gadam sorghum grain among the smallholder farmers in the semi-arid areas of lower Eastern Kenya, covering Kitui, Machakos and Makueni Counties. A cereal grain consumption analysis carried out in 2008 had shown that EABL at the time used 100 million Kg of barley annually. Barley production had gone down because more barley farmers had turned to wheat production following increase in international wheat markets (Kavoi *et al.*, 2010a). To meet its annual grain consumption, EABL had to import barley, thus consuming part of the country's foreign exchange earnings. To address this, barley consumption by the brewing industry needed to be reduced by 60% through use of the fermentable Gadam sorghum grain. It was also envisaged that through commercialization of Gadam, farmers in the target region would acquire a new and more reliable source of household income.

Several factors catalysed the development of the PPP joint initiative. They included the huge demand for Gadam sorghum grain by the EABL. Prior to this initiative, the EABL was sourcing its sorghum for brewing from a neighbouring country. Secondly there was the assured and sustainable market for Gadam sorghum grain. Unlike the previous low farm-gate and local markets prices of KShs.3-5 per Kg, the new stable

farm-gate price was KShs.17 per Kg (Kavoi *et al*., 2011). Thirdly, a proper delivery system was assured - one of the partners was to organize for the Gadam sorghum grain aggregation from a production cell (a group of 15-20 or 25 neighbouring farmers) into a central collection point for eventual delivery of the same to the buyer. Lastly, due to low, erratic and poorly distributed rainfall in the region, the targeted area is suitable for sorghum production compared to other food crop varieties. Low moisture requirements and perseverance to the harsh weather conditions made Gadam sorghum very well suited for production in the semi-arid areas of lower Eastern Kenya (Plate 1).

Plate 1: Well filled head of Gadam sorghum; Launching of the first batch of Lorries (Mwingi town, Kitui County) to transport Gadam sorghum grain to EAML

Gadam sorghum was among other traditional sorghum varieties which have been grown in the area long before the advent of the Gadam promotion and commercialization initiative. Gadam sorghum was therefore not new to the area but what was new was its mode of production through the PPP joint initiative (Figure 4).

Improving Food Security and Household income in Semi-Arid Areas of Lower Eastern Kenya through Commercialization of Gadam Sorghum in a Public-Private-Partnership Initiative

Gadam Sorghum
• Short (1M tall) and uniform
• Drought tolerant
• Maturity period is same as early maturing maize (85-95 days)
• Potential yield ranges from 680-,800Kg/ Acre (8-20 Bags/ Acre)

Stakeholders (Partners) Involved

Kenya Agric. Res. Institute (KARI)
• Awareness creation
• Technical info provision & backstopping
• Monitoring & Evaluation
• Capacity building
• Provision of quality seed
• Research in emerging issues

Ministry of Agriculture, Provincial Admin. & CSOs (CBOs and NGOs)
• Farmer mobilization Sensitization
• Production & marketing cells formation
• Capacity building; Assuring process success
• Identify markets for surplus grain

Farmer Production Cells
• Provide land, labour and other resources
• Assist in monitoring and evaluation
• Assuring grain quality maintenance
• Guarantee members for credit of inputs and labour
• Aggregating Gadam sorghum grain and value addition

Sorghum Buyers
• Organizing marketing groups
• Produce aggregation/collection
• Farmer payments

Banks
• Provide credit to farmers
• Guarantee farmers prompt payment
• Capacity building–Business plan & management

East African Breweries Ltd
• Guaranteed marketing continuity
• Brewing using Gadam sorghum grain

KENYA ARID AND SEMI-ARID LANDS PROGRAMME (KASAL)

Kenya Agricultural Research Institute   European Union   Ministry of Agriculture

Figure 4. Gadam sorghum commercialization model adopted by the partners: Arrows indicate communication linkages between stakeholders (Adapted from Kavoi *et al.*, 2011)

Partners involved in the Gadam sorghum commercialization PPP joint initiative had defined role(s) to play:

a) **Public sector**

The public sector comprised several partners, namely, the Kenya Agricultural Research Institute (KARI) through the European Union funded Kenya Arid and Semi-Arid Lands (KASAL) Project, MoA staff and Ministry of State (Internal security and Provincial Administration). All these partners were engaged in facilitating field activities including stakeholders' training, seed supply, provision of extension services, security provision and assurance and farmer mobilization. The KASAL project facilitated the entire process through timely funding for the planned activities.

b) Civil Society Organization Partners

These comprised Non-Governmental Organizations (Farm Africa, Africa harvest, World Vision and Dorcas Aid International), Community-Based Organizations (Mita Misyi Area Community Development, Mwikililye Grain Growers Association and Yi Kiuuku Community Development Association) and Faith-Based Organizations (Katangi Christain Community Development Services and Catholic Diocese of Kitui) among others. Non-Governmental Organizations included. Apart from mobilizing farmers for sensitization and training on quality Gadam grain production under the formation of production cells, the civil society partners were engaged in Gadam seed sourcing and follow-up visits to the production cells.

c) **Private sector**

The private sector had several partners who included Smart Logistics Solutions Limited, Equity bank, Cooperative Bank and the Kenya Commercial Bank. The role of Smart Logistics was to aggregate and deliver the Gadam grain to the EAML and organize for farmer payment where the role of the Banks came into play. Farmers who presented small amounts (below 2 x 90Kg bags) of Gadam sorghum grain at collection centres were paid cash instead of being issued with warehouse receipts. This seemed to improve farmers' confidence in the PPP joint initiative.

d) East African Malting Limited (A subsidiary of the East African Breweries Limited)

The EAML malted the raw grain and delivered the same to the EABL for the actual brewing. Both the EAML and EABL's involvement and interaction with other stakeholders during farmer training workshops boosted farmers' morale towards Gadam sorghum production in the target area. Financial support to organizations involved in the promotion of Gadam sorghum and marketing such as the transporters and subsequent field visits further boosted the smallholder farmers' morale in the PPP joint initiative.

e) The producers (Farmerss' Self Help Groups and Farmer-Based Organizations)

These were the farmers who formed the production cells for ease of farmer training (capacity building) on quality Gadam grain production and the actual growing of Gadam sorghum. Additionally, individual farmers played the role of grain aggregation into collection centres. At the collection centres, Smart Logistics would then weigh the quantities delivered by individual farmers and issue them with warehouse receipt. Delivered quantities would then be aggregated into large consignments for transportation and delivery at the EAML premises.

f) Local Leaders (Politicians and Faith-Based Organization Leaders)

Local leaders included area local councillors and Member of Parliament. Apart from encouraging farmers to grow Gadam sorghum for the already identified EAML market, local politicians especially area councillors were actively involved in mobilizing farmers to attend farmer-field-days organized by the public sector to further popularize commercialization of Gadam sorghum in the region. The local politicians were trying to take care of the common interest place (the space between the public and the private sectors (Spielman & Grebmer, 2004), while at the same time popularizing themselves politically amongst the farming community.

g) Other Partners

Other partners included local Church groups and Frequency Modulation (FM) Local vernacular Radio stations. These played a very crucial role of publicizing the many

farmer field days which were jointly organized by KARI and the MoA, with the Provincial administration playing an important role in farmer mobilization. Successful publicity of farmer field days was the participation of different stakeholders who included the Smart Logistics, the Banks, Agro-chemical companies/ dealers, Non-Governmental organizations, farmer-based organizations, farmers, primary and secondary school students (Kavoi *et al.*, 2011).

3.4.1.2 Formation of the Gadam Public-Private-Partnership Initiative

This followed the following steps:

a) Stakeholder discussions and definition of roles in the initiative: This involved discussions between the main stakeholders followed by other discussions with other relevant stakeholders.

b) Mobilisation and sensitisation of farmers: The mobilization and sensitization involved presentation and discussion on the importance of growing Gadam sorghum in the area and the available EABL market with attractive farm-gate price. Various methods were used including sensitization and training workshops at Sub-County level, farmer barazas (voluntary public gatherings convened by local administration leaders to convey vital information), farmer field days and local FM radio advertisements.

c) Organising farmers into sorghum grain production cells of between 15 and 20 or 25 individual farmers: Farmers were recruited into village based sorghum enterprise production cells. The production cells became a source of multiplier effect in terms of area under production per farmer and increase of interested farmers in a particular village in the subsequent production season(s).

d) Training of smallholder farmers on appropriate agronomic practices: Farmers in the production cells were trained on good husbandry, post-harvest management and packaging practices to maintain high grain quality for the brewing industry.

e) Provision of certified Gadam sorghum seed to potential farmers: Farmers in the production cells were supplied with certified Gadam seeds from the KARI seed unit for planting. Each farmer was provided with 4Kg of seeds, enough to plant a

hectare of land. The MoA provided backstopping support to the farmers from planting to harvesting, threshing and packaging. To enhance the awareness, farmer field days were held during the grain-filling stage and towards the harvesting of Gadam sorghum. Information was also conveyed to the farmers on the collection procedures and designated collection centres were allocated to respective production cells.

f) Monitoring and evaluation: The entire process was monitored by subject–matter specialists from KARI, MoA staff, the provincial administration and Smart Logistics who at times represented the EABL.

g) Grain aggregation into collection centres: Gadam producers delivered their grain to the nearest collection centre where they dried it to the required moisture content. The collector (transporter - Smart Logistics Solution Company) graded the sorghum grain at the collection centre and issued the producers with a warehouse receipt. Gadam sorghum grain aggregation and collection from a central site solved the challenge of scattered location of the farmers in the production area. This facilitated efficient and effective sorghum grain collection from the production region and delivery to the end-user of the grain, i.e. the brewery (Kavoi, Kamau, Kisilu, Wafula & Ng'ang'a, 2013b). Use of warehouse receipts for the delivered and graded sorghum followed by payment upon presentation of warehouse receipt to the bank was a novelty in the area. The use of warehouse receipts was intended to ensure security for both the middle agent and the farmers, because it did not involve liquid cash transaction in the payment process. In addition, women farmers came up with various sorghum recipes and avoided over-reliance on maize for food, since maize performs poorly compared to sorghum on account of the low rainfall received in the region.

h) Payments by the Banks made to the smallholder farmers: The warehouse receipt was supposed to be presented to the Equity bank in the nearest town where the Equity bank services were available in exchange for cash. Later on, Equity bank introduced mobile banking services from where farmers could be paid their monies. The mobile bank model was thereafter replaced with the bank agencies which were set up in the shopping centres.

With a guaranteed market and better farm-gate price, it was hoped that the Gadam sorghum PPP joint initiative would increase production and marketing of the sorghum grain from the region. To meet the demand from the EABL, the Gadam PPP initiative aimed at delivering 12,000MT of Gadam sorghum grain during the first year of production. It was also hopped that production would raise 24,000MT during the second year and eventually production tonnage to stabilize at 70,000MT. However, just like other past PPP initiatives, production and tonnage from the region picked up during the first two years of its inception. About 300MT of Gadam sorghum grain were delivered from the semi-arid lower Eastern Kenya region to the EAML during the first year of production (Kavoi *et al.*, 2010b). Although production seemed to peak during the second year of production (2011) in the six Sub-Counties covered in the study, tonnage from these Sub-Counties reduced, with some of the production cells opting to stop production of Gadam sorghum altogether (Figure 5). Additionally, the model adopted by the Gadam sorghum PPP joint initiative provided for a specific middle agent to aggregate and deliver Gadam sorghum grain to EABL but did not take account of market prices offered by middlemen (brokers), thus contributing to reduced tonnage from the entire semi-arid lower Eastern Kenya region.
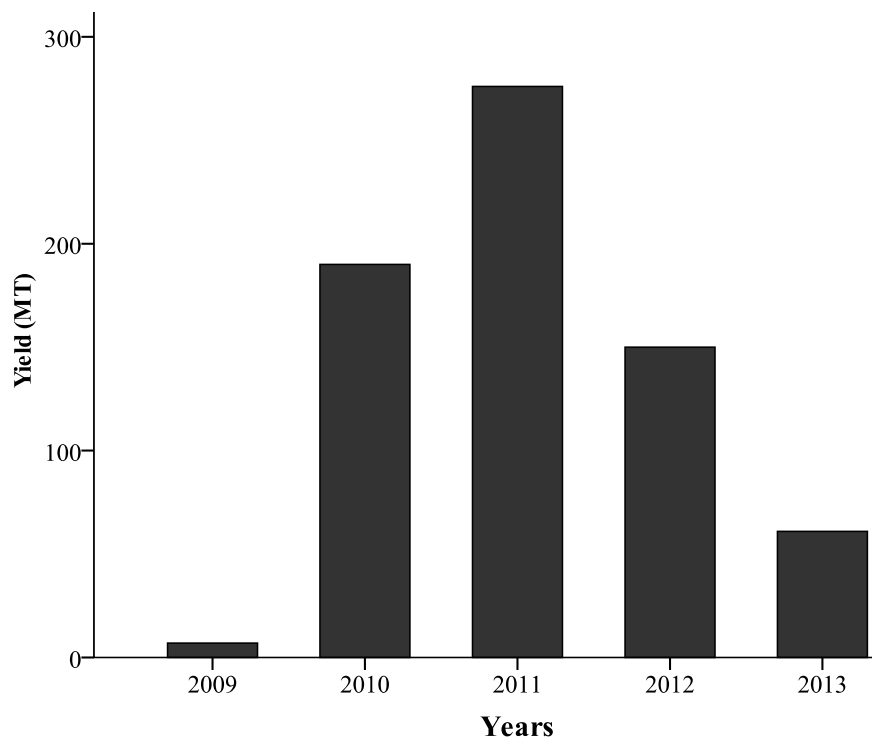
Figure 5. Gadam sorghum production in the six Sub-Counties (Metric Tonnes)
        Source: Study survey data

The Gadam sorghum promotion and commercialization activity fitted very well in a MSLIAD PPP initiative setup.

3.5   Sampling Procedures and Sample Size

Reliable research calls for accurate establishment of appropriate sample size whose characteristics depict those of the target population (Fournel, Tiv, Hua, Soulias, Astruc & Aho, 2010). Calculating a sample size is almost always a trade-off between the ideal and the feasible (SMART, 2012). A sampling frame was established and a sample drawn using multi-stage sampling procedure based on administrative boundaries at different levels until individual sampling unit level was reached (Garson, 2012). Additionally, sample size is usually determined by several factors such as available funds, heterogeneity or homogeneity of the individual sample unit (Hildebrand & Shriver, 2010). Using County and Sub-County administrative boundaries, a multi-stage sampling at County, Sub-County, division, location, sub-location and village level was used to select the study sites (Thompson, Miller, Mortenson & Woodward, 2011). Purposive sampling as recommended by Palys (2009) was used to select the respondents for Key Informants from MoA's subject matter specialists, local administrative leaders and opinion leaders from the six Sub-counties (Table 2). Where applicable, and as provided for in a working research design, the researcher made adjustments based on emerging issues during discussions that related to the questions under study. This was made to ensure that the required data for each study objective were collected.

Table 2

Gender of Key Informants in Respective Sub-Counties (n=34)

County	Sub-County	Institution	Gender		Total
			Male	**Female**	
Kitui	Kyuso	Ministry of Agriculture	4	0	4
		Provincial administration	1	0	1
		Opinion leaders	1	0	1
	Migwani	Ministry of Agriculture	4	0	4
		Provincial administration	0	0	0
		Opinion leaders	1	1	2
Machakos	Machakos	Ministry of Agriculture	5	3	8
		Provincial administration	0	0	0
		Opinion leaders	0	0	0
	Mwala	Ministry of Agriculture	1	2	3
		Provincial administration	0	0	0
		Non-Governmental Organization	0	1	1
Makueni	Kathonzweni	Ministry of Agriculture	2	2	4
		Provincial administration	0	0	0
		Opinion leaders	1	0	1
	Makueni	Ministry of Agriculture	1	3	4
		Provincial administration	1	0	1
		Opinion leaders	0	0	0
Total			**22**	**12**	**34**

Respondents for FGDs were purposively sampled from group leaders (the office bearers) of Gadam sorghum production cells where the Gadam sorghum PPP initiative was initiated and promoted. The number of FGDs to be held is normally determined by the point of saturation (Ditsa & Al Kobaisi, 2009; Mason, 2010). In this study, a total of five FGDs were held (Table 3).

Table 3

Gender of Respondents for Focus Group Discussions (n=55)

County	Sub-County	Gender		Total
		Male	**Female**	
Kitui	Kyuso	10	2	12
	Migwani	1	9	10
Machakos	Mwala	6	8	14
Makueni	Kathonzweni (Kithuki Division)	2	10	12
	Kathonzweni (Kathonzweni Division)	3	4	7
Total		**22**	**33**	**55**

Qualitative research is usually laborious and requires a smaller sample size compared to quantitative research for ease of data collection and analysis (Mason, 2010). Systematic random sampling was used to draw representative samples from different villages and or Gadam sorghum production cells where MSLIAD PPP initiative had been carried out. The researcher took care in establishing the criterion for selecting a Face-to-Face respondent as recommended by Kalenga and Elsa (2011). The guiding criterion for selecting Face-to-Face respondents was to select only those farmers who were involved in the initial sensitization and training workshop for the Gadam sorghum commercialization PPP initiative.

From a target population of 10,000 and above observable units, determination of a sample size follows recommended statistical formulae to arrive at the desired sample size using predetermined confidence levels as suggested by Greene (2000) and SMART (2012):

$$n = \frac{Z^2 p q}{d^2} \tag{1}$$

Where

n = the desired sample size

Z = the standard deviation set using a desired confidence levels (e.g. at 95% confidence intervals Z is 1.96),

P = the proportion of the target estimated to have a particular characteristic for example the target population has 60 % of the households living under the poverty line,

q = 1-P, and,

d = the degree of accuracy desired and in this case it was 95%,

In this study therefore, n was determined as follows:

$$n = \frac{1.96^2 \times 0.60 \times (1-0.60)}{0.05^2} = 369$$

Since the target population was less than 10,000 initial households which were involved in the PPP joint initiative to commercialize Gadam sorghum, the desired sample size for the study was determined thus:

$$nf = \frac{n}{1+\left(\dfrac{n}{N}\right)} \qquad (2)$$

Where

nf = the desired sample size

f = desired sample size if the sampling frame is less than 10,000

N = the target population or number of households comprising the target population,

Thus $\qquad nf = \dfrac{369}{1+\left(\dfrac{369}{1171}\right)} = 281 \qquad (3)$

Having determined the total sample size on the basis of the target population, the number of respondents interviewed in each Gadam sorghum production cell in a selected village was allocated proportionately to avoid bias on villages or production cells that could be larger or had more households than the smaller ones. This was done using the proportion to size method defined as follows:

$$i = \frac{N_1}{N_2}(n) \qquad (4)$$

Where

i = Proportion of the sample in particular village

N_1 = the total number of households in a particular village

N_2 = the total population

n_i = the total sample size calculated on the basis of the target population.

Therefore the number of respondents from each sampled village (production cell) X was determined as follows:

Village (production cell) X = $\left(\dfrac{\text{No. of households in the village}}{\text{Total target population households}} \right)$ x 281 = X_i (5)

The total sample size of respondents selected from all the villages (production cells) ($X_{i=1}, \ldots, X_n$) therefore was $\sum\limits_{i=1}^{n} X_i$ farmers distributed proportionately. Based on previous studies by Kavoi *et al.* (2010a; 2011) on commercialization of Gadam sorghum in the target area, the total number of Face-to-Face respondents for this study worked out to 150. To cater for attrition cases, 11% increase was adopted, giving a sample of 165 respondents.

To select Face-to-Face interview respondents, a proportionate sampling based on the initial number of households issued with Gadam sorghum seed in both long and short rainy seasons in 2009 was adopted. A list of the households in the selected village (production cell) was prepared and systematic random sampling was used to select the number of required respondents following guidelines by SMART (2012). Systematic random sampling requires a sampling interval, which is calculated by dividing the total number of sampling units in the list by the required sample size. For instance, if the list contained 38 households and the required number of respondents was 12 (including units to cater for attrition cases), the sampling interval would be three (rounded to the nearest whole number). The researcher would then randomly pick the first sampling unit that should be between one and the sampling interval and thereafter every third item on the list until 12 units are obtained (SMART, 2012).

With assistance from the local public extension staff, respondents for Face-to-Face interviews in different study sites were selected and invited for interviews at agreed venues. Majority of those invited for the interviews attended the interviews, giving a total of 165 respondents distributed proportionally. A summary of the villages, farmer groups and the number of households selected for Face-to-Face interviews are presented in Table 4.

Table 4

Number of Households in Respective Counties and Sub-Counties

County	Sub-County	Division	Village/ Group sampled	No. of households	Sample size
Kitui	Kyuso	Ngomeni	Kavaani	58	14
			Mitamisyi	68	16
		Kyuso	Muruu	46	11
	Mwingi East	Mui	Mui	134	
	Migwani	Nguutani	Mwikiliye	67	16
			Kivuli	53	13
	Kitui	Central	Miambani	25	
	Mwingi Central	Central	Kyethani/Waita	70	
			Sub-Total 1	**521**	**70**
Machakos	Kathiani	Kathiani	Kathiani	38	
	Machakos	Kalama	Kinoi/ Katuaa	59	14
		Central	Mang'auni	28	7
	Mwala	Yathui	Utithini	45	11
		Mwala	Windala	58	14
	Athi-River	Ndovoini	Ndovoini	62	
	Athi-River	Central	Central	33	
	Matungulu	Matungulu	Kyamukali	68	
			Sub-Total 2	**391**	**46**
Makueni	Makueni	Wote	Silanga	74	18
	Makindu	Central	Ngaakaa	29	
	Kathonzweni	Kithuki	Yikiuuku	92	22
		Central	Ikaasu	38	9
	Mbooni East	Sakai	Sakai	26	
			Sub-Total 3	**259**	**49**
			Total	**1,171**	**165**

The study involved KI respondents, FGDs respondents and Face-to-Face respondents. It covered 254 respondents, comprising 34 Key Informants, 55 Focus group discussions participants and 165 Face-to-Face respondents (Figure 6). Key Informant respondents comprised of Ministry of Agriculture extension staff, local Provincial administrators, opinion leaders and members of civil society groups while respondents for FGDs were farmers. Face-to-Face respondents were the randomly selected household members where the husband or wife was interviewed in case of a married couple. Single mothers, widows, widowers, divorced and separated respondents were interviewed during Face-to-Face interviews.
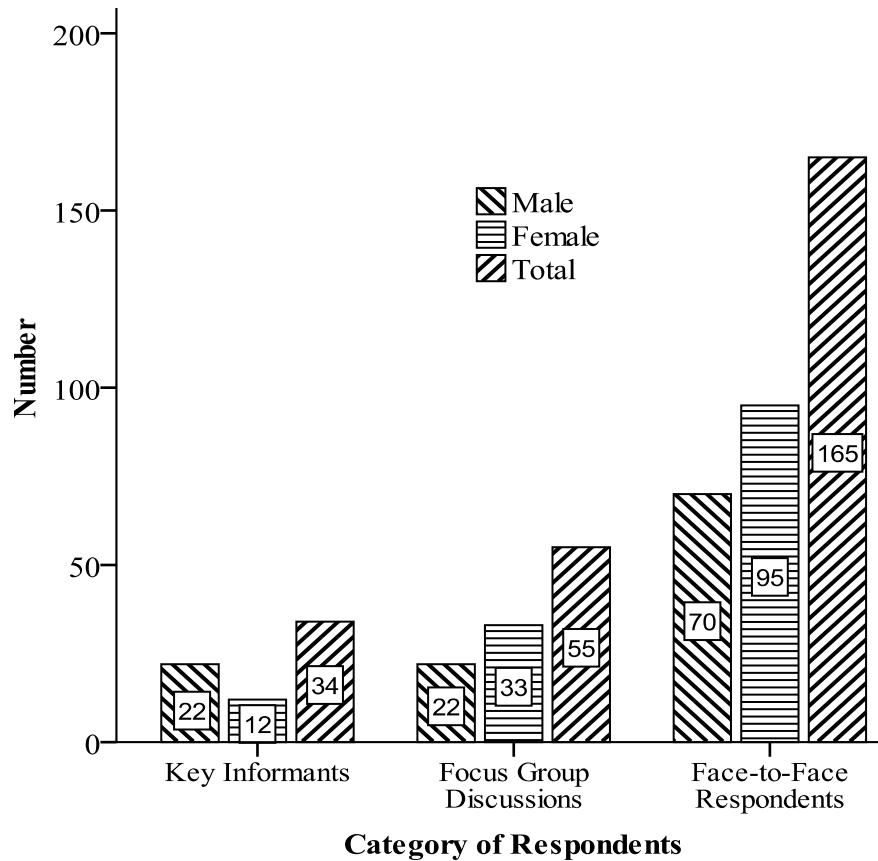
Figure 6. Gender Composition of the Sample

3.6 Instrumentation

Data capture instruments consisted of four sets of instruments, namely, a semi-structured questionnaire, a structured questionnaire, a check-list and discussion guidelines. They were developed based on the study objectives. The instruments were further revised in readiness for pilot study for validation and reliability determination.

3.6.1 Validation of Instruments

Revised instruments were submitted to a panel of experts from the Faculty of Education and Community Studies at Egerton University and KARI headquarters who ascertained the instruments' content validity in terms of the extent and depth of coverage of the subject matter. All suggestions and or comments from the panel of experts were taken into consideration as researcher undertook the final revision of the instruments.

3.6.2   Reliability of Instruments

The Cronbach's alpha (α) reliability coefficient was determined through a pilot study carried out in Kambu location, Mtito-Andei Division, Kibwezi Sub-County, which was not part of the sampling frame of the study area. To be accepted for use in the study, the instruments needed a reliability coefficient of at least 0.70α, which is the minimum threshold required for social sciences. The closer the reliability coefficient is to 1.0, the greater the internal consistency of the items in the scale (Gliem & Gliem, 2003). The pilot study gave a reliability coefficient of 0.86α. This applied only to the closed-ended items in the semi-structured questionnaire used in the pilot study. With a reliability coefficient above the minimum threshold, mass production of the data collection instrument was carried out. Using a five-point Likert scale (1 for strongly disagree (SD) and 5 for strongly agree (SA), except for negatively framed statements where the scoring of the Likert scale was reversed – 5 for SD and 1 for SA), data Collected from 165 Face-to-Face respondents were used to calculate the Cronbach's alpha (α) reliability coefficient. The resultant Cronbach's alpha (α) reliability coefficient of 0.87α compared very well with that obtained from the pilot study. This confirmed the reliability of the instruments used in the study.

3.7   Data Collection

Data were collected using a comparative case study approach through Key Informant structured interviews, self-administered questionnaire, Focus Group Discussions and Face-to-Face interviews (Plate 2). Selected Key informants were each invited for an interview using a check-list. To triangulate the qualitative data obtained from KIs, each Key Informant respondent was given a self administered questionnaire (Instrument D, Appendix C) with clear instructions on how to fill it in. The researcher picked the filled-in questionnaire either later in the day or at a later date in the course of the week.

Respondents for FGDs were invited for a meeting at a convenient venue. The researcher, assisted by the local public extension staff facilitated the discussions using discussion guidelines. The participants in the FGDs were briefed on the rules to be used during the discussions to ensure everyone participated but only with the permission of the facilitators. This was made to avoid dominance by a few individuals or lack of participation by shy participants. The researcher recorded responses and

sought further clarifications where necessary. This enabled the researcher to probe further by following new leads and topics that arose during the discussions. Additional information from the discussions were recorded as recommended by researchers, Philcox, Knowler and Haider (2010) and Popoviciu, Barbu, Costea, Culda and Culda (2011).

To effectively conduct the Face-to-Face interviews, the researcher took time to go through the semi-structured questionnaire (Instrument C, Appendix C) with the Research Assistant in each of the selected study sites who was familiar with the local language to ensure that he/she knows how to put across the question to the respondent. Terminologies contained in the instrument were printed in large fonts in a separate sheet and translated into Swahili using a standard English-Kiwashili dictionary to avoid ambiguity in interpreting such terminologies. The essence was to adequately prepare the Research Assistant to effectively interview illiterate respondents who were not able to understand and respond to questions put to him or her in English (Nkurumwa, Mwangi & Kathuri, 2011). During data collection, the researcher focused on identifying promising situations where actors (different stakeholders along the Gadam sorghum value chain) have been seen to be effective in getting policy makers' attention and achieving acceptable results for wider agricultural development (Arza & López, 2011).

Plate 2. Global positioning system (GPS) recording of household interviews; Face-to-
Face interviews and FGDs in Kyuso and Migwani Sub-Counties

3.8   Data Analysis

Four sets of instruments were used to collect both qualitative and quantitative data for the five objectives. These were a check-list, discussion guide, and a semi-structured questionnaire. The fourth instrument was a structured self-administered questionnaire with a five-point Likert type scale expressed opinions for every given statement. Both the semi-structured questionnaire and the self-administered questionnaire contained 28 Likert scale statements with 1 for strongly disagree (SD) and 5 for strongly agree (SA), except for negatively framed statements where scoring was reversed – 5 for SD and 1 for SA. The first four study objectives to a great extent required the same type of data. To analyse the collected data, qualitative data were coded and converted into quantitative data. Converted data were then analysed and results presented using both descriptive (frequencies and percentages) and inferential statistics. Similarly, quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) software Versions 12.0 and 17.0. Results were presented using both descriptive (frequencies and percentages) and inferential statistics (Chi-square), where Chi-square was used to test the significance of responses presented in categories (Hildebrand & Shriver, 2010). Inferential statistics were used to establish any relationships and or associations between different variables. This was made to obtain an in-depth understanding of the factors that could influence current status of MSLIAD joint initiatives in the target area. Data for objective five were analysed and presented using descriptive statistics to establish which recommendations among the responses obtained have worked in the past. The unit of analysis was the individual respondent (for both households and key informant interviews) and a group (in case of focus group discussions). This helped the researcher to develop recommendations for policy action.

Questions or statements with Likert-type scale can be used to measure the perceptions or factors responsible for a certain phenomenon, for instance, factors related to low adoption of technologies in an area (Khayri, Yaghoubi & Yazdanpanah, 2011; Yaghoubi, 2009). In this study, the researcher used expressed opinions from statements which had five point Likert-type scale to measure the respondents' perceptions on the current status of MSLIAD performance. Qualitative data from KIs structured interviews were coded and transformed into quantitative data for analysis. To separate

ranked responses, each ranking value was transformed by attaching a score (Abeyasekera, 2001; Abeyasekera, Lawson-Macdowell & Wilson, 2001).

The researcher adopted the following scores in descending order of importance of the corresponding ranks: Rank 1, score 5; Rank 2, score 4; Rank 3, score 3; Rank 4, score 2; Rank 5, score 1 to report study findings where ranking of responses was made as recommended by Abeyasekera (2001) and Gido, Langat, Gicuru, Mutai, Sibiko and Mwangi, (2013). To avoid generating incorrect means of the summated scores, system missing values were given a score of zero. Descriptive statistics (sums and means) were derived by generating summated scores and means of the transformed data. Since "n" was constant in any of the variables ranked, using either the summated score or the mean of the summated score would give the same ranking order (Khayri *et al*., 2011). The eventual ranking was put in a descending order of importance where the highest summated score was ranked number 1 and the least summated score was ranked lowest. In the entire study, where ranking was done with more than five ranked items, only the top five ranked items were picked. Where the ranked items were five or less, all items were ranked and presented in respective Tables of the study findings.

3.9   Summary of Data Analysis

Table 5 presents a summary of data analysis for each of the five study objectives.

Table 5

Summary of Study Data Analysis by Research Questions

Research Question	Method of analysis and results presentation	Statistical Tests
a) Who are the stakeholders and what are their roles in MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties?	Information obtained from Key Informants and FGDs was analysed to show who the stakeholders are; their role(s) in MSLIAD in the study area; to show emerging similarities/ patterns. Data on area of coverage and years of operation in the area were summarised into means. Results are presented in Tabular form.	Descriptive statistics (Numbers, Frequencies, Percentages)
b) What are the existing relationships and networks within which MSLIAD operate in the semi-arid areas of Kitui, Machakos and Makueni Counties?	Data obtained from KIs, FGDs Face-to-Face interviews were analysed to establish the existing relationships and networks within which MSLIAD operate in the study area. Qualitative data were coded and converted to descriptive statistics. Inferential statistics used to establish any significance or relationship on different variables in the quantitative data.	Chi-square and descriptive statistics (Numbers, Frequencies, Percentages)
c) What are the factors responsible for the current MSLIAD status in the semi-arid areas of Kitui, Machakos and Makueni Counties?	Data from KIs and FGDs were analysed to obtain information on stakeholders' perceptions and suggestions on how to improve the functioning of MSLIAD in the study area. Qualitative data were coded and converted to descriptive statistics. Results are presented in tabular form.	Chi-square and descriptive statistics (Numbers, Frequencies, Percentages)
d) What are stakeholders' perceptions and suggestions that can improve MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties?	Qualitative data obtained from KIs and FGDs were coded and converted into quantitative data. Data were analysed and used to obtain information on stakeholders' perceptions on current status of MSLIAD and suggestions on how to improve the performance of MSLIAD in the study area. Results are presented in Tabular form.	Chi-square and descriptive statistics (Numbers, Frequencies, Percentages)
e) What are the recommendations that have contributed to policy formulation in the past for development, promotion and diffusion of improved technologies and innovations in the semi-arid areas of Kitui, Machakos and Makueni Counties?	Qualitative data were converted to quantitative data and analysed to establish which recommendations contributed most to policy formulation in the past. Inferential statistics were used to establish any significance or relationship on different variables in the quantitative data. Results are presented in Tabular form.	Chi-square and descriptive statistics (Numbers, Frequencies, Percentages)

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1   Introduction

This chapter presents the study findings and discussions from the analysed data. The study findings are based on the study guiding objectives and research questions as outlined in chapter one, sections 1.4 and 1.5 respectively. The chapter starts by outlining the general characteristics of the study area and general characteristics of the different sets of the respondents followed by study results and discussions under each study objective and research question. Both descriptive statistics (numbers, frequencies and percentages) and inferential statistics (Chi-square) were used to present the study findings under respective sub-sections in the entire chapter. At the end of results and discussions under each study objective, a brief summary of the study findings is presented.

4.2   Characteristics of the Study Target Area

The characteristics of the target area are presented under demographic and ecological conditions based on the detailed findings from the Face-to-Face interview respondents. The intention is to provide the available details within the scope of the study about the prevailing circumstances under which the farming community and development partners operate and under which the study was carried out.

4.2.1 Demographic Characteristics of the Respondents in the Target Area

In this sub-section, demographic characteristics of the Face-to-Face interviews respondents are presented under the following sub-sub-headings: Gender composition; age; marital status; education level; farm size; household main source(s) of income; years of farming experience; livestock production; composition of household members; number of household members living on the farm and directly contributing labour to farm activities; household main source(s) of farm labour; and composition of land tenure.

4.2.1.1 Gender Composition of the Respondents

In Sub-Saharan Africa, smallholder resource-poor female farmers face gender specific constraints such as lack of access to productive resources and low levels of human capital (Quisumbing & Pandolfelli, 2009). Additionally, studies done in the semi-arid areas of lower Eastern Kenya by Bett *et al.* (2010) and Kavoi *et al.* (2010a) showed that female farmers did most of the farm activities while men engaged in off-farm activities such as casual labour (masonry work, charcoal burning and sand harvesting) or permanent employment in neighbouring farms or away in the urban centres. Thus, a higher percentage (58%) of female respondents interviewed in this study seemed to indicate more women involvement in farming activities compared to men. Figure 7 presents gender composition of the Face-to-Face interviews respondents.

Frequency
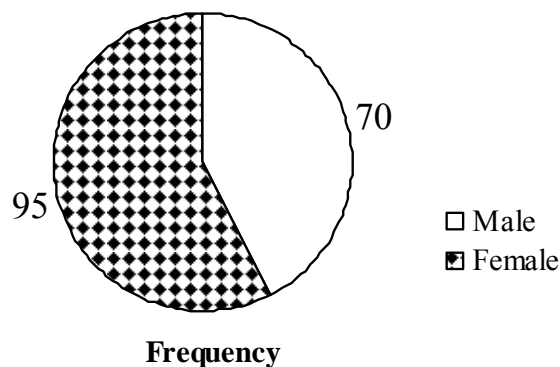
Figure 7. Gender composition of Face-to-Face interviews respondents

4.2.1.2 Age of the Respondents

Decision-making on matters pertaining to farming has been a role of the elderly because it has a bearing on access to production resources especially land (Quisumbing & Pandolfelli, 2009). Accurate decision-making on prevailing agricultural production problems requires timely, reliable and consistent access to extension services (Sivakami & Karthikeyan, 2009). In other parts of Kenya, Quisumbing & Pandolfelli (2009) noted that young married women left decision-making about farming to their mothers-in-law. This scenario is not different from that in the semi-arid areas of Kitui, Machakos and Makueni Counties, especially among households living and farming under communal land tenure (Kavoi, 2003). Thus, the elderly seemed to have more access to production resources and timely respond to extension services. However, it is equally important to put in place interventions that address the younger female farmers

63

facing such differential constraints. This would enable them to maximise on the available extension services (Freidberg & Goldstein, 2011; Quisumbing & Pandolfelli, 2009). The age of the face-to-face interview respondents ranged from 25 to 93 years. About 32% of the respondents were aged between 41 and 50 years while those aged between 51 and 60 years comprised 29%. Those aged above 60 years comprised 25% while over half (54%) of the respondents were above 50 years, possibly an indication that those involved in farming were the elderly. Less than 14% of the respondents were aged below 40 years, suggesting that fewer youth were engaged in farming in the region. The mean age of the respondents was 53 years, median 52 years and mode 60 years and with a standard deviation of 11.6 years. Figure 8 presents the age categories and the respective percentages of respondents interviewed.
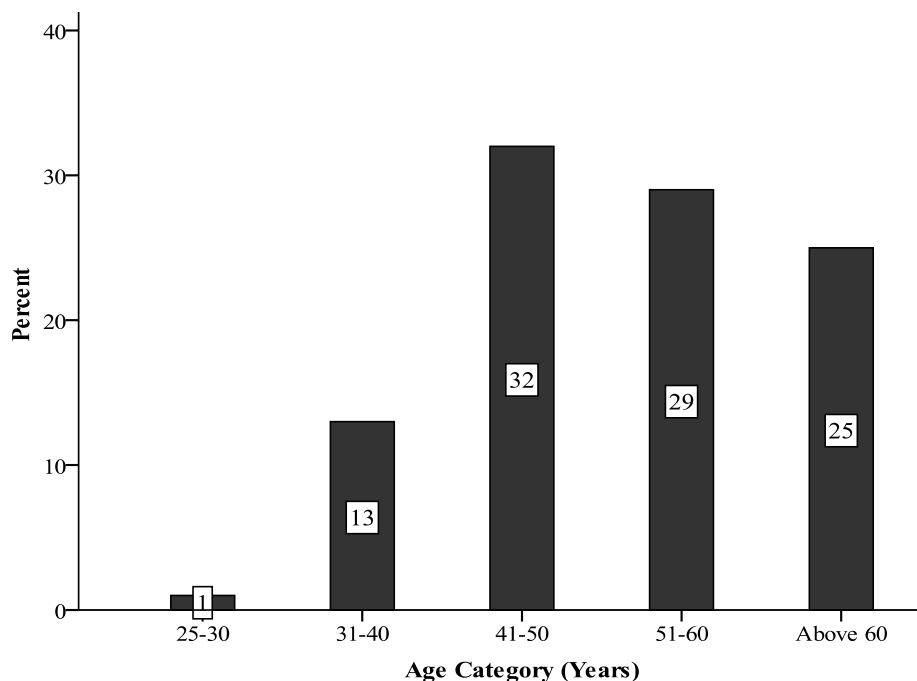
Figure 8. Age categories of Face-to-Face interviews respondents

4.2.1.3 Marital Status

With regard to marital status, 84% of the respondents were married, 13% widowed, 2% single and 1% divorced. Widowed respondents observed that shortage of farm labour especially during the peak periods (planting, weeding and harvesting) of the cropping season presented a major challenge. This could explain the reason why some of the respondents could not participate adequately in technology and innovation

development and validation especially in on-farm experimentation. Table 6 shows the marital status of the respondents involved in the Face-to-Face interviews.

Table 6

Marital Status of the Respondents (n=165)

Marital status	Frequency	Percent
Single	4	2
Married	138	84
Widowed	21	13
Divorced	2	1
Total	**165**	**100**

4.2.1.4 Education Level

Education plays an important role in decision-making across all stakeholders (Quisumbing & Pandolfelli, 2009). It can influence not only those in the target area but the entire farming community, hence a moderating variable. This is especially so in decision-making pertaining technology and innovation adoption – which is also influenced by the technical, financial and adaptability aspects of the technology and or innovation being promoted (Greiner *et al.*, 2009). Education status of the face-to-face interview respondents ranged from no formal education to post-secondary education. Only 3% had attained post-secondary education. However, 56% had attained primary education, 30% had secondary education and 11% had no formal education – which could possibly contribute to low technology and innovation adoption, as observed by Quisumbing and Pandolfelli (2009). Education status of the respondents is given in Table 7.

Table 7

Education Level of the Respondents (n=165)

Level of Education	Frequency	Percent
No education	18	11
Primary education	93	56
Secondary education	49	30
Post-secondary education	5	3
Total	**165**	**100**

Study findings further showed that a higher percentage of female respondents (54%) had attained primary education compared to 23.7% of male respondents. However, almost the same percentage of male and female respondents had attained secondary education (15.2% and 14.5% respectively) (Table 8). The higher percentage of female respondents interviewed seemed to indicate that their male counterparts who had attained formal education had migrated to urban centres in search of formal employment.

Table 8

Relating Education Level of Respondent by Gender of Respondent (n=165)

Education Level	Gender of Respondent				Total	
	Male		Female			
	Frequency	%	Frequency	%	Frequency	%
No education	3	1.8	15	9.1	18	11
Primary education	39	23.7	54	32.7	93	56
Secondary education	25	15.2	24	14.5	49	30
Post secondary education	3	1.8	2	1.2	5	3
Total	**70**	**42.5**	**95**	**57.5**	**165**	**100**

Moreover, additional data collected on respondents' post-secondary training and skills obtained showed that, 19% of the respondents had attained post-secondary education in different fields, for example certificates in agriculture, adult education, nutrition and tailoring. Certificate in agriculture were mainly obtained from short-duration courses usually offered in stakeholders' capacity building workshops. Only 2% had certificates in tailoring. Researchers Friis-Hansen and Duveskog (2011) in their study noted that, smallholder farming calls for farmers that are innovative and able to adapt to the changing situation. They further noted that smallholder farmers needed empowerment by developing their skills (capacity) so that they can effectively articulate their demands and pressurise the system to deliver what they needed. Accordingly, in the semi-arid areas of lower Eastern Kenya and in other parts of the country, development partners have adopted the use of capacity building workshops as a better avenue to reach more farmers (Kavoi *et al.*, 2011). This could possibly explain the reason why the respondents who have attained certificates in agriculture were more than those in other fields.

4.2.1.5 Farm Size

With regard to the individual household farm size, study findings showed that, individual farm size ranged from one to above 10 Hectares. Majority of the respondents (61%) had farm sizes ranging between 0.4 and 2.4 Hectares while 24% had farm sizes ranging between 4 and 8.4 Hectares. Small farm size was mentioned as one of the reasons why some of the respondents either reduced acres under Gadam sorghum production or stopped growing the sorghum altogether. The respondents further observed that Gadam sorghum was out-competed by other high value crops that are suited for the semi-arid areas especially green grams which had a ready market. The average farm size was 2.77 Hectares (Table 9).

Table 9

Approximate Farm Size in Acres (n=165)

Modal Class	Frequency	Percent
1-3	42	25
4-6	59	36
7-9	21	13
10-12	21	13
13-15	11	7
16-18	3	2
19-21	5	2
22-24	1	1
25 and above	2	1
Total	**165**	**100**

4.2.1.6 Household Main Source(s) of Income

The value of crop productivity per acre increases farm productivity which in turn increases agricultural production. This was observed among farmers participating in Farmer Field Schools (FFSs) by Davis *et al*. (2011). Additionally, researchers Rao and Qaim (2010) noted that returns from agricultural production greatly influenced household income. Findings from this study showed that all the respondents (100%) mentioned farming as their main source of household income, while 21% said casual labour was their other major source of income. This agreed with findings in a study by Keino *et al*. (2014) that majority of smallholder farmers depend on farming as their main source of household income. Only a few respondents mentioned business and remittance from working relatives as other sources of their household income (7% and

2% respectively). Additionally, observations made during field data collection showed that, casual labour coupled with charcoal burning were prevalent in the target area especially during the long dry season of June to October. Results of multiple responses on the main source(s) of household income are presented in Figure 9.

Figure 9. Household main sources of income

4.2.1.7 Respondents' Years of Farming Experience

With regard to farming experience of the respondents, study findings showed that over a half of the respondents (59%) have been farming for over 20 years. Although farming experience ranged from two to 58 years, 24% of the respondents had farming experience of up to 15 years. Respondents with few years in farming seemed limited in proving information on the performance of past PPP joint initiatives that have been promoted and initiated in the target area. However, those with many years of farming experience were quick to give information related to perceived causes of less than optimal performance of past PPP joint initiatives. Table 10 indicates the various categories of respondents' farming experience years in farming.

Table 10

Respondents' Years of Experience in Farming (n=165)

Modal Class	Frequency	Percent
1-5	4	2.4
6-10	14	8.5
11-15	22	13.3
16-20	28	17.0
21-25	18	10.9
26-30	27	16.4
31-35	13	7.9
36-40	19	11.5
41 and above	20	12.1
Total	**165**	**100.0**

4.2.1.8 Livestock Production

Although land degradation issues, change in eating habits and worldwide increase in livestock trade continue to persist, farming systems that involve livestock production are facing high challenges of sufficient feed and water availability (Steeg, Verburg, Baltenweck & Staal, 2010). Davis *et al*. (2011) noted that although women benefited more than men from livestock technologies introduced through FFSs, livestock production especially the larger ruminants was predominantly a men activity while women engaged in production of small ruminants and poultry. In the semi-arid areas of Kitui, Machakos and Makueni Counties, resource-poor smallholder farmers practised subsistence farming which involves crops and livestock production (Davis *et al*., 2011; Kavoi, *et al*., 2011). This agreed with the study findings that although crop production was a major farming activity in the target area, different types of livestock were kept. These included cattle, goats, sheep, poultry – especially the local breeds and donkeys.

However, emerging poultry breed such as Guinea fowls, Turkey and Geese were not kept by any of the respondents interviewed despite increased demand for white meat both locally and internationally (Mwangi & Kavoi, 2013). Furthermore, free-range chicken commands a large quality premium and makes up the majority of at-home chicken consumption in urban areas. About 75–80% of the chicken purchased for home consumption is free-range chicken. Free-range chicken is considered to be very tasty and

commands a premium of up to 100% (Ifft, Roland-Host & Zilberman, 2012). Since poultry rearing does not require large space, this seemed to be a farming enterprise that can be promoted amongst the smallholder farmers in the target area.

The number of different types of livestock kept by the respondents varied from farm to farm. Earlier studies (Bett *et al*., 2010; Davis *et al*., 2011) in the region showed that keeping livestock in the semi-arid areas moderates the effects of food shortage resulting from frequent crop failure that is prevalent in the area. Livestock acted as the smallholder farmers' current account when they have to attend to pressing household needs such as school fees and health in addition to sourcing for household food. None of the respondents kept all types of livestock. Study findings showed that 29% of the total respondents had no cattle at the time of the study – some reportedly having been wiped out by the devastating effects of prolonged drought that has frequented the target area in the recent past. It is important to note that, availability of draught power (oxen power) was very crucial especially during the peak periods of the cropping season (land preparation, planting and weeding) (Kavoi, 2003). The number of cattle kept ranged from zero to 15. However, 61% of the respondents had between 1 and 6 heads of cattle, while 10% had between 6 and 15 heads of cattle (Table 11).

Table 11

Number of Cattle Kept by Face-to-Face Respondents (n=165)

Modal Class	Frequency	Percent
0	47	29
1-5	102	61
6-10	15	9
11-15	1	1
Total	**165**	**100**

Davis *et al*. (2011) in their study observed that adoption of improved livestock breeds among women farmers in East Africa has been increasing especially among farmers participating in FFS activities. However, discussions on livestock related issues coupled with observations made on field notebooks during data collection seemed to indicate the opposite. Although small ruminants and poultry production were mostly done by women among smallholder farmers in East Africa (Davis *et al*., 2011), in the target area both men and women engaged in poultry keeping. Moreover, small

70

ruminants and poultry have been reported in previous studies done in the region as the "mobile current accounts" for the smallholder farmers in the target area (Kavoi *et al*., 2010a).

Goat keeping featured prominently among the Face-to-Face interview respondents. Majority (90%) of them kept goats while (10%) of the respondents did not. The number of goats kept by individual household ranged from zero to 50. Slightly below a half of the respondents (45%) kept between one and five goats, while 25% kept between six and 10 goats. The average number of goats kept was 8, median 5 goats, mode 4 goats with a standard deviation of 8.95 goats (Table 12).

Table 12

Number of Goats Kept by Face-to-Face Respondents (n=165)

Modal Class	Frequency	Percent
0	16	10
1-5	74	45
6-10	42	25
11-15	7	4
16-20	17	10
21-25	1	1
26-30	3	2
31 and above	5	3
Total	**165**	**100**

Sheep rearing among the Face-to-Face respondents was noticeably missing. Low numbers of sheep kept by the respondents could be seen grazing among other types of livestock kept. The target population comprised the Kamba community. According to observations made during past studies (Kavoi *et al*., 2011) and work experience in the target area, majority of households kept no sheep – culturally, few households of the Kamba community keep sheep. This was evident from the results from the study findings. Households which did not keep sheep comprised 93% of the total respondents. The number of sheep kept by the respondents ranged from zero to 30. Only 5% of the respondents kept one to five sheep, while about 2% kept between six and 30 sheep - this could possibly indicate a change in cultural attitude among the community. Figure 10 presents the study findings on the number of sheep kept by the respondents.
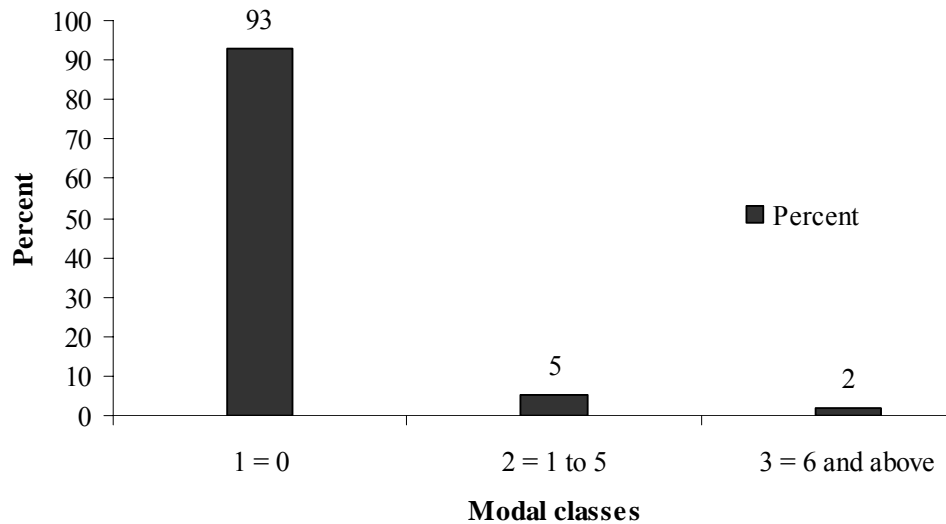
Figure 10. Modal classes of the number of sheep kept by the respondents

With regard to poultry rearing, results showed that poultry rearing was common among the respondents interviewed. This agreed with an earlier study by King'ori, Wachira and Tuitoek (2010) which showed that poultry rearing especially the indigenous chicken amongst smallholder farmers was a common feature. Only a small percentage (8%) of the total respondents had no chicken at the time of study – this could possibly be as a result of either sales to meet household pressing needs or deaths from disease outbreak, as observed by some of the interviewed respondents. The number of chicken kept ranged from zero to 115, with a mean of 14 chicken. The number of chicken kept by individual respondent is shows in modal classes in Table 13.

Table 13

Number of Poultry Kept by Face-to-Face Respondents (n=165)

Modal Class	Frequency	Percent
0	13	8
1-5	32	20
6-10	50	30
11-15	18	11
16-20	27	16
21-25	5	3
26-30	13	8
31 and above	7	4
Total	**165**	**100**

Donkeys play an important role in provision of transport for the household in fetching water and fire-wood; transporting farm yard manure to the cropped land; transporting farm produce from the farm to the homestead; ferrying water, sand, stones, cement and baked adobe bricks to construction sites. They are also used to transport farm produce to the market place (Kavoi, 2003). Donkeys have also been used to provide draught power for land preparation and weeding in the absence of oxen. Despite being such an important beast of burden in the target area, only 33% of the total respondents kept few donkeys ranging from one to five. The number of donkeys kept by different respondents was small as shown in Figure 11.
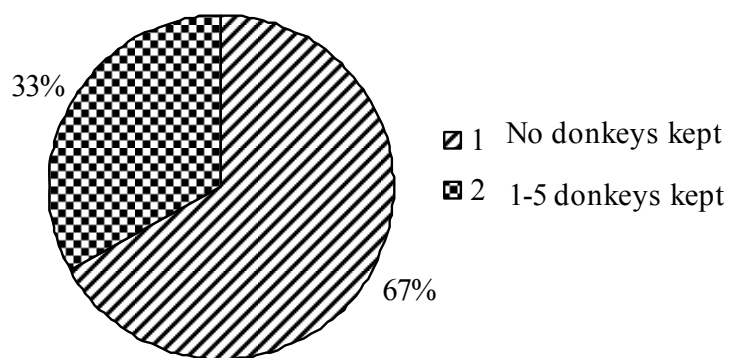
Figure 11. Categories of the number of donkeys kept by the respondents

4.2.1.9 Composition of Household Members

The number of household members varied from respondent to respondent. Over a third of respondents (41%) had one to three household members – possibly an indication of the migration of the men folk in search of employment in other farms or in urban centres. This seemed to agree with the study findings reported under sub-sub-section 4.2.11 that 61% of the respondents had to combine both family and hired labour to address farm family labour requirements especially during the peak of cropping seasons when demand for labour for farm operations such as weeding and harvesting increases. The results also showed that 29% had seven to nine household members, while 10% had 10-15 household members. Only one respondent had 19 household members. It should be noted that although about 40% of the respondents had household member from seven to 15, many of those household members were engaged in activities outside the farm. Household members ranged from three to 19 with a mean of 6 members, median of 6.0 members, mode 6 members, with a standard deviation of 2.962 members. The composition of household members is presented in Table 14.

Table 14

Composition of Household Members (n=165)

Modal Class	Frequency	Percent
1-3	33	20
4-6	67	40
7-9	47	29
10-12	12	7
13-15	5	3
16 and above	1	1
Total	**165**	**100**

4.2.1.10 Family Members Living on Farm and Contributing Labour to Farm Activities

Family members living on the farm and contributing labour for various farm activities varied from household to household. The number of family members living on the farm and providing labour directly to farm activities ranged from zero to 11. Majority (71%) of the respondents had one to three household members living and directly providing labour for farm activities, while 24% of the respondents had four to six household members living and directly contributing farm labour. Household members residing on the farm ranged from zero to 11 with an average of 3 members. Table 15 shows the number of household family members living on the farm and directly contributing labour to farm activities.

Table 15

Family Members Living on Farm and Contributing Labour (n=165)

Modal Class	Frequency	Percent
0	1	1
1-3	118	71
4-6	39	24
7-9	5	3
10-12	2	1
Total	**165**	**100**

4.2.1.11 Household Main Source(s) of Farm Labour

Sources of individual household farm labour differed from respondent to respondent. Majority of households (61%) combined both family labour and hired labour to

address farm activities, while 37% depended only on labour provided by family members to carryout farm operations. This agreed with findings of an earlier study by Kavoi (2003), which showed that availability of adequate farm labour becomes crucial especially during land preparation (to achieve dry planting), weeding and harvesting. Although off-farm income provided farmers with liquid capital for purchasing inputs such as improved seed, pesticides and fertilizers to enhance farm productivity, their pursuit may undermine the adoption of improved technologies and innovations that are labour-intensive. Reduction of available household labour for allocation to farming enterprises in respective households could be attributed to family members' pursuit of off-farm activities (ASARECA, 2013). Study findings showed the main source(s) of family farm labour as shown in Figure 12.
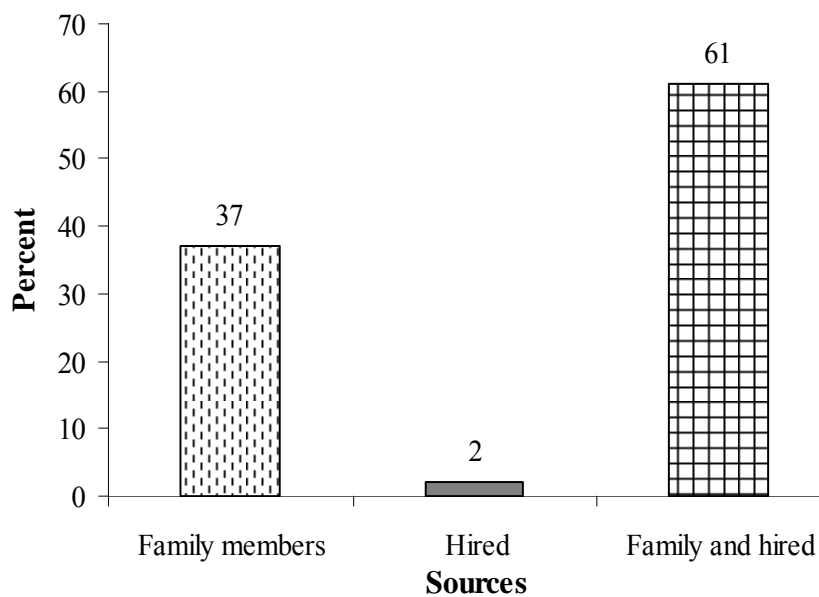
Figure 12. Main sources of household labour

4.2.1.12 Composition of Land Tenure

Land tenure comprised freehold, leasehold, communal and borrowed or rented. Study findings showed that, land tenure comprised four main categories where 80% had freehold land ownership, while 18% were farming on communal land. Both leasehold and borrowed land comprised 1% each. Individual land ownership as a production resource is crucial in decision-making because it enables a farmer to make timely

decision on the kind of operations he/ she needs to carryout in a cropping calendar (Quisumbing & Pandolfelli, 2009). During discussions with respondents on how the type of land ownership can affect an individual's decisions in preparing for a cropping season, respondents observed that the type of land ownership plays an important role. It determines whether or not to adopt technologies and or innovations that contribute to overall farm development. A case in point was given, where a farmer cannot invest in establishing fruit trees and or constructing soil conservation structures on a communal, rented or borrowed piece of land for fear of losing such investment if the land was shared in future and the investment fell to someone else. Figure 13 presents study findings on land tenure.
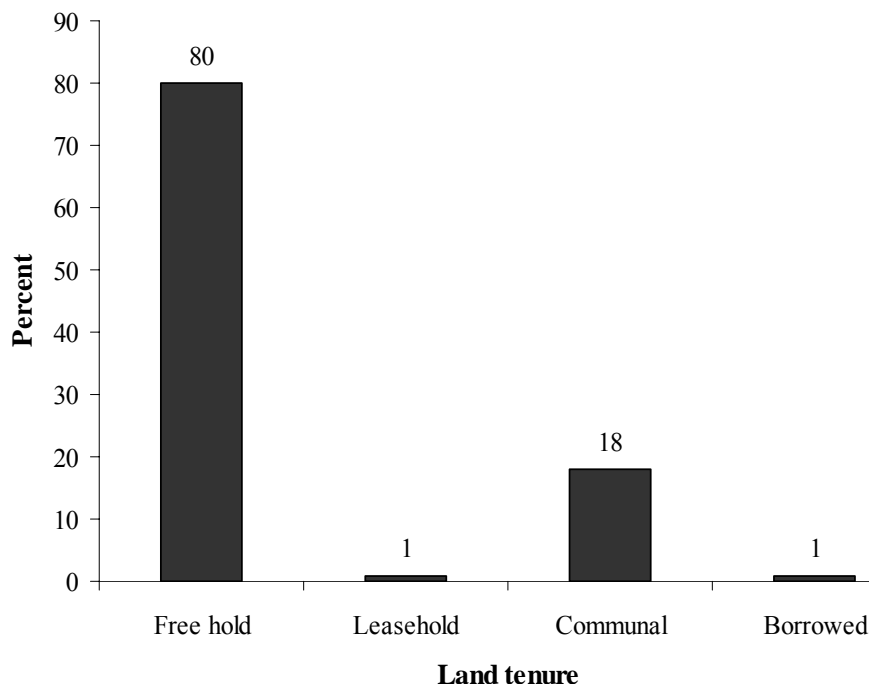
Figure 13. Types of land tenure

4.2.2   Agro-Ecological Zone Characteristics of the Target Area

The study target area fell under agro-ecological zones UM2, UM3, LM3, UM4, LM4 and LM5 (Table 16).

Table 16

Estimated Percentages of Agro-Ecological Zones in the Study Area

Agro-Ecological Zone	Kitui	Machakos	Makueni
Upper Midland (UM)2	0	1	0
Upper Midland (UM)3	2	2	2
Lower Midland (LM)3	3	2	3
Upper Midland (UM)4	5	15	10
Lower Midland (LM)4	15	25	25
Lower Midland (LM)5	75	55	60
Total	**100**	**100**	**100**

Source: Survey data

On average, 90-95% of the total land in the three Counties of Kitui, Machakos and Makueni falls under AEZ 3 to AEZ 5. Small portions of UM2 were found along the hill masses of Kangundo hills in Machakos Sub-County. The rest of arable land in the three Counties of Kitui, Machakos and Makueni fell under UM3, LM3, UM4, LM4 and small portions in LM5 (MoA Kathonzweni Sub-County 2011 Annual Report; MoA Kathonzweni Sub-County, 2012 Annual Report; MoA Kyuso Sub-County 2012 Annual Report; MoA Machakos Sub-County 2012 Annual Report; MoA Makueni Sub-County 2012 Annual Report; MoA Migwani Sub-County 2012 Annual Report; MoA Mwala Sub-County 2011 Annual Report). Hence the promotion of drought tolerant crops as well as rearing of local breeds of goats and poultry in the three Counties.

Additionally, in all the six Sub-Counties, the MoA had high staff: farmer ratios which ranged from 1:1,082 to 1: 2,387. This seemed to present a major challenge in extension service provision by the available public extension workers to the farming community. According to MoA's national extension sector policy (2012), the ratio of frontline extension worker to farmers is about 1:1000 compared to the desired level of 1:400. Thus, in the absence of effective private sector operations to fill the vacuum, the situation has led to reduced spatial coverage, pointing to the effectiveness of service delivery reflected by clientele complaints. During the KI interviews, all the public extension service providers who comprised 82% of the total KI respondents were quick to point out that, their department benefited by teaming up (partnering) with other development partners in their day to day activities. Extension units in the Sub-

Counties ranged from 10 to 15. An extension unit refers to an administrative (in most cases a location) area manned by an extension officer (MoA Makueni Sub-County annual report, 2012; Migwani Sub-County annual report, 2012). The demographic features of the study area are summarized and presented in Table 17.

Table 17

Summary of Demographic Features of the Six Sub-Counties in the Study Area

Sub-County	Total land area Km^2)	Total Arable land (Ha)	Total cultivated land (Ha)	Total population	Total households	Ave. farm size (Ha)	Extension Units	Staff: Farmer ratio
Kathonzweni	880.10	78,100.0	34,597.0	76,605	4,413	2.1	10	1:2,387
Kyuso	2,573.80	65,950.0	40,000.0	68,790	13,260	1.6	14	1:1,429
Machakos	821.74	38,299.4	21,096.1	199,211	48,979	2.0	13	1:1,400
Makueni	616.10	46,024.0	34,099.0	109,318	23,756	1.9	10	1:1,082
Migwani	675.65	60,670.0	48,500.0	71,170	14,769	3.2	15	1:1,898
Mwala	1,017.80	89,800.0	26,450.0	163,032	35,573	2.4	15	1:1,097

Source: Study secondary data

The study area covered Kyuso and Migwani Sub-Counties in Kitui County, Machakos and Mwala Sub-Counties in Machakos County and Kathonzweni and Makueni Sub-Counties in Makueni County. It borders the Tseikuru and Mumoni Sub-Counties to the North, Mbeere and Thika Sub-Counties to the North-West, Nairobi and Athi-River Sub-Counties to the West, Kajiado County to the South-West, Nzaui and Makindu Sub-Counties to the South, Kitui and Mutomo Sub-Counties to the South-East, Mwingi East Sub-County and Tana-River County to the East. The six Sub-Counties fall under agro-ecological zones UM4, LM4 and LM5, with small portions of UM2, UM3 and LM3 occurring in the hill masses of Machakos, Mwala, Makueni and Migwani Sub-Counties (MoA Farm management handbook of Kenya, 2010).

Secondary data review done on KARI-Katumani Research Centre annual reports as well as respective Sub-County annual reports showed that the target area receives a bi-modal rainfall. Rain occurs during the long rainy (LR) season (March-May) and the short rainy (SR) season (October December), the latter being more reliable. Reviewed secondary data further showed that in the last 16 years, KARI-Katumani Research Centre, whose research mandate covers the target area, received annual rainfall above 1000mm only once. During the same period, the Centre received annual rainfall above 600mm in only five years (Figure 14).
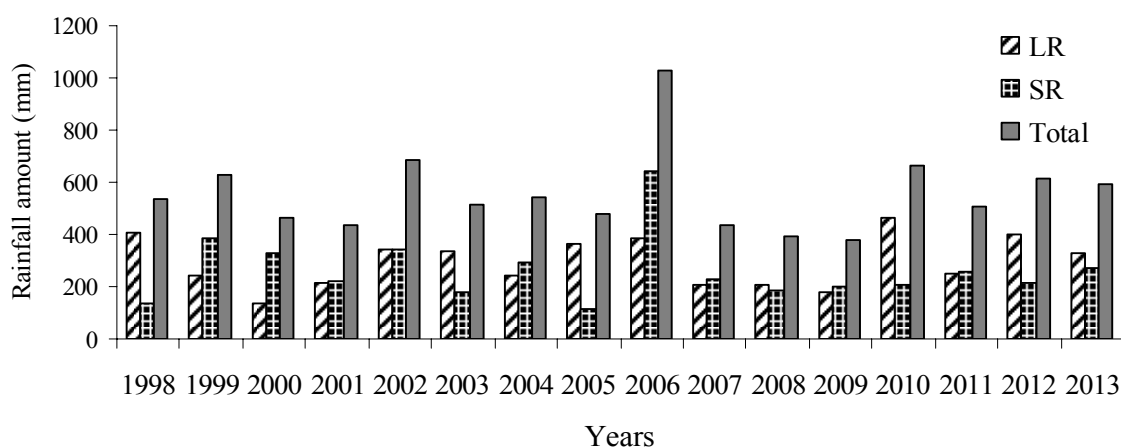
Figure 14. Amount of rainfall (mm) received in KARI-Katumani Research Centre
        (1998-2013)
            Source: Study secondary data

Average annual rainfall ranges from 300mm in the drier Sub-Counties of Kyuso and Kathonzweni to a high of 800-1100mm in the hill masses of Makueni and Machakos

Sub-Counties (MoA Kyuso Sub-County Annual Report, 2012; MoA Migwani Sub-County Annual Report, 2012; MoA Machakos Sub-County Annual Report, 2012; MoA Makueni Sub-County Annual Report, 2012; MoA Kathonzweni Sub-County Annual Report, 2012). Temperature ranges from 18^0C to 34^0C. The region lies at an altitude ranging from 650M in parts of Kyuso Sub-County to 1,400MASL in hill masses of Machakos Sub-County. Poverty level across the six Sub-Counties ranged from 55% to 65% (Kenya National Bureau of Statistics, 2010).

Most of the smallholder farmers in the semi-arid areas of Kitui, Machakos and Makueni Counties grew local crop varieties, with some farmers growing few improved crop varieties. Crop varieties grown were mostly dry land crops which included high value traditional crops such as sorghum (*Sorghum bicolor*), Pearl millet (*Pennisetum glaucum*), Finger millet (*Eleusine coracana*), cowpeas (*Vigna unguiculata*), pigeon peas (*Cajanas cajan*), dolichos (*Lablab purpureus*), cassava (*Manihot esculantum*), sweet potatoes (*Ipomoea batatas* L) and green grams (*Vigna radiata*) and were most suited in the semi-arid areas of Kitui, Machakos and Makueni Counties (KARI-Katumani Annual Report 2010; Katumani Annual Report, 2011; MoA Kyuso Sub-County Annual Report, 2012; MoA Migwani Sub-County Annual Report, 2012; MoA Machakos Sub-County Annual Report, 2012; MoA Makueni Sub-County Annual Report, 2012; MoA Kathonzweni Sub-County Annual Report, 2012).

4.3   Stakeholders and their Roles

4.3.1   Introduction

The first objective sought to determine and describe the stakeholders and their roles in MSLIAD joint initiatives in the target area.

In order to establish strong linkages for sustainable agricultural development one would need to know the stakeholders, their roles in MSLIAD initiatives and the best way for linking them with one another (Kavoi *et al.*, 2013a). One also needs to know how agricultural extension delivery approaches and methods have been evolving over the years and how these have affected the dissemination and adoption of agricultural technologies. Table 18 presents a summary of the different stakeholders, their

respective roles in MSLIAD joint initiatives in the target area. The stakeholders are linked through participation in joint development initiatives that involve technology and innovation development, promotion and diffusion for wider adoption. Such initiatives include regional and national and international agricultural shows, farmers field and demonstration days and farmer open days among others.

Table 18

Stakeholders and their Roles in Multi-Stakeholder Linkages for Innovative Agricultural Development Initiatives in the Target Area

Stakeholder	Roles
Researchers from KARI, Universities and CGIAR Centres (CIAT, CIMMYT, ICIPE, ILRI, ICRISAT)	a. Development, validation and promotion of improved agricultural technologies and innovations through individual, group and mass extension communication methods – catalyzing uptake of technologies. b. Identification and prioritization of researchable areas. c. Capacity building for intermediaries in dissemination of improved technologies and provision of support information on improved technologies and innovations; Back-stopping extension staff on issues related to the use of improved technologies and innovations. d. Manpower training (capacity development) – training and provision of technologies and innovations.
Ministry of Agriculture	a. Promotion and dissemination of validated agricultural technologies and innovations. b. Capacity building for end users of agricultural technologies and innovations. c. Coordination and regulation of extension services delivery.
Provincial administration	a. Mobilization of human and other resources for development. b. Provision of security.
Private Sector (East African Malting Limited, Contracted Grain suppliers, Banks, Farm input suppliers - Agro-Vet Dealers, Transporters, Financial institutions)	a. Purchase of sorghum grain delivered to the malting company by suppliers; Support to input acquisition. b. Sorghum grain purchasing from farmers and delivery to brewing industry and payment to farmers for delivered farm produce (sorghum grain) through Banks; Farm input suppliers.
Civil Society Groups (CBOs, Faith-Based Organizations and NGOs)	a. Capacity building for end users of improved agricultural technologies. b. Promotion and dissemination of validated agricultural technologies and innovations; Value addition of farm produce; farmer support on input acquisition.
Farmers (Farming community)	a. Identification and prioritization of researchable areas. b. Implementation of improved agricultural technologies and innovations; Value addition of agricultural products; and Provision of feedback on the usefulness of agricultural technologies and innovations.

An understanding of past and current technology dissemination approaches and the changes associated with the paradigm shifts are vital (Vanloqueren & Baret, 2009). The paradigm shifts can be based on two interrelated influencing factors namely, the sectoral specific transformative capacity of new technologies themselves - their substantial or incremental impact on socio-economic and institutional change in a given sectoral system (Dolata, 2009); and the sectoral adaptability of socio-economic structures, institutions, and actors confronted with the opportunities presented by new technologies.

The trend in paradigm shift has been for the introduction and promotion of one top-down approach with its own set of principles and guidelines by the respective proponents over a few years followed by another promotion approach in the agricultural sector development (Hashemi & Hedjazi, 2011). Such approaches fell into three broad methodological categories: Linear – Top-Down approach in technology transfer; Farming systems approach and Farmer participatory research approach. Within these broad categories were different methodologies, namely, whole farm management in the 1950s to 1970s; farmers training centres and participatory methodologies in the 1980s. Other methodologies include the shifting focal extension, farmer field schools and agricultural information desks that disseminate agricultural technologies using the concept of the agricultural product value chain (APVC) (Narrod *et al.*, 2009).

Information on factors responsible for shifting paradigms in technology and innovation promotion and diffusion approaches, which explain how the paradigm shifts occur, is globally available. But this information is either lacking or inadequate in the semi-arid areas of Kitui, Machakos and Makueni Counties and creates a knowledge gap that is yet to be filled. New development projects are often introduced by different agencies that have their own preferences attached to such projects in terms of the mode of implementation, the reporting format and target community. Leys and Vanclay (2011) argues that the earlier technology transfer approaches and methods are unsuitable for resource-poor farmers in the third world countries' complex, diverse and risk-prone agriculture. Little focus, they say, has been given to the development of institutional frameworks for implementation and evaluation of emerging technology dissemination approaches and methods.

Study findings from the four different sources of information (KIs, FGDs, Face-to-Face interviews and self administered questionnaire) were in agreement and showed that several stakeholders have been involved in different MSLIAD joint initiatives in the target area. The stakeholders include researchers from the Kenya Agricultural Research Institute (KARI), Egerton University, University of Nairobi, and MoA. They also included Civil Society Groups (Community-Based Organizations (CBOs), Non-Governmental Organizations (NGOs) and Faith-Based Organizations (FBOs), farmers and researchers from the Consultative Group on International Agricultural Research (CGIAR). The CGIAR comprised of the International Centre for Insect Physiology and Ecology (ICIPE), International Livestock Research Institute (ILRI), International Maize and Wheat Improvement Centre (CIMMYT), International Centre for Tropical Agricultural (CIAT) and International Crop Research Institute for Semi-Arid Tropics (ICRISAT). Other stakeholders were the Provincial administration and the Private sector (Financial institutions, transporters, marketers, processors and farm input suppliers).

Based on innovation systems concepts and perspective, several actors have been observed as being relevant to agricultural innovation – such actors include but not limited to the agricultural entrepreneurs, researchers, consultants and policy makers (Klerkx & Leeuwis, 2008a). This agreed with the study findings which showed that, all the stakeholders previously mentioned (Table 18) have been in involved in joint innovative agricultural initiatives in the target areas for a wide-ranging number of years. On average, the MoA has been in operation in the target area for over 40 years, covering Sub-County down to the sub-location. However, in certain areas, coverage was reportedly low (poor) due to shortage of extension staff in the entire Sub-County, with all Sub-Counties reporting a high staff: farmer ratios. With regard to the researchers and especially those from KARI, they have been rendering their services for over 25 years, with some areas being reported as low as six years while the area of coverage ranged from Sub-County to the entire County. The Provincial administration has been providing services since independence. Presence and duration of operations by different CSOs' differed across all Sub-Counties.

4.4   Existing Relationships and Networks

The second objective sought to establish the existing relationships and MSLIAD networks within which MSLIAD operate in the semi-arid areas of Kitui, Machakos and Makueni Counties.

4.4.1   Community Networking Groups

Study results showed that majority of the respondents (99%) belonged to several farmer self-help groups. The actor-network-theory (ANT) describes such members as boundary actors and what brings them together (information, technology or innovation) as the boundary object (Glasbergen, 2010; Latour, 2005; Morse, 2010). The ANT argues that nothing takes place in isolation and that both the boundary actors and boundary objects are expected to contribute towards increased information sharing within and across the boundaries. However, although ANT assumes that all actors are equal, no accommodation for power imbalances within and across the boundaries can be made. At community level, networking among members of the farming community existed. Although often neglected by formal extension services, such networks are an important resource for the diffusion of information (Quisumbing & Pandolfelli, 2009).

All female respondents belonged to several groups and were engaged in merry-go round, soil and water conservation activities as well as assisting group members during weeding and harvesting. One farmer self-help group was engaged in farm produce aggregation for joint marketing. Each farmer group had a particular day when members meet and carryout group activities. This seemed to be a very involving task for female farmers. This agreed with studies by Yakasai and Fagwalawa (2013) which showed that female farmers do most of the farming activities as their male counterparts are engaged in off-farm activities. The results further showed that over 99% of the respondents were in agreement that being a member of several groups helps farmers to interact and share information with more people. Whereas 99% of the respondents acted like boundary actors, this seemed not to contribute to increased information sharing and thus increased uptake of improved technologies and innovations in the target area (Figure 15). Those interviewed said that existing farmer groups had 10 to 84 members. Majority (88%) of the farmer self-help groups comprised men and

women. Only 5% and 7% were all women and all men farmer groups respectively. Figure 15 shows membership of community networking groups.
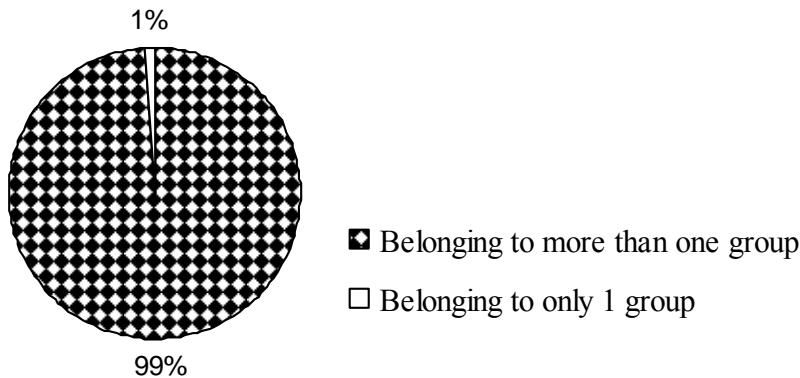
Figure 15. Membership of community networking groups

Eleven groups were either all male or all female. The rest of the group had male members ranging from four to 25 while the existing farmer groups were run by an elected committee. Additionally, the committee gender composition varied from group to group. Twenty percent of the respondents observed that their group management committee was male-dominated, while 62% of the respondents said their group committee composition was female-dominated and 18% said there was equal representation (Figure 2).
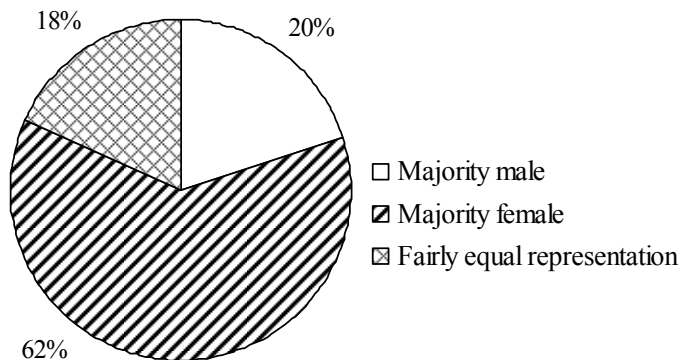
Figure 16. Respondents' group committee composition

Several factors seemed to relate to group dynamics among the existing farmer self help groups. Male dominance negatively affected group performance in achieving group objectives. To further probe on the effects of male dominance in group leadership and performance, the researchers sought to establish if male dominance in group composition affected the group's performance in achieving its development activities.

Respondents gave various reasons why male dominance affected group's performance. Thirty five percent of the respondents felt that male group members were selfish or had self interests, 24% felt that male group members had conflict of interests while 4% felt that group members mismanaged group resources. However, 34% said there was no problem involving male members in group activities.

Respondents observed that female dominance in group committee did not negatively affect group performance. Several reasons explaining why female dominance in group committee did not negatively affect the group's performance were reported. Majority (56%) of the respondents said that women were more cooperative among themselves unlike their male counterparts while 19% felt that women were more patient and committed to group matters. A further 16% of the respondents said that they did not have any problem working with fellow women in farmer self help groups.

With regard to farmer networking, study results showed that most (80%) of the networking between the farming communities especially in farmer self-help groups existed mainly to pool resources together. The respondents observed that pooling resources together was geared towards uplifting one another. This agreed with researchers Prager and Freese (2009) who observed that actors who network together must have an interest in the issues that bring them together. Some of the existing farmer groups networked to achieve bargaining power, better marketing of their farm produce and to minimize exploitation by the brokers who meddle with both farm-gate and market prices. For instance, Mwikililye farmers' self help group, one of the pioneer Gadam sorghum PPP initiative production cells in Nguutani Division, Migwani Sub-County, apart from selling Gadam sorghum to an agent contracted by the EABL to supply Gadam sorghum grain also sold maize, beans, cowpeas and green grams to neighbouring schools. Thus, by getting involved in group's activities, the skills of an individual are improved (Moayedi & Azizi, 2011). However, the effectiveness of individual group member's networking depended on their collective capacity to facilitate the exchange of information and resources (Spielman *et al.*, 2009). Existing farmer groups in the study area related and networked together for various reasons. Majority (80%) of the respondents networked to uplift each other by pooling resources together, while 12% networked to gain bargaining power and market

their farm produce better. Only 4% networked for their community development (Table 19).

Table 19

Reasons for Networking (n=165)

Reason given	Frequency	Percent
To assist/ uplift/ help each other by pooling resources.	132	80
To do better marketing of our farm produce.	20	12
To improve agricultural production/ livelihoods in the area.	10	6
To enhance area/ community development.	6	4

4.4.2   Community Relationships and Networking with Development Partners

As reported earlier under sub-section 4.3.1 of this chapter, different development partners existed and were involved in various development initiatives in the target area. With regard to the existence of networks among the stakeholders in the area, 58% agreed that networks (systems, associations or arrangements) existed between different stakeholders in the study area. The study findings further showed that 58% of the respondents agreed that somehow networks existed between different stakeholders in the study area (Figure 16). However, those who agreed of their existence were quick to say that such networks were not effective in promoting information sharing among different stakeholders. This study finding coupled with low technology and innovation adoption in the target area contributes partly to explain the less than optimal performance of the MSLIAD joint initiatives in the study area.
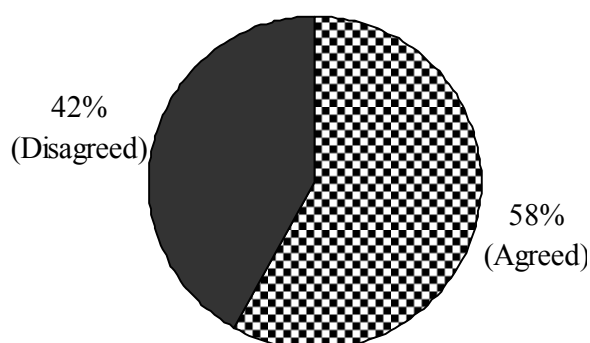
Figure 17. Respondents' perceptions on the existence of networks in the area

Study findings further showed that stakeholders were linked in several ways. From the study findings, it was indicative that stakeholders in the target area were linked through activity implementation; through farmer field days and demonstrations; and through public meetings (Barazas – voluntary public meetings convened by local administrative leaders to convey vital information). This networking could possibly facilitate information sharing among the smallholder farmers in the target area as observed in a study by researchers Amudavi *et al*. (2009). However, in the study area, there seemed to be lack of clearly defined and effective linkages among different stakeholders for joint activity planning and implementation. Ways through which stakeholders were linked are presented in multi-response Table 20.

Table 20

Ways through which Stakeholders were Linked in the Target Area (n=165)

Point of linkage	Frequency	Percent
Implementation of activities (Capacity building workshops).	101	61
In farmer field days and farm demonstrations.	67	41
In public meetings (Barazas).	8	5
In participatory monitoring and evaluation farm visits.	2	1

Further probing during the Face-to-Face interviews revealed that somehow linkages existed between the farming community and development partners in technology and or innovation development and packaging, especially during on-farm research trials. Study findings on technology and innovation development, packaging and promotion for adoption and utilization showed that 45% of the respondents were collaborating with the four development partners, namely, researchers, extension service providers, civil society organizations and the private sector. Additionally, there seemed to be a variation with respect to technology and or innovation development and packaging compared to technology promotion for adoption and utilization. While only 44% and 45% of the respondents were collaborating in technology and or innovation development and packaging respectively, all the respondents said they collaborated with development partners in promoting technologies and or innovations for adoption. Similarly, citing field demonstrations, open days and farmer field days, 98% of the respondents said they collaborated with development partners in promoting technologies and or innovations for utilization (Table 21).

Table 21

Areas of Linkages and Networking in Technology and Innovation Development and Dissemination Process (n=165)

Area of networking	Frequency	Percent
Technology/ innovation Development.	72	44
Technology/Innovation packaging.	74	45
Technology/innovation promotion for adoption.	165	100
Technology/innovation promotion for utilization.	162	98

The effectiveness of linkages between stakeholders can be based on the knowledge of stakeholders' functions, accessibility, relevance, urgency and timeliness of service delivery (Mwangi, 2012). It can also be based on the end-users' perceptions on their performance in achieving the intended goals over time (the progress made), the mandate and representatives in their formulation and the legitimacy of concerned stakeholders. Respondents had varied views on the effectiveness of the existing linkages between stakeholders involved in development initiatives in the target area. A Key Informant respondent remarked (Sub-County Agricultural Officer): *"Linkages only exist where mandate and functions interact"*. Study findings from KIs structured interviews showed that the effectiveness of the existing linkages between stakeholders (farming community and development partners) was average. Existence and involvement of different stakeholders in joint MSLIAD development initiatives had not contributed to increased innovative agricultural development in the area. This could possibly be attributed to the degree of the effectiveness of the existing linkages. Only 8.8% of the KIs rated the effectiveness of the existing linkages as good. Chi-square test for the goodness of fit of the existing linkages showed that moderate linkages were significantly higher than strong linkages ($\chi^2 = 9.588$, df = 2, $p = 0.008$). Table 22 presents KIs' responses on the effectiveness of the existing linkages.

Table 22

Perceptions on the Effectiveness of the Existing Linkages between Stakeholders (n=34)

Response	Observed N	Expected N	Residual	Statistical Test
Strong/ good	3	11.3	-8.3	Chi-Square
Moderate/ fair	17	11.3	5.7	9.588
Weak/ poor	14	11.3	2.7	df 2 P=0.008
Total	**34**			

The researcher probed further on the effectiveness of the existing linkages using Face-to-Face respondents. Study findings from Face-to-Face respondents compared very well with those from KIs. As noted in a study by Hildebrand and Shriver (2010), χ^2 test can be used to assess the significance of responses presented in categories. In this study, χ^2 test of significance was used to assess the respondents' perceptions on the effectiveness of the existing linkages between different stakeholders in contributing towards increased innovative agricultural development in the target area. The opinions on selected statements which related to the effectiveness of the existing linkages were expressed in three categories of strong/good, moderate/fare and weak/poor.

In addressing study objective two, Chi-square test for goodness of fit was used to assess the significance of responses presented in three categories. The three categories were strong/good, moderate/fair and weak/poor. These categories were used to define the existing relationships and networking between the farming community and development partners. Weak linkages were significantly higher than strong linkages (χ^2 = 76.07, df = 2, p = 0.001) (Table 23). This finding agreed with findings in a study by Okoko *et al.* (2008) that the farming communities and in common with other Sub-Saharan African countries were facing weak linkages. Weak linkages explain the factors that relate to the sub-optimal performance of MSLIAD in the target area.

Table 23

Expressed Opinions on Existing Linkages' Effectiveness and Chi-Square Test

Opinion	Observed N	Expected N	Residual	Statistical test
Strong/ Good	3	55	-52.0	Chi-Square
Moderate/ Fair	73	55	18.0	76.07
Weak/ Poor	89	55	34.0	df 2
				p=0.001
Total	**165**	**165**		

Generally, the desire for partnership was there but translating this desire into visible actions remains a challenge. For instance, different NGOs visit farmers at different times without coordinating their activities to avoid duplication of effort or unnecessary wastage of available scarce resources. The gap in coordination of activities is a major challenge. Finding and having a consensus on the person or institution to coordinate other stakeholders is another challenge. Proper sharing of available resources is yet another challenge (Kavoi *et al*., 2013a). A clear identification of stakeholders and their roles in the MSLIAD is important because one partner's failure, as Narrod et *al.* (2009) observed, is likely to affect the performance of other stakeholders. Poulton and Macartney (2011) recommends, for instance that if the state extension service provision fails, innovative ways should be sought to bring the private sector on board. Public-Private-Partnerships (PPPs) are multidisciplinary and are known to impact on society positively especially where resources for research are inadequate. They minimise transaction costs on contracting, coordinating and enforcing relationships between different stakeholders as well as costs associated with forming and sustaining relationships (Kavoi *et al*., 2011; Oreszczyn, Lane, & Carr, 2010).

Many opportunities are available for MSLIAD initiative stakeholders to get together in County development fora to work out strategies for translating their aspirations into concrete activities on the ground. To avoid duplication of effort or unnecessary wastage of available scarce resources, for instance, they can agree to visit farmers on specific days and hours together. They also have the opportunity to decide who among them is best suited to play the coordination role and to agree on the best way of sharing resources. Proper utilization of these opportunities is likely to improve the impact of MSLIAD development initiatives in the target area.

4.5 Factors Responsible for the Current Status of Multi-Stakeholder Initiatives

The third objective sought to identify the factors responsible for the current status of MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties.

4.5.1 Introduction

To effectively address the third objective of the study, study findings from four sets of data were used. These were data from Key informant interviews; Focus Group discussions; Face-to-Face interviews; and Self-administered structured questionnaire with five point Likert type scale statements.

4.5.2 Responses from Key Informants

According to KIs' perceptions, lack of joint planning was a major cause of the less than optimal performance of MSLIAD joint initiatives in the target area. It was ranked the first among five causes that were mentioned. This agreed with findings from a study by Ali and Kumar (2011) that lack of planning and joint implementation has been a major concern on the failure of government-led extension programmes to respond to the changing needs of the farming communities. Adoption of technologies and innovations is also influenced by risk-related issues, where an inclusive definition of risk here refers to both what is measurable and immeasurable (Greiner *et al.*, 2009). Additionally, failure to acknowledge female farmers' needs and preferences could lead to low adoption of improved technologies and innovations.

However, researchers Quisumbing and Pandolfelli (2009) observed that gender is not the only factor that may hinder increased technology and innovation adoption, arguing that a close focus on the differences between men and women may greatly reveal crucial differences among women such as age, marital status and education levels. Thus, a clear understanding of such differences is crucial in analysing the factors influencing agricultural production and technology adoption. Furthermore, low adoption of technologies and innovations can greatly be influenced by the effectiveness of the existing networks as well as prevailing government policies and regulations (Garrigos *et al.*, 2009). Similarly, poor coordination of extension service provision as well as poor or low and disjointed PM&E farm visits which were ranked second and third respectively and were observed by the respondents as being

contributors of low technology and innovation adoption in the target area. To address study objective three, study findings from KIs on causes of the current status of MSLIAD performance were used. These are shown in Table 24.

Table 24

Perceptions on Cause for the Current Performance of Multi-Stakeholder Linkages in the Target area (n=34)

Cause	Summated Score	Mean	Rank
Lack of joint planning and implementation of activities	134	3.94	1
No coordination of extension services	97	2.85	2
Poor or low and disjointed PM&E farm visits	89	2.62	3
Unnecessary competition and poor perceptions coupled with lack of transparency among stakeholders	82	2.41	4
Lack of a platform for all stakeholders to share their views	61	1.79	5

To further triangulate the results from KIs qualitative data, data from self-administered questionnaire by KI respondents about their perceptions on factors responsible for the current status of MSLIAD performance were used. Over 90% of all the KI respondents were in agreement that existing policies on linkages have contributed to the current status of linkages between development partners in the area; individual's negative attitude towards partnerships also contributed to the current status of linkages between development partners in the area; relatively weak linkages exist between different stakeholders working in the area; poor stakeholders' perceptions could contribute to weak linkages; there was no clearly defined communication mechanism between stakeholders at all levels for conveying improved technologies and feedback to and from the end users; and that there is no proper coordination of information flow at all levels in extension service provision between stakeholders and end users in the target area. This agreed quite well with study findings from KI respondents on perceived causes of less than optimal MSLIAD performance. Similarly, to address study objective three, the results from self-administered questionnaire by KI respondents were used. These are shown in Table 25.

Table 25

Perceptions on Factors Responsible for the Current Status of Performance of Multi-Stakeholder Linkages in the Target Area (n=34)

Statement	Expressed opinions									
	DS		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
Existing policies on linkages have contributed to the current status of linkages between development partners in the area	0	0	1	2.9	0	0	28	82.4	5	14.7
Individual's negative attitude towards partnerships has contributed to the current status of linkages between development partners in the area	0	0	0	0	0	0	22	64.7	12	35.3
Relatively weak linkages exist between different stakeholders working in the area	0	0	1	2.9	1	2.9	24	70.6	8	23.5
Poor stakeholders' perceptions can contribute to weak linkages	0	0	0	0	0	0	14	41.2	20	58.8
There is no clearly defined communication mechanism between stakeholders at all levels for conveying improved technologies and feedback to and from the end users	0	0	1	2.9	0	0	21	61.8	12	35.3
There is no proper coordination of information flow at all levels in extension service provision between stakeholders and end users	0	0	2	5.9	0	0	23	67.6	9	26.5

4.5.3 Responses from Focus Group Discussions

The researcher conducted five FGDs with a total of 55 participants to triangulate information gathered during KI structured interviews. To obtain a consensus on findings gathered from FGDs, the respondents were asked to rank their opinions. As noted earlier from KI findings, again lack of joint planning and implementation of activities was ranked the highest by FGDs respondents, thus agreeing with the ranking by earlier KIs. Although it was not mentioned directly by KIs, poor priority setting was ranked second by FGDs respondents - possibly an indication of lack of or poor coordination of extension services which was also ranked second by KIs. Lack of transparency was ranked fourth by KIs. However, FGDs respondents ranked it third,

giving more or less similar impression. Additionally, low or poor and disjointed PM&E farm visits by different development partners was ranked fourth by FGDs respondents while KIs ranked the same as the third highest cause. The overall impression of the study findings portrayed consistency in results from both KIs and FGDs. The study findings from the two sets of respondents greatly agreed on the perceived causes of the current status of MSLIAD performance in the study area. Table 26 presents the expressed opinions from FGDs respondents.

Table 26

Perceived Causes for the Current status Performance of Multi-Stakeholder Linkages in the Target area (n=5)[3]

Cause	Summated Score	Mean	Rank
Lack of joint planning and implementation of activities	16	3.20	1
Poor priority setting	14	2.80	2
Lack of transparency	11	2.20	3
Poor or minimal joint PM&E farm visits and feedback	10	2.00	4
Lack of a platform for all stakeholders to meet and share views	8	1.60	5

Study findings obtained from FGDs can be summarised into four main findings:

a. Lack of effective joint planning and implementation of planned activities.

b. Poor or uncoordinated participatory monitoring and evaluation of implemented development activities.

c. Lack of openness (lack of transparency) among different development partners.

d. Lack of a platform where different stakeholders meet and effectively engage each other to enhance proper coordination of extension service provision.

4.5.4 Responses from Face-to-Face Interviews

Results from Face-to-Face interviews were used to triangulate the information obtained from both KI and FGDs. Respondents for Face-to-Face interviews were asked to express their opinion on what they considered to be the cause of the current status of

---

[3] Five Focus Group Discussions (FGDs) with a total of 55 participants were held.

MSLIAD performance in the target area. They attributed the current status to poor joint planning of development activities (observed by 63% of the respondents) and poor participatory monitoring and evaluation (PM&E) of implemented activities (mentioned by 62% of the respondents). Respondents further observed that the PM&E reports were not shared freely among development partners in the target area, raising the concern that "Joint planning and implementation of activities as well as PM&E" probably existed on paper only rather than in practice. Other respondents (27%) attributed the current status to the low farmer commitment coupled with dependency syndrome on farm inputs, which led to low technologies and innovations uptake. Additionally, 19% of the respondents attributed the current status to negative attitude coupled with poor perceptions and mistrust among partners (Table 27).

Table 27

Face-to-Face Respondents' Expressed Opinions on Factors Responsible for the Current Status of Multi-Stakeholder Linkages in the Target area (n=165)

Expressed opinion	Frequency	Percent
Lack of joint planning & implementation/ No joint team work	104	63
Poor, low and disjointed PM&E farm visits	102	62
Low farmer commitment/ dependency syndrome on farm inputs	44	27
Negative attitude/ Poor perceptions/ mistrust among partners	31	19
No transparency	8	5
No platform to remove conflicting interests (competition) among partners	7	4
Unreliable/Disorganized markets or market prices	1	1
Low and unreliable amount of rainfall received	5	3

Study findings from Face-to-Face respondents showed several main reasons for either stopping growing of Gadam sorghum or reducing the acreage under Gadam sorghum in the target area. Delayed picking of harvested Gadam coupled with delayed payment were the main reasons for reduced Gadam sorghum production and grain tonnage from the region. Delayed picking of harvested Gadam coupled with delayed payment of the same was exemplified by the Chi-square test for goodness of fit. Delayed picking of harvested Gadam and delayed payment was significantly higher than distorted or low

farm-gate and market prices (χ^2 = 59.49, df = 2, p = 0.001) (Table 28). The three aspects of poor PM&E, broken promises and disorganised markets seemed to be related. The respondents were quick to point out that poor PM&E contributed to mistrust and negative attitude among the stakeholders, especially between the farming community and the development partners. Furthermore, respondents said that farmers wished to produce and market their produce efficiently. This agreed with findings by Freidberg and Goldstein (2011). In their study, Freidberg and Goldstein (2011) observed that returns from agriculture, which influence household income, depend on a farmer's ownership of assets and capacity to produce and market goods and services efficiently. As such, the respondents observed that the development partners did not keep their promises, thus contributing to mistrust and weak linkages among the stakeholders in the target area (Kavoi *et al*., 2013a).

Table 28

Reasons why Respondent Stopped Growing Gadam Sorghum or Reduced Acreage (n=165)

Reason	Observed N	Expected N	Residual	Statistical Test
Distorted/ low farm gate and market price	39	55	-16.0	Chi-Square 59.491
Delayed picking of harvested Gadam coupled with delayed payment	101	55	46.0	df 2 *p*=0.001
Birds menace and small farm sizes	25	55	-30.0	
Total	**165**	**165**		

Respondents' expressed their perceptions as to whether or not joint MSLIAD development initiatives contributed to increased technology and innovation adoption in the target area were either "Agreed" or Disagreed". Those who agreed were quick to point out that where adoption of improved technologies and innovations had occurred, it was minimal. This gave an overall impression that adoption of improved technologies and innovations in the target area has been minimal – indicating a less than optimal performance of MSLIAD joint initiatives. This agreed with earlier study by Kavoi *et al*. (2011) which showed that over the years, the inhabitants of the semi-arid areas of Kitui, Machakos and Makueni Counties had remained food insecure. This created the need for provision of famine relief food to the area residents.

Although 47% and 53% of the respondents agreed and disagreed respectively as to whether or not joint MSLIAD initiatives' contributed to increased technology and innovation adoption in the target area, the difference between the responses was not statistically significant ($\chi^2 = 0.491$, df = 1, $p = 0.484$) (Table 29). Additionally, 100% of all the Face-to-Face respondents confirmed the presence of different development partners in the target area. Their presence, however, had not contributed to increased improved technologies and innovations adoption and utilization in the area. Thus, resource-poor smallholder farmers in the target area were operating under challenging circumstances which inhibit their ability to adopt the technologies and innovations that were being promoted. This study finding agreed with researchers Greiner *et al.* (2009) who observed that, adoption of a technology an innovation is greatly influenced by farmer characteristics and circumstances under which the farmer operates. The study finding gave the overall impression that, the presence and involvement of different stakeholders in joint MSLIAD development initiatives had not contributed to increased technology and innovation uptake in the study area – hence the less than optimal performance of MSLIAD in the target area.

Table 29

Responses to the Statement "Joint Agricultural Initiatives Contributed to Increased Technology and Innovation Uptake in the Target Area" (n=165)

Response	Observed N	Expected N	Residual	Statistical Test
Agreed	78	82.5	-4.5	Chi-Square
Disagreed	87	82.5	4.5	0.491
Total	**165**	**165.0**		df 1 *P*=0.484

With regard to the existing policies, over 95% of the respondents were in agreement with the statements which had five points Likert scale about the existing policies. Study findings were based on expressed opinions by the Face-to-Face interview respondents (Table 30). The results from Face-to-Face respondents were comparable with those obtained from KIs on the same statements - giving a strong indication on the consistency of the data collected using structured statements on a five-point Likert. It also gave the overall consistency in responses obtained from the three sets of respondents about the perceived causes of less than optimal MSLIAD performance.

Table 30

Face-to-Face Respondents Perceptions on Factors Responsible for the Current Status of Performance of Multi-Stakeholder Linkages in the Target Area (n=165)

Statement	Expressed opinions									
	DS		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
Existing policies on linkages have contributed to the current status of linkages between development partners in the area	0	0	0	0	4	2.4	129	78.2	32	19.4
Individual's negative attitude towards partnerships has contributed to the current status of linkages between development partners	0	0	0	0	1	.6	112	67.9	52	31.5
Relatively weak linkages exist between different stakeholders working in the area	0	0	0	0	4	2.4	104	63.0	57	34.5
Poor stakeholders' perceptions can contribute to weak linkages	0	0	0	0	1	.6	113	68.5	51	30.9
There is no clearly defined communication mechanism between stakeholders at all levels for conveying improved technologies and feedback to and from the end users	0	0	0	0	3	1.8	104	63.0	58	35.2
There is no proper coordination of information flow at all levels in extension service provision between stakeholders and end users	0	0	0	0	2	1.2	99	60.0	64	38.8

4.5.5 Summary of Factors Responsible for Current Status of Multi-Stakeholder Linkages for Innovative Agricultural Development in the Study Area

The essence of summarising the study findings was because data were from three sets which needed triangulation to ascertain the consistency of the study findings in addressing study objective three. Based on the study findings, evidence gathered from the three sets of data indicates eight factors were responsible for the less than optimal performance of MSLIAD in the target area. However, the eighth factor (Low and

unreliable amount of rainfall received) (Table 27) though mentioned by a mere 3% of the Face-to-Face respondents as a factor, the researcher viewed it as a natural phenomenon which affected all the farmers in the study area. The overall ranking of the top five factors was: Overall ranking of the triangulated study findings in decreasing order of importance was:

a. Lack of joint planning and implementation of planned activities.

b. Poor coordination of extension service provision which was also seen as emanating from conflict of interests (each partner having different objectives).

c. Lack of openness, or transparency among different development partners, especially in resource availability and accountability.

d. Poor or low and disjointed participatory monitoring and evaluation of implemented MSLIAD joint initiatives.

e. Broken promises (late picking; payments; price distortion) by development partners.

4.6 Stakeholders' Perceptions and Suggestions for Improving Multi-Stakeholder Linkages in the Target Area

The fourth objective sought to determine the stakeholders' perceptions and suggestions for improving MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties.

Perceptions on the improvement of the performance of MSLIAD in the target area were assessed based on two sets of data obtained from the self-administered questionnaires by KIs and the Face-to-Face interviews. The perceptions were based on respondents' expressed opinions on a five-point Likert scale (1 for Strongly Disagree (SD)) and 5 for Strongly Agree (SA)) scale on four selected statements that related to the improvement of MSLIAD performance in the target area.
Study findings showed that about 56% of the respondents strongly agreed that working as a group or team improves access to market information as well as marketing of farm

produce. About 59% of the respondents strongly agreed that working as a group or team improves access to improved technologies and innovations, while about 68% of the respondents strongly agreed that to improve MSLIAD current status of performance, all stakeholders must be fully committed to contribute the required resources. A further 79% of the respondents strongly agreed that effective MSLIAD performance requires clearly defined role(s) and commitment to contribute the needed resources by all partners. Similarly, about 21 to 44% agreed with the same statements. None of the respondents strongly disagreed, disagreed or was undecided whether to agree or to disagree with the statements presented to them (Table 31).

Table 31

KIs' Expressed Perceptions on how to Improve the Performance of Multi-Stakeholder Linkages in the Target Area (n=34)

Statement	Expressed opinions									
	DS		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
Working as a group or team improves access to improved technologies.	0	0	0	0	0	0	14	41.2	20	58.8
To improve the MSLIAD current status, all stakeholders must be fully committed to contribute the required resources.	0	0	0	0	0	0	11	32.4	23	67.6
Working as a group or team improves access to market information and marketing of farm produce.	0	0	0	0	0	0	15	44.1	19	55.9
Effective MSLIAD performance requires clearly defined role(s) and commitment to contribute the needed resources by all partners.	0	0	0	0	0	0	7	20.6	27	79.4

To triangulate the above findings from KIs, Face-to-Face respondents were asked to give their opinion on the same four statements based on a five-point Likert scale (1 for Strongly Disagree (SD) and 5 for Strongly Agree (SA)). Sixty percent of the respondents strongly agreed that working as a group or team improves access to market information as well as marketing of farm produce. Over 66% of the

respondents strongly agreed that to improve the current status of MSLIAD performance, all stakeholders must be fully committed in resource mobilization and provision. About 68% of the respondents strongly agreed that working as a group or team improves partner's access to improved technologies and innovations. Similarly, about 69% of the respondents strongly agreed that effective MSLIAD performance requires clearly defined role(s) and commitment to contribute the needed resources by all partners. Only one respondent was unable to decide whether to agree or disagree with the presented statement. None of the respondents disagreed or strongly disagreed with the same set of statements (Table 32). The overall indication is that study findings presented strong consistency across the study findings from KIs and Face-to-Face respondents. Thus, teamwork, clearly defined role(s) and total commitment among the development partners are crucial for the improvement of MSLIAD performance in the target area. This agreed with findings in a study by Rajalahti (2009) which showed that the totality of the involvement of all actors and factors needed for technology, innovation and growth is essential.

Table 32

Face-to-Face Respondents' Expressed Perceptions on how to Improve the Performance of Multi-Stakeholder Linkages in the Target Area (n=165)

Statement	Expressed opinions									
	DS		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
Working as a group or team improves access to improved technologies.	0	0	0	0	1	0.6	52	31.5	112	67.9
To improve the MSLIAD current status, all stakeholders must be fully committed to contribute the required resources.	0	0	0	0	0	0	55	33.3	110	66.7
Working as a group or team improves access to market information and marketing of farm produce.	0	0	0	0	0	0	66	40.0	99	60.0
Effective MSLIAD performance requires clearly defined role(s) and commitment to contribute needed resources by all partners.	0	0	0	0	0	0	52	31.5	113	68.5

Key informant respondents were further asked to give suggestions on how the current MSLIAD status would be improved. Promotion of effective joint activity planning and implementation coupled with effective joint PM&E farm visits were seen as potential avenues through which the current status of MSLIAD could greatly be improved. The KIs also observed that, proper coordination of extension service provision could be achieved if a platform was established where the concerned stakeholders can meet, share views and effectively coordinate the provision of extension services (Table 33).

Table 33

KIs' Suggestions on how to Improve the Performance of Multi-Stakeholder Linkages in the Target Area (n=34)

Suggestion	Summated Score	Mean	Rank
Promote joint planning and implementation of activities	144	4.24	1
Promote effective joint PM&E farm visits	95	2.79	2
Establish a platform to share views and coordinate extension services	81	2.38	3
Promote ready markets and transparency among stakeholders	55	1.62	4
Have clearly defined roles for each stakeholder	41	1.21	5

Findings from KIs were further subjected to triangulation during FGDs. The FGDs respondents were asked to give their suggestions on how to improve the current MSLIAD status. Efforts were made by the researcher to ascertain the consistency of the suggestions made by FGDs respondents by voting several times on each of the suggestions made. With regard to suggestions for improving the current status of MSLIAD in the target area, study findings from five FGDs showed that this could be achieved through effective joint planning and implementation of the planned activities, having been ranked the highest. To complement joint planning, the respondents ranked openness (transparency) among development partners second. Effective joint PM&E of the implemented activities was ranked third highest – absence of the same had been observed and or perceived as one of the factors responsible for the less than optional performance of MSLIAD. Taking full responsibility of the activities in which each

development partner was involved as well as full commitment by all stakeholders in resource mobilization and provision was ranked fourth and fifth highest respectively (Table 34).

Table 34

FGDs' Suggestions on how to Improve the Performance of Multi-Stakeholder Linkages in the Target area (n=5)

Suggestion	Summated Score	Mean	Rank
Promote effective joint planning and implementation of activities	16	3.20	1
Promote openness (transparency) among development partners	14	2.80	2
Partners should promote effective joint participatory monitoring and evaluation of development activities	11	2.2	3
Each stakeholder should take full responsibility of the activities such a stakeholder is involved	10	2.00	4
There should be full commitment by all concerned stakeholders with regard to resource mobilization, availability and accountability	8	1.60	5

Similarly, the researcher also asked Face-to-Face respondents to suggest what they considered should be done to improve the current MSLIAD status. The results from Face-to-Face respondents on suggestions to improve the current status of MSLIAD performance showed a similar ranking to that obtained from FGDs. Promoting effective joint planning and implementation of the planned activities was ranked the highest. Although FGDs had ranked PM&E as third highest, Face-to-face respondents ranked the same as second highest. However, different suggestions other than those made by FGDs respondents were made. Suggestion by Face-to-face respondents that a platform which would provide an enabling environment for all stakeholders to effectively and constructively participate in sharing views and ideas be put in place was ranked third. The suggestion for establishing clearly defined role(s) for each stakeholder in order to avoid confusion and time consuming on the farming community was ranked fourth (Table 35).

Table 35

Face-to-Face Respondents' Suggestions on how to Improve the Performance of Multi-Stakeholder Linkages in the Target Area (n=165)

Expressed suggestion	Frequency	Percent	Rank
Promote joint planning & implementation to improve linkages	142	86	1
Promote effective joint PM&E	93	56	2
Provide platform for all stakeholders to exchange their views	35	21	3
Create/establish clearly defined roles for each stakeholder	1	1	4
Train more farmers capacity building	2	1	5

Over the years, several PPP joint development initiatives have been carried out in the target area. However, information from literature reviewed showed that the performance of past joint PPP initiatives was less than optimal (Karanja *et al.*, 2011). The researcher sought to obtained information from KI respondents on the perceived causes for the less than optimal performance of past joint PPP development initiatives in the target area. Study findings gave additional information, building on what had been reported earlier under this objective with regard to factors or causes for the current status of MSLIAD performance. Although there was a slight deviation, the overall impression was that lack of teamwork and openness among stakeholders had greatly contributed to the less than optimal performance of MSLIAD development initiatives in the target area (Table 36).

Findings from KIs indicated their dissatisfaction with development partners who rushed to promote new technologies and innovations without first of all making efforts to analyse the immediate farmers' operating circumstances and matching the same with available technologies and innovations. Lack of joint planning and implementation of planned activities was ranked third highest. Low farm-gate prices coupled with unreliable markets have been a major contributor of poor performance of past joint PPP initiatives in the target area. Uncoordinated participatory monitoring and evaluation (PM&E), farm visits as well as conflict of interests among development

partners though ranked fourth had partly contributed to the less than optimal performance of past MSLIAD joint initiatives.

Table 36

KIs' Perceived Causes for Less than Optimal Performance of Past Joint Public-Private-Partnership initiatives in the Target Area (n=34)

Cause	Summated Score	Mean	Std. Dev	Rank
Promoting technologies that do not address farmers' immediate needs and also with limited utilization options	113	3.32	1.628	1
Low farm-gate prices coupled with distorted and unreliable markets	112	3.29	1.835	2
Lack of joint planning and implementation of the planned activities	84	2.47	2.178	3
Uncoordinated PM&E farm visits coupled with conflict of interests	68	2.00	1.688	4
Lack of openness among stakeholders coupled with broken promises and group dynamics	62	1.82	1.696	5

The researcher sought to establish from the respondents any suggestions that they thought would assist smallholder farmers to effectively make informed choices on the uptake of available improved technologies and innovations in the target area. Promotion of technologies and innovations that address farmers' immediate needs and having many utilization options was ranked the highest. Analysing and understanding farmer circumstances and improved and sustaining farm-gate prices as well as market prices were ranked second and third respectively. The issues of brokers and promotion of openness among stakeholders were ranked fourth and fifth respectively (Table 37).

Table 37

KIs' Suggestions on how to Improve the Uptake of Improved technologies and Innovations in the Target Area (n=34)

Suggestion	Frequency	percent	Rank
Promoting technologies that address farmers' immediate needs/ with many utilization options	26	76	1
Analyse the circumstances under which farmers are operating before introducing and technologies	22	65	2
Improve farm-gate and market prices coupled with reliable markets	21	62	3
Address the issue of middle men who exploit the farmers	20	59	4
Promote openness among stakeholders	18	53	5

To further triangulate these study findings, the researcher asked FGDs respondents the same questions asked to the KIs. Findings from the five FGDs agreed to a great extent with those from the KI interviews on perceived causes of poor performance of past PPP joint initiatives in the target area. Both KIs and FGDs respondents ranked issues related to the technologies that have been promoted in the target area as number one. Low farm-gate prices and distorted or unreliable markets together with weak linkages that were associated with lack of effective joint planning and implementation of activities were ranked second and third highest. Citing past PPP joint initiatives that had been promoted in the target area such as cotton, sunflower and castor production for a ready market, the FGDs respondents were quick to point out that past PPP joint initiatives promoted technologies with limited utilization options. The FGDs respondents added that, limited utilization options coupled with unreliable markets and low farm gate prices could not address the farmer's family immediate cash needs. Instead, farmers needed quick money to settle pressing family needs. Development partners who have been involved in such PPP joint initiatives were blamed for promoting technologies without analysing what farmers really needed to meet their household pressing needs such as school fees and health related issues. Table 38 presents study findings from the FGDs.

Table 38

FGDs Respondents' Perceived Causes for Current Performance of Past Joint Public-Private-Partnership initiatives in the Target Area (n=5)

Cause	Summated Score	Mean	Std. Dev	Rank
Need for quick money to meet urgent/ pressing family cash needs.	17	3.40	2.302	1
Weak linkages coupled with lack of transparency among development partners.	13	2.60	1.517	2
Low farm-gate prices coupled with broken promises	12	2.40	1.817	3
Unreliable or distorted markets	10	2.00	1.581	4
Lack of clearly defined roles of different development partners	8	1.60	2.191	5

Findings from discussions with KIs showed interviews showed that 21% of the respondents were aware that past recommendation, which showed that value addition at farm level was crucial in contributing to increased adoption of improved technologies and innovations. This study finding agreed with earlier studies by Narrod *et al.* (2009) and Okoko *et al.* (2008) that development partners need to embrace value addition especially at farm level to increase utilization of improved technologies and innovations that they promote. Value addition especially at farm level was crucial in widening the window for utilization options of improved technologies. Of the total KIs, 66% of the respondents said that development partners should promote technologies that address farmers' family immediate needs such as school fees, health and food. They should also promote technologies with many utilization options so that in the event that farmers are unable to market their farm produce, they can have other options of utilizing them. Additionally, 65% of the KIs said that development partners need to jointly analyse the circumstances under which farmers operate before promoting improved technologies. The respondents further said that issues of farm-gate and market prices, middlemen and openness among development partners should be addressed to increase the uptake of technologies and innovations in the target area.

The overall impression therefore indicated that to improve the performance of MSLIAD joint initiatives in the target area. Development partners need to analyze the

circumstances under which resource-poor smallholder farmers operate under and match the same with available improved technologies and innovations; In addressing the market issues, development partners need to promote technologies and innovations that have a wide range of utilization options; and promote joint planning, implementation as well as coordinated PM&E activities.

a. et, share views and effectively coordinate the provision of extension services.

4.7   Past Recommendations that Contributed to Policy Formulation

The fifth objective sought to identify past recommendations that have contributed to policy formulation for the development, promotion and diffusion of improved technologies and innovations in the semi-arid areas of Kitui, Machakos and Makueni Counties.

Results from KI interviews showed that 53% of the respondents were aware of past recommendations from Sub-County level which contributed to policy formulation. These included the recommendation that the Government provides farm input subsidies for increased uptake of available improved technologies. Such past recommendations centred on provision of subsidies on fertilizers and certified seeds. Majority (82%) of the respondents for KI interviews came from Sub-County agricultural offices. They observed that there has been an increase in demand for inorganic fertilizers in the target area contrary to the situation prior to the introduction of farm input subsidies. However, small percentages of the respondents mentioned other past recommendations such as promotion of high value traditional crops (especially drought tolerant improved crop varieties) and promotion of the 10% forest cover in all homesteads (Table 39). Only two Face-to-Face respondents (less than 2%) mentioned recommendation of provision of farm input subsidies. The rest of the Face-to-Face respondents who comprised the farming community did not mention any such past recommendation, implying they were not aware of the same.

Table 39 presents study findings on past recommendation that respondents observed as having contributed to policy formulation that led to increased technology and innovation uptake.

Table 39

Perceived past recommendations that contributed to policy formulation for increased technology and innovation uptake in the target area (n=34)

Recommendation	Frequency	Percent
Provision of farm input subsidies	18	53
Promotion of high value traditional crops/ value addition at farm level	7	21
Promoting 10% forest cover	3	9
Use of Metal silo for grain drying and storage	2	6

The researcher sought further to know from KI respondents if there were matters that they felt should be considered for inclusion during policy formulation to make policies more applicable and create more positive impact through MSLIAD development initiatives. Study findings indicated there is need for policy formulators to adopt an inclusive process in policy formulation to make policies more applicable. Similarly, the performance of policies that are in place should be evaluated from time to time. Deliberate efforts need to be made to give feedback to all stakeholders on the performance of the evaluated policy or policies. The KI respondents noted that, it was equally important to sensitize all stakeholders on key policy issues. This was considered more crucial rather than just publishing policies while the concerned stakeholders, especially the end users were not aware of what such policies entailed (Table 40).

Table 40

KIs' Suggested Matters that should be Considered for Inclusion in Policy Formulation (n=34)

Suggestion	Summated Score	Mean	Rank
Involve all the concerned stakeholders.	142	4.18	1
Generate information for policy formulation from grassroots.	130	3.82	2
Sensitize all stakeholders on key policy issues.	60	2.86	3
Establish a platform at all levels for stakeholders to give their views (ideas).	57	1.68	4
Let there be a deliberate feedback upon the evaluation of policy performance	24	0.71	5

To further triangulate the study findings from KIs of policy formulation, KI respondents were asked to give their opinion based on a five-point Likert scale (1 for Strongly Disagree (SD) and 5 for Strongly Agree (SA)) on six related statements from a self administered questionnaire. Further probing on KIs responses on perceptions on matters related to past policies was carried out. With regard to the performance of past policies and how to improvement policy formulation for greater impact, all the items were rated as being "highly agreed". The two highest expressed opinion of improving policy formulation were "To enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved (targeted)" and "Government policies should provide room to establish effective linkages between development partners in this area" (Table 41).

Table 41

KIs' Expressed Opinions on Policy Issues (n=34)

Expressed opinion on policies	Mean	Std. Dev	Variance
To enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved (targeted)	4.76	0.431	0.185
Government policies should provide room to establish effective linkages between development partners in this area	4.56	0.504	0.254
Past policies were unsuccessful because their formulation did not involve all the stakeholders	4.38	0.493	0.243
Review of policies to enhance increased technology and innovation adoption should be carried out within specified time period	4.38	0.493	0.243
Performance of past policies in achieving increased technology and innovation adoption in the area has been less than optimal	4.15	0.702	0.493

Put in order of decreasing importance, the expressed opinions by the KIs seemed to confirm their ranking of suggestions on matters that should be considered for inclusion in policy formulation to make policies more applicable. The respondents rated all the six statements as being in "high importance". This indicated that all the KIs agreed on all their expressed opinions on past policies performed with regard to innovative agricultural development and how policy performance can be improved for enhanced MSLIAD performance in the target area.

Study findings from KIs were triangulated by asking the same questions to FGDs respondents. Comparing findings from KI interviews with those from FGDs, on average the ranking results seemed to concur very well. Although the top two suggestions switched their ranking positions, the overall impression of the suggestions on matters that should be considered for inclusion in policy formulation by the two sets of respondents seemed to agree fairly well (Table 42). Thus, instead of the top-down approach that has over the years dominated policy formulation, all the respondents observed that policy formulators need to embrace an all inclusive policy formulation

process that would provide and allow all concerned stakeholders to come onboard and positively and willingly contribute their ideas towards policy formulation issues. Furthermore, although ranked fourth, provision of a platform where all concerned stakeholders who may at times have conflicting ideas can meet and share their ideas seemed very crucial. This agreed with findings in a study by Paassen, Klerkx, Adu-Acheampong, Adjei-Nsiah, Ouologuem, Zannou, Vissoh, Soumano, Dembele and Traore (2013) which noted that constructive conflict helps in improving the quality of learning and transforming an initially loose group of actors into an effective innovation platform.

Table 42

FGDs' Suggested Matters that should be Considered for inclusion in Policy Formulation (n=5)

Suggestion	Summated Score	Mean	Rank
Generate information for policy formulation from grassroots.	23	4.60	1
Involve all the concerned stakeholders	22	4.40	2
Sensitize all stakeholders on key policy issues	14	2.80	3
Establish a platform at all levels for stakeholders to give their views	7	1.40	4

The researcher engaged Face-to-Face respondents to further probe on the issues raised during FGDs that related to policy formulation. Findings from the Face-to-Face respondents compared very well with those from KI interviews. Study findings from Face-to-Face respondents showed that it was important to generate policy formulation information from the grassroots and involve all concerned stakeholders ((Table 43). In addition, all stakeholders need to be sensitized on key policy issues – to enable the end users to effectively participate and contribute constructively and freely during policy performance review. The essence of involving all the concerned stakeholders, gathering information from grassroots as well as sensitizing stakeholders on key policy issues was clear from the three sets of respondents (KIs, FGDS and Face-to-Face).

Table 43

Ranking of Matters that should be Considered for Inclusion in Policy Formulation (n=165)

Suggestion	Summated Score	Mean	Rank
Generate information for policy formulation from grassroots.	612	3.71	1
Involve all the concerned stakeholders.	502	3.04	2
Sensitize all stakeholders on key policy issues.	156	0.95	3
Establish a platform at all levels for stakeholders to give their views (ideas).	143	0.87	4
Promote strong joint stakeholder linkages.	48	0.29	5

According to the MoA's Strategy for Revitalizing Agriculture (2005), reforms in the agricultural sector should be implemented without disrupting production, processing, marketing functions and or delivery services. The MoA document further indicates that proposed reform changes aimed at achieving transparency, accountability, efficiency and effectiveness in managing the entire agricultural sector. Such reforms would in addition improve delivery of research, extension and advisory support services. However, the Face-to-Face respondents noted that over the years, the trend had been top-down approach in policy formulation and implementation. They further noted that there were no concerted efforts to sensitize the end users. Furthermore, there were no deliberate efforts to provide feedback on how such policies performed and or impacted on promotion and adoption of improved technologies and innovations in the target area. The respondents observed that, although agricultural policies have been in place for years, their success in moving the smallholder farmers out of poverty still remained minimal.

Face-to-Face respondents were also asked to give their expressed opinions on six selected statements using a Likert scale on how they thought policy formulation could be improved. Results showed that over 95% of the respondents were in agreement that past policies did not contribute to increased promotion and adoption (uptake) of improved technologies and innovations. Failure to establish strong linkages between development partners in the past had contributed to less than optimal technology and

innovation adoption in the area (Table 44). However, because of the great potential that research has in raising agricultural productivity particularly among small-holder farmers, reducing poverty and ensuring sustainable development as indicated by Alene and Coulibaly (2009) and Nyagumbo and Rurinda (2011), there should be adequate funds for research. Study findings further showed that there was need to review policy performance within a specified time period to give room for necessary adjustment(s).

Table 44

Face-to-Face Respondents' Expressed Opinions on Policy Issues (n=165)

Statement	Expressed opinions									
	SD		D		U		A		SA	
	F	%	F	%	F	%	F	%	F	%
Past policies were unsuccessful because their formulation did not involve all the stakeholders	0	0	0	0	4	2	90	55	71	43
To improve the MSLIAD current status, all stakeholders must be fully committed to contribute the required resources	0	0	0	0	3	2	130	79	32	19
Review of policies to enhance increased technology and innovation adoption should be carried out within specified time period (from time to time)	0	0	0	0	0	0	83	50	82	50
To enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved (targeted)	0	0	0	0	0	0	49	30	116	70
Failure to establish strong linkages between dev partners in the past has contributed to less than optimal technology and innovation adoption in the area	0	0	0	0	0	0	108	66	57	35
Government policies should provide room to establish effective linkages between development partners in this area	0	0	0	0	0	0	59	36	106	64

From the fore-going study findings, the researcher observed that the application of AIS as a framework for analysing technological, economical and institutional change in agriculture is vital (Byerlee & Bernstein, 2013; Sneddon *et al*., 2011; Spielman,

Ragasa & Rajalahti, 2012). By virtue of their networking and interactive learning nature, AIS drive the profitability, productivity and sustainability of the agricultural sector and must therefore be emphasized in the semi-arid areas of Kitui, Machakos and Makueni Counties. Furthermore, the interacting agents in the working groups can influence policy and provide a space for information sharing and dialogue on thorny issues such as transparency and accountability (Wells & Magara, 2013). Similarly, study findings indicated that, to enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved (targeted) as well as providing room to establish effective linkages between development partners and other stakeholders involved in joint development initiatives in the target area.

4.8 Identified Factors that Influence Multi-Stakeholder Linkages for Innovative Agricultural Development in the Target Area

The researcher identified the following factors influencing MSLIAD in the target area:

1. Relatively weak linkages that define the existing networks and relationships between different stakeholders engaged in development initiatives.

2. Poorly defined existing networks and relationships, leading to minimal sharing of information among development partners.

3. Lack of openness and breach of contracts between development partners and farming communities.

4. Poor teamwork and poor networking among stakeholders enaged in development initiatives.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1   Introduction

In this concluding chapter, a brief summary of the background of the study, statement of the problem, methodology and key study findings are presented. The chapter also presents conclusions and recommendations made based on the key findings of the study.

5.2   Summary

This study was necessitated by the less than optimal performance of MSLIAD joint initiatives in the semi-arid areas of Kitui, Machakos and Makueni Counties. Analysis and documentation of information on the factors responsible for the less than optimal performance of MSLIAD initiatives were inadequately understood and documented. Additionally, information on the role(s) of different stakeholders and existing networks within which the MSLIAD operate was limited. The study sought to determine and document factors that influence multi-stakeholder linkages for innovative agricultural development in the region. It also sought to provide the missing information that would help readers understand the current performance of MSLIAD in the semi-arid areas of Kitui, Machakos and Makueni Counties of Kenya.

The researcher used an emergent research design (also known as a working research design) to collect data. Primary data were collected from the semi-arid areas of Kitui, Machakos and Makueni Counties. Secondary data were collected from desktop search, making use of most current peer reviewed journal papers; review of MoA annual reports of respective Sub-Counties in the study area; review of concluded project technical reports; as well as review of quarterly and annual KARI-Katumani technical reports. The study used a sample of 254 respondents (34 Key Informants, 55 focus group discussions participants and 165 face-to-face respondents). Data from these respondents were collected using a semi-structured questionnaire, discussions guidelines and a self-administered structured questionnaire and analysed using the statistical package for social sciences (SPSS) versions 12.0. and 17.0.

5.3 Key Findings of the Study

With respect to study *objective one*, key study findings showed that:

a). Stakeholders in the target area were from the public and private sector; local and international research institutions; local and international NGOs and farmers. Their participation in MSLIAD initiatives enhanced knowledge and information sharing, public-private partnerships, and cooperation among them.

b). Stakeholders' roles ranged from technology development, packaging, dissemination and promotion for wider adoption and use. Their participation in joint MSLIAD development initiatives had the potential for community development and improved and sustainable farm productivity, increased household food security and household incomes.

With respect to study *objective two*, key study findings showed that:

a). Relatively weak networking among stakeholders existed. Networking among members of the farming community existed at community level mainly to pool resources together. Although networks existed in the target area, such networks were not clearly defined.

b). Stakeholders in the target area were linked through activity implementation; farmer field days and demonstrations; and through public meetings. Identifying the role(s) of each stakeholder in MSLIAD is important in ensuring that the initiative is sustainable.

With respect to study *objective three*, key study findings showed that:

a). Relatively weak linkages existed between different stakeholders working in the target area.

b). Lack of openness and mistrust among development partners especially in resource mobilization, availability and accountability contributed to weak linkages. There

was no clearly defined communication mechanism at all levels for conveying improved technologies and feedback to and from the end users.

c). There was no proper coordination of information flow at all levels in extension service provision between development partners and the farming community.

With respect to study *objective four*, key study findings showed that:

a). Weak linkages and poor planning of joint development activities were responsible for the less than optimal performance of past PPP joint initiatives.

b). Breach of contract coupled with distorted farm-gate and market prices led to mistrust between the development partners and the farming community.

c). Due to ineffective team-work and poor networking, improvement of different agricultural product value chains remained less than optimal.

With respect to study *objective five*, key study findings showed that:

a). Past recommendations from Sub-County level that the Government provides subsidies for farm inputs led to increased demand of inorganic fertilizers in the target area.

b). Past efforts to formulate policies did not involve all the key stakeholders; neither did it embrace an all inclusive policy formulation process which allows effective participation by all concerned stakeholders. Moreover, there were no deliberate efforts made to provide a feedback to the end users of policies whenever evaluation of the performance of policies was carried out.

5.4   Conclusions

Based on the findings of the study, the researcher with respect to *objective one* of the study concluded as follows:

1. Joint MSLIAD initiatives in the target area had the support of key stakeholders and their support and participation in MSLIAD initiatives was crucial in community development.

2. Technology development, evaluation, packaging, dissemination and promotion for wider adoption and use needed clear identification of the different stakeholders' role(s).

Based on the findings of the study, the researcher with respect to *objective two* of the study concluded as follows:

1. Pooling resources together enhanced community networking. Although the desire for partnership among stakeholders was evident, translating it into action remained a challenge because the existing networks in the target area were not clearly defined.

2. Strong and sustainable linkages were required to help the community improve its development and to overcome the challenges of hunger, ill health and education, among others.

Based on the findings of the study, the researcher with respect to objective three of the study concluded as follows:

1. Strong and sustainable PPP-based linkages are necessary in strengthening stakeholders' individual and collective capacities to innovate and improve organizational cultures and behaviours.

2. Effective extension service provision requires proper coordination of information flow at all levels between development partners and the farming community.

Based on the findings of the study, the researcher with respect to *objective four* of the study concluded as follows:

1. Strong linkages that promote effective joint planning and implementation of planned development activities are important in improving the performance of MSLIAD joint initiatives.

2. Effective team-work can improve stakeholders' access to improved technologies, innovations and improved performance of different agricultural product value chains. Additionally, proper coordination of extension service provision needs a platform where stakeholders can effectively coordinate extension services provision using the available meagre resources.

Based on the findings of the study, the researcher with respect to *objective five* of the study concluded as follows:

1. Past efforts to formulate policies needed the involvement of all the concerned stakeholders who would be involved in the eventual policy evaluation and sharing of feedback from the evaluation report.

2. Policy formulators therefore need to embrace an all inclusive policy formulation process which allows effective participation by all concerned stakeholders.

5.5   Recommendations

Based on the conclusions of *objective one*, the researcher recommends as follows:

1. Local leaders and development partners in the target area should take advantage of the prevailing stakeholders' support during information exchange fora such as agricultural shows, field and demonstrations days to initiate and implement joint agricultural projects that will speed up agricultural development in the area.

2. In view of their usefulness, MoA staff, researchers and CSGs involved in MSLIAD initiatives in the target should effectively play their individual roles in order to strengthen and sustain technology development.

Based on the conclusions of *objective two*, the researcher recommends as follows:

1. Researchers, extension service providers and other development agents working in the study area should put in place strategies to help improve community networking.

2. All stakeholders working in the target area should put strategies in place during their joint planning meetings to ensure strong and sustainable linkages that define the existing relationships and networking among them are established and maintained for enhanced community development.

Based on the conclusions of *objective three*, the researcher recommends as follows:

1. Extension service providers working in the target area should encourage formation of PPP-based linkages to help them strengthen stakeholders' individual and collective capacities to innovate and improve organizational cultures and behaviours.

2. In order to establish and maintain sustainable strong linkages between development partners, all stakeholders working in the target area should engage each other in information sharing and embrace openness and trust in resource mobilization, availability and accountability.

Based on the conclusions of *objective four*, the researcher recommends as follows:

1. To sustainably improve the performance of MSLIAD initiatives, stakeholders should establish strong linkages between them through effective joint activity planning and implementation.

2. Since strong linkages among development partners promote effective joint planning and implementation of planned activities, joint planning and implementation should be combined with effective participatory monitoring and

evaluation of the implemented activities to sustainably improve the performance of MSLIAD initiatives.

Based on the conclusions of the study *objective five*, the researcher recommends as follows:

1. To achieve a positive and sustainable policy impact on the productivity of the agricultural sector, a policy formulation process should adopt a mechanism that considers the views, suggestions and involvement of all concerned stakeholders.

2. Since agricultural innovation systems (AIS) provide an important framework for analysing technological, economic and institutional change in agriculture, their use should be encouraged by all extension service providers working in the target area during their day to day service provision.

REFERENCES

Abeyasekera, S. (2001). Analysis approaches in participatory work involving ranks or scores. Statistical Services Centre, The University of Reading and Natural Resources Systems Programme, Natural Resources Institute, University of Greenwich, United Kingdom.

Abeyasekera, S., Lawson-Macdowell, J. & Wilson, I. (2001). Converting ranks to scores for an ad-hoc assessment of methods of communication available to farmers. A theme paper associated with outputs from the DFID-funded Natural Resources Systems Programme (Socio-Economic Methodologies Component) project R7033 titled Methodological Framework Integrating Qualitative and Quantitative Approaches for Socio-Economic Survey Work.

Alene, A. & Coulibaly, O. (2009). The impact of agricultural research on productivity and poverty in Sub-Saharan Africa. *Food Policy*, *34*: 198-209.

Ali, J. & Kumar, S. (2011). Information and communication technologies (ITCs) and farmers' decision-making across the agricultural supply chain. *International Journal of Information Management, 31*: 149-159.

Amudavi, D., Khan, Z., Wanyama, J., Midego, C., Pittchar, J., Nyangau, I., Hassanali, A. & Pickett, J. (2009). Assessment of technical efficiency of farmer teachers in the uptake and dissemination of push-pull technology in Western Kenya. *Crop Protection 28*: 987-996.

Anandajayasekeram, P. & Gebremedhin, B. (2009): Integrating innovation systems perspective and value chain analysis into agricultural research for development: Implications and challenges. Working paper (International Livestock Research Institute: Improving Productivity and Market Success of Ethiopian Farmers Project); no. 16.

Arithi, C., & Wafula, J. (2010). Research-extension liaison planned activities for the year 2009/2010. Proceedings from *2009 Centre Research Advisory Committee Meeting*, May 2009, KARI-Katumani Research Centre, Machakos, Kenya.

Arza, A. & López, V. (2011). Firms' linkages with public research organizations in Argentina: Drivers, perceptions and behaviours. *Technovation*, *31*: 384-400.

Association for Strengthening Agricultural Research in Eastern and Central Africa (2010a, October 8). Water security and climate change: Transforming agriculture for improved livelihoods. Policy Analysis and advocacy programme (PAAP). *Electronic Newsletter, 13* (22), 1-2.

Association for Strengthening Agricultural Research in Eastern and Central Africa (2010b, October 22). Sustainable land management. Policy, legal frameworks and governance. Policy Analysis and advocacy programme (PAAP). *Electronic Newsletter, 13* (20), 1-3.

Association for Strengthening Agricultural Research in Eastern and Central Africa (2011, February 4). From food aid to food assistance: Issues, lessons and implications. Policy Analysis and advocacy programme (PAAP). *Electronic Newsletter, 14* (2), 1-5.

Association for Strengthening Agricultural Research in Eastern and Central Africa (2013, April 19). Impact of off-farm income on technology adoption, intensity and productivity. Policy Analysis and advocacy programme (PAAP). *Electronic Newsletter, 16* (7), 1-4.

Bakioğlu, A. & Kurnaz, Ö. (2008). Quality criteria of research perceived by academics in social sciences at higher education, Marmara and Istanbul Technical University, Istanbul, Turkey.

Bett, C., Ouma, J. & De Groote, H. (2010). Perspectives of gatekeepers in the Kenyan food industry towards genetically modified foods. *Food Policy, 35*: 332-340.

Buchanan, K., Brouwer, H., Klerkx, L., Schaap, M., Brouwer, J. & Le Borgne, E. (2013). Facilitating multi-stakeholder processes: Balancing internal dynamics and institutional politics. *Knowledge Management for Development Journal, 9*(3): 3-10.

Buttoud, G., Kouplevatskaya-Buttoud, I., Slee, B. & Weiss, G. (2011). Barriers to institutional learning and innovations in the forest sector in Europe: Markets, policies and stakeholders. *Forest Policy and Economics, 13*: 124-131.

Byerlee, D. & Bernstein, J. (2013). Feed the Future Learning Agenda Literature Review: Improving Research and Development, Rockville, MD: Westat.

Cäker, M. & Siverbo, S., Management control in public sector Joint Ventures. Manage. Account. Res. (2011), doi:10.1016/j.mar.2011.08.002.

Cavallo, D. (2000) Emergent Design and learning environments: Building on indigenous knowledge. *IBM Systems Journal 39* Issue: 3.4 pp-768 – 781.

Chen, K. & Guan, J. (2011). Mapping the innovation production process from accumulative advantage to economic outcomes: A path modelling approach. *Technovation, 31*: 336-348.

Coenen, L. & López, F. (2010). Comparing systems approaches to innovation and technological change for sustainable and competitive economies: An explorative study into conceptual commonalities, differences and complementarities. *Journal of Cleaner Production, 18*: 1149-1160.

Colwell, K. & Narayanan, V. (2010). Foresight in economic development policy: Shaping the institutional context for entrepreneurial innovation. *Futures, 42*: 295-303.

Cotton Development Authority. (2014). http://www.cottondevelopment.co.ke/pages/The_Cotton_Industry.vrt (accessed on 12th February, 2014).

Daily Nation Newspaper, October 4 (2010). Published article on sunflower industry. (http://www.nation.co.ke/magazines/smartcompany/Sunny%20days%20for%20sunflower%20growers%20/-/1226/1025904/-/2crsnf/-/index.html (Accessed on 12th February, 2014.

Davis, K., Nkonya, E., Kato, E., Mekonnen, D., Odendo, M., Miiro, R. and Nkuba, J. (2011). Impact of Farmer Field Schools on Agricultural Productivity and Poverty in East Africa, *World Development* (2011), doi:10.1016/j.worlddev.2011.05.019.

Ditsa, G. & Al Kobaisi, S. (2009). IS user behaviour testing using triandis theoretical framework: An explanatory research design. *International Journal of Global Business*, *2*(2): 30-60.

Dolata, U. (2009). Technological innovations and sectoral change transformative capacity, adaptability, patterns of change: An analytical framework, *Research Policy, 38*: 1066–1076.

Encyclopaedia of the Nations, (2011): Kenya-agriculture. Retrieved on 13-09-2011 from http://www.nationsencyclopedia.com/Africa/Kenya-AGRICULTURE.html

English Thesaurus Dictionary (2012).

Esders, M. (2009). Innovations for sustainability through multi-stakeholder innovation initiatives. Paper presented during the 15th annual international sustainable development research conference, 5-8 July 2009, Utrecht University, Netherlands.

Faria, P., Lima, F. & Santos, R. (2010). Cooperation in innovation activities: The importance of partners. *Research Policy, 39*: 1082-1092.

Food and Agriculture Organization. (2011). Factors influencing the strength of the link in agricultural extension in developing economies.

Fournel, I., Tiv, M., Hua, C., Soulias, M., Astruc, K. & Aho, L. (2010). Randomisation and sample size for clinical audit on infection control. *Journal of Hospital Infection, 76*: 292-295

Freidberg, S. & Goldstein, L. (2011). Alternative food in the global south: Reflections on a direct marketing initiative in Kenya. *Journal of Rural Studies*, *27*: 24-34.

Friis-Hansen, E. & Duveskog, D. (2011). The empowerment route to well-being: An analysis of farmer field schools in East Africa. *World Development.*

Garcia-Retamero, R., Müller, S., Catena, A. & Maldonado, A. (2009). The power of causal beliefs and conflicting evidence on causal judgements and decision making. *Learning and Motivation, 40*: 284-297.

Garrigos, J., Oliver, J. & Hidalgo, A. (2009). Analysing high technology adoption and impact within public supported high tech programs: An empirical case. *Journal of High technology management Research, 20*: 153-168.

Garson, D. (2012). Sampling. Statistical associates publishing, Blue book series. North Carolina State University, School of public and international affairs, United States of America.

Gido, O., Langat, J., Gicuru, K., Mutai, B., Sibiko, W. & Mwangi, K. (2013). Maize Farmers Perceptions towards Organic Soil Management Practices in Bungoma County. *Research Journal of Environmental and Earth Sciences* 5(2): 41-48.

Gill, C. (2009). Union impact on the effective adoption of high performance work practices. *Human Resource Management Review, 19*: 39-50.

Giuliani, E. & Arza, V. (2009). What drives the formation of "valuable" university-industry linkages? Insights from the wine industry. *Research Policy, 38*: 906-921.

Glasbergen, P. (2010). Global action networks: Agents for collective action. *Global Environmental Change, 20*: 130-141.

Gliem, J. & Gliem, R. (2003). Calculating, interpreting and reporting Cronbach's alpha reliability coefficient for Likert-type scales.

Greene, W. (2000). *Econometric analysis*. Fourth Edition. Prentice-Hall, Inc. Upper Saddle River, New Jersey, 07458, USA.

Greiner, R., Patterson, L. & Miller, O. (2009). Motivations, risk perceptions and adoption of conservation practices by farmers. *Agricultural Systems, 99*: 86-104.

Hansen, J., Mishra, A., Rao, K., Indeje, M. & Ngigi, R. (2009). Potential value of GCM-based seasonal rainfall forecasts for maize management in semi-arid Kenya. *Agricultural Systems, 101*: 80–90.

Hashemi, S. & Hedjazi, Y. (2011). Factors affecting members' evaluation of agri-business ventures' effectiveness. *Evaluation and Program Planning, 34*: 51-59.

Hashemi, S., Hossein, S., & Damalas, C. (2009). Farmers' competence and training needs on pest management practices: Participation in extension workshops. *Crop protection, 28*: 934-939.

Hawkins, R., Booth, R., Chitsike, C., Twinamasiko, E., Tenywa, M., Karanja, G., Ngcobo, T. and Verschoor, A. (2009): Strengthening inter-institutional capacity for rural innovation: Experience from Uganda, Kenya and South Africa, In: Sanginga, P., Waters-Bayer, A., Kaaria, S. and Njuki, J. (Eds.): Innovation Africa: Enriching Farmers' Livelihoods, Earthscan, United Kingdom. Pages 313-325.

Hildebrand, D. & Shriver, L. (2010). A qualitative and quantitative approach to understanding fruit and vegetable availability in low-income African-American families with children enrolled in an urban head start program. *Journal of the American Dietetic Association, 110*(5): 710-718.

Ifft, J., Roland-Host, D. & Zilberman, D. (2012). Consumer valuation of safety-labelled free-range chicken: results of a field experiment in Hanoi. *Agricultural Economics 43* (2012) 607–620

Kabubo-Mariara, J. (2009). Global warming and livestock husbandry in Kenya: Impacts and adaptations. *Ecological Economics 68*: 1915–1924

Kalenga, R. & Elsa, F. (2011). Trekking back to mainstream for inclusive education. Problems of education in the 21st Century: *Contemporary Issues in Education, 33*: 29-37.

Kamau, G. & Almekinders, C. (2009). From Strangler to Nourisher: How Novice Rice Farmers Turned Challenges into Opportunities, In: Sanginga, P., Waters-Bayer, A., Kaaria, S. and Njuki, J. (Eds.): Innovation Africa: Enriching Farmers' Livelihoods, Earthscan, United Kingdom. Pages 297-310.

Karanja, D., Kavoi, J. & Mutuku, R. (2011). The role of the market in addressing climate change in the semi-arid lands of Kenya: The case of Gadam sorghum. Paper presented during the End of Project Conference, 9th to 11th August, 2011, KARI Headquarters, Nairobi, Kenya.

KARI-Katumani Research Centre, Annual Report 2010.

KARI-Katumani Research Centre, Annual Report 2011.

Kavoi, J., Mwangi, J. & Kamau, G. (2013a). Strategies for effective multi-stakeholder linkages for innovative agricultural development in Eastern Kenya. *Journal of US-China Public Administration, 10*(5): 497-506.

Kavoi, J., Kamau, G., Kisilu, R., Wafula, J. & Ng'ang'a, T. (2013b). Innovation in gadam sorghum production and marketing in Eastern Kenya, In: Triomphe, B., Waters-Bayer, A., Klerkx, L., Schut, M., Cullen, B., Kamau, G. & Le Borgne, E. (Eds.): Innovation in smallholder farming in Africa: recent advances and recommendations. Proceedings of the International Workshop on Agricultural Innovation Systems in Africa (AISA), 29–31 May 2013, Nairobi, Kenya. Montpellier: CIRAD.

Kavoi, J. (2003). Crop protection contribution towards improved livelihoods in semi-arid Eastern Kenya: Challenges and opportunities (Unpublished MSc. (By Research) Thesis, University of Greenwich, Central Ave. Chatham Maritime, United Kingdom).

Kavoi, J., Karanja, D. & Wafula, J. (2010a). Turning challenges into opportunities: Commercialization of Gadam Sorghum in maize dominated farming systems of lower semi-arid areas of Eastern Kenya. Paper presented during the 12th KARI biennial scientific conference, 9th – 11th August, 2011, KARI headquarters, Kaptagat road, Nairobi, Kenya.

Kavoi, J., Kamau, G., Kirigua, V., Masila, S. & Wanja, A. (2010b). Finger millet nursery and out-scaling: A farmer-led innovation in semi-arid Eastern Kenya. P Paper presented during the second National JOLISAA workshop. 6th to 10th December, 2010, KARI headquarters, Nairobi.

Kavoi, J., Karanja, D., Wafula, J., Kisilu, R. & Arithi, C. (2011). Gadam sorghum commercialization through a public-private-partnership initiative in semi-arid areas of Eastern Kenya: Lessons learnt. Paper presented during the European Union funded end of project conference, 8th – 12th November, 2011, KARI headquarters, Kaptagat road, Nairobi, Kenya.

Keino, S., Plasqui, G. & den Borne, B. (2014). Household food insecurity access: a predictor of overweight and underweight among Kenyan women. *Agriculture & Food Security 2014, 3:2.*

Kenya National Bureau of Statistics (2010): The Kenya population and housing census, Vol. 1C.

Keus, F., Vries, J., Gooszen, H. & Laarhoven, C. (2010). Assessing factors influencing return back to work after cholecystectomy: A qualitative research. *BMC Gastroenterology, 10*(12): 1-7.

Khayri, S., Yaghoubi, J. & Yazdanpanah, M. (2011). Investigating barriers to enhance entrepreneurship in agricultural higher education from the perspective of graduate students. *Procedia Social and Behavioral Sciences 15*: 2818-2822.

Kimberley, C. (2011). What are Innovation Platforms: Enhance Development.

Kimble, C., Grenier, C., & Goglio-Primard, K. (2010). Innovation and knowledge sharing across professional boundaries: Political interplay between boundary objects and brokers". *International Journal of Information Management, 30*(5): 437–444.

Kingori, A., Wachira, A. & Tuitoek, J. (2010). *Indigenous Chicken Production in Kenya. International Journal of Poultry Science 9* (4): 309-316.

Klerkx, L. & Leeuwis, C. (2008a). Balancing multiple interests. Embedding innovation intermediation in the agricultural knowledge infrastructure. *Technovation, 28*: 364-378.

Klerkx, L. & Leeuwis, C. (2008b). Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. *Food Policy, 33*: 260-276.

Klerkx, L., Aarts, N. & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, 103,390-400.

Labarthe, P. (2009). Extension services and multifunctional agriculture: Lessons learned from the French and Dutch contexts and approaches. *Journal of Environmental Management, 90*: 5193-5202.

Latour, B. (2005). Reassembling the Social: An Introduction to Actor-Network-Theory (Oxford: Oxford University Press).

Le Gal, P., Dugué, P., Faure, G. & Novak, S. (2011). How does research address the design of innovative agricultural production systems at the farm level? A review. *Agricultural Systems, 104*: 714–728.

Leys, A. & Vanclay, J. (2011). Social learning: A knowledge and capacity building approach for adaptive co-management of contested landscapes. *Land Use Policy, 28*: 574-584

Love, J., Roper, S. & Bryson, J. (2011). Openness, knowledge, innovation and growth in UK business services. *Research Policy Journal article in press*.

Lwoga, E., Ngulube, P. & Stilwell, C. (2010). Managing indigenous knowledge for sustainable agricultural development in developing countries: Knowledge management approaches in the social context. *The International Information & Library Review, 42*: 174-185.

Maeda, E., Pellikka, P., Clark, B., & Siljander, M. (2011). Prospective changes in irrigation water requirements caused by agricultural expansion and climate changes in the eastern arc mountains of Kenya. *Journal of Environmental Management, 92*: 982-993.

Mahoney, R. & Morel, C. (2006). A global health innovation system (GHIS). *Innovation Strategy Today 2* (1):1-12.

Maina, S. & Mwangi, J. (2011). The effectiveness of agro-dealers in enhancing dissemination and adoption of the "Push-Pull" technology among smallholder farmers in Western Kenya. Problems of education in the 21st Century: *Contemporary Issues in Education, 33*: 118-129.

Makete, N. & Mbakaya, D. (2010). Improved provision of agricultural lime to neutralize soil acidity and improve productivity in Western Kenya. Paper presented during the second National JOLISAA workshop. 6th to 10th December, 2010, KARI headquarters, Nairobi.

Martin, A. (2008). Self-reflection on emergent research design: GJSS, 5 (1).

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Volume 11, No. 3, Art. 8.* Online. Retrieved on 29-10-2011 at: http://www.qualitative-research.net/index.php/fqs/article/view/1428/3027

Ministry of Agriculture (2012a). National agricultural sector extension policy (NASEP). Government Printer, Nairobi, Kenya.

Ministry of Agriculture (2012b). National agribusiness strategy: Making Kenya's agribusiness sector a competitive driver of growth, Government Printer, Nairobi, Kenya.

Ministry of Agriculture (2010). Farm management handbook of Kenya. Machakos and Makueni Counties, Government printer, Nairobi, Kenya.

Ministry of Agriculture Kathonzweni Sub-County 2011 Annual Report.

Ministry of Agriculture Kathonzweni Sub-County 2012 Annual Report.

Ministry of Agriculture Kyuso Sub-County 2012 Annual Report.

Ministry of Agriculture Machakos Sub-County 2012 Annual Report.

Ministry of Agriculture Makueni Sub-County 2012 Annual Report.

Ministry of Agriculture Migwani Sub-County 2012 Annual Report.
Ministry of Agriculture Mwala Sub-County 2011 Annual Report.

Ministry of Agriculture Mwala Sub-County 2012 Annual Report.

Ministry of agriculture and Ministry of livestock development (2009). National agriculture and livestock extension programme (NALEP) July 2009 – June 2010 work-plan, Government printer, Nairobi, Kenya.

Ministry of Agriculture (2005). Strategy for revitalizing agriculture 2004-2014 (Short Version), Government printer, Nairobi, Kenya.

Moayedi, A. & Azizi, M. (2011). Participatory management opportunity for optimizing in agricultural extension education. *Procedia Social and Behavioural Sciences, 15*: 1531-1534.

Moebius-Clune, B., Es, H., Idowu, O., Schindelbeck, R., Kimetu, J., Ngoze, S., Lehmann, J., & Kinyangi, J. (2011). Long-term soil quality degradation along a cultivation chronosequence in western Kenya. *Agriculture, Ecosystems and Environment, 141*: 86–99.

Morse, R. (2010). Integrative public leadership: Catalyzing collaboration to create public value. *The Leadership Quarterly, 21*: 231-245.

Murage, A., Obare, G., Chianu, J., Amudavi, D., Pikett, J. & Khan, Z. (2011). Duration analysis of technology adoption effects of dissemination pathways: A case of "Push-Pull" technology for control of *striga* weeds and stem borers in Western Kenya. *Crop Protection, 30*: 531-538.

Mwangi, J. & Kavoi, J. (2013). Developing a Vibrant Livestock Industry in East Africa through Market-Driven Research. *Journal of US-China Public Administration, 10*(6): 608-617.

Mwangi, J. (2012). Agricultural extension strategies for effective mitigation against the effects of climate change. Keynote paper presented at the 2012 annual general meeting of agricultural professionals in Nzukka, Nigeria.

Mwangi, J. (2011). Challenges and opportunities for effective linkages between research, policy and practice. Paper presented during the African Technology Policy Studies Network (ATPS) annual conference. 7th to 11th November, 2011, Mombasa, Kenya.

Mwirigi, J., Makenzi, P. & Ochola, W. (2009). Socio-economic constraints to adoption and sustainability of biogas technology by farmers in Nakuru district, Kenya. *Energy for Sustainable Development*, *13*: 106-115.

Narrod, C., Roy, D., Okello, J., Avendaño, B., Rich, K. & Thorat, A. (2009). Public–private partnerships and collective action in high value fruit and vegetable supply chains. *Food Policy, 34*: 8–15.

Nkurumwa, A.O., Mwangi, J.G., & Kathuri, N.N.J. (2011). A gender-based analysis of the role of agricultural extension services among Maasai agro-pastoralists. Problems of education in the 21st Century. *Education, Policy, Management and Quality, 32*: 98-112.

Nyagumbo, I., & Rurinda, J. (2011). An appraisal of policies and institutional frameworks impacting on smallholder agricultural water management in Zimbabwe. J. Phys. Chem. Earth (2011), doi:10.1016/j.pce.2011.07.001

Okoko, N., Mahasi, M., Kidula, N., Ojowi, M. and Makini, F. (2008). Participatory sunflower production, technology dissemination and value addition in southwest Kenya. *Africa Journal of Agricultural Research, Vol. 3* (6), pp 396-399.

Omwami, E. & Omwami, R. (2010). Public investment and the goal of providing universal access to primary education by 2015 in Kenya. *International Journal of Educational Development, 30*: 243–253.

Oreszczyn, S., Lane, A. & Carr, S. (2010). The role of networks of practice and webs of influencers on farmers' engagement with and learning about agricultural innovations. *Journal of Rural Studies, 26*: 404-417.

Ouma, J.O., Odendo, M., Bett, C., De Groote, H., Mugo, S., Mutinda, C., Gethi, J., Njoka, S., Ajanga, S. & Shuma, J. (2011). Participatory farmer evaluation of stem borer tolerant maize varieties in three maize growing ecologies of Kenya. *African Journal of Agricultural Research 5*(13): 3021-3028.

Oxford Dictionary of Sports Science: *http://www.answers.com/topic/group-dynamics-2* Accessed on 18-03-2012.

Paassen, A., Klerkx, L., Adu-Acheampong, R., Adjei-Nsiah, S., Ouologuem, B., Zannou, E., Vissoh, P., Soumano, L., Dembele, F. & Traore, M. (2013). Choice-making in facilitation of agricultural innovation platforms in different contexts in West Africa: Experiences from Benin, Ghana and Mali. *Knowledge Management for Development Journal, 9*(3): 79-94.

Palys, T. (2009). Purposive sampling. Simon Fraser University.

Philcox, N., Knowler, D., & Haider, W. (2010). Eliciting stakeholder preferences: An application of qualitative and quantitative methods to shrimp aquaculture in the Indian sundarbans. *Ocean & Coastal Management, 53*: 123-134.

Poulton, C. & Macartney, J. (2011). Can public-private partnerships leverage private investment in agricultural value chains in Africa? A preliminary review, *World Development* (2011), doi:10.1016/j.worlddev.2011.05.017

Popoviciu, S., Barbu, A., Costea, D., Culda., L. & Culda, S. (2011): Students' desire to engage in cognitive activities, family of origin characteristics and need for cognition scores, Problem of education in the 21st Century, *33*: 62-70.

Prager, K. & Freese, J. (2009). Stakeholder involvement in agri-environmental policy making – Learning from a local- and a state-level approach in Germany. *Journal of Environmental Management, 90*: 1154-1167.

Quisumbing, A. & Pandolfelli, L. (2009). Promising approaches to address the needs of poor female farmers: Resources, constraints and interventions. *World Development, 38*(4): 581-592.

Rajalahti, R. (2009). Promoting agricultural innovation systems approach: The way forward. Knowledge for development, Agriculture and Rural Development Department, the World Bank.

Rao, E. & Qaim, M. (2010). Supermarkets, Farm household income, and poverty: Insights from Kenya. *World Development*, 39(5): 784-796.

Schut, M., Paassen, A., Leeuwis, C., Bos, S., Leonardo, W. & Lerner, A. (2011). Space for innovation for sustainable community-based biofuel production and use: Lessons learned for policy from Nhambita community, Mozambique. *Energy Policy*, 39: 5116-5128.

Sivakami, S. & Karthikeyan, C. (2009). Evaluating the effectiveness of expert system for performing agricultural extension services in India. *Expert Systems with Applications, 36*: 9634-9636.

Standardized Monitoring and Assessment of Relief and Transitions (SMART) Methodology, (2012). Sampling Methods and Sample Size Calculation for the SMART Methodology.
http://www.smartmethodology.org/documents/sampling/Sampling_Paper_June _2012.pdf and
http://www.smartmethodology.org/index.php?option=com_content&view=artic le&id=1093&Itemid=291&lang=en Accessed on 18th March 2013.

Sneddon, J., Soutar, G. & Mazzarol, T. (2011). Modelling the faddish, fashionable and efficient diffusion of agricultural technologies: A case study of the diffusion of wool testing technology in Australia. *Technological Forecasting & Social Change*, 78: 468-480.

Spielman, D. J., Ragasa, C., & Rajalahti, R. (2012). Designing agricultural research linkages within an AIS framework (Module 4, TN 1). In World Bank (Ed.), *Agricultural innovation systems: An investment sourcebook* (pp. 277-288). Washington, DC: World Bank.

Spielman, D. and Grebmer, K., (2004). Public-Private Partnerships in Agricultural Research: An analysis of challenges facing industry and the consultative group on international agricultural research. The International Food Policy Research Institute, 2033 K Street, N.W. Washington D.C. 20006 U.S.A.

Spielman, D., Ekboir, J., Davis, K., & Ochieng, C. (2008). An innovation systems perspective on strengthening agricultural education and training in Sub-Saharan Africa. *Agricultural Systems*, *98*: 1-8.

Spielman, D., Ekboir, J. & Davis, K. (2009). The art and science of innovation systems inquiry: Applications to Sub-Saharan African agriculture. *Technology in Society*, *31*: 399-405.

Spielman, D. Byerlee, D., Alemu, D. & Kelemework, D. (2010). Policies to promote cereal intensification in Ethiopia: The search for appropriate public and private roles. *Food Policy*, *35*: 185-194.

Spring, M., Stevenson, M. & Selviaridis, K. (2007). Emergent Research Design Strategies in Collaborative Research: A Tale of Two Studies. POMS 18th Annual Conference, Dallas, Texas, U.S.A.

Steeg, J., Vurburg, P., Baltenweck, I. & Staal, S. (2010). Characterization of farming systems in the Kenyan Highlands. *Applied Geography, 30* (2010) 239-253.

Sycamnias, E. (2010, July 4). Policy and planning. Retrieved 04/01/2014 from http://www.oppapers.com/essays/Policy-And-Planning/355201

Tenywa, M., Rao, K., Tukahirwa, J., Buruchara, R., Adekunle, A., Mugabe, J., Wanjiku, C., Mutabazi, S., Fungo, B., Kashaija, N., Pali, P., Mapatano, S., Ngaboyisonga, C., Farrow, A., Njuki, J. & Abenakyo, A. (2011). Agricultural innovation platform as a tool for development oriented research: Lessons and challenges in the formation and operationalization. *Learning Publics Journal of Agriculture and Environmental Studies, 2* (1): 117-146.

The *EastAfrican* Business Newspaper, November 24 (2012). Kenya to start production of biotech cotton in 2014.

Thompson, W., Miller, A., Mortenson, D. & Woodward, A. (2011). Developing effective sampling designs for monitoring natural resources in Alaskan national parks: An example using simulations and vegetation data. *Biological Conservation, 144*: 1270–1277.

Trauger, A., Sachs, C., Barbercheck, M., Kiernan, N., & Findeis, J. (2008). Agricultural education: Gender identity and knowledge exchange. *Journal of Rural Studies*, *24*: 432-439.

Triomphe, B., Floquet, A., Kamau, G., Letty, B., Vodouhe, S., Ng'ang'a, T., Stevens, J., Berg, J., Selemna, N., Bridier, B., Crane, T., Almekinders, C., Waters-Bayer, A. & Hocdé, H. (2013). What does an inventory of recent innovation experiences tell us about agricultural innovation in Africa? *Journal of Agricultural Education and Extension 19* (3): 311-324.

United Nations (2011). Sustainable development for Africa.

United States Department of Agriculture (2014). Published article on Kenya Cotton Production by Year. At *http://www.indexmundi.com/agriculture/?country=ke&commodity=cotton&graph =production* (Accessed on 13-02-2014).

Unluer, S. (2011). Barriers in the integration of ICT at the school for the handicapped. Problems of education in the 21st Century: *Contemporary Issues in Education, 33*, 92-106.

Vanloqueren, G. & Baret, P. (2009). How agricultural research systems shape a technological regime that develops genetic engineering but locks out agro-ecological innovations. *Research Policy, 38*: 971–983.

Wang'ombe, J. & van Dijk, M. (2013). Low potato yields in Kenya: do conventional input innovations account for the yields disparity? *Agriculture & Food Security 2013 2:14.*

Wells, C. & Magara, P. (2013). From project-based to institutionalized multi-stakeholder learning in water sanitation and hygiene sector: experience from Uganda. *Knowledge Management for Development Journal, 9*(3): 167-173.

Western, D., Groom, R., & Worden, J. (2009). The impact of subdivision and sedentarization of pastoral lands on wildlife in an African savannah ecosystem. *Biological Conservation, 142*: 2538–2546

Wheeler, S. (2008). What influences agricultural professionals' views towards organic agriculture? *Ecological Economics, 65* (2008) 145-154.

Whitten, J. (2011). Types of qualitative research designs. Retrieved on 20-10-2011 at Types of Qualitative Research Design | eHow.com http://www.ehow.com/list_7607707_types-qualitative-research-design.html#ixzz1bGV6ZrgJ

Wiersma, W. & Jurs, S. (2009). Research methods in education: An introduction, 9th edition (pp. 241-242). Boston, NY: Pearson.

Wilson, E., Bunn, M., & Savage, G. (2010). Anatomy of a social partnership: A stakeholder perspective. *Industrial Marketing Management, 39*: 76-90.

World Economic Forum. (2005). Global corporate citizenship initiative. Partnering for success, Business perspectives on multi-stakeholder partnerships.

Wright, H. (2009). Using an 'emergent design' to study adult education. Special issue, December 2009, pp 62-73.

Yaghoubi, J. (2009). Assessment of agricultural extension and education graduate students' perceptions of e-learning in Iran. *Procedia Social and Behavioural Sciences, 1*: 1914-1918.

Yakasai, M. & Fagwalawa, L. (2013). Factors influencing women's involvement in programme of the national special programme security in Niger State, Nigeria. *Bayero Journal of Pure and Applied Sciences, 6*(1): 58 – 61.

APPENDICES

Appendix A: Copy of Research Authorization Letter from the National Commission for Science, Technology and Innovation

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOG

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787 , 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref:

NCST/RCD/10/013/1

Date:

23rd January, 2013
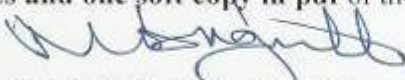
Justus Muteti Kavoi
Egerton University
P.O.Box 536-20115
Egerton.

RE: RESEARCH AUTHORIZATION

Following your application dated *8th January, 2013* for authority to carry out research on " *Factors influencing multi-stakeholder linkages for innovative agricultural development in the semi arid areas of Kitui, Machakos and Makueni Counties, Kenya,*" I am pleased to inform you that you have been authorized to undertake research in **Kitui, Machakos and Makueni Counties** for a period ending **31st August, 2014.**

You are advised to report to **the District Commissioners, the District Education Officers and the District Agricultural Officers, Kitui, Machakos and Makueni Counties** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR M.K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The District Commissioners
The District Education Officers
The District Agricultural Officers

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development".

Kitui County
Makueni County
Machakos County.

Appendix B: Copy of Research Permit from the National Commission for Science, Technology and Innovation

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/ four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

GPK6055t3mt10/2011

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS–see back page)

PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Justus Muteti Kavoi
of (Address) Egerton University
P.O.Box 536-20115, Egerton.
has been permitted to conduct research in

Location
District
Kitui, Machakos & Counties
Makueni
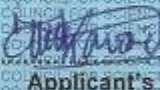
on the topic: Factors influencing multi stakeholder linkages for innovative agricultural development in the semi arid areas of Kitui, Machakos and Makueni Counties.

for a period ending: 31st August, 2014.
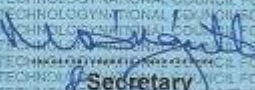
PAGE 3

Research Permit No. NCST/RCD/10/013/01
Date of issue   21st January, 2013
Fee received   KSH. 1,000

Applicant's
Signature

Secretary
National Council for
Science &Technology

141

Appendix C: Data Capture Instruments

A. A Check-list for Interviewing Key Informants

The purpose of this interview is to collect information on factors influencing Multi-Stakeholders Linkages for Innovative Agricultural Development (MSLIAD) in your area. Findings from this study will be used to contribute towards improving the performance of MSLIAD, inform policy makers, policy implementers, farmers and other stakeholders on how to address issues relating to MSLIAD performance for improved and sustainable livelihoods in the semi-arid regions of Kitui, Machakos and Makueni Counties and beyond. I am pleased to inform you that you have been chosen to assist in providing the required information on current MSLIAD status in your areas. The information will contribute towards improving innovative agricultural development in the Counties. It will be used exclusively for this study and will be treated confidentially.

1). Sources of livelihoods _____

2). Membership to any group or organization: Yes/ No

3). Hold a position in the group/ organization: Yes/ No

4). Stakeholders conduct agriculture related activities: Yes/ No

5). Mention the stakeholders _____

6). Mention the ways in which the stakeholders are linked to innovative agricultural development: _____

7). Mention the role(s) of each stakeholder in innovative agricultural development_____

_____

_____

8). Does a member of more than one group contribute to more information sharing?

9). Does your group/organization/ institution benefit from partnering with other stakeholders?

10). Are the networks (associations or working arrangements) within which MSLIAD operate in this area? If yes, how are the existing relationships between different stakeholders?

11). How would you rate the effective of the existing linkages of different stakeholders working within such networks? **(Good, moderate or poor).**

12). Can stakeholders' perceptions towards linking with other development partners contribute to weak or strong linkages? Please explain _____

_____

13). **In your opinion**, what do you think has contributed to the current performance of joint stakeholders initiatives in the area?

14). Pick the top five causes you have just mentioned and rank them in decreasing order of importance, 1 being the most important and 5 as the least important. If the causes are less that five, rank all of them **(Combine 13 & 14 by listing and ranking them in the Table).**

Causes Responsible for Current Performance of Stakeholders' Linkages

	Cause	Rank
a		
b		
c		
d		
e		
f		
g		
h		

15). **In your opinion**, what do you think or suggest should be done to improve the performance of joint multi-stakeholder initiatives in this area?

16). Pick the top five suggestions you have just mentioned and rank them in decreasing order of importance, 1 being the most important and 5 as the least important. If the suggestions are less that five, rank all of them **(Combine 15 & 16 by listing and ranking them in the Table).**

Suggestions for Improving the Performance of Stakeholders' Linkages

	Suggestion	Rank
a		
b		
c		
d		
e		
f		
g		
h		

17). Are there past recommendations that contributed to policy formulation for increased technology and innovation promotion and adoption?

18). Can stakeholders' attitude towards linking with other development partners contribute to weak or strong linkages? Please explain

19). How have past policies performed in achieving increased technology and innovations promotion and adoption?

20). Are there matters that you think or suggest should be considered for inclusion in policy formulation to make policies more applicable?

21). Pick the top five suggestions you have just mentioned and rank them in decreasing order of importance, 1 being the most important and 5 as the least important. In case the suggestions are less that five, rank all of them **(Combine 20 & 21 by listing and ranking them in the Table).**

Matters to be considered for Inclusion in Policy Formulation

	Suggestion	Rank
a		
b		
c		
d		
e		
f		
g		
h		

22). Can **availability** and **accountability** of stakeholders' resources (Time, Money and Manpower) for linking with other development partners contribute to weak or strong linkages? Please explain _____

_____

_____

23). In your opinion, who (stakeholder) do you think should be involved in generating the required information for policy formulation to make policies more applicable?

_____

_____

24). Pick the top five stakeholders you have just mentioned and rank them in decreasing order of importance, 1 being the most important and 5 as the least important. If the stakeholders are less that five, rank all of them (**Combine 23 & 24 by listing and ranking them in the Table).**

Stakeholders to be involved in Generating Information for Policy Formulation

	Stakeholder	Rank
a		
b		
c		
d		
e		
f		
g		
h		

25). **In your opinion**, what do you think caused less than optimal (below expectation) performance of past joint Public-Private Partnership initiatives in this area/ region?

_____

_____

26). Pick the top five causes you have just mentioned and rank them in decreasing order of importance, 1 being the most important and 5 as the least important. If the

stakeholders are less that five, rank all of them **(Combine 25 & 26 by listing and ranking them in the Table).**

Causes for the less than Optimal Performance of Past Joint Public-Private Partnership Initiatives in this Area/ Region

	Cause	Rank
a		
b		
c		
d		
e		
f		
g		
h		

Thank you very much for your time and responses

B. Guiding Questions for Conducting Focus Group Discussions

Guidelines/Instructions for the Discussions:

☞ Only one speaker at a time with permission from the facilitator

☞ Everyone should feel free to participate and should participate.

☞ Express your views without criticising other participants.

1). Are there stakeholders working in agriculture-related activities?

2). How are they involved in innovative agricultural development?

3). What are the roles of each stakeholder in innovative agricultural development?

4). Are the networks (associations or working arrangements) within which MSLIAD operate in this area? If yes, how are the existing relationships between different stakeholders?

5). How do different stakeholders link with one another in carrying out their activities?

6a). Can stakeholders' resources (Time, Money and Manpower) **availability** for linking with other development partners contribute to weak or strong linkages? Please explain

6b). Can stakeholders' resources (Time, Money and Manpower) **accountability** for linking with other development partners contribute to weak or strong linkages? Please explain

7). How effective are the existing linkages of different stakeholders working within such networks mentioned earlier? How would you rate the effectiveness – **Good, moderate or poor?**

8). How do you perceive the performance of existing linkages among the stakeholders working in this area?

9). Can stakeholders' perceptions towards linking with other development partners contribute to weak or strong linkages? Please explain

10). **In your opinion**, what do you think has contributed to the current performance of stakeholders linkages for innovative agricultural development in this area?

11). Pick the top five suggestions you have just mentioned and rank them in decreasing order of importance, 1 = the most important; 5 = the least important. If the suggestions are less that five, rank all of them **(Combine 10 & 11 by listing and ranking in the Table).**

Perceived Causes for Current Performance f Stakeholders Linkages

	Causes	Rank
a		
b		
c		
d		
e		
f		
g		
h		

12). What should be done to improve the performance of multi-stakeholder linkages for innovative agricultural development in this area?

13). Pick the top five suggestions you have just mentioned and rank them in decreasing order of importance, 1 = the most important; 5 = the least important. In case the suggestions are less that five, rank all of them **(Combine 12 & 13 by listing and ranking in the Table).**

Suggestions for Improving Stakeholders' Performance

	Suggestion	Rank
a		
b		
c		
d		
e		
f		
g		
h		

14). Are there past recommendations that contributed to policy formulation for increased technology and innovation adoption?

15). How do you perceive the performance of past agriculture (related) policies in achieving increased technology and innovations adoption in this area or region?

16). Can stakeholders' attitude towards linking with other development partners contribute to weak or strong linkages? Please explain.

17). Are there matters of concern that you think should be considered for inclusion in policy formulation to make policies more applicable?

18). Who do you think or suggest should be involved in generating the required information for policy formulation to make policies more applicable in this area?

_____
_____
_____

19). Pick the top five suggestions you have just mentioned in item 17 and rank them in decreasing order of importance, 1 = the most important; 5 = the least important. In case the suggestions are less that five, rank all of them **(Combine 17 & 19 by listing and ranking in the Table).**

Suggested Matters that should be considered for Inclusion in Policy Formulation to Make Policies More Applicable

	Matter suggestion	Rank
a		
b		
c		
d		
e		
f		
g		
h		

20). In your own opinion, what do you think caused poor performance of past joint Public-Private Partnership initiatives in the area/ region e.g. Cotton, sunflower and recently Gadam sorghum?

21). Pick the top five causes you have just mentioned and rank them in decreasing order of importance, 1 = the most important; 5 = the least important. In case the suggestions are less that five, rank all of them **(Combine 20 & 21 by listing and ranking in the Table).**

Causes of Poor (less than optimal) Performance of Past Joint PPP Initiatives

C	Causes	Rank
a		
b		
c		
d		
e		
f		
g		
h		

22). Do a quick Gadam sorghum value chain analysis to establish if there is/are any stakeholders who was/were left out in the Gadam sorghum commercialization joint initiative.

Thank you very much for your time and responses

Questionnaire No._____

C. A Semi-structured Questionnaire for Face-to-Face Interviews

The purpose of this interview is to collect information on factors influencing Multi-Stakeholders Linkages for Innovative Agricultural Development (MSLIAD) in your area. Findings from this study will be used to contribute towards improving the performance of MSLIAD, inform policy makers, policy implementers, farmers and other stakeholders on how to address issues relating to MSLIAD performance for improved and sustainable livelihoods in the semi-arid regions of Kitui, Machakos and Makueni Counties and beyond. I am pleased to inform you that you have been chosen to assist in providing the required information on current MSLIAD status in your areas. The information will contribute towards improving innovative agricultural development in the Counties. It will be used exclusively for this study and will be treated confidentially.

Instructions: For all the closed-ended questions, **circle** the response given.

Interviewer's Names _____ Interview date _____

County _____ Sub-County_____ Division _____

Location _____ Sub-Location _____ Village _____

GPS Reading: Latitude (S) _____   Longitude (E) _____
Altitude (MASL) _____

SECTION 1: Socio-Economic Characteristics of the respondent

1). Names (optional) _____

2). Gender   (1) Male   (2) Female

3). Respondent's age (Years) _____

4). Marital status: (1) Single   (2) Married   (3) Widowed   (4) Divorced

5a). Respondent's highest class of education   (1) No education   (2) Primary
                                               (3) Secondary   (4) Post secondary

5b). If post secondary education, please probe further to get field of specialization.
     (1) Certificate in_____(2) Diploma in _____
     (3) BSc in _____   (4) Other (Specify) _____

6). What is the main source(s) of household income? (1) Formal Employment;
     (2) Casual employment   (3) Business   (4) Farming (Crops & Livestock – record
     the Nos. of livestock kept) (5) Remittance from working relatives
     (6) Other (Specify) _____

7). Establish family members and the No. in each age category (Use the Table).

Family Members' Composition by Age

Age bracket	No.
Children 1-12 years	
Teenagers 13-19 years	
Young Adults 20 – 39 years	
Middle aged 40 – 65 years	
Over 65 years	

8). How many family members live on the farm and contribute labour to farming activities? _____

9). What are the main sources of household farm labour?
    (1) Family members   (2) Hired   (3) Both family and hired
    (4) Other Specify _____

10). What is your approximate farm size in Acres? _____

11). What type of land ownership is your farm?   (1) Free hold   (2) Leasehold
    (3) Rented   (4) Communal   (5) Borrowed
    (6) Other specify _____

12). How long have you been farming (Years) _____

SECTION 2: Gadam Sorghum Production (Through a PPP Initiative) in Semi-arid Areas of Kitui, Machakos and Makueni Counties

13a). Have you been growing Gadam sorghum? (1) Yes   (2) No

13b). How many acres are currently under Gadam sorghum? _____

14). When did you start growing Gadam sorghum (Year/Season)? _____

15). How did you get to know about Gadam?   (1) From extension providers
    (2) Researchers (KARI)   (3) NGOs   (4) Provincial administrators
    (5) Neighbours   (6) Church leaders (7) FM radios
    (8) Newspapers   (9).Other Specify _____

16a). Why have you been growing Gadam sorghum (**Circle all that apply**)?
    (1) Food (2) Sale (3) Animal feed (4) Others Specify_____

16b). Are you still growing Gadam sorghum on same acres as you started?
    (1) Yes   (2) No

16c). If not why did you stop or reduce the acres under Gadam sorghum?
    1) Low or distorted farm-gate and market price
    2) Buyer delayed picking the harvested Gadam and delayed payment
    3) Birds menace and also small farm sizes
    4) Other (Specify_____

17). Do you grow Gadam sorghum as a member of a production group?
    1 = Yes   2 = No

18). Do you sell your Gadam sorghum grain through your group?   1 = Yes   2 = No

19). In your opinion, what do you think should be done to improve Gadam production in your area? _____
_____

20). Why was the group formed? _____

21). How many members are in your group? _____ (Males _____) (Females _____)

22). Are there group members who are members of another group?   1 = Yes   2 = No

23). Your group has a management committee.   1 = Yes   2 = No

24). The committee members are elected by _____

25). Composition of the committee in terms of gender.
      1 = Majority Male;   2 = Majority female;   3 = Fairly equal representation

26). Male dominance in the committee composition affects the performance of the group with respect to linkages for innovative agricultural development.   1 = Yes   2 = No

27a). Please explain _____
_____

28). Female dominance in the committee composition affects your group performance with respect to linkages for innovative agricultural development.
      1 = Yes   2 = No

29). Please explain _____
_____

30). Your group has a constitution which guides it on how to run its affairs.
      1 = Yes   2 = No

31). There is a penalty for those you break group rules.   1 = Yes   2 = No

32a). There are stakeholders (development partners) working in agriculture related activities in this area.   1 = Yes   2 = No

32b). Different stakeholders have been involved in joint agricultural initiatives in the area. 1 = Yes   2 = No

32c). Have joint agricultural initiatives contributed to increased technology and innovation uptake in the area?   1 = Yes   2 = No

32d). In your opinion, what do you think has contributed to the current performance of joint agricultural initiatives in the area? _____
_____

33). If Yes to item 32b, mention the top most active five stakeholders, years of operation, indicate what they do and the extent of coverage (Use the space provided in the Table).

Stakeholders, Their Years of Operation, Their Roles and Coverage

Stakeholders	Years in operation	What this partner does (Services provided)/ Role(s)	Extend of coverage (Administrative borders)

34). There are networks (systems or associations or arrangements) in this area through which different stakeholders work.   1 = Yes   2 = No

35). If yes to item 32b, how are the stakeholders mentioned (in item 33) linked/relate with respect to innovative agricultural development? _____

_____

_____

36). How would you describe the effectiveness of the existing linkages on different stakeholders working within such networks? _____

_____

37). Does your group partner (collaborate or associate) with any of the stakeholders (in item 33) in innovation development, packaging and promotion for adoption or utilization?   1 = Yes   2 = No   (If Yes, use the Table to record the answers given).

Activities and Stakeholders with Which Respondent's Group Partners

Activity	Stakeholder	1= Yes; 2 = No
Technology/Innovation		
a) Development		
b) Packaging		
c) Promotion for adoption		
d) Promotion for utilization		

38). If Yes to item 37, which organization or stakeholder? (**Circle all that apply**)
    (1) KARI   (2) MoA   (3) NGO   (4) Private company
    (5) Commercial Banks   (6) Other (specify) _____

39). If Yes to item 37, why do you partner with this/ these organization(s)? (Use the Table to record the answers given).

Stakeholders and Reasons for Partnering

Stakeholder	Reason(s) for Partnering

40). If No, please explain why _____
_____
_____

41). What should be done to improve the performance of multi-stakeholder linkages for innovative agricultural development? _____
_____

42). Some past recommendations have contributed to policy formulation for increased technology and innovation adoption.   1 = Yes   2 = No

43). If Yes, what are those recommendations? _____
_____
_____

44). Pick the top five recommendations you have just mentioned and rank them in decreasing order of importance, with 1 being the most important and 5 as the least important. If the recommendations are less that five, rank all of them (Use the Table 5).

Past Recommendations that Contributed to Policy Formulation for Increased Technology and Innovation Adoption

	Recommendation	Rank
a		
b		
c		
d		
e		
f		
g		

45). How should policy formulation be done to enhance multi-stakeholder linkages for innovative agricultural development? _____
_____
_____

46). Pick the top five suggestions you have just mentioned and rank them in decreasing order of importance, with 1 being the most important and 5 as the least important. If the suggestions are less that five, rank all of them (Use the Table).

Suggested Items for Consideration and Inclusion to Improve on Policy Formulation

	Suggestion	Rank
a		
b		
c		
d		
e		
f		
g		
h		

For item Nos. 47 to 74 in the Table, each statement has five sets of expressed opinion, namely: -

Strongly Disagree = **SD**

Disagree = **D**

Undecided = **U**

Agree = **A**

Strongly Agree = **SA**

<u>**Circle**</u> the choice that best describes the opinion given.

Respondent's Expressed Opinion on Factors that could Influence MSLIAD Status

No.	Factor	Expressed opinion				
47	Past policies were unsuccessful because their formulation did not involve **all** the stakeholders.	SD	D	U	A	SA
48	Being a group member helps a farmer to interact and share information.	SD	D	U	A	SA
49	Existing policies on linkages have contributed to the current status of linkages between development partners in this area.	SD	D	U	A	SA
50	Individual's negative attitude towards partnerships has have contributed to the current status of linkages between development partners in this area.	SD	D	U	A	SA
51	Existing linkages among stakeholders have contributed to the current performance status of MSLIAD in this area.	SD	D	U	A	SA
52	A farmer benefits by being a member of a group.	SD	D	U	A	SA
53	Working as a group improves access to improved technologies and innovations in farming.	SD	D	U	A	SA

54	Being a member of more than one group helps a farmer to interact and share information with more people.	SD	D	U	A	SA
55	To improve the MSLIAD current status, all stakeholders must be fully committed to contribute the required resources.	SD	D	U	A	SA
56	Performance of past policies on partnerships (cooperation) in achieving increased technology and innovation adoption in this area has been less than optimal.	SD	D	U	A	SA
57	There is minimal evidence that innovative agricultural development has increased in this area.	SD	D	U	A	SA
58	There are no strong linkages between different stakeholders working in this area.	SD	D	U	A	SA
59	Working as a group improves access to market information and marketing of farm produce.	SD	D	U	A	SA
60	A group benefits as a result of partnering with other stakeholders in the area.	SD	D	U	A	SA
61	Poor stakeholders' perceptions can contribute to weak linkages.	SD	D	U	A	SA
62	Effective MSLIAD performance requires clearly defined role(s) and commitment to contribute needed resources by all partners.	SD	D	U	A	SA
63	Review of policies to enhance increased technology and innovation adoption should be carried out within specified time period.	SD	D	U	A	SA
64	Penalties imposed on errant group members help the group members to stay united and contribute towards improving the group's performance.	SD	D	U	A	SA
65	Negative attitude towards partnerships can contribute to weak linkages.	SD	D	U	A	SA
66	To enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved.	SD	D	U	A	SA
67	Linkages between your group/ institution and other development partners are relatively weak.	SD	D	U	A	SA
68	Inadequate information on availability of resources (Time, Funds and Manpower) **cannot** contribute to weak linkages.	SD	D	U	A	SA

69	Failure to establish strong linkages between development partners in the past has contributed to inadequate technology and innovation adoption in this area.	SD	D	U	A	SA
70	Working as a group improves interactions, linkages and sharing of information with other stakeholders working in this area.	SD	D	U	A	SA
71	Inadequate information on accountability of resources (Time, Funds and Manpower) **cannot** contribute to weak linkages.	SD	D	U	A	SA
72	Government policies should provide room to establish effective linkages between development partners in this area.	SD	D	U	A	SA
73	There is no clearly defined communication mechanism between stakeholders **at all levels** for conveying improved technologies and feedback to and from the end users.	SD	D	U	A	SA
74	There is no proper coordination of information flow **at all levels** in extension service provision between stakeholders and end users.	SD	D	U	A	SA

Thank you very much for your time and responses/ opinions

Questionnaire No._____   Date _____

D. A Self Administering Questionnaire for Key Informants

Purpose: To collect information on factors influencing Multi-Stakeholders Linkages for Innovative Agricultural Development (MSLIAD) in your area. The information you provide will be used for this study and will be treated confidentially.

Instructions: Each question in the Table has five sets of expressed opinion, namely: -

Strongly Disagree	**= SD**
Disagree	**= D**
Undecided	**= U**
Agree	**= A**
Strongly Agree	**= SA**

<u>**Circle**</u> the choice that best describes your opinion.

Respondent's Expressed Opinion on Factors that Could Influence MSLIAD Performance

No.	Factor	Expressed opinion
1	Past policies were unsuccessful because their formulation did not involve **all** the stakeholders.	SD D U A SA
2	Being a group member helps a farmer to interact and share information.	SD D U A SA
3	Existing policies on linkages have contributed to the current status of linkages between development partners in this area.	SD D U A SA
4	Individual's negative attitude towards partnerships has have contributed to the current status of linkages between development partners in this area.	SD D U A SA
5	Existing linkages among stakeholders have contributed to the current performance status of MSLIAD in this area.	SD D U A SA
6	A farmer benefits by being a member of a group.	SD D U A SA
7	Working as a group improves access to improved technologies and innovations in farming.	SD D U A SA
8	Being a member of more than one group helps a farmer to interact and share information with more people.	SD D U A SA
9	To improve the MSLIAD current status, all stakeholders must be fully committed to contribute the required resources.	SD D U A SA
10	Performance of past policies on partnerships (cooperation) in achieving increased technology and innovation adoption in this area has been less than optimal.	SD D U A SA
11	There is minimal evidence that innovative agricultural development has increased in this area.	SD D U A SA

12	There are no strong linkages between different stakeholders working in this area.	SD	D	U	A	SA
13	Working as a group improves access to market information and marketing of farm produce.	SD	D	U	A	SA
14	A group benefits as a result of partnering with other stakeholders in the area.	SD	D	U	A	SA
15	Poor stakeholders' perceptions can contribute to weak linkages	SD	D	U	A	SA
16	Effective MSLIAD performance requires clearly defined role(s) and commitment to contribute needed resources by all partners.	SD	D	U	A	SA
17	Review of policies to enhance increased technology and innovation adoption should be carried out within specified time period.	SD	D	U	A	SA
18	Penalties imposed on errant group members help the group members to stay united and contribute towards improving the group's performance.	SD	D	U	A	SA
19	Negative attitude towards partnerships can contribute to weak linkages	SD	D	U	A	SA
20	To enhance increased adoption of technologies and innovations, policy formulation should first seek the opinions of all stakeholders to be involved.	SD	D	U	A	SA
21	Linkages between your group/ organization/ department and other development partners are relatively weak.	SD	D	U	A	SA
22	Inadequate information on availability of resources (Time, Funds and Manpower) **cannot** contribute to weak linkages.	SD	D	U	A	SA
23	Failure to establish strong linkages between development partners in the past has contributed to inadequate technology and innovation adoption in this area.	SD	D	U	A	SA
24	Working as a group improves interactions, linkages and sharing of information with other stakeholders working in this area.	SD	D	U	A	SA
25	Inadequate information on accountability of resources (Time, Funds and Manpower) **cannot** contribute to weak linkages.	SD	D	U	A	SA
26	Government policies should provide room to establish effective linkages between development partners in this area.	SD	D	U	A	SA
27	There is no clearly defined communication mechanism between stakeholders **at all levels** for conveying improved technologies and feedback to and from the end users.	SD	D	U	A	SA
28	There is no proper coordination of information flow **at all levels** in extension service provision between stakeholders and end users.	SD	D	U	A	SA

Thank you very much for your time and responses

ANNEXES

Annex 1: Study Findings Published in Peer-Reviewed Journal Papers

Strategies for Effective Multi-Stakeholder Linkages for Innovative Agricultural Development in Eastern Kenya

Justus Muteti Kavoi
Katumani Research Centre,
Machakos, Kenya

John Gowland Mwangi
Egerton University,
Egerton University,

Geoffrey Mbuthia Kamau
KARI Headquarters,
Nairobi, Kenya

Abstract

Smallholder farmers in Eastern Kenya experience food insecurity due to climate change, scarce resources, poor infrastructure, and low rainfall that is poorly distributed. The less than optimal multi-stakeholder linkages for innovative agricultural development (MSLIAD) initiatives inhibit farmers' adoption of technologies and innovations. This study sought to establish the factors influencing the performance of MSLIAD. The results indicated that the stakeholders experienced challenges in translating desire into action, coordination, consensus building and avoiding duplication of efforts and wastage of resources, but could use research, agricultural innovation systems (AIS), and public-private-partnership (PPP)-based linkages to improve the situation. The researchers concluded that the stakeholders supported MSLIAD initiatives and could use strong and sustainable linkages to address community challenges; that giving farmers inappropriate messages wasted resources; that identifying stakeholders and their roles enhanced sustainable MSLIAD initiatives; that PPPs reduced transaction costs for forming and sustaining relationships; that farmers' characteristics and circumstances influenced adoption; and that AIS enhanced economic development. Consequently, extension providers should strengthen and use MSLIAD initiatives to address community challenges; should coordinate visits to farmers; should know stakeholders and their roles as well as farmers' characteristics and circumstances; and should encourage the use of AIS and formation of PPP-based linkages.

Keywords: food security, household income, innovative agricultural development, public-private-partnership (PPP), challenges

Factors Related to the Low Uptake of Technologies and Innovations in Semi-Arid Areas of Lower Eastern Kenya

Justus Muteti Kavoi[1]*, John Gowland Mwangi[2] and Geoffrey Mbuthia Kamau[3]
[1]KARI-Katumani Research Centre, Box 340-90100, Machakos, Kenya. Machakos, Kenya
[2]Egerton University, P. O. Box 13-20100 Nakuru, Kenya. Division of Research and Extension, Egerton University
[3]KARI Headquarters, Box 57811-00200, City Square, Nairobi, Kenya. Division of Outreach and Partnerships, KARI Headquarters

*Corresponding Author E-mail: jmkavoi@yahoo.com; j.kavoi59@gmail.com
Accepted 13 May, 2014

ABSTRACT

The semi-arid areas of lower Eastern Kenya are characterized by poor infrastructure, low, erratic and poorly distributed rainfall. Although joint poverty-reduction initiatives have been carried out in the region, low adoption of improved technologies and innovations still inhibits farmers' ability to improve their farm productivity and household income. A study involving 165 respondents, for instance, was carried out to establish the factors related to low uptake of improved technologies and innovations. Data were collected through a survey using a semi-structured questionnaire and analyzed using SPSS versions 17.0. Results showed that poverty-reduction joint initiatives had the potential to improve farm productivity but were being negatively affected by relatively weak linkages; breach of contracts (Weak linkages were significantly higher than strong linkages (($\chi 2 = 76.07$, df = 2, $p = 0.001$; breach of contracts was significantly higher than distorted farm-gate and market prices ($\chi 2 = 59.49$, df = 2, $p = 0.001$). The researchers concluded that joint poverty-reduction initiatives were likely to help smallholder farmers improve their farm productivity and that openness among stakeholders could greatly strengthen existing linkages. Stakeholders should use the prevailing support by stakeholders in planning and implementing joint poverty-reduction initiatives while embracing transparency and accountability to enhance the uptake of technologies and innovations.

Keywords: *Breach of contracts, farm productivity, household income, Low adoption, support of key stakeholders.*

Challenges faced by small land holder farmer regarding decision making in innovative agricultural development: An empirical analysis from Kenya. International Journal of Agricultural Extension

[a]Justus Muteti Kavoi[*], [b]John Gowland Mwangi, [c]Geoffrey Mbuthia Kamau

[a] KARI-Katumani Research Centre, Machakos, Kenya.
[b] Division of Research and Extension, Egerton University, Njoro, Kenya.
[c] Department of Outreach and Partnerships, KARI Headquarters, Nairobi, Kenya

[*] Corresponding Author:
Email: jmkavoi@yahoo.com AND j.kavoi59@gmail.com

Abstract

Declining agricultural productivity among smallholder farmers in Sub-Saharan Africa remains a major bottleneck to the continent's agricultural sector development. In Kenya's semi-arid lower Eastern region, efforts have been made through public-private partnership (PPP) initiatives to address food insecurity in particular. Inadequate understanding and poor documentation of factors related to challenges facing smallholder farmers in decision-making to improve farm productivity and food security exists. A study was carried out to determine the factors related to decision-making among smallholder farmers to increase farm productivity for improved food security. It involved 34 Key Informants (KI) and five Focus Group Discussions. Data were collected using a check-list, a semi-structured questionnaire and a self administered questionnaire and analyzed using Statistical Package for Social Sciences (SPSS). Results showed that: farmers faced challenges in deciding how to improve their farm productivity. About 76% of KI respondents observed that some of the promoted technologies did not address farmer's immediate needs; 65% argued that technologies were promoted without considering prevailing farmers' circumstances. The study concluded that farmers needed accurate information to make informed farming decisions; their immediate needs required technologies with diversified utilization options; analysis of farmers' operating circumstances was crucial. Consequently, development partners should: provide adequate information on available technologies and innovations; exploit the existing PPP meetings to promote technologies and innovations with wide utilization options; put strategies in place to analyse farmers' circumstances and promote improved technologies and innovations to increase farm productivity for improved food security.

Key Words: *Declining agricultural productivity, decision-making, farmer circumstances, food insecurity, improved technologies and innovations, limited utilization options*

161