



THESIS APPROVAL

GRADUATE SCHOOL, KASETSART UNIVERSITY

Doctor of Philosophy (Tropical Agriculture)

DEGREE

Tropical Agriculture

Interdisciplinary Graduate Program

FIELD

PROGRAM

TITLE: Collective Actions and Local Institutions in Managing Rangeland
Resources in Somali Region, Ethiopia

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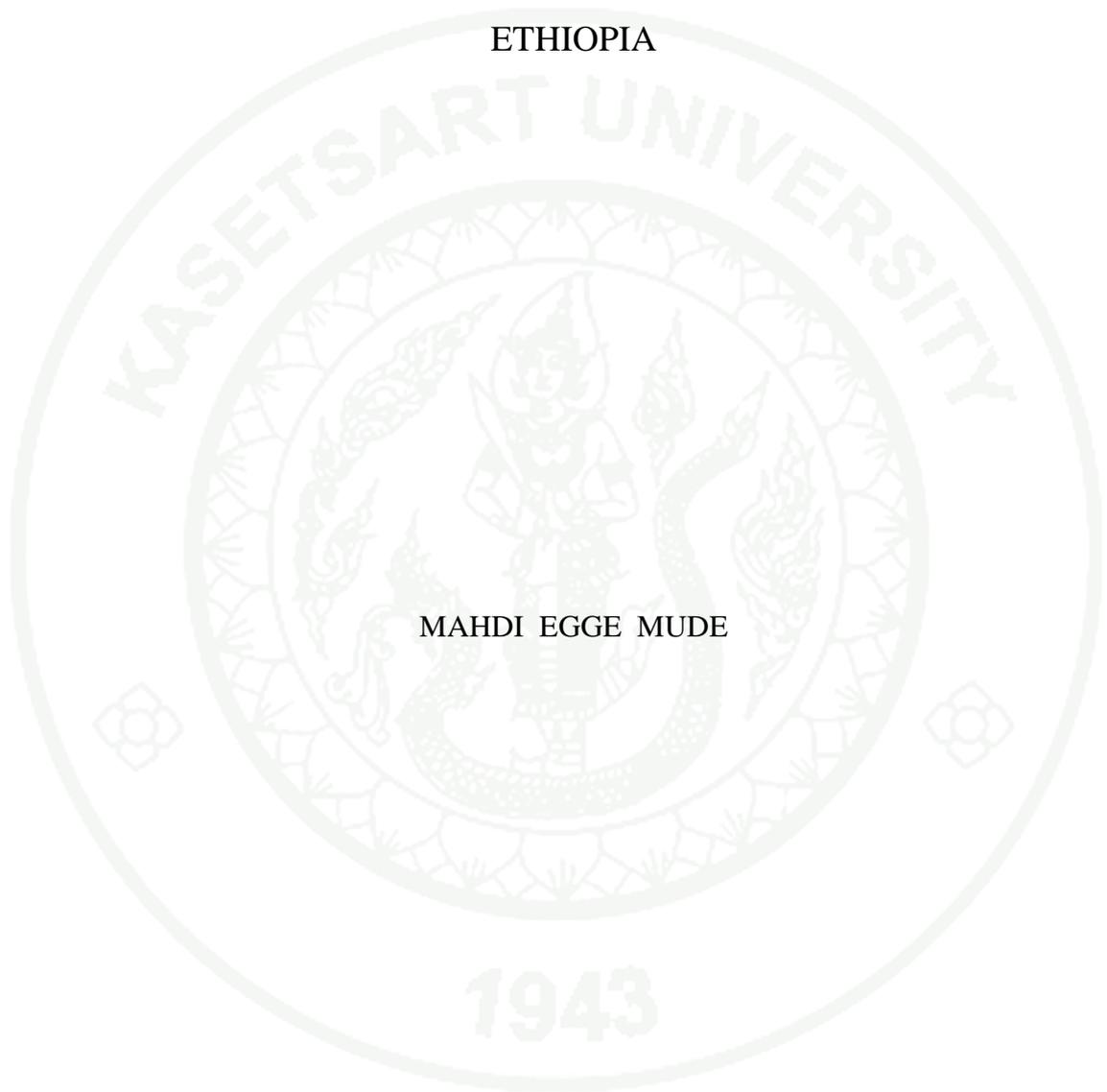
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THESIS

COLLECTIVE ACTIONS AND LOCAL INSTITUTIONS IN
MANAGING RANGELAND RESOURCES IN SOMALI REGION,
ETHIOPIA



MAHDI EGGE MUDE

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Doctor of Philosophy (Tropical Agriculture)
Graduate School, Kasetsart University

2011

Mahdi Egge Mude 2011: Collective Actions and Local Institutions in Managing Rangeland Resources in Somali Region, Ethiopia. Doctor of Philosophy (Tropical Agriculture), Major Field: Tropical Agriculture, Interdisciplinary Graduate Program. Thesis Advisor: Associate Professor Pichai Tongdeelert, Ph.D. 198 pages.

The main objectives of this research were to describe the characteristics of pasture resources and pasture resources users; institutions that regulate access to and control over the rangeland resources and the interaction between organizations; the types collective actions; and analysis of factors affecting adoption of improved sorghum varieties. The research methodology employed was both qualitative and quantitative techniques. Data were collected using focus group discussion and survey for qualitative and quantitative techniques respectively. Data were analyzed through narrative and ethnographic analysis for qualitative data; and through use of descriptive statistics (percentages, mean and standard deviation), X^2 , T -test and logistic regression model for quantitative data analysis.

The findings reveal that pasture resources, in the study area, have clearly defined boundaries, which primary users use to identify their territory from others. Moreover, the attributes that pasture resource exhibited are high mobility and storage, which enable the resource users to reasonably ensure their livelihood. Pasture resource users were entirely dependent on rangeland resources, had system of assessing the condition of their rangeland resources, trust each other, developed reciprocity arrangements, have autonomous to devise their own institutions and have past experiences of self-organization. There are many ways in which agro-pastoralists have adapted to the uncertainty of their environments, but a key feature is their strong social organization and customary institutions. The use of rangeland resources is regulated and conflicts are resolved by well-established rules and norms (*xeer*).

Government and non-government organizations were found to have been important in managing and conserving rangelands at the local level. However, they operate in very separate world and isolated from the wider experiences of others, and fail to see themselves as part of a broader agricultural technology system. The research conducted also was identified four kinds of collective actions, such as collective herding, labor sharing group, *mag*-paying group, and constructing ponds and water wells, with distinct rules of managing the collective activities. Furthermore, age of household head, farm size, distance to input market and type of house owned were found to have a significant influence on the adoption of improved sorghum varieties.

Student's signature

Thesis Advisor's signature

ACKNOWLEDGEMENTS

I wish to make special mention of individuals and institutions that facilitated my study and research both in Ethiopia and Thailand. All deserve my words of appreciation and thankfulness. First of all, I would like to specially express my sincere appreciation to my Advisory Committee Associate Professor Dr. Pichai Tongdeelert, as a Chairman, for his limitless encouragement, support and guidance throughout my entire study period. I would like also to express my sincere appreciation to my Advisory Committee Associate Professor Dr. Savitree Rangsihaht, major advisor and Professor Dr. Sayan Tudsri, minor advisor, whose support and guidance was crucial to the successful completion my research work.

I am highly thankful to the Somali Region Pastoral and Agro-pastoral Research Institute for encouragement and offering me the scholarship, and the Rural Capacity Building Project of the Ministry of Agriculture and Rural Development, Ethiopia, for granting me a financial support for my entire study period. I would like also to thank the staffs of the Bureau of Livestock, Crop and Rural Development of the Somali Regional State for their interest and assistance during the data collection.

I am also grateful to a number of individuals and agro-pastoralists who spent many hours in responding to questions and explaining the real conditions of their environment that go to the focus of the research, to a stranger from whom they could not expect much in return. I must also thank my parents and friends; Mr. Muhumed Omer Kulmiye, Mr. Ahmed Osman Dolal, Mr. Ahmed Sheik Mohammed, Mr. Mohammed Meygag Bare and Mr. Omer Abdi Meydane for their support and encouragement throughout my study period.

Mahdi Egge Mude

April 2011

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ABBREVIATIONS

CAHWs	=	community-based animal health workers
CPRs	=	Common-pool resources
CPRRs	=	Common-pool rangeland resources
CSA	=	Central Statistical Agency
EPA	=	Environmental Protection Authority
FAO	=	Food and Agriculture Organization of the United Nations
FDRE	=	Federal Democratic Republic of Ethiopia
GO	=	Government organization
IMVs	=	Improved maize varieties
IPS	=	Industrial Projects Service
ISVs	=	Improved sorghum varieties
JZOA	=	Jijiga Zonal Office of Agriculture
LCRDB	=	Livestock, Crop and Rural Development Bureau
LWF	=	Lutheran World Federation
MERET	=	Managing Environmental Resources to Enable Transitions
MoARD	=	Ministry of Agriculture and Rural Development
MoFED	=	Ministry of Finance and Economic Development
NGO	=	Non-government Organization
PFE	=	Pastoral Forum Ethiopia
SCF-UK	=	Save the Children Fund of the United Kingdom
SoRPARI	=	Somali Regional Pastoral and Agro-pastoral Research institute
UNFPA	=	United Nations Population Fund
WFP	=	World Food Program of the United Nations
WOA	=	<i>Wereda</i> Office of Agriculture

CHAPTER I

INTRODUCTION

Ethiopia, a country where this study has been conducted, is located in the horn of Africa. It stretches between three and 18 degrees north latitude and, 33 and 48 degrees east longitude and has a total area of 1,127,127 square km (MoFED, 2002). Ethiopia is the second most populous country in Sub-Saharan Africa with a population count of 73.9 million, and an annual population growth rate of 2.6% (CSA, 2008). About 88% of the population lives in the highlands (altitude above 2,000 meters above sea level) that constitute 44% of the land mass. The highlands are settled hoe and ox plough agriculture dominated. The rest of the population lives on mid highlands (area located between altitude ranges of 1,500–2,000 meters above sea level) and lowland (area located at altitudes below 1,500 meters above sea level). The mid highlands are transitory between the highlands and the lowlands, whereas the lowlands are predominantly inhabited by agro-pastorals and pastorals (EPA, 1997).

Pastoralists in Ethiopia are mainly found in four lowland regions, Afar, Oromiya, Somali and the Southern Nations, Nationalities and People's regional states. Pastoral groups are also found in Gambella and Benishangul areas. They constitute a minority in Ethiopia, with an estimated 12–15 million of Ethiopia's population (PFE, 2006). The main pastoral communities are the Somali (53%), Afar (29%) and Borana (10%) living in the Southeast, North-eastern and Southern parts of Ethiopia, respectively and the balance (8%) are found in Southern, Gambella and Benshangul regions (Sandford and Habtu, 2000). The main livelihood systems include pastoralism, farming and ex-pastoralism – those who have dropped out of pastoralism and now survive on petty income-earning activities (Behnke *et al.*, 2007).

The pastoral population occupies a disproportionately large area of Ethiopia and produces much more than its share of national livestock output. The Ministry of Agriculture estimates that pastoralists use 60% of the country's total land area (MoARD, 2005), and own 73% of its goats, 25% of its sheep, 20% of its cattle and all

of its camels. Livestock in pastoral regions accounts for an estimated 40% of the country's total livestock population (Aklilu, 2002). Livestock and livestock products provide about 10% of Ethiopia's foreign exchange earnings, with hides and skins constituting about 90% of this (Sandford and Habtu, 2000).

Somali Regional State, a region where this study was conducted, is the largest of Ethiopia's pastoral regions. It lies between four degree to 11 degree north latitude and 48 degree east longitude. The area of the region is estimated to be 340,000 square km. It is bounded by Kenya and Somalia to the south, the Republic of Djibouti and the Afar region to the north, Somalia to the east and southeast, and Oromiya region to the west. The Somali region is divided into nine administrative zones and 52 *weredas* – literally means districts (Ayele, 2005). According to CSA (2007) census, the population of the region is 4,439,147 of which 86% live in rural areas. The region is almost entirely inhabited by people of Somali ethnicity who speak a common language, Somali, and share a rich cultural heritage with Somalis living in Djibouti, Kenya and Somalia. Many of the clan territories stretch across the international boundary and the same groups live on both sides of the border, which has facilitated reciprocity, trade and services in the region (Ayele, 2004). The region is almost entirely Muslim (CHFI, 2006). About 92% of the population of the Somali region is estimated to be illiterate. The region has poorly developed socio-economic services and infrastructure such as schools, health facilities, transport and communication, water supply and marketing services. As a whole the region has been neglected and lags behind in social and economic development (Getachew, 2000a; Hagmann, 2005).

The Somali region falls under the arid and semi-arid agro-ecological and climatic zone. Its altitude ranges from 400 meters above sea level in the southeast to about 1,000 meters above sea level in the north. In some hilly areas the maximum elevation goes up to 1,600 meters above sea level (Hagmann, 2005). Most are pastoralists, though there are some agro-pastoralists and pure farmers, and about 14% are urbanized (FDRE, 1998). The rainfall pattern across most of Somali region corresponds to the division of the year into four seasons: main rainy season (*gu*), short

dry season (*hagaa*), short rainy season (*deyr*) and long dry season (*jilaal*) (Hagmann, 2005). The rainfall in the region has been low, erratic and unreliable. The northern part encompassing Jijiga and its surroundings get the first rainy season (*gu*) from April to June and the rest in the second rainy season (*deyr*) from October to December. The temperature ranges from 20 to 45°C and the average annual rainfall is 300 – 1,000 mm. Evaporation is twenty more times in excess of rainfall in some places in the region. The region receives insufficient amount of rainfall and frequently faces droughts that cause shortage of food and water for humans and livestock (Devereux, 2006; CHFI, 2006).

Livestock is the backbone of the economy in the region and about 85% of the Somali population depends on livestock products for their livelihood. Crop production is also practiced in the region and important farming zones include Gode, Jijiga, Liben and Afder (Ayele, 2004). The major livestock species they raise include cattle, sheep, goats and camels. In areas of lower altitude and lower moisture content camel, sheep and goats are the dominant livestock species while in the relatively higher altitudes cattle raising is the most dominant livestock farming.

Rangelands comprise the low rainfall and variable climate of arid and semi-arid areas. Approximately, 56.8% of the regional rangeland is classified as grasslands, 22.2% as shrub land and 19% as bush land. All provide pasture resources for the livestock in the region (IPS, 2001). The distribution of grazing land and the ratio of grazing to browse resources vary from place to place due to environmental variability across locations (Sandford and Habtu, 2000).

In pastoral area, the grazing communal lands are decreasing from time to time. These changes are due to population pressure and degradation of the rangeland, increasing pattern in droughts that have reduced reliance on livestock as means of subsistence, competition from neighboring sedentary agrarians encroaching upon the grazing commons and land tenure policies favoring sedentary life marginalizing traditional livestock production system. As a result, many herders are experiencing

diversification into different economic activities that directly or indirectly affects common-pool resources (CPRs) and their management (Belay *et al.*, 2005). In addition to ecological change, pastoralists also face administrative threats as their production strategies hardly fit into states interest to tax, educate, provide service and control them. The political interest to govern them within a rigid administrative structure has resulted in designing development programs undermining indigenous resource use systems (Markakis, 1994).

Most of the common rangeland resources are used and managed by the immediate users, the pastoralists, where state interference is lower. Pastoralists establish customary institutions which include kin networks, local cultural administrative structures, customary land tenure rules, as well as conventions about marriage, inheritance or trade and customary procedures to resolve conflicts over resources. Customary rules arrangements allow pastoralists to make a good use of rangeland resources, overcoming resource degradation and maintaining common property resilience. Information exchange among resource users in the resource use system characterized by large spatial extent is common among pastoralists where environmental uncertainty is very high. Exchange of information on the flow and stock of resources is commonly used for developing rules and regulations in the use and management of rangeland resources (Scoones, 1995).

Statement of the Problem

The management of natural resources has been and will continue to be of crucial importance for pastoralists and agro-pastoralists life based on the simple fact that they are dependent on these resources for their survival and well-being. That is, the livelihood obtained from individually owned resources (privately operated cultivated land) and communal resources (rangelands – grassland, forest and communal water points, etc.) includes a wide range of social and economic benefits for a wide variety of users in Somali region. Similarly, in Awbere *Wereda*, the study area, communal grazing and browsing lands (pasture), communal water resources

(ponds and cisterns) and individually cultivated lands are known of providing various benefits to the agro-pastoralists.

However, the sustenance of diverse uses of resources for diverse users depends on the effective management of the resources. Various authors of common property resource noted the problem of natural resource degradation. Overgrazing, over-cultivation and deforestation could be invariably identified as predominant human activities contributing to the resource degradation. Moreover, Ethiopia has never privileged to have comprehensive and properly worked out environmental and natural resources management policies, legislations and strategies. In situation where it had policy and legislative provisions, they were poorly developed, top-down in their formulation and implementation, and were fragmented among various government institutions. As a result, they not only failed to prevent natural resources from degradation but also faced a great deal of resistance from local communities when implemented since they were based on primarily on the exclusionary principles (Melesse, 2001). Therefore, poor definition and enforcement of the institutional arrangements governing the use of CPRs has led to social conflict and resource degradation (Williams, 1998).

The multiple functions the resource system provides to the users who have complex and wide range of interest and institutional problems involved in improving their management made the management of CPRs more challenging. The many variables of the resource system, the communities involved and the rules-in-use combine to affect the structure of the resource use situations, the pattern of interactions among the resource users from the resource system, and the outcome achieved (Ostrom, 2005). In a given action situation, what actions are physically possible, what outcomes corresponding to the actions can be produced and how actions are linked to outcomes are all affected by the resource system and resource users attributes (Kiser and Ostrom, 1982). No two CPRs settings are likely to be the same. Similarly, the number and type of attributes conducive to self-organization present in a resource system can also differ from setting to setting (Ostrom, 1999).

Moreover, types of institutional arrangements for effective use and management of the resource (common-pool resources and individually allotted resources) require understanding the attributes of the resource users who have different objective, production strategies and priorities in resource use. Thus, it would be unrealistic to suggest specific institutional arrangement (i.e. autonomous local management or co-management between state and local communities) as the arrangement depends on particular circumstances. Therefore, understanding the nature of the resource system and resource users and their attributes is crucial in the design and implementation of institutions that influence rangeland management (conservation and use).

Agro-pastoralists do not rely only on a single resource but also on multiple resources as a base of their livelihoods. When a resource is not individually or state-owned, it requires a collective of people that organize and protect the resource in order to avert open-access situation (Ghate *et al.*, 2008). Moreover, when users are highly dependent on the resource system, they would most likely to place greater value on the long term sustainability of resources and, therefore, invest in collective actions geared towards developing institutions that ensure sustained management of the resources (Varughese and Ostrom, 2001). Hence, the inherent potential of resource users to manage resources is often justified on the bases of their ability to develop institutions (adapt rules and regulations) and enforce them. Resource users often create institutional arrangements and management regimes that help them allocate benefit equitably, over long time periods, and with only limited efficiency losses (Rajan, 2006).

Designing the types of institutional arrangements for effective use and management of the resource, hence, depend on the prior understanding of the local institutions existing. In situation where resource users design rules for managing resources, external agencies also involved in assisting the resource users. Such external agencies are many and their efforts depend on the extent they work in a coordinated manner. However, the nature of coordination and linkages that existed in Ethiopia among the various organizations has been very weak often leading to

redundancy, duplication of effort and institutional conflict. This has negatively influenced the implementation of natural resources management strategies (Melesse, 2001). Moreover, researchers have also extensively documented the role of institutional networks in Ethiopia, but there is little understanding of the inter-linkages among them and more formal government activities. Therefore, it is important to analyze the rules-in-use in rangeland management by agro-pastoralists and identify the organizations involved in rangeland management and their mechanisms of interactions in the development efforts.

Effective management of natural resource requires collective action among resource users. Local institutions for resource management and collective action are not only fundamental for agriculture but they function in a diversity of ways including organizing labor resources for production, collective herding, mobilizing of material resources (savings, credit) to help produce more, assisting newly formed groups to access productive resources, securing sustainability in natural resource use, providing social infrastructure (water, clinics, roads, schools) for communities at the village level, influencing policy institutions that affect them, improving access to information for rural populations, improving flow of information between them and government and NGOs, advocating for community rights, and mediating access to resources for disadvantaged or excluded groups of people (Scoones and Thompson, 1994). With respect to innovation, collective action can be used to facilitate dissemination and adoption of technologies. People can try out and test new technologies using common resources and in the process they create the opportunity to learn more effectively from one another. Collective action also helps to overcome seed supply and provision related problems arising out of government and private sector inefficiencies. However, the types and importance of collective action in the management of CPRs and the use of new technology options are something about which little are known (Knox *et al.*, 1998).

Many rangelands in the driest areas of Africa are not suitable for crop cultivation and thus are appropriately referred to as permanent pastures (Niamir-

Fuller, 2005). But large areas of Africa's rangelands are located in somewhat more humid areas and thus can be cultivated (Swallow *et al.*, 1997) and agriculture is becoming an increasingly common subsistence strategy among many East African pastoralists (Smith, 2005). Furthermore, sedentary activities create incentives for groups or individuals to own, or at least seek rights to specific plots of land that they can harvest and from which they can derive economic benefits (CHFI, 2006). Now a day's rangelands do not exist in isolation from non-rangeland systems that means cultivation is one of the components of rangeland systems in humid areas. In cultivated areas, sorghum is mainly used as staple food by pastoralists and agro-pastoralists of the Somali region. To increase productivity of sorghum, the regional Bureau of Agriculture is introduced many improved sorghum varieties (ISVs) and yet their level of adoption is not known. Hence, it is necessary to study the magnitude of adoption of ISV within the rangeland resource system.

In general, this study was looked into examining and properly describing the practical situation of the attributes of pasture resources and pasture resource users; identifying the institutional arrangement governing rangeland management and analyzing the institutions exist and their interactions; identifying the types of collective actions in rangeland management; and analyzing factors affecting the adoption of improved sorghum varieties in the rangeland resource system of the study area.

Objectives of the Study

The objectives of this research are:

1. To describe the characteristics of pasture resource system and the characteristics of pasture resource users (agro-pastoralists).
2. To analyze local level institutions (institutional arrangements or rules-in-use) that influence the management of pasture resources.

3. To analyze local level institutions (relevant organizations, their practices and interactions between them) that influence the management of pasture resources.

4. To explore collective actions in rangeland management, and management of collective activities.

5. To identify factors affecting adoption of improved sorghum varieties by farmers within rangeland resource system.

Significance of the Study

In the past, The Government of Ethiopia gave emphasis to crop production. The policy and development strategies favored the highland agrarians. The importance given to lowland livestock production and rangeland development was lower. Due to this, the lowland population in Ethiopia is marginalized in term of development interventions.

These days, Ethiopia is looking for a new and deeper understanding of its pastoralist/agro-pastoralist regions and an accurate appreciation of their environmental and socio-economic trajectories. The emphases given to this sector initiated the inclusion of pastoral policy issues in the Rural Development Policy and A Plan for Accelerated and Sustained Development to End Poverty (PASDEP). The Somali Regional State is also developing a regional pastoral/agro-pastoral extension packages.

To develop strategies and development intervention plans, there is little information available to use as a baseline data. Studies conducted in the area of willingness and ability of people to work together in rangeland management, property rights of using rangeland resources and institutions regulating rangeland management are very scanty. An understanding of the causes of success or failure for these collective actions and local level institutions governing the management of rangeland

can provide valuable lessons for strengthening public and private efforts to alleviate poverty, promote rural sustainable development, and improve the management of rangelands. Therefore, this study was tried to generate information on characteristics of pasture resources and pasture resources users; the role of institutions in conserving and using available rangeland resources; collective action activities in rangeland management; and adoption of improved sorghum varieties within the rangeland resources system. The results of this study might create a clear understanding of the study area and serve as an input to design policy and plan intervention strategies of rangeland research and development for areas having similar socio-economic, cultural and agro-ecology conditions.

Scope and Limitations of the study

This study was focused on rangelands of Awbere *Wereda* in Somali Regional State, Ethiopia. Both qualitative and quantitative research techniques are employed. This *wereda* was selected because it contains both pastoral and agro-pastoral systems, and the fund provided to this research focused in this area. The study was used both focus group discussions and household survey. The study was mainly explored the interaction between rangeland resource users and their collective actions; and local institutions that control over the resources. It was focused also on the potential of agro-pastoral institutions in shaping individual's and collective actions, expectations and their actions in use of the commons and individually owned resources. The study was undertaken in ten *kebeles* (The lowest administrative unit at village level) for collection of qualitative data, and in eight *kebeles* for conduct of formal survey with the sample size of 180 agro-pastoralists. Time and budget were the major limiting factors to this study, particularly during data collection.

Definition of Terms

Rangelands are a type of land on which the natural vegetation is dominated by grasses, forbs and shrubs suitable for grazing and browsing by animals and the land is managed as a natural ecosystem.

Rangeland management is the manipulation of rangeland components to optimize returns or products from rangeland to meet societal needs as well as conserving the resources.

Resource system is stock variables that are capable, under favorable conditions, of producing a maximum quantity of a flow variable (pasture and water).

Resource units are what individuals use from a resource system, such as the cubic meters of water withdrawn from a ground water basins, and the tons of food consumed by animals from a grazing area, etc.

Common-pool resources are natural or man-made resources from which it is difficult to exclude or limit users once the resource is provided by nature or produced by humans. A resource is owned by some defined group of people, like a community. The group of individuals has the right to exclude non-members and use resources inline with the norms and rules set by the group.

A **Pastoral** production system is a system concerned with the raising of livestock: the care, tending and use of animals such as camels, goats, sheep, and cattle. It has a mobile aspect that is moving the herds in search of fresh pasture and water in arid and semi-arid areas.

An **agro-pastoral** production system is concerned with the raising of livestock: the care, tending and use of animals such as camels, goats, sheep, and cattle; and also engaged in crop production. It has settled and mobile aspects that are

partly leaving some animals in the settlement and moving the rest of the herds in search of fresh pasture and water in arid and semi-arid areas only on seasonal bases.

Participants/Actors are individuals, such as citizens of a state or of a community, or they may be collective entities, such as organizations acting as a coherent agent, e.g. a specific government department, a private company, the state, or an NGO.

Collective action is voluntary action taken by a group to achieve common interests. Members can act directly on their own (internally initiated) or through an organization (externally initiated).

Institution is the rules that govern a specific activity of a group or organization, as well as the behavior of people in that activity.

Formal institutions are institutions backed by the law (legally recognized or written), implying enforcement of rules by the state.

Informal institutions are institutions that upheld by mutual agreement (which is not written), and rules are thus enforced traditionally.

Governance is the formal and informal institutions through which authority and power are conceived and exercised. It is the way power is used to make and implement collective decisions, enforce rules and resolve conflicts.

Institutional analysis is the examination of a set of rules, or institutional arrangements, typically with the goal of identifying rule-based incentives that encourage various actors to behave in ways that create cooperation in resource management or encourage actors to degrade common resources.

Institutional arrangements are combinations of rules (whether operational, collective decision-making or constitutional rules) that establish a set of legal permissions (liberties), authorizations (rights) and commands specifying certain acts or behavior that individuals must or must not carry out (duties).

Technology is the application of knowledge for practical purposes, which is used to improve the human condition, the natural environment, or to carry out other socio-economic activities.

Adoption is a decision to make full use of an innovation as the best course of action available or extended use of the innovation in terms of time and extent.

CHAPTER II

LITERATURE REVIEW

The chapter reviews the various empirical literatures available on the concepts and theories of collective actions and role of institutions in common-pool resources management. The literatures on the subject are very large and it has been delimited to review some important literatures to capture the core issues. It starts with the concepts of rangeland and rangeland management, and pastoralists' mode of living; and systematically moves to the concepts of common-pool resources with comprehensive review of the characteristics of resources and the resource users, and their collective action activities and the deriving forces shaping cooperative behavior in collective action for managing common resources. The influence of local institutions in the management of common resources with the conceptual link to property rights are also reviewed in depth. The review proceeds further with the factors affecting the adoption of technologies. The last part of this chapter describes the conceptual framework and research hypothesis employed by this research.

Rangeland and Its Multiple Functions

Rangeland is a type of land, mostly unfenced, on which the natural vegetation is dominated by grasses, forbs and shrubs efficient at water and nutrient utilization and suitable for grazing and browsing by animals, and the land is managed as a natural ecosystem. The vegetation is always dominated by natural plant communities rather than by sown pasture. Rangelands are typically characterized by low precipitation, shallow soils and slow nutrient cycling. So practices that are appropriate to temperate pastures, such as fertilization and plowing, are often inappropriate on rangelands (Singh, 1988; Grice and Hodgkinson, 2002; Walker and Janssen, 2002; Niamir-Fuller, 2005; Rinehart, 2006). Stoddart *et al.* (1975 cited in Busby 1986; Mengistu, 2006) also defined rangeland as those areas of the world which are unsuited to cultivation and which are a source of forage for domestic animals as well as

sources of wood products, water and wildlife. Moreover, rangeland is defined as uncultivated land that will provide the necessities of life for grazing and browsing animals. However, it is erroneous to define all rangelands as being unsuitable for cultivation but most rangelands in the world will not sustain cultivation because of low precipitation, thin soils and rugged topography (Holechek *et al.*, 2001).

Water is the primary limiting factor to plant production on most rangelands of the world. All water used on rangelands is derived from precipitation. A portion of the precipitation is retained on the site by the process of infiltration and becomes available for plant growth. Another portion moves laterally off the sites to streams, ponds, lakes, and reservoirs. The major portion of precipitation received on rangelands evaporates and returns to the atmosphere as water vapor (Holechek *et al.*, 2001). Pastoralists' adaptation to a marginal and unpredictable environment has made living in the rangelands possible. Failed rains and poor rainfall affect pastoralism through shortfall of fodder and water (Fassil *et al.*, 2001).

Rangelands are home to significant concentrations of large mammals and plants with a high value, and to human populations as well (Blench and Sommer, 1999). Rangeland resources provide food, fodder, herbs, fuel, construction materials, income to rural and urban dwellers across the region (Williams, 1998; Oumer, 2007), medicinal plants, recreational activities (Heady and Child, 1994; Grice and Hodgkinson, 2002) and hunting (Weddell, 2002). Also natural resource systems have other valuable environmental or social functions, such as preserving biodiversity or providing security and mitigating risk (Swallow *et al.*, 1997). In this dry zone where annual rainfall is low and its distribution erratic, the products obtained from rangeland resources have been critical elements in the livelihood and survival of many rural communities, particularly in times of drought. The collection of leaves, fruits and twigs from forests has long been a method of assuring household subsistence during droughts and in resolving imbalances in the diets of rural households (Soerjani, 1993; Williams, 1998). Similarly, the edible leaves of trees that remain green all year round are often eaten to relieve hunger. The sale of products – stimulant leaves, fruits,

fodder, and firewood – collected from rangeland resources provide an important contribution to household income (Williams, 1998).

Rangeland management is the art and science of planning and directing the use of rangelands to obtain optimum and sustained returns based on the objective of land ownership and on the needs and desires of society (Vallentine, 1989). Rangeland management is also defined as the manipulation of rangeland components to optimize returns or products from rangeland to meet societal needs as well as conserving the resources (Stoddart *et al.*, 1975 cited in Busby, 1986; Heady and Child, 1994; Holechek *et al.*, 2001).

Rangeland management has two components, such as 1) protecting and enhancement of the soil complex, and 2) maintaining or improving the output of consumable products. Rangeland management is based on five basic concepts: 1) rangeland is a renewable resource; 2) energy from sun can be captured by green plants which can be harvested by the grazing and browsing animals. Ruminant animals best adapted to use rangeland plants; 3) rangelands supply humans with food and fiber at very low cost compared to those associated with cultivated lands; 4) rangeland productivity is determined by soil, topographic, and climatic characteristics; and 5) a variety of products, including food, fiber, water, recreation, wildlife, minerals and timber are harvested from rangelands (Holechek *et al.*, 2001). Resource management, therefore, examines strategies and technologies for resource development in order to sustain livelihood economies without causing unnecessary environmental impairment (Omara-Ojungu, 1992) since rangeland systems vary with regard to their geographic range, density of specific plant and animal populations, patterns of species diversity, nutrient cycling, and landscape dynamics. In addition to the diversity of rangeland systems, the “social” side varies with regard to the size and socioeconomic attributes of users, the history of their use, the location of their residences, the types of leadership, the cultural norms they share, the level of human and social capital they have, their knowledge about the ecological system, their dependence on the system for diverse purposes, and the technologies available to them (Ostrom, 2007).

Traditional resource managers, such as pastoralists and agro-pastoralists, have extensive understanding of local systems and an interest in applied learning that might lead to increased livelihood security and beliefs (McDougall and Braun, 2003). As it is discussed above, rangeland resource management at the local level involves interventions in the resource base. But there are other factors to consider. These include the embedded rights which different people and groups have to use or manipulate the resource base, the social relations between them which condition the scope of actions which are possible, and recognition of who holds power and how it can be exercised (Tyler, 2006b).

Although lowland areas are often perceived as arid regions with no potential for agriculture, this perception is almost always inaccurate. In many pastoralist areas, livestock rearing coexist with farming, and are often cultivating crops is practiced (Devereux, 2006). The flood plains traditionally used by crop farmers during the flood season. These clearly demonstrate the ability of a set of users to appropriately time their use of rangeland resources to a period when others are not exploiting it. Furthermore, a given resource may produce flows that are subject to two different property regimes seasonally or over the long term. For example, in areas of low population pressure, fields that are cultivated by individual households often revert to communal use after grain harvest or when they are left in fallow so that crop residues and natural vegetation on these fields can be freely grazed by the entire village herd (Williams, 1998). This means that pastoralism is the most efficient way of using resources in dry land and marginal areas (Kandagor, 2005); and at the same time the livelihoods of pastoralists depend greatly on plants, water, animals and other natural resources (including cropping land) found in the rangelands (Dong *et al.*, 2009).

As a strategy to manage rangeland resources, pastoralists widely practice herd splitting, the practice of dividing the livestock into separate herds depending on their age, sex, type and productivity. This results in taking each type of animal to the range that suits it best, little competition among livestock for the same vegetation and in dispersion of the stocking pressure (Mengistu, 2006). Pastoralists frequently separate

small and large ruminants; herd camels together with sheep, and cattle with goats; and separate livestock into a 'milk' herd (mostly pregnant and milking animals and their young). Herd diversity and splitting are techniques that allow pastoral communities to cope with the variable and widely-dispersed presence of natural resources and can be used to maintain the long term productivity of the range, to ensure sustainable production at a comparatively low cost, and in some cases to improve degraded rangelands (Niamir-Fuller, 2005). Pastoralists also have patterns of labor allocation for herding. Men and/or boys are responsible for herding cattle or camels while women and young girls are responsible for herding sheep and goats and milking all animals (Niamir-Fuller, 2005; Mengistu, 2006). In a few cases, women are responsible for both small ruminants and cattle, but not camels or may travel with the men and help them in herding and watering the camels (Niamir-Fuller, 2005).

Pastoralists and Their Living Strategies

Pastoralists typically occupy large tracts of communally shared rangeland and utilize kinship ties for mutual herding and defense. Pastoralists are people who are highly dependent on livestock for their basic food, income and social needs (FAO, 2001; Fratkin and Mearns, 2003). Pastoral production systems have normally developed in arid lands, where there is climatic uncertainty/unreliability (Ayele, 2005; Pantuliano and Wekesa, 2008) and the nature of soils affects spatial as well as temporal variations in the availability of crucial natural resources, notably pasture and water. Livestock represents the main asset while a mobility pattern is the key strategy to cope with these conditions. The major livestock species they raise include cattle, sheep, goats and camels. In areas of lower altitude and lower moisture content camel, sheep and goats are the dominant livestock species while in the relatively higher altitudes cattle raising is the most dominant livestock farming (Ayele, 2005).

Amongst pastoralists, the ownership of livestock is the main determinant of wealth as well as the main determinant of food security. Livestock are not only a saleable asset but provide income and food in the form of milk, ghee and hides and

skins. Pastoralists reduce their risks by combining the animal species in their herds and flocks; female stock make up the larger half of the herd in order to enhance production and reproduction options. Choosing which animal to herd depends mainly on ecological factors, combined with social values and market factors. Camels are particularly important in Somali society. They are perceived as life-saving assets as they resist harsh ecological extremes, due to their ability to survive in dry conditions and produce milk throughout the year. They also embody prestige and key social roles, such as compensation for dowry (*yarad*) and blood payment (*mag*) (FAO, 2001).

Pastoral groups tend to be classified according to their degree of mobility: nomadic (opportunistic and variable migration patterns); transhumant (set migratory routes on seasonal basis); and agro-pastoralists (almost sedentarized and also attached to crop production) (FAO, 2001; Kebebew *et al.*, 2001; Markakis, 2004).

Mobility and Sedentarization

In arid and semi-arid lands of Africa, livestock mobility was traditionally practiced by the pastoralists as the key strategy to make use of the scattered rangeland resources on a large spatial scale (Sandford, 1983; Smith, 1992; Agrawal, 1998; Niamir-Fuller, 2000; Goodhue *et al.*, 2005). Mobility enables opportunistic use of resources and helps minimize the effects of droughts and appear to be economically more efficient than sedentary systems (Scoones, 1995). Its benefits include lower-cost fodder at minimal labor cost and increased resistance of animals to diseases (Niamir-Fuller, 2000).

Most Somali pastoralists tend to be transhumant through traditionally established indicative routes and can be found close to their origin areas during the main rainy season (*Gu*), the time pasture is available and the milk production is higher. During the main dry season (*Jilaal*), when water and quality pasture become the constraining factors, household efforts are aimed at subsisting through household

and herd splitting, and migration to where pasture and water are available. Migration decision-making is normally based on an integrated multiple-choice system, where major determinants are rainfall, range resource access, animal disease, marketing options and political insecurity (FAO, 2001). Although the quantity and quality of water and forage, and the occurrence of disease are of paramount concern to pastoralists, other factors also determine movement patterns. These factors include the location of salt licks, soil conditions, other environmental factors (such as dew, excessive heat, lack of shade, and presence of wildlife), household labor availability, and social relations with neighbors (especially alliances and enmities). All of these factors introduce a high degree of flexibility into pastoral movements. Herders from the same social unit are usually free to use any part of their territory, but in practice confine themselves to the range they know best, and prefer to stay with the same group of people, especially relatives. This usually ensures a continuity and consistency in range use by the same managers (Smith, 1992; Niamir-Fuller, 2000).

Other benefits are ecological: continuous sedentary grazing in the wet season may result in lower pasture palatability and productivity, higher soil compaction and lower water infiltration, ultimately leading to pasture degradation (Niamir-Fuller, 2000). It also reduces the grazing pressure around the wells (Homann *et al.*, 2004). Under-grazing of remote pastures or under-grazing in protected areas can lead to invasion of unpalatable plants, lower vegetation cover, and lower diversity of plants, and can sometimes be a more serious problem than overgrazing. Mobility can contribute to pasture sustainability and improvement, since mobile (or transhumant) pastoralists can modify herds and access alternative areas while waiting for degraded pastures to regenerate. The mobile system involves common-property regimes that share the risk and spread the burden in arid lands (Niamir-Fuller, 2000).

Many Sub-Saharan Africa land management systems provide herders with flexibility to respond to adverse rainfall shocks. Clans maintain access to different pastures through their own actions and through alliances with other clans. Such alliances function as a mutual insurance mechanism; it is often observed that clans

adjust their use of forage on the basis of relative rainfall shocks to their grazing areas and those of affiliated clans (Goodhue *et al.*, 2005).

High rates of sedentarization and declining mobility have been driven by a combination of factors, including major droughts resulting loss of livestock, increased individualization due to farming, the growing economic vulnerability of transhumant groups, increased competition and conflicts over land, and increased land ownership by investors outside the pastoral sector (Niamir-Fuller, 2000), and increased number of water points (Sugule and Walker, 1998).

From income diversification view, several pastoralists have started tilling land, due to the opportunities crop production provides to the households in terms of employment, income generation, and food supply. But, expansion of cropland by intruding into pasture areas has been considered as threat to livestock production. Apparently, it is the productive land, which is put under cultivation reducing pasture production (Niamir-Fuller, 2000).

In general, sedentarization and the practice of crop production is a reaction to climatic hazard as a coping strategy. In particular, government policies have upset the economic balance between crops and livestock by favoring crops and agricultural encroachment onto rangelands. Settlements are easier and more suitable for providing and distributing emergency famine relief, basic social and infrastructure services such as linking roads, clean water supplies, electricity, schools, clinics and extension services to the people. It is cost effective and easy to administer. It will also facilitate the participation of pastoralists in the political and economic processes of the country (Getachew, 2000b). For these reasons, governments have discouraged investments in the range and livestock sector and claimed “vacant” pastoral land for national parks and government-owned farms (Niamir-Fuller, 2000). However, this kind of government system tends to marginalize pastoralists and favor sedentarization, however, is not an option for the great majority of the pastoralists. Over-development of one aspect of the system may encourage depletion of others: thus dictates a

culturally and ecologically adapted approach to development in the pastoral areas (Kassa, 2000).

Characteristics of Common-Pool Resources and the Resource Users

Ostrom in 1990 defined common-pool resources (CPRs) as natural or man-made resources that can be kept from potential users only at great cost or with difficulty but there are subtractable in consumption and can thus degrade. CPRs are those resources which located within the village boundary where a group of people or say the concerned villagers has the users right i.e. everybody can use the resources but ownership and trade ability rights are not defined that means nobody can own or sale it. Thus, CPR is not access open to all but access limited to a specific group of users who hold their rights in common. Examples of CPRs include groundwater basins, forests, grazing lands, fisheries, and irrigation systems. Ostrom *et al.* (2002) stated that, human beings use CPRs by harvesting or extracting some of the finite flow of valuable goods produced by them or by putting in unwanted byproducts, thus treating the resource as a sink.

In general, human beings using CPRs face at least two underlying incentive problems. The first is the problem of over-exploitation, depletion or degradation because one person's use subtracts the benefits (e.g. bundles of firewood or fodder) from a CPR available to others. The second is the free rider problem that stems from the difficulty of excluding some individuals from the benefit generated by the resource. Most of the CPRs are sufficiently large and the multiple actors are able to use the resource systems simultaneously, and efforts to exclude potential beneficiaries are costly (Feeny *et al.*, 1990; Ostrom, 1990; Ostrom *et al.*, 1994; Thomson and Freudenberger, 1997; Williams, 1998; Ostrom *et al.*, 1999; Hess and Ostrom, 2001; Janssen and Ostrom, 2001; Conroy, 2002; Ostrom *et al.*, 2002; Husain and Bhattacharya, 2004), and, hence, when no property rights define who can use a CPRs and how its uses are regulated, a CPR is under open-access regime (Ostrom *et al.*, 2002).

Three sets of contextual attributes structure the action situation facing participants in a CPR system: 1) physical attributes of the resource, 2) attributes of the resource users/participants, and 3) the set of institutional arrangements in use by the participants (Kiser and Ostrom, 1982; Ostrom *et al.*, 1994; Ostrom, 2005). No two CPRs are likely to be the same. Similarly, the number and type of attributes conducive to self-organization present in a resource system can also differ from setting to setting (Ostrom, 1999).

The characteristics of CPRs fall under a broad set of physical variables. They are the set of boundary conditions within which humanly devised rules of the game must be situated. Some of the most commonly cited resource characteristics relevant to effective governance of common resources are size of the resource system, its boundaries, whether the resource is mobile and the resource units can be stored, and ease of monitoring resource conditions (Ostrom *et al.*, 1999; Agrawal, 2007).

Size refers to the physical quantity of the resource (area in case of rangelands and volume in case of water resources). It (how large or small the size of the resource system is) affects the flow or supply of the resource system, which can be described by the extent of predictability in quantity, over time and space and, therefore, the management of the resource system. The larger the size of the resource system, the more difficult it is get sufficient information about the resource system, the less predictability of the resource flow and the more difficult to effectively manage the resource and vice versa although this relationship may not always hold true (Ostrom, 1990).

The concept of boundaries refers to the degree to which the areas of the resource systems are clearly defined or are less conspicuous (Ostrom *et al.*, 1994). It affects resource users' management decisions and their resulting incentive. It also determines the rules to be designed to manage the resources since it defines the predictability of the resource flow and the acquisition of common knowledge about the resource. The management of the resource system with well defined boundaries is

relatively effective since significant parts of the resources can be controlled or easy to monitor and supervise (Ostrom, 2005).

Mobility is the ease with which resource units are utilized from a storage system e.g. the ease with which a quantity of grass can be grazed from a pasture unit. Storage in the system refers to the stock of the resource unit available in the system e.g. the number and species diversity of trees and shrubs in a pasture unit (Ostrom, 1990). Resource system with high mobility and limited storage in the system are more liable for over exploitation and, hence, degradation and public ownership of such resources often leads to their ineffective management (Kiser and Ostrom, 1982).

The other set of variables that affects the structure and functions of the resource system is participants (resource users). Participants are those that affects or are affected by their own management decisions and actions, and/or by the decisions and actions of others in the system. They are decision making entities assigned to a position and capable of selecting actions from a set of alternatives made available at points in the action process (McKean and Ostrom, 1995). The number, status and attributes of participants are, therefore, significantly important in affecting the structure and functions of the resource system and thereby the outcomes of the action arena (Ostrom, 2005). Teklu (2006) identified a variety of participants taking active part in the management (conservation and use) of coffee forests in Ethiopia; ranging from individuals in the households, traders, and different socio-economic groups, government and non-government organizations. However, coffee forest users in each category share certain common characteristics and differ in others.

Several characteristics of the participants can give clues to the degree of its social cohesion and anticipate problems that may arise. Individual attributes of participants that affect the action arena include dependence on the resources, size of users, shared understanding of the physical condition of the resource, the degree of homogeneity in preferences, shared norms and common interests, degree of trust among themselves, autonomy to device institutions, and past experience with

governance institutions (Ostrom *et al.*, 1999; Agrawal and Goyal, 2001; Agrawal, 2003; Ostrom, 2005; 2007).

Users' dependence on natural resources is one of the attributes that affects their actions, involvement in collective actions leading to the design of institutions and, therefore, the management of the resources. If users are highly dependent on the resource system, they would most likely to place greater value on the long term sustainability of resources and, therefore, make their own rules and invest in collective actions geared towards developing institutions that ensure sustained management of the resources. Participants who are dependent on a resource intend to use their resources over a long period of time and have achieved levels of trust and are more likely to self-organize (Tang, 1989; Agrawal and Goyal 2001; Varughese and Ostrom, 2001; Ostrom, 2005). In general, rural people need both secure individual rights to farm plots and secure collective right to CPR upon which the whole villages depend (Ayalneh *et al.*, 2006).

One of the conditions for successful collective action and natural resource management is that user groups must have a small size (Baland and Platteau, 1996; Rydin and Falleth, 2006). A small size may mean that the user group is small, and enables to clearly identify the beneficiaries (Rydin and Falleth, 2006). When groups are small, members tend to have frequent and highly personalized relationships and they have, therefore, a strong incentive to consider the more indirect and long-term consequences of their choices instead of paying exclusive attention to immediate costs and benefits (Baland and Platteau, 1996), and inter-linkages among group members are more likely to be high and negotiation costs are lower (Meinzen-Dick *et al.*, 1997). Moreover, the close, face-to-face nature of these relationships guarantees that people are well informed about each other's actions and preferences. Identity feelings are also likely to be strong with the result that emotions easily come into play to sustain co-operative behavior. The most important source of failure with the community approach to resource management lies in the large size and internal stratification of communities as social units. A small group is likely to be less diverse

and less subject to internal strife. It is also better able to enforce rules about equal contributions by its members through peer pressures (Baland and Platteau, 1996; 1999). It also appeared that when centralized enforcement is ineffective, it is frequently more difficult to induce cooperative behavior in large group than in small one. A key reason for this difficulty is that the cost of monitoring conditional strategies rises as group size increases (Keohane and Ostrom, 1995).

The larger groups, on the other hand, found relatively easier to create and maintain processes that would organize their members and ensure their contribution to resources protection. Larger groups are more successful in two senses. First, a group that gains in size as more villagers participate in its activities is better able to raise more resources and expend a greater monitoring and enforcement effort. Second, larger groups also find it easier to prevent residents of other villages from coming and breaking rules related to resource use. Thus, success in forming a group may come easier to smaller groups, but success in protecting resources is easier for larger groups. What one should note is that successful collective action is not just about forming groups; it is as much about being successful in achieving the objective for which the group was formed (Agrawal, 2000).

Community is assumed to be a group of similar households (in terms of assets and incomes) with common characteristics (in terms of ethnicity, religion, caste, or language). People living together within a resource system may indeed follow similar occupations, depend on the same resources, use the same language, and belong to the same ethnic or religious group. Such notion that community is homogeneous meshes well with beliefs about its spatial boundaries. Homogeneity in turn is assumed to enhance collective actions, reduce conflicting interactions and promote better resource management (Agrawal, 1997; Agrawal and Gibson, 1999).

Even if members of a group are similar in several respects, few studies wrestle with the difficulty of operationalizing social homogeneity (Bardhan and Johnson, 2000). All human groups are stratified to some extent, such as gender, age, religion,

ethnicity and cast (Thomson and Freudenberger, 1997; McDougall and Braun, 2003). There are many heterogeneous communities made up of people of varying backgrounds who are nevertheless able to overcome their differences in order to work toward common objectives (Thomson and Freudenberger, 1997). Therefore, communities that were supposed to be homogeneous may sprout conflicts over issues of resource use. And even highly differentiated communities may be able to use local resources sustainably when elites within the community impose their will on weaker factions (Agrawal, 1997).

Community as shared norms and common interests depends on the perceptions of its members. It is supposed to grow out of common location, small size, homogeneous composition, or shared characteristics. Community exists among individuals who share common interests and common identification; growing out of shared characteristics (Ascher, 1995; Bromley and Cernea, 1989). Shared common goals are what make successful resource management by communities more likely, because in a community, individuals give up some of their individuality to behave as a single entity to accomplish goals. Internalized norms of behavior within communities can guide resource management outcomes in desired directions. Shared community norms can promote conservation in that norms may specifically prohibit some actions, promote cooperative decision making concerning resource conservation (Agrawal, 1997) and reduce potential conflicts, thus making it easier to agree on strategies (Rydin and Falleth, 2006). If members of a community believe in a shared identity, they also may be willing to cooperate in decisions about more formal rules for conserving resources. If communities are also trust each other, it is more likely that they will engage in collective action and the sustainable management natural resources (Agrawal, 1997; 2001). If cooperation over the use of CPRs is to be achieved, the resource users have to trust one another to enforce the agreement (Ghate *et al.*, 2008). Resource users who trust one another to keep agreement and use reciprocity in their relationships face lower expected costs for collective action (monitoring and sanctioning) over time (Ostrom, 1999).

Communities' shared understanding of the physical condition of the resource is one of the attribute that determine their action and thereby influence the action arena. It drives from direct personal experiences, massive immigrants flowing into the locality and from the indirect external influences such as policies and strategies (Agrawal and Gibson, 2001). If communities perceive the existing physical condition of resource system to be scarce, it is highly likely that they will organize themselves and invest in the development of institutions that govern the utilization of the resources (Ostrom, 1990). But if otherwise, they will be more likely to push aside the need for conservation and, therefore, tend to invest less in collective action aimed at designing institutions that enhance their management (Poteete and Ostrom, 2004).

Communities' autonomy to device their own institutions significantly affects the management of natural resources. If communities have autonomy to device their own institutions, it is more likely that they will engage in setting up rules and regulations that enhance the sustainable management natural resources. Communities' past experience of self organization is also affect the management of natural resources. If communities have tried to manage some resource or issue in common and have been successful, it is more likely that they will engage in setting up rules and regulations that enhance collective action and the sustainable management natural resources (Thomson and Freudenberger, 1997; McKean and Ostrom, 1995) and thus reducing the cost of cooperation (Rydin and Falleth, 2006). If communities' perceive their actions on natural resources is not damaging, the likelihood of adopting conservation measures or institutions of their own or those recommended by outsiders is low (Agrawal and Gibson, 2001). Further, resource users are more likely to agree upon rules whose operation they understand from prior experience, than upon rules that are introduced by external actors and are new to their experience (Ostrom, 1999).

In general, the many variables of the resource system, the communities involved and the rules-in-use combine to affect the structure of the resource use situations, the pattern of interactions among the resource users from the resource system, and the outcome achieved (Ostrom, 1995). CPRs are regulated by a large

diversity of property right regimes. These include broad categories such as 1) state property – held by a government that decides on access and use limitations; 2) private property – individuals have the right to exclude other users and regulate the use of resources; these rights are generally recognized, ownership is also usually transferable and enforced by the state; 3) communal property – property held by a community whose members have equal rights of access and use; and 4) open access – a situations where no property rights define use and access to the resource (Feeny *et al.*, 1990; Schlager and Ostrom, 1992; Hess and Ostrom, 2001; Ostrom, 2005; Vatn, 2005; Basili *et al.*, 2006; Rogers *et al.*, 2008).

All categories provide different sets of rules and different ways of making decisions about the resource. In other words; different categories come with different institutions. At this point, however, no consistent evidence exists to support that any type of regime is best suited for all kinds of resource management (Ostrom, 2005).

Common-Pool Resources are neither public nor private property, but are communal property. For example, cattle are private property, but the pasture is neither privately owned nor state property, and thus it is communally owned. Outsiders are not permitted to graze their cattle in the pasture without prior agreement with the resource owners, meaning that there is no open access to the land. When a resource is not individually or state-owned it requires a collective of people to organize and protect the resource in order to avert open-access situation in which resource is free to all who use it (Ghate *et al.*, 2008).

Property Rights and Institutions in Natural Resource Management

Property rights can be defined as the capacity to call upon the collective to stand behind one's claim to a benefit stream (Bromley, 1991 cited in Fekadu and Korf, 2008), involving a relationship between a right holder, group members and institutions backing up a claim. They encompass a diverse set of tenure rules and other aspects of access to and use of resources. Collecting firewood from a forest or

water from a stream, grazing a herd on a pasture, felling trees, preventing entry to a protected area, and making decisions about who should or should not have rights to collect firewood or water are all expressions of the exercise of property rights to natural resources. Property rights govern who can do what with resources (Meinzen-Dick *et al.*, 2005), and they determine also when and how they can do it (Wiebe and Meinzen-Dick, 1998). They specify the claims and related obligations of different actors, individuals or groups, to the benefits of a resource and under what conditions. They distribute access to resources between the members of a society and regulate conflicting uses (Vatn, 2005). The assigned set of rights and obligations, shape the authority and incentives structure of the rights holder. Generally, property rights mean the formal and informal institutions and arrangements that govern access to land and other resources, as well as the resulting claims that individuals hold on those resources and on the benefits they generate (Meinzen-Dick *et al.*, 2005).

People often think about property rights in a narrow sense as ownership; the right to completely and exclusively control a resource. But property rights are better understood as overlapping “bundles” of rights. These bundles comprise: access (the right to enter a defined physical area and enjoy non-subtractive benefits); withdrawal (the right to obtain resource units or products of a resource system, for example, graze a field, drink water); exploit a resource for economic benefit; management (the right to regulate internal use patterns and transform the resource by making improvements); exclusion (the right to determine who will have access rights and withdrawal rights, and how those rights may be transferred); and alienation (the right to sell or lease management and exclusion rights) (Schlager and Ostrom, 1992; Ostrom, 2000b; Connor and Dovers, 2004; Meinzen-Dick *et al.*, 2005). Even without complete ownership (i.e. the right to alienate), individuals and groups may still have access to resources that make significant contributions to their livelihoods, for example, where pastoralists graze livestock on fallow land that may belong to individual farmers. On the other hand, groups may collectively own resources, with shared access restricted among recognized members (Ostrom, 2000a).

These rights may also be conditioned by the amount, kinds of resources used at different seasons and recognition for ownership by different agents under different circumstances. These rights can be held by individuals, family group or communities defined in various ways (Tyler, 2006a). Several individuals or groups may have different kinds of rights over the same resource. For example, all members of a community may be allowed to bathe in a river or collect drinking water, but only certain farmers may be allowed to draw water for irrigating fields and to decide how to distribute that water in the dry season, while the state may claim ultimate “ownership” of the water, including the right to reassign it to others. Even on land declared as state forest land, individuals from a community may have the right to collect medicinal plants, fallen branches for firewood, or local groups may have the right to plant trees (management) and guard them (exclusion), but the state may retain the right to approve any felling of trees and to collect revenue from users (Meinzen-Dick *et al.*, 2005).

Property right gives necessary authorization and control over the resource. Property rights provide confidence that the holder of the rights will reap the future benefits of investment and careful management, and bear the losses incurred by misuse of the resources. As a result, holding property rights provides a strong incentive for management. If the resource is seen as the government’s property, then users will not identify with it, and will expect the government to do all maintenance and investment (Meinzen-Dick *et al.*, 2005) and, hence, result in conflict over resources or loss of longstanding resources and lead to degradation (Tyler, 2006b).

Property rights are a fundamental component of a society’s institutional systems. They arise and are conditioned by rules in constitutional documents, statute law and the precedence of common law. Informal rules – social norms – also sanction property rights. Property rights provide the backbone of incentive structures that reduce uncertainty about the behavior of others and make higher levels of coordination and social organization possible (Connor and Dovers, 2004). To be secure, rights should be of sufficient duration to allow one to reap the rewards of

investment and should be backed by an effective, socially sanctioned enforcement institution. This institution is not always the government; communities or other institutions that may provide the backing (Meinzen-Dick *et al.*, 2005; Tyler, 2006b).

Many customary rangeland management systems negotiate access rights depending on factors like weather and the social relations between the groups. This flexibility provides a measure of security in times of drought or other disasters, by creating reciprocal expectations of resource sharing between groups. In pastoral societies, many resources are based on communal property rights, meaning those resources used by a group of users, normally the (sub) clan who holds customary rights over a specified territory. Secondary user rights exist in territories held by other clans. Secondary access and user rights are subject to negotiation with the primary rights holders (Fekadu and Korf, 2008). The clan system forms the basis for most of the core social institutions and norms of traditional Somali society, including personal identity, rights of access to local resources, and customary law (CHFI, 2006).

Local resource management institutions have evolved as a result of the need to have some form of measures to control the resource use to ensure sustainability and reduce access-deferential to the resources in and around the local communities. In situations where human being and natural resources co-exist, sustainability of the resource largely depends upon the suitability of the institution affecting the CPR. The writings of scholars of “the commons” have shown that resource users often create institutional arrangements and management regimes that help them allocate benefit equitably, over long time periods, and with only limited efficiency losses (Rajan, 2006).

In the literatures, institution is understood in two ways. In one situation, institution is understood as order to a thing (rule-in-use); orderly arrangement and regulation. Related to this, there is an established law, custom, usage and practice that structure human interaction. In another situation it is understood as organizations, more commonly the public organizations, which tend to persist over time.

Organizations provide structural setup within which groups of individuals bound by some common purpose to achieve objectives (North, 1990; Watson, 2001; Choudhury and Springer-Heinze, 2004; Rajan, 2006). According to Hayami and Ruttan (1971 cited by Stevens and Jabara, 1988), institutions are the rules of a society or of organizations that facilitate coordination among people by helping them from expectations which each person can reasonably hold in dealing with others.

Institutions in “rules-in-use” sense determine individual access to and control over resource, which in turn influence incentive for resource management (Agrawal and Gibson, 1999; Varughese and Ostrom, 2001; Husain and Bhattacharya, 2004). Bortis (1997) defined institution as habits that have developed historically and represent regulated behavior directed towards individual aims, which provides a durable framework for persistent action. More particularly, institutions may signal what the individual should do or should not specifically do in a certain situation. Institutions not only influence peoples’ preferences, they also structure the decision environment by defining the condition of the situation (Crawford and Ostrom, 1995; Watson, 2001; Schmid, 2004; Vatn, 2009). According to Tyler’s (2006b) explanation, the institutions of resource management reflect prevailing social and political practices – how do people interact, who holds power, and how can it be legitimately used. They may be based on legal and judicial procedures, on religious beliefs, or on traditional practices. Institutions are the mechanisms by which societies define who can use the resource and who is excluded, and how access and benefits may be shared among rights holders. They also can provide mechanisms to resolve conflicts.

Institutions contain a structural feature requiring that single individuals do not create institutions on their own; instead, they relate to a group of people who have a common understanding (Peters, 1999). Institutions are multifaceted, durable social structures (Bortis, 1997; Peters, 1999; Scott, 2008); relatively resistance to change; and tend to be transmitted across generations, to be maintained and reproduced. Thus, institutions are inhibited by people and their interactions. Rules, norms and meanings arise in interaction, and they are preserved and modified by human behavior.

Institutions impose restrictions by defining legal, moral and cultural boundaries. Hence, institutions provide guidelines and resources for taking action as well as prohibitions and constraints on action (Scott, 2008). Generally, institutions determine what is appropriate, legitimate and proper. They define obligations, self-restraints, rights and immunities, as well as the sanctions for unacceptable behavior (Bloor, 1997; Mohamed *et al.*, 2001).

Institutions can be categorized into formal and informal institutions. A key distinction between formal and informal institutions is that formal institutions are those backed by the law (legally recognized or written), implying enforcement of rules by the state, while informal institutions are upheld by mutual agreement (which is not written), and rules are thus enforced traditionally (North, 1990; Cousins, 1997; Thomson and Freudenberger, 1997; Leach *et al.*, 1999; Zenger *et al.*, 2001; Watson, 2001; Omiti and Irungu, 2002; Skoog, 2005; Scott, 2008). Formal institutions are enforced by official entities (courts, judges, police officers, bureaucrats, etc.). By contrast, informal institutions are largely self-enforcing through mechanisms of obligation, such as clan networks, or simply because following the rules is in the best interests of individuals who may find themselves in a situation in which everyone is better off through co-operation (Bromley and Szarleta, 1986; North, 1990; Leach *et al.*, 1999; Skoog, 2005; Jutting *et al.*, 2007).

When actors are confronted with recurrent interaction problems, rules facilitate their decision making behavior by shaping expectations about how to behave successfully in those situations, thus reducing their behavioral uncertainty. Rules thereby shape incentives for behavior (Skoog, 2005; Jutting *et al.*, 2007). When rules are accepted in a community, someone who breaks a rule face a high likelihood of receiving both formal sanctions as well as forms of disapproval extended to him by others in the group (Ostrom *et al.*, 2001; Gibson *et al.*, 2005).

Both formal and informal institutions coexist, they attempt to organize and control behavior through the use of explicit rules that take place at a multiplicity of

levels within society, and within a variety of social fields (Cousins, 1997; Nee, 2001; Skoog, 2005). For example, in regards to theft, both formal and informal institutions constrain peoples' behavior (Nee, 2001). Also the relationship between formal and informal institutions is largely complementary (Bortis, 1997; Agrawal and Gibson, 1999; Skoog, 2005) since it is neither possible nor desirable to design detailed formal rules for all possible and specific recurrent situations. Informal rules emerge spontaneously to take care of recurrent interaction problems that are not regulated by the formal rules. These problems often occur as a result of the formal rules, so that informal rules become adaptations to the formal rules (Skoog, 2005).

The use of resources influences and shapes the capacity of resources to generate services, and the resource services available for human use influence human choices, preferences, and, therefore, institutions governing access to those resources. The outcomes of resource-human interaction are highly dependent on the effectiveness of the local institutions that mediate the interaction. Institutions that are not enforced are ineffective and may be considered non-existent, in terms of their influence on human behavior and social interaction (Ostrom, 1990; Agrawal and Gibson, 1999; Skog, 2005).

Institutions perform both individual and social functions. First of all, they facilitate decision making and behavior for individual actors in recurrent interaction situations. Besides, members following of the rules facilitate the behavior of others, by shaping their expectations about how they will behave. Institutions, thereby, reduce the social uncertainty in the system by making the actions of the agents more predictable. They solve coordination problems between individuals and provide standard solutions to recurring social interaction problems. These are important social functions. Hence institutions correlate social activity over time, between actors and situations and thus bring structure and stability to society (Skoog, 2005). Therefore, designing institutions enhance the production and use of any kind of commons, whether natural or human-made. Effective design requires successful collective action

and self-governing behaviors; trust and reciprocity; and the continual design and/or evolution of appropriate rules (Ostrom and Hess, 2007).

Institutions, when used in their organizations sense refers to a structure (entities of recognized and accepted rules) to human interaction. They are structures or group of individuals bound together by some common purpose to achieve objectives (Daft, 2004; Scott, 2008). The structure can be formal as in the case of government ministries, agencies, banks, farmers' associations, cooperatives etc.; or informal as in the case of community based organizations. Formal organizations refer to fixed set of written rules of organizational procedures and structures. Informal organizations are the sum of relationships and communication links among members, which are not often written (North, 1990; Powell and Dimaggio, 1999; Scott, 2008). Examples of informal organizations are those around labor sharing, indigenous information exchanges, savings societies, and commons institutions.

Organizations generally develop as instrument for attaining specific goals, and that they are likely to emerge in a situation where people recognize a common or complementary advantage that can be best served through collective action, as opposed to individual's action. Thus, by their very nature, organizations imply an integrating and structuring of activities directed toward goal accomplishment. Features common to most organizations are: organizations develop to achieve goals; organizations are social entities composed of set of interacting positions (collaborative actions of individuals give rise to organized activities); organizations are deliberately structured and consciously coordinated; and organizations exist as part of the larger social environment (Bedeian and Zammuto, 1991; Daft, 2004).

An organization is a response to and a means of satisfying human needs. New organizations are established when new technologies become available and new needs are discovered, and an organization die or are transformed when the needs they once satisfied are no longer important or have been replaced by other needs. Sometimes several people come together and form a group to respond to a perceived need or

recognize opportunities to satisfy needs by creating an organization (Jones, 2007). Organizations alone will not have an effect on resource management unless they are active. The extent of collective action enables us to differentiate between organizations that exist only “on paper,” and those that are alive (Meinzen-Dick *et al.*, 2002).

The management of natural resources is most often a question of collective management involving many organizations (actors). The four main sets of institutions engaged in management of natural resources are research, extension, education and support systems (which include both public and private sector entities). The relevance of these organizations and others (research, extension, farmers’ organization, NGO, trading, and so forth), however, is in the eyes of the beholder. Farmers and others are seen as actively seeking relationships that will allow them to learn and to make changes in their practices. This is known as networking. Actors build networks with those they consider relevant to their cause and those they think committed to the actions (Engel, 1997). Such networking may result in either developing new methods and materials themselves, or adapting ideas, practices and things developed by others. To gain access to a range of options and insights, actors actively engage in building and managing interactive relationships with others – people they consider relevant to their concerns. The dissemination and use of innovations originated by others lies in the quality of the interaction among farmers, businesses, donors and governments (Salomon and Engel, 1997). Such interaction is important in order they achieve results that exceeds what could have been expected from the sum of individual efforts (Engel, 1997).

Linkages among actors, and the related linkage mechanisms, show how actors communicate (produce, exchange and process information) and work together, in order to have regular contact and improved productivity (Engel, 1997; Starkey, 1999; Agbamu, 2000). Linkages enable actors to exchange resources such as information, money, labor, and other materials (Salomon and Engel, 1997), cooperation and consultation between local governments at the same institutional level, collaboration

between institutional levels in terms of decision-making, developing proposals for action, service provision, resource flows and accountability (Engel, 1997; Bonfiglioli, 2004). Specific organizational procedures that establish, maintain or improve integration are called linkage mechanisms. Linkage mechanisms are arrangements that facilitate communication (e.g. meetings among farmers or with extension staff, or liaison offices), coordination (e.g. mutual adjustment of activities, or water distribution) or resource transfers (perhaps credit or sharing labor). Some linkages are of a more formal character, such as administrative links between a project and its donor(s). Others are more informal, as the links that often exist between extension staff and researchers at a personal level (Salomon and Engel, 1997).

Almost, each actor has a relative autonomy that generally characterizes them and each act according to an individual strategy and operational agenda. They use their own resources, intellectual and otherwise to achieve their own objectives (Engel, 1997). No one actor, whether farmers, scientists or technicians, is alone responsible for development in agriculture. Rather, the interdependent activities of a whole set of actors including farmers, traders, producers of inputs and services, processing industries, policymakers, planners, researchers, technicians and extension services that stimulate the development processes (Crowder, 1996; Salomon and Engel, 1997). Looked at in this way, development in agriculture can be seen as the outcome of a mutual learning process taking place among a large number of autonomous actors (Salomon and Engel, 1997) but in reality this is an ideal world where organizations operate within their own particular arena, and according to their own responsibilities (Starkey, 1999; Bonfiglioli, 2004) and they tend to be top-down and narrow, restricted to single disciplines and limited geographical area (Starkey, 1999).

Generally, partnerships begin when a common interest arises and end when the proposed results are achieved or when the partners decide to terminate the partnership (Hartwich *et al.*, 2008). Basic prerequisites for effective partnerships include internal motivation rather than being driven by external donors; sincere commitment from all partners; good facilitation to discuss issues, to find common

ground and to agree on joint action; shared responsibility rather than depending on only one organization; openness and transparency to make their interests and expectations clear, as well as to clarify objectives and identify stakeholders and stakes is an iterative process (Waters-Bayer *et al.*, 2005).

Even though many efforts to enhance linkages have been undertaken, it seems to remain as a sort of grey area, as factors and mechanisms that make linkages functional over an extended period of time are poorly understood (Pluss *et al.*, 2008). In most developing countries, therefore, the involvement of extension persons and farmers in the technology development process is limited and passive. The present feedback system is very weak. Further, the technology recommendations are too general ignoring the multiple farming situations available within a given agro-ecology (Reddy *et al.*, 2006). They generally compete over the same scarce government resources and, frequently, leaders of these institutions do not see themselves as part of a broader agricultural technology system (Swanson *et al.*, 1997).

Collective Action and Deriving Forces of Collective Action

Collective action can be defined as voluntary action taken by a group to achieve common interests. Members can act directly on their own (internally initiated) or through an organization (externally initiated) (Marshall, 1998 cited in Pandolfelli *et al.*, 2007; Siagian and Neldysavrino, 2007; Fekadu and Korf, 2008; DiGregorio *et al.*, 2008). Moreover, collective action requires the involvement of a group of people, shared interest within the group and it involves some kinds of common action which works in pursuit of that shared interest. Further, the action should be voluntary which distinguishes collective action from hired labor. Collective action is organized when greater benefits are expected through joining a group than acting individually. This implies a conscious working together, such as in investing in a resource or excluding outsiders from using it. Collective action might differ depending on the specific objective of collective action. In the literature, collective action has been described as taking various forms including the development of institutions, resource mobilization,

coordination activities and information sharing, collective decision-making, setting rules of conduct of a group and designing management rules, implementing decision, and monitoring adherence to rules (Meinzen-Dick *et al.*, 2004). Collective action and networks among community members can facilitate access to information and even allow farmers to participate in technology development (Ostrom, 2004).

Collective action occurs when more than one individual is required to contribute to an effort in order to achieve an outcome. Collective action mostly occurs informally (Meinzen-Dick *et al.*, 2002; 2004; Ostrom, 2004) through social networks or even through people coming together temporarily for specific short-term purposes (Ostrom, 2004). People living in rural areas and using natural resources engage in collective action on a daily basis when they plant or harvest food together, animal herding, use a common facility for marketing their products or patrol a local forest to see that users are following rules, and meet to decide on rules related to all of the above (Ostrom, 2004). Also they engage in collective action voluntarily contribute to the construction of a collective infrastructure, such as constructing ponds, or a water control structure in an irrigation scheme or it can take on the form of people's participation in the setting up of a regulatory agency endowed with powers to collect fees, impose contributions on members, lay down rules and punish deviant behavior (Baland and Platteau, 2001).

In natural resource management, the appropriate level of cooperation is determined by the scale of the natural resource system to be managed. For instance, a small grazing area can be managed by a small pastoral community (Bonfiglioli, 2004). In some cases, the scale of the resource to be managed may go beyond what can be done by voluntary collective action by a community. The state or even NGOs become critically important partners to manage larger resources. In these cases, co-management between the community and government often leads to better outcomes (Bonfiglioli, 2004; Meinzen-Dick *et al.*, 2004). But, the most important challenge in collective action is how to find individuals acting collectively in an environment where they face a dilemma about one another's action. To better understand this,

studies on collective action tend to examine factors motivating individuals to coordinate their activities to improve their collective wellbeing. Trust, reciprocity and reputation are the three core individual level variables determining individual cooperative behavior in collective action (Ostrom, 1998a).

These individuals sharing a common goal or interest are characterized by well-defined group membership or boundaries without necessarily encompassing the whole society (Ostrom, 2000a; Baland and Platteau, 2001). The presence of clear boundary enables participants to know who is in and who is out of a defined set of relationships and thus with whom to cooperate (Ostrom, 2000a). Well-defined group memberships, boundaries and a limited scale facilitate effective collective management (Ostrom, 1990). This may include a plot of forest or pasture reserved for common use to a certain community that is used exclusively by group members. The scale and excludability allows the group to regulate use, including prohibiting outsiders and enforcing sanctions on overuse by members (Agrawal, 2001). Collective action is also facilitated when the resource is located in or near the vicinity of group members and when all members exhibit a high level of dependence on the resource (Ostrom, 2000a).

Small group size, shared norms, previous successes in collective action (social capital), effective leadership, and interdependence among group members are also factors that can encourage and support effective collective action (Agrawal, 2001). While increasing the group size results in costly cooperation due to higher transaction costs associated with monitoring and enforcement costs (Hardin, 1993; Agrawal, 2001). In cohesive community where custom, the habit of living together and the in-built compliance with traditional norms can largely reduce coordination costs. The intensity of cohesion, custom, the habit of living together and compliance to norms creates a favorable environment in enhancing contribution and motivation for collective activities because shirking can result in shame and guilt (Bardhan and Ray, 2006 cited in Fekadu, 2008).

Generally, Ostrom (1990) in her design principles argues that collective action for CPR management will be long enduring and successful under conditions of well-defined boundaries, congruence between appropriation and provision of rules, effective monitoring, graduated sanctions, efficient conflict-resolution mechanisms and minimal recognition of rights to organize.

Attributes of groups that facilitate successful collective action are perception of the problems at hand; the degree of autonomy a group has to take collective action on its own; the way users of a resource view both the future and each other (if one take advantage of them or not). Motivations are shaped by the preferences and interests of actors, as well as the way they perceive their chances of succeeding through collective action. The latter, in turn, relate to the rules and expected bargaining power of different groups. However, formal recognition and validation by government authorities can also assure cooperating groups that their activities will not be disrupted in the future (Agrawal, 2001).

Collective action as any form of cooperation is costly. Where benefits from collective activities (such as planting of vegetation along riverbanks to reduce runoff and erosion) cannot be withheld from people that do not participate in the collective effort, free riding can break down cooperative effort: some people will be tempted not to help with the planting, but will nonetheless enjoy the benefits from others people's work. Collective rules can help reduce the likelihood of free riding. These can include rules of use, monitoring, and sanctioning, which all reduce the incentives to free ride as well as provide assurance to other members that their peers will also be contributing. Even in the absence of monitoring, rule violations can be limited when rule obedience is based on mutual trust that others would do the same (McCarthy, 2004). Generally, collective action is sustained only if there is a significant gain for all agents involved (Ghate *et al.*, 2008).

Technology Adoption and Empirical Studies

Technology is the application of knowledge for practical purposes. Generally, technology is used to improve the human condition, the natural environment, or to carry out other socioeconomic activities (Swanson *et al.*, 1997; Contado, 2003). Technology is often used broadly to encompass physical/biological structures or objects as well as management practices (Place and Swallow, 2000). Therefore, technology can be classified into two major categories: 1) material technology, where knowledge is embodied into a technological product such as tools, equipment, agrochemicals, improved plant varieties or hybrids, improved breeds of animals, and vaccines; and 2) knowledge-based technology such as the technical knowledge, and management skills that farmers need to successfully grow a crop or produce animal products. The transfer of material technology to farmers generally involves the production, distribution, and marketing. Therefore, the transfer process for material technology is generally simpler than training and disseminating technical knowledge and management skills to large numbers of farmers who operate in different agro-ecological zones (Swanson *et al.*, 1997).

Technically approved technology has inherent qualities to improve product quality, increase production efficiency and heighten productivity. This implies that the potential benefits of technology are actualized only when it is successfully transferred to a large number of end-users. When the perceived technology impact is positive, i.e., economically positive and environmentally non-destructive, the technology is likely to be desired and enhanced (Contado, 2003).

The technologies people use play a fundamental role in shaping the efficiency, equity, and environmental sustainability of natural resource management. This has been the reason for substantial investments in research to improve agricultural technologies, from new crop varieties to natural resource management practices. However, improved agricultural and natural resource technologies are of little value unless they are judged to be appropriate by farmers and subsequently adopted. There

are many factors constraining farmers' technology choices, but the lack of secure property rights has been commonly identified as an important barrier to adoption, particularly for longer-term investments in things like tree crops and improvements to natural resources. For technologies and natural resource management practices that require that farmers make joint decisions and cooperate in their implementation, inadequate and ineffective institutions for managing collective activity can be a constraint to adoption (Knox *et al.*, 2002).

Conventional on-farm technologies like improved high-yielding crop varieties have a short, usually seasonal, time horizon and a small spatial scale, often a single plot. They can be adopted by a single farmer. Other technologies may require longer time horizons between their adoption and their payoff. In those situations, farmers need secure tenure (property rights) to have the incentive and authority to adopt (Ostrom, 2004). Most natural resource management technologies have 'spill-over' effects that require larger-scale action, and have benefits that accrue only after years and, sometimes, generations (Knox *et al.*, 2002).

Adoption is viewed as a variable representing behavioral changes that farmers undergo in accepting new ideas and innovations in agriculture. The term behavioral change refers to desirable change in knowledge, understanding and ability to apply technological information, changes in feeling behavior such as changes in interest, attitudes, aspirations, values and the like; and changes in overt abilities and skills (Ray, 2001).

The traits which influence the rate of diffusion of a technology, as perceived by potential adopters are: 1) relative advantage – the degree to which an innovation is perceived as better than the idea or objects it is intended to replace. It is usually expressed in terms of economic gain; 2) compatibility – the degree to which the farmer perceives an innovation to be consistent with his socio-cultural and beliefs, traditional management objectives, his past experience and the existing level of technology; 3) complexity – the degree to which an innovation is understood and be

used by farmers; 4) trialability – the degree to which the farmer perceives an innovation can be tried out in small scale on their field; and 5) observability – the degree to which results of an innovation are visible to farmers (Adams, 1982; van den Ban and Hawkins, 1998; Dasgupta, 1989; Ray, 2001; Rogers, 2003).

Farmers' decision to adopt or not to adopt is usually based on the profitability and risk associated with the new technology. It is obvious that farmers critically compare the characteristics of new varieties with those of prevailing varieties. The process of adoption begins with farmers' experimenting with new varieties. The decision in favor of new variety is expected if its performance is viewed superior over the local varieties. Adoption or rejection of technologies by farmers may reflect rational decision making based up on farmers' perceptions of the appropriateness or inappropriateness of the characteristics of the technology under investigation (Adesina and Zinnah, 1993). Therefore, the adoption pattern to a technological change in agriculture is not uniform at the farm level. It is a complex process, which is governed by many socio-economic factors. The farmers degree of readiness and exposure to improved practices and ideas that is changes like the awareness and attitude of farmers towards improved agricultural technologies, which act as incentives/disincentives to agricultural practices in bringing about the technological change in agriculture (Salim, 1986).

Several literature on adoption of improved crop varieties and crop management technologies in developing countries points towards a number of factors operating in quite complex and interactive ways that condition the adoption decision of farmers. According to Kaliba *et al.* (1998) the factors that affect the adoption of any agricultural technologies are divided into three major categories: farmer specific and farmer associated attributes, technology specific attributes, and the farming objectives. Farmer specific and farmer associated attributes are age, farming experience, family size (labor resource), education, farm size, number of livestock owned, income (on-farm and off-farm), availability of credit, distance to the nearest market, access to information (access to mass media, access to market, contact to

extension service, attendance of agricultural training and field days), etc. Technology specific attributes are taste, yield, ease of cooking, ease of threshing and tillering capacity etc. (Adesina and Zinnah, 1993). Those empirical results can confirm or reject some of the theoretical explanations in specific cases.

The results of Nkonya *et al.* (1997) indicated that farmer's age did not significantly influence on improved maize varieties (IMVs) adoption. Doss *et al.* (2002) indicated that age (or experience) was positively associated with the use of improved wheat varieties. Shiyani *et al.* (2002) also reported that the more experience of growing chickpea, the higher the adoption of new varieties. Such a pattern is expected, because elder and more experienced farmers may have better skills and the ability to obtain, process, and use information relevant to its cultivation. In contrary, the result of Million and Belay (2004), and Shiferaw and Tesfaye (2006) shows age has negative and significant influence on the adoption of improved seeds and fertilizers. Younger farmers are more optimistic where older farmers are reluctant to change their farming techniques. Hence, younger farmers are risk takers to adopt new technology.

Small-scale farms obtain labor from household members or by hiring labor. One measure used frequently in adoption studies to account for labor availability is household size. Households with more adults will be able to provide the necessary labor that might be required by improved varieties. Doss *et al.* (2002) did not find a clear relationship between household size and use of improved varieties. But the result of Mariam *et al.* (1993), and Shiferaw and Tesfaye (2006) shows that family size has a positive and significant influence on the adoption of improved seeds, indicating that farmers with larger labor force are more likely to increase the adoption of IMVs than otherwise. The possible explanation is that since the package associated with the adoption of IMVs entails additional labor for such practices as raw planting and intensive management. Hence, farmers' decision on the adoption of such technologies becomes dependent on the availability of labor force.

Farmers with better education are early adopters of modern technology and apply modern inputs more efficiently throughout the adoption process. Exposure to education will increase the ability of farmers to obtain, process, and use information relevant to the adoption of improved technologies. Mariam *et al.* (1993), Nkonya *et al.* (1997), Million and Belay (2004), and Shiferaw and Tesfaye (2006) results indicated that farmer's education had positive and significant influence on adoption. Each additional year of education increases the probability of adoption of improved seed. Shiyani *et al.* (2002) in their study stated that though education plays a significant role in the adoption decision, this variable was not found significant in their study since a majority of the sample farmers were either illiterate or had education up to primary schooling.

Some studies have found a negative relationship between farm size and adoption. The findings of Kiresur *et al.* (1999), Jabbar and Alam (1993), Tesfaye *et al.* (2001), Shiyani *et al.* (2002), and Nega and Sanders (2006) indicated that with an increase in the size of the farm there was a decrease in the probability of a farmer being an adopter of modern technologies. A small farmer, with limited land holding, attempted to achieve this objective through cultivation of modern technology sorghum with its higher yield levels, required relatively small piece of land to yield a given quantity of sorghum grains and fodder. They have more labor available per unit of land while larger farmers have higher transaction costs to acquire hired labor. On the other hand, a larger farmer, with limited labor resource per unit of land preferred to go for traditional sorghum technology which was less labor intensive. On the other hand, Mariam *et al.* (1993), Huque *et al.* (1996), Nkonya *et al.* (1997), and Ramasamy *et al.* (1999) reported that farm size exerts a positive influence on adoption of improved technologies. Farm size can be positively related to adoption because larger farmers can experiment with new technologies on a portion of land without worrying about endangering the family food security.

Livestock provide production services as well as being an indicator of the economic resources available to the farmer. Livestock are sources of food security,

traction power, manure, and cash income. Farmers who have large number of livestock have the capacity to liquidate some of their animals to purchase new technologies. Tesfaye *et al.* (2001), Doss *et al.* (2002), and Shiferaw and Tesfaye (2006) reported that number of livestock owned had a significant and positive influence on the adoption of IMVs.

Extension is a way of building the human capital of farmers by exposing them to information that increase incomes and reduces uncertainty about the expected outcomes of the technology. In rural area where other means of technology transfer are rudimentary or absent, exposure of farmers to new information and technologies occur through contact with extension agents, and their participation in on-farm trials and demonstrations. Farmers with more extension contacts are more likely to be adopters of improved technologies than those with less number of extension contacts. Frequent contact to extension service is positively and significantly related to the adoption decision of farmers (Nkonya *et al.*, 1997; Tesfaye *et al.*, 2001; Doss *et al.*, 2002; Shiferaw and Tesfaye, 2006; Nega and Sanders, 2006). The significance of information sources indicate the possibility of using different complementary programs that help farmers to be accustomed with the performance of new technologies (Tesfaye *et al.*, 2001). Tesfaye *et al.* (2001), Shiyani *et al.* (2002), and Shiferaw and Tesfaye (2006) also reported that distance to the nearest market had a significant and negative influence on adoption of IMVs, indicating that farmers far away from market centers are less likely to adopt IMVs than those who are located in the vicinity of market centers. The possible explanation for this is that farmers far away from market centers will tend to be less market-oriented.

Credit helps farmers to minimize the cash constraint and there by enhances the rate of adoption of technologies. Tesfaye *et al.* (2001), and Shiferaw and Tesfaye (2006) reported that access to credit, had a significant and positive influence on the adoption of improved technologies, implying that farmers who have access to credit are more likely to adopt IMVs than those who have no access to credit. Jabbar and Alam (1993) were found that access to credit was not significant.

The extent that agricultural inputs must be purchased, depend on the availability of cash or credit to a farmer. One of the sources of cash is off-farm income. Farmers with better on-farm and/or off-farm income are able to relieve capital constraints to purchase fertilizer and improved seeds, which is the major problem of small-scale farmers in Ethiopia. Mariam *et al.* (1993) and Doss *et al.* (2002) reported that on-farm and off-farm income were found to have a positive and significant impact on the adoption of IMVs and fertilizer use. Hence, farmers who managed to earn more cash income (on-farm and off-farm income) are more likely to adopt new technologies.

Many technology adoption studies have been conducted in developing countries. However, because of natural resources, cultural, political, socio-economic and institutional differences, the importance of factors affecting technology adoption differ across countries. Technology adoption studies showed that factors influencing adoption differed by location. Therefore, there is a need to conduct specific technology adoption studies in areas where extension and research programs are implemented to understand the important factors affecting adoption of new technologies in these areas (Nkonya *et al.*, 1997).

The Conceptual Framework

Developing the conceptual framework is an integral part of understanding and analyzing the research problem. The successful development of a conceptual framework helps one understand the problem, which leads directly to the statement of the objectives. Conceptual analysis help indentify relationships that are needed to achieve the objectives. It is common for the conceptual framework to point to relevant variables within relationships as well (Ethridge, 1995). The conduct of research requires the use of a conceptual framework. Conceptual framework organizes diagnostic and prescriptive inquiry by providing the most general set of variables that should be used to analyze all types of settings relevant for the framework. The framework for this study provides a general set of variables, and their relationships

that are crucial in any type of institutional analysis. It consists of three major components that deal with multiple levels of analysis. These include: 1) exogenous variables, 2) action arena and 3) outcomes (Ostrom, 1998b; Ostrom and Hess, 2007). The exogenous variables are the attributes of rangeland resources; attributes of resource users; and rules governing the resource use (institutions), which affects the utilization of resources and collective actions, and govern those inter-relationships.

Exogenous variables may include, sets of institutions that define the conditions of access to, and control over, goods and services arising from a rangeland resource system. Hence, the most important step in the analysis is to assess how these exogenous variables shape events in the action arena and producing outcomes that feedback to participants/actors and the institutions. This research gives due attention to all variables i.e. rangeland resource, participants or actors and institutions. Resource system is a system in which participants act i.e. utilize, conserve, develop or manage grazing field, bushes and/or pond/cisterns, adopt new technologies either individually or collectively. A number of attributes characterize the exogenous variables and the attributes are found to be important in influencing the structure and functions of the action arena. The understanding of these attributes and the interaction among them is vital in the conduct of institutional analysis. The attributes of the resource system include resource flow and storage, size, natural boundaries etc.

Participants are the actors/stakeholders that are engaged in the management (conservation, utilization and protection) of the resource system and make decisions on institutional arrangements, collective action activities and technology adoption. Their number, status as individuals or group and their individual attributes (dependence on the resource system, their shared understanding of the physical condition of the resource system, their perception on the impact of their own action on the resource system, the degree of homogeneity among users, the trust among themselves, autonomy to devise institutions, etc.) are important in affecting the action arena.

Institutions form the most influence on the action arena. Institutional factors affect the resource users in the way they invest in and benefit from those resources and respond to changes in the physical condition of resources. Institutions devise rules that mediate the interaction between the actors and the resource system and stipulate what actions are required, permitted, or forbidden in a particular situation.

The action arena is the space in which resource users interact with each other and with the resource system. Action arena includes an action situation and an actor/participant component. Action situations refer to the special space where individuals with diverse preferences interact, exchange goods and services, solve problems, dominate one another, or fight.

In general, the “action arena” shows how multiple actors, including individuals, states, and organizations, make use of and change institutions to manage resources. The dynamics in the action arena are conditioned by the actors, resource system they draw upon, and the factors that lead to the change in both material conditions and institutions. Resource systems give actors the capability to act, i.e. to exercise livelihood choices, participate in collective action on various levels, to influence other actors’ agency choice, and to participate in political processes (Mwangi and Markelova, 2008; Pandolfelli *et al.*, 2007).

The decision taken by participants/actors being influenced by institutions leads to interaction among participants and between them (collective action) and the resource system (utilization of rangeland resources). This pattern of action may lead either to cooperation or conflict and the ultimate outcome to either conservation or degradation of rangeland resources.

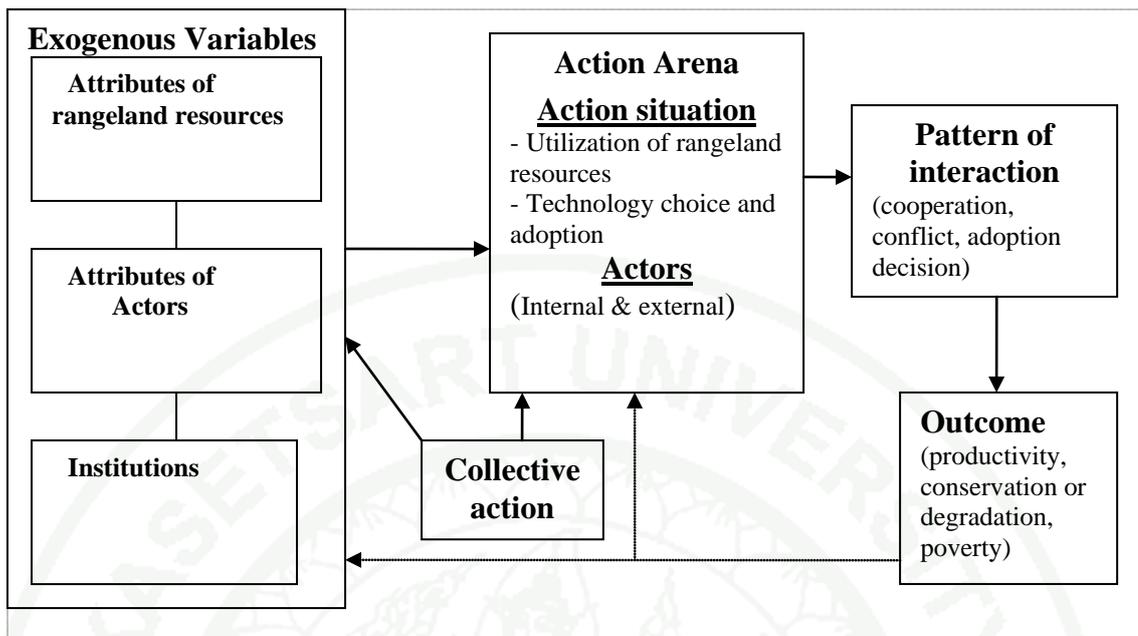


Figure 1 The conceptual framework

Source: Adopted from Ostrom, Gardner and Walker (1994: 37)

Research Hypothesis

On the basis of the various studies already reviewed, it is hypothesized that a farmer's decision to use a given crop technology is influenced by the demographic and personal characteristics of the household head, the household's resource endowments, and institutional support systems.

Dependent variable: it represents the observed status of a farmer's adoption decision towards ISVs. In the Logit model, the farmer who used any ISVs, in a given production season, is considered to be "an adopter" and the variable takes the value 1. Otherwise, the farmer is considered as "non-adopter" and the variable takes the value 0.

Independent variables: it is hypothesized that farmers' decisions to adopt or reject new technologies at any time are influenced by the combined effect of a number

of factors. The following variables are hypothesized to influence the adoption of ISVs.

Age of the household head: in traditional societies, age serves as an important indicator of the individual's position in the society. Older farmers are in a position to experience much with their traditional farming practices and are expected to be less responsive to newly introduced agricultural technologies. Therefore, in this study, it is hypothesized that the farmer's age and adoption of ISVs are inversely correlated.

Farming experience: this refers to the total number of years the respondent has spent in farming. With longer experience in farming, a wide knowledge and experiences are gained on the operation and conduct of the traditional agricultural activities and methods of production. Thus, it is less likely that farmers with longer farming experience will be ready to accept changes and adopt ISVs.

Household size: household size is expected to increase the probability of adoption of ISVs. Large households could provide the labor that might be required by ISVs. It is measured in number of people above six years old in the household.

Level of education: level of education is assumed to increase farmers' ability to obtain, process, and use information relevant to the adoption of ISVs. Education is, therefore, expected to increase the probability of adoption of ISVs. It is measured as a categorical variable: 1, if the farmer is illiterate, 2, if the farmer able to read and write, 3, if the farmer attended the elementary school level.

Farm size: in many empirical studies, it has been noted that adequate size of land holding is the basic requirement for adoption of ISVs. It is assumed that the larger the farm size the farmer has, the better his risk bearing ability and the higher the probability to adopt ISVs. It is measured in hectares.

Number of shoats: it is hypothesized that number of shoats (sheep and goats) owned by farmers is positively related to the adoption of ISVs. Shoats can easily be liquidated either to buy agricultural inputs or to buy food crops in a case of crop failure. It is assumed that the larger the number of shoats the farmer has, the better his risk bearing ability and the higher the probability to adopt ISVs.

Type of house owned: the type of house owned is suggested as a proxy indicator of economic status of the household head. The better the type of house owned the better the economic status of the household. Therefore, owning better house type is assumed to indicate the probability of adopting ISVs. It is measured as a categorical variable: 1, if the farmer own traditional tent, 2, if the farmer own soil roofed house and 3, if the farmer own corrugated iron house.

On-farm income: the farm income refers to the total annual earnings of the family from sale of agricultural produce after meeting family requirements. This is believed to be the main source of capital for purchasing agricultural inputs. Thus, those households with a relatively higher level of farm income are likely to purchase improved seeds or other essential agricultural inputs. It is measured by the amount of Birr obtained from sale of crop produce.

Contact with extension agents: it is hypothesized that frequent contacts with extension agents (development agents) will increase farmers' likelihood of adopting ISVs. It is measured as number of contacts between the extension agent and the farmers.

Attending field days: it is hypothesized that attending field days will increase farmers' awareness and thereby increase farmers' likelihood of adopting ISVs. It is measured in number of field days a respondent was attended.

Radio ownership: at present, radio is the popular means of communication. Therefore, the radio ownership is assumed to increase the access to information and

thereby the probability of adopting ISVs. It is measured as a binary variable: 1, if the respondent has a radio and 0, otherwise.

Use of chemical fertilizer: ISVs are alleged to perform better with chemical fertilizer. Hence, use of chemical fertilizer is expected to be positively related to the adoption of ISVs. It is measured as a binary variable: 1, if the farmer used fertilizer and 0, otherwise.

Perception on yield: this variable measures farmers' recognition of superiority or inferiority of ISVs yield that is expected to influence its adoption. It is hypothesized that yield perception is expected to positively influence the adoption of ISVs. This variable takes the value 1, if the respondent perceived that the yield of ISVs superior to the local sorghum varieties and 0, otherwise.

Distance to input market: distance to input market is hypothesized to be negatively related to the probability of adoption of ISVs in that households near by input market centers tend to use ISVs, and they can have easy access to dispose of their production. It is measured in kilometers.

Access to credit: access to credit can relax the financial constraints of farmers, and in some cases, access to credit is tied to a particular technology package. It is expected in this study that access to credit would increase the probability of adopting ISVs. It is measured as a binary variable: 1, if the farmer has access to credit and 0, otherwise.

CHAPTER III

RESEARCH METHODOLOGY

This chapter depicts the detail picture of the research methods employed to effectively execute the research work. It starts with the description of the study area followed by sampling procedure, data collection methods and finally data analysis techniques.

Description of the Study Area

Awbere *Wereda* is one of the six *weredas* in Jijiga Zone. Its altitude ranges from 1,200 to 1,660 meters above sea level. The climate of the *wereda* is semi-arid marked by seasonal variations and it receives an annual rainfall that varies from 400 to 900 mm. The area experience bimodal type of rainfall classified as main rainy season (from April to June) and short rainy season (from October to December) (Devereux, 2006). The mean monthly minimum temperatures varies from 5.8⁰C in November to 14⁰C from July to September and mean monthly maximum temperature varies from 25⁰C in July to 29⁰C from March to April (JZOA, 2001).

According to CSA (2008), roughly 88% of the inhabitants of Awbere *Wereda* are agro-pastoralists with a population of 299,336 persons (male 165,148 and female 134,188). The *wereda* (literally means a district) is divided into 59 *kebeles* (The lowest administrative unit at village level). The people in the Awbere *Wereda* are mainly from Somali tribe and Muslim in religion. The clans living in Awbere *Wereda* are of mixed clans consisting of Isak, Gedebursi, Medigan and Akisho. They share similar ethnic and cultural backgrounds but only differ in terms of clannishness. The geographic location of the *wereda* gives an opportunity to the residents. For instance, cross-border movement facilitates involvement in trade as an additional income stream. This cross-border mobility also provides access to grazing resources since there are other members of Isak and Gedebursi clans who live in Somaliland.

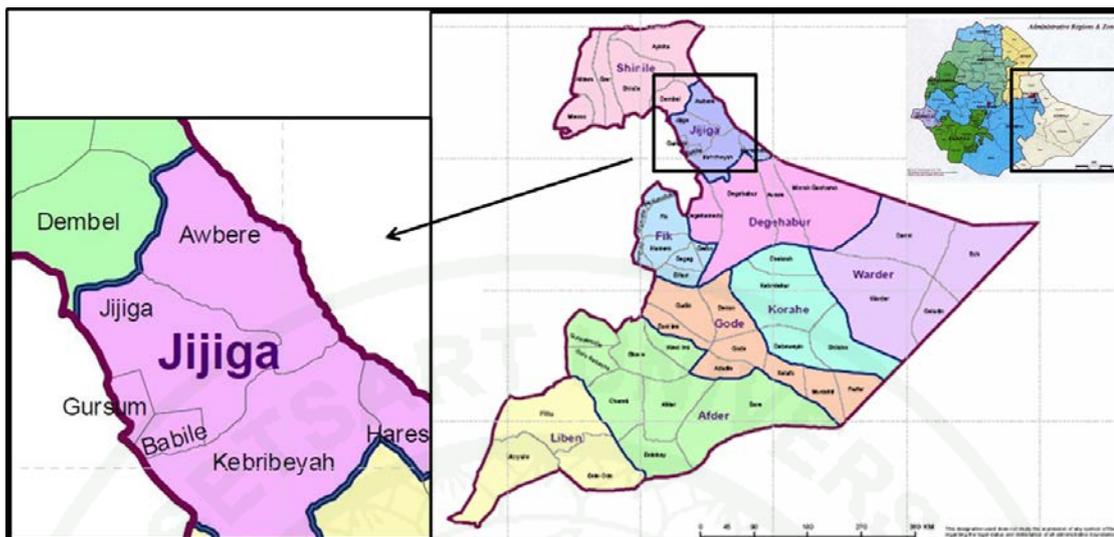


Figure 2 The study district (Awbere *Wereda*)

The natural vegetation in the *wereda* is a mixture of deciduous bush land and shrub land with different species and vast area of pasture land. The farming system is agro-pastoralism; and land use system is a mixture of private cropland and communal grazing land. Increasingly, destitute agro-pastoralists are becoming settled farmers. They mostly consist of local livestock poor households. The ecosystem of the *wereda* is fragile and subject to intensive grazing, intensive destruction of tree for fuel wood, fencing and construction material. The low amount and erratic distribution of rainfall, and high evapotranspiration limited to the use of drought tolerant crop (sorghum and maize) varieties (Eshetu and Teriessa, 2000). The soil is mostly black clay and there is no permanent river running through the *wereda* (SCF, 2008).

According to CEDEP (1999), 127,000 hectares (out of 339,688) in Awbere *Wereda* have been converted to crop cultivation, which is 37.4% of the total rangeland. Indigenous agro-pastoral communities are not the only ones that practice cultivation of marginal crop areas. Refugees, from Somalia, temporarily settled in refugee camps and returnees are also engaged in crop cultivation. Though the size of cropland cultivated per household is relatively small (since refugees are not officially allowed to cultivate areas other than the plot allocated in their homestead), the

refugees and returnees involvement in crop cultivation is increasing rapidly (Yemane, 2003). Most of plots on agro-pastoral farms are occupied with sorghum, maize and chat. Sorghum is the main staple food of rural people. Farmers cultivate part of their landholdings. Better-off farmers have resources to cultivate wider areas. *Guus* is the principal labor arrangement used to ensure all farmers are able to plough and cultivate their land (SCF, 2008). The production of sorghum and maize in the *wereda* was 1,500 and 1,900 kg/ha, respectively (Teka and Azeze, 2002).

The extension system gives special consideration to the package approach to agricultural development. Different packages have been developed. The major ones include cereal production for moisture stress areas, livestock development, and soil and water conservation technology packages. Package based extension program in Somali region was started in the early 1990s. The technologies which were assumed to be appropriate and fit to region were introduced from research centers in Ethiopia. Different varieties of ISVs were introduced, such as Birmash, Dinkmash, Gambella, Kobomash, Seredo, Tashale and 76 T₁ #23. But, the varieties that were rejected by farmers are Birmash (due to susceptible to bird attack), Birmash, Dinkmash, Kobomash and Seredo (due to taste). Some farmers still use Gambella (but it yields less fodder), while 76 T₁ #23 and Tashale were well accepted by farmers, because some of its characteristics are similar to local ones and superior in yield (LCRDB, 2006).

Agro-pastoralists in Awbere *Wereda* own ruminants (mainly cattle, sheep and goats). The major feed sources for the livestock are communal and private pasture, crop residue, and hay. Pasture is supplemented by crop residue between May and July (primarily for milking cows and oxen) and livestock eat stored fodder from January to March. March is the most difficult month in terms of pasture and fodder availability. Runoff water is harvested into ponds and cemented cisterns (*Berkads*) during the rainy season. *Berkads* and seasonal ponds are the main water sources. *Berkad* water is owned by better-off households and sold to poor households but seasonal ponds are communally shared (Sugule and Walker, 1998; SCF, 2008). In the year where the

rainfall is normal, livestock remain grazing on clan land close to the family base, but in years of poor rainfall, households with livestock move to closest grazing areas such as Danbel and Aysha in Shinile Zone, Kebribeyah in Jijiga zone and Somaliland (SCF, 2008).

Income is mainly from crop and livestock production. Households rely on different markets for the sale and purchase of specific items. The potential market area is Jijiga where households sale crops and livestock, charcoal and some labor; and buy improved seeds, fertilizers and farm implements. Small ruminants (sheep and goats) are sold to meet immediate cash need whereas milk is consumed by the household. The surplus milk is sold or converted to butter. Oxen (Bulls) are used for draft power or sold for export if there is extra. Camels and donkeys are also used as a draft power to carry farm produces to the market and carry water from water points. The income from sales of the produce is used to buy household expenditures and to pay fees of education and contribution for social affairs. The main determinants of wealth are the number of livestock that the household owns and the area of the land that they are able to cultivate. Extensive mobility, cross-boarder trade and dominance of livestock production, large area of land under cultivation and presence of agricultural extension service are important features of the *wereda*.

Sampling Procedure

A clear identification and definition of the target population is an important prerequisite for research sample design. The target population is the population that should be investigated. Once the target population was defined, the next task is the question of taking samples from the population. However, for most researches, unless you have a huge budget, limitless timescale and large team of interviewers, it will be difficult to speak to every person within your research population. This problem is overcome by choosing a smaller sample which is representative of the population. Appropriate sample size, therefore, depends on various factors relating to the subject

under investigation like the time aspect, the cost aspect, the degree of accuracy desired, etc. (Rangaswamy, 1995; Gupta and Gupta, 2002; Bethlehem, 2009).

There are many different ways to choose a sample. Basically there are two main types of sample such as probability samples and purposive samples (Sapsford and Jupp, 2006; Dawson, 2007). The sampling procedures that were employed for this research are both purposive and random. For the qualitative research, the selection of *Kebeles* and agro-pastoralists who took part in the key informant interview and focus group discussion was done purposively. From Awbere *Wereda* ten *Kebeles* were selected to ensure variation in village size and distance between villages. There are no rules for sample size in qualitative inquiry. On the basis of theoretical saturation – the point in data collection where new data no longer bring additional insights to the research questions – in each of these *Kebeles*, three to four focus group discussions were held with seven members in each group at a time (in the entire data collection period 250 pastoralists were participated in focus group discussions). Snowball sampling technique (informant with whom contact has already been made, uses his social networks to refer the researcher to other people who could potentially contribute to the study) was also used while conducting key informant interviews. Agro-pastoralists who took part in the focus group discussion and some more key informants were identified with the close collaboration of the respective *Kebeles* administrators and extension agents.

In the selection of sample frames to be interviewed in conducting the formal survey, probability random sampling technique was employed. A two stage sampling procedure was used to select the *Kebeles* and sample households. In the first stage, eight *Kebeles* were selected randomly from 34 *Kebeles* in Awbere *Wereda*, where extension package program has been operational. In the second stage, 180 farm household heads were randomly selected using probability proportional to size. This sample size could be statistically justified by the principle of ten observations per independent variable when using logistic regression. Having an adequate sample size is just an important when fitting logistic regression as any other regression model.

However, the performance of the model-based estimates may be determined more by the number of events rather than the total sample size (Hosmer and Lemeshaw, 2000; pages 346–347). For this study 15 independent variables were used, which are presented earlier in the research hypothesis.

Data Collection Techniques

Data collection was done through a mixed methods consisting of: 1) focused group discussions to familiarize research team and the local population, to gain a basic understanding of characteristics of pasture resource system and resource users, rules-in-use in the management of pasture resources, types of collective action activities and management on collectively provided resources, and institutions in the study area and the mode of interaction among and between them; 2) key informant interviews with government bureaucrats, NGO staff, local elders and other key informants to generate information required; and 3) a household survey to collect data on demographic and socio-economic characteristics of farmers that may affect adoption improved sorghum varieties.

The methods of primary data collection that were employed for qualitative data include key informant interview and focus group discussion with the help of semi-structured questions, and participant observation. Each method is particularly suited for obtaining a specific type of data and they are effective in obtaining culturally specific information about the values, opinions, behaviors, and social contexts of particular populations).

Key informant interview is a one-to-one interviewing method of data collection. They are useful in the early stages of research when the researchers are trying to gain an overall view of the problem area. Nevertheless, different informants can be useful at almost any point in the research process: description, explanation and verification. A key informant is any individual who is knowledgeable about his community and is willing to be interviewed. The interview is informal, in the sense

that it does not employ a predetermined questionnaire, although it might well follow a predetermined theme. It is important to talk to people who represent the different interest groups and different perspectives of the theme being studied, to gain an overall view of the problem and to identify topics for more in-depth research (Powell, 1999; Payne and Payne, 2004; Given, 2008). The key informants for this study were agro-pastoralists, elders, businessmen, experts (subject matter specialists and extension agents) working in the area, and officials of the *wereda*.

Focus group discussion is a technique of primary data collection where a smaller group (six to eight persons) of people is selected for their similar backgrounds and specialized knowledge or perspective on an issue. Focus groups are useful in obtaining detailed explanation and verification for issues of the research and allow the researcher to generate a rich understanding of the issues which cannot be gathered from standard multiple choice surveys. A researcher guides the interview while the group discusses the topics that the research raises. What the participants in the group say during their discussion are the essential data in focus group (Morgan, 1998; Powell, 1999; Krueger and Casey, 2000). In this research, focus group discussion (with 250 pastoralists) was used at the community level with the use of semi-structured questions and “the group” is the unit of analysis, this means the group that uses and conserves rangeland resources.

Participant observation is a data collection technique in which the researcher participates as an actor in the events under study. Participant observations are used to understand the physical, social, cultural, and economic contexts within which the people of the village live, and the relationships among and between people. The researcher openly shares in the life and activities of the people for the duration of the study (Neergaard and Ulhoi, 2007). Thus, the researcher, as much as possible, has taken time to observe and interact with the community, and traveled inside the villages to gain an in-depth understanding.

A formal household survey was also conducted to analyze factors affecting the adoption of ISVs by agro-pastoralists. Examining the adoption of ISVs by the agro-pastoralists in the rangeland resource system requires a well-designed and well-executed household survey to gather detailed data on the factors that affect adoption of ISVs. Formal structured survey is an ordered way of collecting information from the respondents and enables precise and statistically analyzable data to be obtained. It involves designing questions in structured way, pre-testing them before hand and then collecting the data by administering the interview schedule on strategically selected sample interviewees (Payne and Payne, 2004; Bethlehem, 2009). However, the costs of gathering such comprehensive household data are notoriously high and time consuming. Consequently, the analyst is forced to establish a partial process for an analysis by separating the elements that deserves central attentions from those considered less relevant (Kalof *et al.*, 2008). Therefore, researchers should limit themselves to collecting data, which are most relevant for adoption study. The variables under consideration when conducting adoption study include both dependent and independent variables (see the research hypothesis presented in the last section of the literature review).

The data examined, in this research, for sorghum adoption was come mainly from a rural household survey that was conducted in eight *Kebeles*. A structured survey interview schedule was designed on issues that covered factors affecting adoption of ISVs, and attributes of pasture resource system and pasture resource users. The interview schedule was pretested on selected few non-sample farmers at each of the *Kebeles*. After gathering feedbacks, the interview schedule was modified to its final version. This was followed by identification of the *Kebeles* from which sample households were selected and interviewed to collect relevant data. The household head was the main source of information. Hired enumerators were took part in conducting the formal survey. In order to realize this, first the researcher was indentified potential enumerators and then trained them on the interview schedule. Finally, they were held the interviews with sample respondents that were identified.

Data Analysis

This research was employed both the qualitative and quantitative data analysis techniques. Qualitative research, unlike quantitative research, requires data analysis techniques and processes throughout all phases of the research. However, generating findings that transform the dataset into new knowledge by employing the appropriate data analysis technique is a challenging task. Although, there are many qualitative data analysis techniques, this research was employed narrative and ethnographic analysis. This was done through engagement of the researcher in the fieldwork and in the various data collection techniques.

Quantitative data collected through survey were compiled and checked for consistency and completeness. This task has, of course, proved to be much difficult and time consuming, because of the large amount of data to be dealt with and sometimes the need to check and correcting by referring to the original interview schedule. Finally, the quantitative data analysis was done through use of descriptive statistics and mean comparisons; and logistic regression (binary logit model).

Model Specification

Logistic Regression (sometimes called the logistic model or logit model) is a type of predictive model that can be used when the target variable is a categorical variable with two categories (i.e., a binary or dichotomous variable). When facing a dichotomous dependent variable, sociologists almost automatically turn to logistic regression, and this practice is generally recommended in textbooks in quantitative methodology (Mood, 2009). As an example of logistic regression, consider a study whose goal is to model the response to a technology as a function of the adoption of the technology introduced. The target dependent variable, response, has a value 1 if the technology is adopted and 0 if the technology is not adopted. Thus, the general form of the model is:

Response = f (adoption)

One obvious question is “Why not simply use linear regression?” In fact, many studies have done just that, but the problems is that there are no limits on the values predicted by a linear regression, so the predicted response might be less than 0 or greater than 1 – clearly nonsensical as a response probability. The logistic model formula computes the probability of the selected response as a function of the values of the predictor variables. If a predictor variable is categorical variable with two values, then one of the values is assigned the value 1 and the other is assigned the value 0 (Gujarati, 2004).

In the case of technology adoption study, one can study the probability (p) of adoption (y) depends on independent variable (x). For example, when the technology is adopted ($y = 1$) or not adopted ($y = 0$) after being introduced to a given population.

Here, y is the probability that a technology is being adopted or not, and possible independent variables (x). Note that the independent variables can be either categorical or quantitative (discrete or continuous). The impact of independent variables is usually explained in terms of odds ratios. Logistic regressions work with **odds** rather than **proportions**. The odds ratios are simply the ratio of the proportions for the two possible outcomes (Liao, 1994).

If p is the proportion for one outcome, then $1 - p$ is the proportion for the second outcome. Where $p =$ probability ($y = 1$) is the conditional probability that a farmer adopts a technology; $(1 - p) =$ probability ($y = 0$).

$$Odds = \left[\frac{P_i}{1 - P_i} \right]$$

Hence, in most of the studies on adoption behavior, the dependent variable is constrained to lie between 0 and 1 and the models used are exponential functions. However, the decision to adopt a new technology can be effectively captured using

binary choice models. Therefore, for this study logit model is used to estimate the probability of adoption of ISVs that takes either of the two values of $Y=1$ for adoption and $Y = 0$ for non-adoption of ISVs. The functional form of the model is presented as follows:

$$Pr ob(Y = 1) = \ln \left[\frac{P_i}{1 - P_i} \right] = \frac{e^{(\beta'X)}}{1 + e^{(\beta'X)}}$$

Where $B'X$ is defined as: $\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_i X_i + U_i$

Where β_0 is the constant, $\beta_1, \beta_2, \beta_3 \dots \beta_i$ are the coefficients of the independent variables to be estimated, $X_1, X_2, X_3 \dots X_i$ are independent variables, and U_i is the error term with zero mean and constant variance.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter discusses the results of field studies conducted based on the objectives of this research. The first part explores the characteristics of the two factors affecting the structure, function and the outcome of the resource utilization and conservation which are the pasture resource system and the pasture resource users. The second and third parts present the detailed analysis of local level institutions both in their sense of rules-in-use and organizations. The proceeding part explains the types, coordination and governance of the collective actions. The last part analyses the factors affecting the adoption of improved sorghum varieties.

Part 1: Characteristics of Resource System and Resource Users

The two variables that affect the structure and outcomes of the action arena are the resource system characteristics, and resource users and their characteristics. They are presented separately and discussed in detail below.

Characteristics of Resource System

The resource system investigated in this research was pasture resources of Awbere *Wereda*. It provides resource users with both direct and indirect benefits. The direct benefits the pasture resource system generates include grazing and browsing resources; forest products such as fuel, construction and fencing material; non-timber forest products such as grass and medicinal plants; and source of agricultural land. The indirect uses include reducing soil loss, climate regulation, shed and biodiversity store.

A variety of pasture resource system characteristics affect the structure, function and outcome of the resource users' action at the local level. The most

important are discussed below.

Resource Size and Boundaries

The most commonly existing social structure of the Somali people is the clan system. In the study area, the population is divided into four kin-groups such as Gedebursi, Isak, Medigan and Akisho clans. The clans are divided into innumerable divisions, sub-clans and sub-sub-clans. Numerous smaller clans of different lineage, in the form of group of households (*beel*), are dispersed within their established clan territory. Thus, a number of households of the same lineage often come close together to occupy a micro-spatial rangeland area. The size of the territory depends on the spatial area they occupied and varies from clan to clan. They established a strategy of dispersing themselves in their territory in order they can use the resources efficiently and able to monitor and control the resources. The common rule in pasture land is never to fix a village (*degaan*) too near to another one. The minimum distance between villages of even very close relatives is 0.5 km. Moreover, the above minimum distance serves to control the territory as well as prevent the degradation of the environment, and ensures that cries for help can be heard.

Groups of people or social segments living in the same territory recognize themselves as part of the same social community and form cohesive relationships or networks, since a *beel* is usually linked to a village or cluster of villages. A village is made by a group people consisting of an extended family made up of 10 to 15 nuclear families (households). People at any lineage segment of the same clan claim to belong to a clan and access the resources in the territory. In normal (non-drought) periods, the agro-pastoralists' movements are limited to nearby villages, where the intrusion to other group's territory is lower, and in long dry seasons and droughts the *beel* settlements disperse by migrate to more distant area even beyond their clan territory, where long time users and occasional users meet seasonally with households of different lineage. The above social-territorial arrangement allows for a flexible

resource use system accommodating different agro-pastoral groupings' interest and the right to use the rangelands resources in their clan territory.

The size of the pasture resource, in the study area, is relatively large. The response of respondents revealed that the size of the pasture resource is very large 17.3%, large 43.3% and small 39.4%. Supervision and control of the resource is also very easy 25.6%, easy 41.1 and difficult 33.3%. This situation is prominent in area where livestock production dominated over crop production. In this area the pattern of settlement and availability labor force for monitoring the pasture resource favors the utilization and control of resources, where crop producing areas are engaged more on the management of growing crop. But after harvest similar situation in all study area will happen where all the community labor force is engaged in utilization and control of pasture resources.

No matter how big or small the size of the resource systems is, where local communities have strategic settlement pattern, have the sense of security over the ownership and management of resources, and where they are happy with the rules and regulations they designed, it is highly likely that the management of the resource system will be effective. The same situation was prevailed in the study area since they continued to utilize and control their resources despite being relatively large in size. This may have arisen because in such a situation the problems of an authorized users and non-rule-obedient members can be prevented very easily. Convergence in management practices and rules and regulations between communities also favor in influencing local communities' decisions about the value of the resources and the way they should be managed.

Table 1 Perception of resource users on the characteristics of resource system
(n=180)

Description	Number	Percent
To what extent the boundary of your pasture resources is known to you?		
Very clear	87	48.3
Clear	93	51.7
How far do the individuals in the user group live from this pasture?		
Within 1 km	45	25.0
2 to 5 km	66	36.7
6 to 10 km	69	38.3
How individuals who are not member of the community prevented from using your pasture?		
Very easy	46	25.6
Easy	74	41.1
Difficult	60	33.3
How is the size of your pasture resource		
Very large	31	17.3
Large	78	43.3
Small	71	39.4

The concept of boundaries refers to the degree to which the areas of resource systems are clearly defined or not. Resource boundary affects resource users' management decisions and determines the rules to be designed to manage resources. The boundaries of the pasture resources are formed by planting *Aloe Vera* species or by cutting tree branches to make fence, by creating furrow or putting bigger rocks on the border, and by settling or constructing pond on the border of their territory. Natural boundaries like rivers and mountains are also used in situations it is difficult to make the above mentioned methods of forming boundaries. Walking in and

through the pasture resource, one can see where the boundary marks are and how they are made. Clearly marked or well understood boundaries are less expensive when compared to fencing. The existence of boundaries allowed the resource users to manage their pasture resources effectively since significant parts of the resource can be controlled or are easy to monitor and supervise. Thus, those who invade others' territory know they are doing it, and those who are invaded can prove that they have been invaded.

The existence of boundaries also allows identifying whether unknown person seen in the areas is an invader or member of the clan. If an individual is seen in the locally who is not identified by the villagers, they will ask the stranger (*toyasho*) to identify himself. In fact, every Somali person can identify himself or being identified only by tracing his relationship to the founding father of his genealogical tree (*abtirsiin*). Clanship is important for individuals to know how they are related to each other because the kind and the degree of relationship are associated with rights to use the pasture resources.

However, in dry season agro-pastoralists extend to other clan territory to access resources through establishing relations. Community maximizes resource access options rather than limiting their relation to a single clan or sub-clan. Horizontal ties (relations) were created through inter-marriage between clans and sub-clans. For example, Gedebursi clan established relations with Isak in the *wereda* and Isa clan in neighboring Denbel and Aysha *weredas*; and similarly Isak established relations with Gedebursi in the *wereda* and other Isak sub-clan in neighboring Kebribeyah *Wereda*. The relation they established further extends to clan members living in Somaliland, which led to giving less concern to ownership of specific grazing area. This relationship that came into being show the presence of formal boundaries among *weredas* and between countries (Ethiopia and Somaliland) did not restrict reciprocal arrangement and mobility between clans and sub-clan. Thus, this practice of reciprocal grazing arrangement created a dry season fuzzy boundary between clans and sub-clans (for details of relationships see title: Trust and

reciprocity below).

Resource Mobility and Storage

Rangeland provides a wide range of products of subsistence and commercial values which are mobilized from the resource system. Mobility is the act of extracting a resource unit from the resource system e.g. the quantity of grass grazed by the livestock from the pasture land or the quantity of fuel wood collected from the pasture land. Agro-pastoralists mobilize a wide range of resources such as pasture grazed or browsed by livestock; grass for making household equipment, carpet or broom for house dirt sweeping; wood for fuel wood, fencing, making household equipment, bed and stool, making farm implements and house construction; and collecting tree fruits and medicinal plants.

To mobilize these resources units from the resource system, no sophisticated technologies are required since agro-pastoralists use traditional technologies to utilize rangeland products. Thus, communities use extensive livestock production system where animals directly graze or browse from pasture land, and use traditionally made axe to cut trees down for various purposes (fuel, fencing, farming equipment, construction material), and to clear forests in order to get access to agricultural land; use wood made equipment to collect and transport rangeland products; and use family labor to collect non-timber rangeland products such as grass, fodder, medicinal plants and tree fruits. In normal season, to access and utilize the resources, agro-pastorals travel within their settlement to where pasture is available. The distances they travel vary depending on the place of settlements. Agro-pastoralists who settled near cropping farms travel longer distance compared to those who settled near pasture resources. Those reside far (38.3% of the respondents) from the pasture were daily travel six to eight kilometers to graze their livestock. The average daily travel to pasture area for all respondents is 4.2 km.

Mobility affects the storage of resources in the system i.e. negatively (degradation) particularly when the resources are not replenished. The situation even gets worse (degradation) if the resource exhibits such attributes as low regeneration-ability, high subtract-ability and when the institutions guiding utilization are not effective. In the case, particularly the study area, where the resource users have utilization rules and the strategy to control the resources (scattering the settlement in the entire resource system), the resource subtraction and storage can be kept in balance through preventing overexploitation of the resources. Even though the communities agree that the current rangeland condition is declined (decline in the abundance of palatable grass species, and an increase in woody vegetation and bare ground) when compared to the past decades, they still believe that the resources available can sustain the generation to come. This indicates that agro-pastoral societies have survived in this harsh environment for hundreds of years, which strongly confirms that pastoralism is a viable way of using rangeland resources capable of maintaining quite large populations and the storage of resources (storage in the system refers to the stock of the resource unit available in the system e.g. the quantity pasture of available in the resource system for grazing and browsing).

Rain water, the most appreciated resource by the agro-pastoralists, is scanty, seasonal, and varies greatly from year to year and from place to place. Availability of pasture and the surface water depend on the extent of the annual rainfall. This fact indicates that resources are sparsely distributed among different ecological zones. To cope with this harsh environment, agro-pastoralists have developed a strategy of shifting grazing land to take advantage of these widely scattered and diverse pastures. Agro-pastoralists also keep a diverse mix of livestock in terms of species to exploit different components of the pasture resources and to match labor, grazing and water resources to livestock demands. The communities are transhumant, i.e. they are not nomadic, but instead maintain permanent settlement while the herders move their livestock seasonally in order to exploit areas away from the permanent settlements. They normally move to another area when the available amount of pasture decreases and before being depleted. This continues to be a crucially important mechanism for

transferring grazing pressure from area deficit to those of surplus. This is to allow the older pasture area the time to regenerate (pasture constitute varies renewable resources) and maximize the utilization of yet unexploited pasture distributed in the rangeland.

The other strategy they use for pasture conservation is herd splitting. Herd splitting is the practice of dividing the livestock into separate herds depending on their age, sex, type and productivity. In doing so, they herd camels together with sheep, and cattle with goats; and separate livestock into a 'milk' herd (mostly pregnant and milking animals and their young) in order to reduce competition among livestock for the same vegetation. Herd splitting is a technique that allows agro-pastoral communities to cope with the variable and widely-dispersed presence of pasture and can be used to maintain the long term productivity of the range and to improve degraded rangelands. These strategies, shifting grazing land and herd splitting, are traditionally adopted opportunistic strategies to optimize the use of the limited vegetation through raising mixed species of stock with different preference to standing vegetation. These clearly demonstrate the ability of a set of users to appropriately time their use of rangeland resources to a period when others resource are needed to be exploited; and also indicate that they have a familiarity with conservation principles that underlie sustainable use.

The main factors that determine the route of mobility are distance to grazing, availability of feed for livestock and the security of the route. The duration of stay of camels and the other livestock species (cattle, sheep and goats) during mobility differs. The camels migrate year round, while the migration for cattle, sheep and goats was during dry season. The average distance of migration does vary, but due to ethnic boundaries it usually does not exceed 50 km. The agro-pastoral groups indicated that compared to the past, the frequency of migration has increased because of the shortage of rainfall and subsequent drought conditions.

Pasture Resource Users

Resource users are those that affect and/or affected by their own management decisions and actions, and by decisions and actions of others in the system. A variety of participants (resource users) was identified as taking active role in the management (conservation and use) of pasture resources. They include individuals in the households, community, absentee herd owners, traders, and governmental and non-governmental organizations, which exhibit some differences in their attributes.

Communities

Communities are often assumed to be relatively homogeneous, with members' shared characteristics distinguishing them from outsiders. Their membership does not change too rapidly; interact with each other over extended time periods about multiple issues; and collectively depends on certain resources for their livelihood. Communities have, therefore, come to encompass a great variety of individuals, groups and sub groups with distinct social, economic, and cultural characteristics that continuously interact and ultimately define the way they engage in livelihood strategies and use resources.

Communities, in the framework of this research, include groups and subgroups of households that reside in the localities and that depend on pasture resources in the pursuit of their livelihood. At the community level wider decisions are made about the strategy on access and use to water and pasture resources. Despite variations in some of the attributes they exhibited, they also share similarities such as ethnicity, religion, language, crop-livestock production, and settlement patterns and mobility as livelihood strategies. The variations and diversities are described under the section that deals with attributes of resource users (see below).

Absentee Herd Owners

Absentee herd owners are townsmen and local retailers who are members of the clan and own livestock. Many town-dwellers acquired animals (cattle or sheep) through purchase. Absentee stock owners will contract with a kin family to look after their livestock. The contracted family is usually receives some type of remuneration for taking care of his livestock and perhaps given animals. Typical forms of payment for herding include gifts of cloth, rice, sugar, house hold implements; and/or boarding the school-aged children of herders in town during the school year. Herders may use some or all of the milk from absentee's cattle, although absentee cattle owners often milk their own animals in the rainy season. By making such an arrangement, absentee herd owners take advantage of using local rangeland resources.

Traders

There are traders who were involved in the management (conservation and use) of pasture resources. They essentially include private traders who are involved in milk, hide and live-animals trading activities. These traders have kinship ties to livestock producing communities. They buy and bring animal, to graze them temporarily, to their lineage settlement areas and rest the animals (rams, oxen and male camels) for a while before transporting them for export. They live in nearby towns or far from the settlements and operate through hired laborers. Traders provide assistance during climatic disasters by helping households through providing food and assisting them in moving stock and household to distant pastures. They are, therefore, considered as participants of the action arena.

Government Organizations

The Somali Regional State is structured hierarchically into Zone, *Wereda* and *Kebele* Administrations, each of these hierarchical government structures being made up of the judicial, the executive and the legislative. The local government

organizations, *Wereda* Administration and development offices, are involved in the management (conservation and use) of pasture resources based on the national policies and strategies. Its involvement is both direct that is pasture resources utilization for various purposes, and indirect through issuing policies, legislations and strategies and programs for improving and rehabilitating the rangelands.

Non-governmental Organizations

Non-governmental organizations (NGOs) include local and international organizations that have been involved in assisting communities and the local government in the management (conservation and utilization) of pasture resources. Their involvement is direct through implementing development programs and indirect through giving technical, managerial and financial assistance so that pasture resources are managed sustainably. They also assist the local government by providing the necessary knowledge and skill upgrading training, and helping them to establish the required infrastructure to enable it give sound services to the communities.

Characteristics of Pasture Resource Users (Agro-pastoralists)

The literature on CPRs management identifies several attributes of the participants (resource user) as important in affecting the structure, functioning and outcomes of the resource utilization and conservation (see characteristics of common-pool resources and the resource users under literature review). Those characteristics of pasture resource users are discussed in detail under this section.

Dependence on Pasture Resources

The pasture resources, in the study area, are the most important natural resources that communities, individuals, government and non-governmental organizations depend on for various purposes. Local communities depend on them for feed, fuel, household fencing, equipment and construction materials, and medicines.

Communities gather under forest sheds for social and cultural celebrations such as discussion on communal issues and conflict resolution, and they also use them as public burial places. This, therefore, asserts that pasture resources are a means of existence for the communities.

The pasture resources have particular importance to local communities, even though communities practice crop production. Crop production is less beneficial compared to pasture resources in terms of contribution to household income. Households in the communities spend much of their time in pasture resources utilization (tending animals, watering animals, collecting wood for fuel, fencing and construction, and monitoring their resources). The income they generate from pasture resources surmounts every other income and it is through this income that they get access to the basic services such as education and health. According to estimates by the *Wereda* Office of Agriculture (WOA) in Awbere for example, the income generated from pasture resources accounts for more than 80% of the household income (discussion with head of WOA).

Given the importance and high dependence of communities on the various benefits derived from the utilization of pasture resources, one would expect local communities to invest on collective actions that lead to the design of effective institutions which guide their management. This, therefore, clearly depict that local communities organize themselves and establish pasture resource conservation and utilization rules and regulations (see *xeer* under institution as rule-in-use).

Shared Understanding of the Condition of the Pasture Resources

Agro-pastoralists, in the study area, developed certain techniques to assess the condition of their pasture resources in order to decide which area should be exploited. They make periodic assessment on the condition of their pasture and water resources before they decide where to graze. The indicators used to assess the condition of the rangeland are plant growth and vegetation composition and the availability of water.

Presence of ticks, biting flies and diseases are also indicators used in addition to the condition of pasture and water. The main aim of monitoring the status of the rangeland is to know the amount of animal feed that it may yield and the period that it may hold, and thereby enable livestock to produce adequate amount of animal products such as milk, meat and physical growth of young stock.

Using these indicators, agro-pastoralists make consistent assessment on the condition of the rangeland. The information on the condition of the resource is obtained by scouting (*sahan*) the area and traditional interviewing (*waraysi*). Rangeland scouting is carried out by members of the community who have good knowledge on the rangeland condition assessment. During scouting, the scouting group will observe moisture condition of the soil, availability of water, pasture quality and presence diseases and parasites in comparison to their current settlement.

The evidence derived from the study showed that the large majority of respondents 57.8% and 36.7% perceived that the existing condition of the pasture resources are relatively degraded and in a good condition, respectively. Very few (5.5%) respondents have perceived the existing pasture resources condition as an abundant. Thus, the great majority of respondents have perceived the existing pasture resource situation as slightly degraded. The degraded area were largely where much of the pasture land is converted to crop cultivation land, and where the human population was increased due to refugees and returnees from Somalia in 1988 when the Somali National Movement (SNM) had begun fighting the regime of Siyad Barre, and as a result produced massive displacement in the north and the displaced population was settled in the *wereda* in few established refugee camps by UNHCR. These settled refugees and returnees were, then, exerted a pressure on the rangeland resources of the area.

If and when communities perceive the existing physical condition of resource systems to be in a relatively better condition or that resources are perceived to be relatively scarce, they will be more likely to have concern on the need for

conservation and therefore tend to invest more in collective actions aimed at designing institutions that enhance their management (Poteete and Ostrom, 2002). The result of this study supports this idea in that the ongoing degradation of pasture resources increased the concern of agro-pastoralists to enforce resource use rules and also to prevent non-members from using their resources (refugees in their settlement area). The rule enforcement is the result of the resource degradation which is believed not to occur if the resources would have been abundant.

Table 2 Resource users' perception on condition of the pasture

(n=180)

Description	Number	Percent
How do most individuals in the user group rank the condition of the pasture?		
Sparse	104	57.8
Normal	66	36.7
Abundant	10	5.5
How is the dynamics of your pasture resources overtime?		
The same	21	11.7
Degraded	150	83.3
Very degraded	9	5.0
Is your actions resulted degradation of your pasture resources?		
Yes	141	78.3
No	39	21.7
What are root causes of resources degradation?		
Increasing population	95	52.8
Agricultural expansion	48	26.7
Over exploitation	37	20.5

The discussion with group of agro-pastoralists also revealed that agro-pastoralists who have lived for more than 20 years in the locality perceived the

physical condition of the resource as degraded while younger agro-pastoralists and returnees in the locality relatively perceived otherwise i.e. the pasture resource condition as it is now appears to be in a normal condition. It is not only agro-pastoralists' understanding of the present condition of pasture resources that matters but also the dynamics of pasture resources cover over time. The analysis of agro-pastoralists' perception of the pasture resources dynamics revealed that the majority of respondents indicated that it has been degraded compared to five years ago (83.3% perceived it as relatively degraded where as 5% perceived as very much degraded). The proportion of agro-pastoralists that have reported the pasture resources condition to be the same compared to the past ten years was 11.7%.

Variations in agro-pastoralists' perception of the dynamics of the pasture resources condition were influenced by length of stay in the locality. For agro-pastoralists that have resided in the locality since long time ago, the pasture resource condition has been degraded over the years while for young members and returnees from Somalia the degradation has not been that serious. This could perhaps have arisen from previous experience of most settlers with pasture resources. For instance, young members and returnees do not have proper information of what the pasture resource situation was like some decades ago. Therefore, whatever comparison they make is based on the knowledge they have about pasture resource conditions.

Households that reported decreasing pasture resource situation over the years supported their observation by referring to indicators like increases in cropping land and weed infestation, and decrease in the population of grasses and woody vegetation. They said they used to experience a dense vegetation (*haud*) and vast grass land (*dhul daaqsimeed*) with many antelopes (*duudgal*) such as Oryx, Kudu, Gazelle and others. Areas that were covered by trees and bushes and were not accessible to human and livestock became less dense. However, they indicated that it has almost been more than decades since they last saw that wildlife in the locality. The invasion by *parthenium*, and spiny cactus has also been one indicator that agro-pastoralists have cited to support their observation. Agro-pastoralists were also of the opinion that the

available rangeland was not utilized to its maximum potential. The reasons for this, ranked in order of importance, were inaccessibility (too far), lack of infrastructure (e.g. roads), hilly and mountainous topography, and unavailability of water (Focus Group Discussion).

Agro-pastoralists indicated a number of factors as causes to pasture resources degradation. The majority of the respondents (52.8%) indicated population increase to be the number one factor. Expansion of agricultural land (26.7%), and over exploitation of resources (20.5%) have also been indicated as causes of pasture resources degradation.

The main reason for communities, whether they are locals, returnees or refugees, to be engaged in indiscriminate tree clearing is to get access to agricultural land. The demand for fuel, fencing, charcoal making and construction material have also been among the factors that have led to the over exploitation of pasture forests. Such demands have in turn been translated as versions of population increase. The impacts of indiscriminate deforestation are more pronounced because of the lack of livelihood options for some communities. Nowadays, because of decreasing livestock number and productivity that resulted from recurrent drought led to the decline in family income, the poor and destitute agro-pastoralists were forced to seek an alternative source of income to maintain the livelihood and, hence, charcoal making became the cheapest and the most available source of income to them.

Agro-pastoralists' recognition of their own actions is a factor that lead the pasture resources to degradation. The most important reasons were lack of alternative livelihood options and lack of government institutional support in resource development interventions. The institutions in the past and even today have not been effective and efficient in guiding the production and management of pasture resources. Policy planning has been top-down with economic and political influences dominant. Policies have often been designed to benefit economically dominant crop production sector. The pastoral and agro-pastoral sector was considered as a sector

which does not contribute its fair share to the national economy, as an irrational production practice and environmentally destructive production system, and, hence, need to be replaced. From these assumptions policies determining commercial ranching, optimum stocking rates, sedentary mode of living, and de-stocking and re-stocking strategies were planned and implemented. Pastoral and agro-pastoral development projects, in line with these policies, had not provided clear title to key resources, weakened traditional management rules and strategies, and had not focused on acquiring pastoral knowledge through working together with pastoral and agro-pastoral communities (see also Scoones, 1995).

For example, the South-East Rangelands Development Project (SERP) was established in 1989 in the Somali Region. SERP had provided infrastructural improvements (roads, markets, water) and support services (veterinary and marketing facilitation). The project was designed also to incorporate participatory approaches to pastoral development in addition to provision of infrastructure and support services. Despite advances in pastoral development concepts, impact of pastoral development activities has been routinely constrained by shortages of operating funds and trained manpower and periods of insecurity. The experience of SERP also highlighted the retarding effect of poor project governance on operational effectiveness and non-compliance with the agreed rules and procedures. The overall performance, with respect particularly to improving animal health, livestock productivity, marketing and rangeland conservation and improvement, was unsatisfactory during eleven years of operation (see also Tesfaye, 2008).

Agro-pastoralists, therefore, often view government policies as a burden rather than assistance since their production systems are well suited to highly variable rainfall and utilization of scattered resources. Moreover, development programs in livestock production and management has been designed with a bias for western models of livestock production and management, which have failed to realize the uniqueness of the western experiences and developed independently of the local context.

Communities' Perception of the Impact of Their Own Actions

The great majority (78.3%) of the respondents perceived that the actions they have been taking have contributed to pasture resource degradation whereas the remaining 21.7% perceived otherwise. Perception differences are highly influenced by the distance households resided from pasture resources. The proportion of settlers near pasture resources was as high as 61.7%. Accordingly, households that live in the locality near the pasture resources perceived that the impacts of their own actions are resulted degradation.

The theoretical consideration suggests that if communities' perceive their own actions on natural resources as not damaging/degrading, the likelihood of adopting conservation measures of their own or those recommended by outsiders is low (Ostrom, 1990). In line with this, the majority of the respondents who perceived that their own actions had considerable impact on the resource condition (damaging) were engaged in activities like degraded area rehabilitation and conservation measures with the support of government and non-government organizations.

Degree of Trust among Themselves and Reciprocity with Others

The agro-pastoral society in the study area is known traditionally, to be organized into clans with clan lineages that have common culture, language, religion, and production system. Each Somali clan or group of clans is known to inhabit specific area. Within this area, each clan or group of clans have a social structure with rules that govern their interaction and interaction with other Somali clans. Mostly agro-pastoral communities observed and adhered to the codes and conducts of the customary law (*xeer*), which defined the rights and the responsibilities of the individual within a group bound together by ties of kinship. At the same time, the respect of the *xeer* is an integral part of any Somali clan, which elders of neighboring groups enforce the *xeer* in the process of governing. Members of one clan who contest it without very good reasons will be criticized or punished. For instance, the *mag*

(blood compensation) among pastoral groups is generally expensive. The reason behind the *mag* being expensive is related to the intent of discouraging the committal of a crime. The traditional *xeer* dictates the blood compensation for a murder committed to 100 camels to be compensated to the family of the victim (see *mag*-paying group under section: types, coordination and governance of collective actions).

Table 3 Resource users' perception on pasture management

(n=180)		
Description	Number	Percent
How would you characterize the levels of mutual trust among appropriators		
High	110	61.1
Moderate	62	34.4
Low	8	4.5
Do individuals in the user group follow the rules for using pasture?		
Most of the time	118	65.6
Always	62	34.4
If penalties are imposed, what is the level of compliance by the users?		
Most of users	93	51.7
All users	87	48.3
How often do individuals in the user group interact with respect to monitoring and sanctioning?		
Year round	46	25.6
Seasonally	134	74.4

Clan ties and existence of customary law (social sanctions are in place) created social cohesion and thus trust among members of the communities. Trust is, then, developed through the creation of a mechanism where neighbors could share their respective concerns and desires openly and regularly. Such trust-building resulted in

improved understanding of local problems and willingness to work towards resolving disputes and effectively reaching common goals and sustain group cohesion.

Respondents' responses with respect to the level of trust among agro-pastoralists were 61.1% high level, 34.4% moderate level and 4.5% low level of trust. This higher level of trust is maintained by the social ties and threat of punishment (a fine or avoidance) for anyone who breaks a contract. The results demonstrate some degree of trust about others' action in accordance with the established norm is a precondition for individuals to cooperate. Moreover, the level of trust would be higher in more homogeneous groups like agro-pastoralists in the study area, which would in turn enable them to succeed in managing the local commons. For this reason, villagers trust one another.

In the agro-pastoral community, reciprocal access to water and pasture resources is negotiated between different clans through customary rules to grant access to grazing land for secondary users; meaning those neighboring clans who ask for permission to utilize the communal grazing resources of another clan. In principle, each clan possesses primary user rights over its own clan territory and is expected to confine herd movement within the boundaries of this clan territory under "normal" conditions. Secondary user rights, meaning asking for permission to enter another clan's territory and use its communal grazing resources, is only considered when the own clan territorial resources are inadequate due to drought or inaccessible due to violent conflict with other clans.

Reciprocal access to clan territories and its resources is granted on the expectation that similar treatment will be returned by the clan or another clan in similar conditions. Negotiations encompass discussions over the rights to use communal pasture and water points, the length of stay in the grazing area, the number of livestock admitted, complete payment of blood compensation (*mag*) if any, and the assurance of the livestock entering into the clan territory is healthy (to avoid spread of

disease). Entrance to another clan's territory, therefore, requires prior negotiation, even though the hosting clan is socially inclined to grant access.

Inter-clan kinship relations are important in negotiating and differentiating access to grazing resources, meaning clan members have relatives within other clans with distinct territories. These lineages and networks across clans or sub-clans have played an essential role in establishing the reciprocity (informal resources sharing arrangements) principle. For example, the inter-marriage between Gedebursi and Isa as well as Isak and Gedebursi, which is most common, was strengthened clan relations (networks), and created fuzzy borders between clan territories and unlimited access to pasture resources during drought period.

Autonomy to Devise Institutions and Past Experience of Self-organization

This study revealed that agro-pastoralists used to have autonomies to devise their own institutions and have past experiences of self-organization. There are various types of indigenous institutions/organizations that have been operational in the localities quite for long period (for details see section: types, coordination and governance of collective actions). Some of these traditional institutions typically reflect social norms of solidarity and reciprocity, constituting a social safety net that ensures survival and relative harmony of the communities in villages. The performances of some of these institutions were regulated by *xeer* and *mag*-paying group while that of others were guided by norms and a set of expectations about other people's behavior. These expectations in turn derived from a common understanding of the rules-in-use and the penalties for deviations. They were based on shared identities of network members. Since they are self-enforced based on mutually agreed upon rules and regulations, the transaction costs were often low and the enforcement mechanisms were very strong.

Communities' autonomy to devise their own institutions, and past experiences of self-organization significantly favored the incentive for collective action and

therefore the management of natural resources. Discussions held with groups revealed that communities had autonomy to devise their own institutions (rules and regulations) and had past experience of self-organization, and, hence, this opportunity allowed them to engage in setting up rules and regulations (*xeer* and *mag*-paying group) that enhance collective action and therefore the sustainable management of natural resources.

In general, pasture resource dependent communities' shared some attributes and differed in others. They differed in such attributes as resource endowment; and in the perception of their own actions on the physical condition of pasture resources. On the other hand, they shared similarities in such attributes as livelihood strategies, dependence on the rangeland resources, and in the autonomy to design institutions (*xeer*) and past experience in self-organization (*mag*-paying group and *guus*). The variations in some and similarities in others shape their resource utilization strategies, which mostly done through negotiation among and between communities.

Part 2: Institutions

Institution is understood in two ways, in one situation it is understood as order to a thing (rule-in-use); orderly arrangement and regulation. In another situation as an organization having structural setup within which individuals may interact according to agreed rules and procedures around a shared purpose. It is discussed in detail below in both of its sense of meanings.

Institutions as a Rule-in-Use

As mentioned earlier, rangeland resources are important to the livelihoods of many households in rural areas. Local management rules and regulations can help to fulfill different needs and interests so that everyone benefits from resources and minimize conflicts as much as possible.

Rangeland utilization and conservation decisions are taken at three levels such as household, community and government levels. The household is the basic institution through which livelihoods are carried out. Day to day decisions such as grazing and watering animals, collecting fuel and fencing wood etc. are made by individual household heads to meet the food requirement of the household. Every member of the household is assigned specific duties and should act according to rules and regulations. Household head is a man who controls property, maintains order within his household and enforces rules on the rangeland management that have been agreed at community level.

Communities make joint decisions on communal issues and involve in setting up rules that guide households' access to resources to facilitate economic activity and provide security to live in peace and harmony. The rules are informal and traditional covering rangeland management, blood compensation payment, marriage practices, and management of property resources that can sustain smooth social relations between communities. Communities in areas without formal or structured administration relied on the traditional informal governance. These informal practices are those, which are developed locally and practiced and enforced by the agro-pastoral communities. Informal practices mostly may not follow the government regulatory procedures, but cases that have relations with formal practices are discussed that is they both filter and ignore the government's rules that contradict their daily patterns of resource use. They are generally undertaken by local unpaid leaders and elders (*odayaal*) and the decisions are often not legally endorsable (see the details below).

The third decision making body with regard to rangeland utilization and conservation is the government. The government established formal development policies and intervention strategies. This formal practice involves official procedures, guided by governmental rules, regulations and laws, and handled by paid government staffs. The common formal practices in the study area are the activities carried out by the *wereda* court, police and administration office. However, the *wereda* level law

enforcing offices lack financial, human and physical resources to enforce rangeland use and conservation rules and regulations adequately, and hence their roles are remained only to handle conflicts of wider-scope and political importance.

Based on the above reality, the decisions individuals and households made and that impact on the rangeland management are, in most cases, influenced by informal institutions. The common informal institutions that exist in the study area are customary law, *guus*, and *mag*-payment rules. Customary law, which is developed by the communities through consensus, is discussed below while the latter two are discussed under section: types, coordination and governance of collective actions.

Customary Law

Historically, Somali agro-pastoral society was a stateless society where government administrative offices were non-existent – but it was not without governance or rules. What Somalis have in common, even more than similar language, lifestyle, and physical character is a body of Somali customary law, the *Xeer Soomaali*, with respect to its provision for the protection of persons and property. Customary law (*Xeer*) is an informal institution because it neither codified nor legally positioned upon different groups. As it is today, law and order was maintained through a mixture of customary law (*xeer*), Islamic law (*sharia*), traditional values (*caado*), and social norms (*dhaqan*). Thus, the Somali system employs a mix of Islamic *sharia* and *xeer*, in which the later plays a considerable part, and is applied to all issues from the smallest to the largest. *Xeer* consists of a set of unwritten agreed upon principles, values and practices that govern the everyday life of the pastoral and agro-pastoral community. This includes reciprocal rights and obligations between clans covering domestic matters, social welfare, political relations, property rights, and management of natural resources, which are negotiated between lineages (*jilib*) by councils of elders (*xeer-beegti*), which act as judges. *Xeer* does not recognize a professional group defined as lawyers. The elders (*odayal*) are the traditional authorities with the responsibility to control the management and

allocation of the right of access to land and natural resources to their clans. Another important task of these elders is to resolve disputes that occur over access to rangeland resources within or between clans or sub-clan groups.

Xeer employs rules covering *mag*-payment (blood compensation for death), marriage practices, and management of property resources. Unlike *sharia*, *xeer* is not universalistic but is specific (*xeer gaar*) to relations between and within clans and its rule is flexible and varies from place to place depending on circumstances and situations. However, the most significant principles of *xeer* (*xeer guud*) are common across all Somali clans, which include collective payment of blood compensation for death (*mag*), physical harm or defamation (*qoon*), theft (*tuugo*), rape (*kufsi*), as well as the provision of assistance to relatives; maintenance of inter-clan harmony by sparing the lives of ‘socially respected groups’ (including the elderly, the religious, women, children, poets and guests), entering into negotiations with ‘peace emissaries’ in good faith, and treating women fairly without abuse; family obligations including payment of dowry (*yarad*), the inheritance of a widow by a dead husband’s brother (*dumal*), a widower’s rights to marry a deceased wife’s sister (*higsian*); provision of financial support to newlyweds and married female relatives; resource utilization rules regarding the use of water, pasture and other natural resources; and the temporary or permanent donation of livestock and other assets to the poor.

Furthermore, different *xeer* exist for the dominant livelihood systems: agricultural customary law (*xeer beereed*); pastoral customary law (*xeer xooleed*); agro-pastoral customary law (*xeer xoolo-beereed*). With regard to rangeland management, there are many rules formulated such as setting aside pasture buffer zones, ensuring that pasture self-seeds before it is grazed, preventing over grazing leading to pasture depletion, shifting grazing area to less exploited pasture area, mapping dry and wet season grazing areas, preserving water resources, and protecting trees.

If *xeer* is violated during violent conflict, it will be restored through negotiation. In Somali peace processes, *xeer* can provide a moral and legal framework guiding decision-making and peace negotiation which also involve the renewal and renegotiation of *xeer*. Conflict within and between clans occur as environmental change (e.g. recurrent droughts) and demographic change (e.g. population growth, and migration) generate competition over rangeland resources, such as grazing pasture land, using communally owned water sources, collection of fire wood and felling trees for charcoal making. Due to the growing poverty in the rural areas, many poor people, for their livelihood, are involved in illegal felling of trees to make charcoal. These forces can push people to exceed the sustainable harvesting limits of renewable natural resources (grazing areas, forests, water bodies, and agricultural land). Moreover, in areas where the number of people is increasing, resources often need to be shared among more users with different interests. These users range from agro-pastoralists who seek access to agricultural land, and pastoralists require pasture resources for livestock. When these different interests seem incompatible, securing access to resources can become people's greatest concern, and when those resources are scarce, a conflict over interests and scarce resource may occur. For example, disputes over the definition of land for cultivation between the two main cultivating groups – Isak and Gedebursi clans – sometimes leads to fighting, but much less frequent. Such disputes are, therefore, settled by local elders without the interference of the government, and a person who takes a case to the administration without first consulting his elders is liable to punishment.

Conflicts over rangeland resources can be useful in making needs and rights clear and helping to solve injustices or inequities in resource distribution. However, some conflicts have the potential for becoming obstacles to livelihoods and sustainable resource management if they are not addressed. Disputes over grazing land or water are ended through negotiation and the formation of new social harmony to ensure community survival. Furthermore, there is also an extensive practice of intermarriage between different sub-clans in order to establish and to strengthen inter-

clan relationships and *xeer* agreements, especially on the usage of grazing and water resources.

Since peacemaking was geared towards reestablishing social relations and restorative justice as the basis for reconciliation (*nabadayn*) and a peace agreement based on compensation or restitution, rather than retribution or punishments, is more likely to be sustainable in Somali society. This can involve restoring honor so that two groups can cohabit, agreeing reciprocal access to rangelands to enable people to pursue common livelihoods, or compensating a group for losses incurred during war. The most common form of restitution in the case of homicide is the payment of *mag* (blood compensation) by the aggressor to the aggrieved party. Payment is traditionally made in the form of livestock and is paid collectively by the *mag*-paying group. However, a delay in the payment of *mag* is taken as demonstrating a lack of respect for the offended party and is a common factor in the recurrence of conflicts (see the details for *mag*-paying group in section: types, coordination and governance of collective actions).

Xeer cases prevent four different types of individuals from participating in the process of judicial decision making. On the positive side, persons who have close family relations with the parties, persons who have personal grievances against either party, and persons who have previously sat in judgment of the same case, are all excluded. On the negative side, women are discriminated against and are neither allowed to sit as *xeer beegti* nor to act as an advocate for either party. In general, *xeer* is male dominated. Participation of women in the formation and practice of (*xeer*) is negligible, as they do not enjoy equal political rights with men.

Role of Elders in *Xeer*

Elders, lineage elders, are traditionally the first actors to become involved in dispute-resolution, since they are crucial actors in conflict management as negotiators, facilitators or mediators. They are representatives rather than executive leaders who

are chosen by their clans for their particular attributes, such as age, devotion to divine worship, knowledge of history and customary law, their powers of oratory, negotiating skills, courage and reputations for fairness, and sometimes wealth. Somali society has been exclusively oral until now, so the skilled orator (*hadalyaqaan*) is highly respected. A good orator is one who can convince others through the art of speaking effectively, and such a person can then become a successful negotiator for his clan, provided he has knowledge of customary law (*xeeryaqaan*). Therefore, oratory and knowledge of *xeer* strongly influence the selection of elders.

In a society where skills of oratory are highly respected, speeches and verbal agreements can carry more weight than written documents. In the dialogue-based problem-solving forum of a peace meeting, skilled orators can dramatically affect emotions and outcomes. Poetry in particular is a powerful medium in Somali culture that is used to appeal to the emotions and intellect and can transform the atmosphere of a meeting. Social sanctions, such as shaming or the curse of a religious elder can be used to pressure parties which are resistant and difficult to manage. Poets and religious leaders (□*heikh*) therefore often have an important role in peace meetings. Poets draw on history and precedent to get across their points, while the sheik seeks inspiration from the Quran.

Xeer is applied after a violation of laws has taken place. Once an incident has occurred, a delegation of elders (*ergo*) is dispatched by one or both of the concerned clans, or a neutral third-party clan, to begin mediating the dispute and preventing it from spreading. The head of the *mag*-paying group (*aaqil*) is also involved in resolving conflicts amongst his group and with others. Somali societies also have a senior clan head, which the agro-pastoralist in the study area called a *Suldaan* (for Isak clan) or *Ugaas* (for Gedebursi clan), often an inherited position and traditionally their authority is based on respect rather than executive power and their role is to facilitate and approve agreements rather than negotiate them. A clan head also devolves decision making power to the village chief, who regulates access to and

control over rangeland resources, and grants exclusive crop land use rights to individuals.

In response to particular needs, elders gather in council (*shir*) to deliberate on matters affecting the clan. In the absence of government, these have become important instruments of local governance. Their composition can vary depending on the problem being addressed and meetings can last for days or months. These are relatively public consultative forums in which all adult men have the right to speak. However, the opinions of different men carry different weight depending on status. Here status differences refer to age, wealth, inherited prestige, skill in public oratory, political keenness, wisdom, and other personal characteristics. Men of outstanding character, therefore, naturally tend to have greater influence in the meeting. The agreements reached through consensus are strongly binding and, thus, consensus decision-making is a key principle of conflict resolution. As the parties in conflict have the power to reject any settlement that they are not happy with, only decisions reached by consensus carry real authority.

Conflict resolution in agro-pastoral society may involve direct mutual agreement and negotiations among conflicting parties but it is a public process to which the whole community contributes with food, finance or accommodation indicating that local negotiations do not charge a fee for the elders' service in resolving conflict. However, elders often expect some physical labor from negotiating parties, perhaps for them to work on their crop farm. If the conflict is severe and seriously hampering the society then its members show their great concern and in this case third party mediation is required, but if the conflict is of a less severe nature its members are generally less concerned. Resolution of a conflict is also a means of establishing power and influence in the community. The principle is that as everyone is collectively responsible for the conflict, everyone also has to take responsibility for its solution.

Relationships between Customary and State Institutions

It is common to see customary institutions to operate alongside the system of the government. Government established a local level administrative entity called a *kebele*, governed by *kebele* council. *Kebele* councils are elected from among the community members. The *kebele* administration is responsible for the management of natural resources and makes decisions according to the government policies and strategies. But it lacks both financial and physical resources to monitor and to enforce the laws adequately, and hence their role was remained only to handle the day-to-day management of social issues in a locality or neighborhood. Therefore, elders play the major role in the management of rangeland resources.

Sharia, the Islamic law, is officially incorporated into the state judicial system. *Sharia* is organized and implemented in towns and *sharia* judges are educated through informal religious studies. Most legal functions performed by the *sharia* courts are concerned with civil matters, including sanctifying marriages and divorces, determining inheritance rights, settling business disputes, and minor civil matters. Thus, the political role of *sharia* courts and their involvement in large-scale security problems was generally limited. Moreover, *sharia* courts are not involved with the settlement of clan conflicts, which include the payment of *mag* or financial compensation for harm. These matters are left for clan elders to address, which clearly shows how religion is a matter of a private, individual business, while the clan law is communal and public, subject to all. Agro-pastoralists assert that there is no conflict between Islamic law and traditional Somali clan law (*xeer*). They state that Somali culture was fully integrated into Islam and thus no conflict was possible.

According to the constitution of Ethiopian, if one commits murder, the government legal system (*wereda* court) examines the case for the homicide and sentence the murderer to imprisonment for years. Even though the murderer is punished through imprisonment, blood compensation is claimed by the injured group. If *mag* is not paid, the aggrieved clan may opt to kill the criminal after release from

prison or members of that person's clan. The result would be both for a clan to lose a valued member. On the other hand, when the relatives settle an offence and blood - compensation is received by the injured group according to customary laws outside the judiciary system, judges and law enforcement officers was used to resist the release of the offender that have been imprisoned while the relatives insist on his release. This indicates that *xeer* is stronger than government's laws and the government laws don't satisfy the people. Moreover, many people believe that *xeer* is the justice system best suited to Somali and people still support this system.

Nevertheless, elders also used to debate on government policy and discuss matters which they wish to bring to the notice of the state administrations. As a result of the informal relations between government and traditional structures, the regional government in a sense also comes under their authority as it is not wise to contradict the elders. Then Somali councils of elders (*amakaries*) were formally incorporated into regional and local administration structure of the Somali region in the year 2000 to integrate customary and formal decisions. Salaried *amakaries* are expected to work with the traditional elders and are appointed to convey state policies and programs to the local community and provide feedback to the state bureaucrats. *Amakaries* advise also the local government in matters of peace and security and assist in mediating violent clan conflicts. *Amakaries* certainly manage to hold the respect of their kinsmen, and at the same time to discharge their duties as government officials fairly satisfactorily. At least they provide a means of mediation between the regional government and the agro-pastoral communities. The regional authority supports the traditional leaders in handling crime issues and conflict resolution by providing them with fuel, vehicles and security forces. Thus, the regional government gives more recognition to traditional conflict management institutions.

Generally, until now legal institutions safeguarding group rights are entirely missing and there is no clear land tenure policy that suits requirements of agro-pastoral production system. This vacuum led the government to work with traditional elders to ensure group rights. The established collaboration between *wereda*

authorities and clan elders not only reflects the important social status of elders and of *xeer* as the dominating normative order, but has also been actively propagated and instrumentalized by the regional government.

Institutions as an Organization

There were many public and non-public organizations working in agricultural development in the region. Public organizations (research and extension) are dominant and play a key role in providing a wide range of production inputs, improved technologies and extension advices. Well established non-government organizations (NGOs) were present in the region which actively working with the local peoples in limited geographical areas. The private actors (input and marketing agencies) had rather limited roles, relatively non-visible across the region. Furthers more, there are limited farmers organizations but there are numerous informal community organizations that offer mutual socio-economic support to their members. Experiences of cooperation among people residing in close neighborhoods have been a tradition of Somali culture. Communities organize traditional institutions that commonly have the objective of assisting each other. They mobilize financial, material and labor resources. The most widespread forms of such institutions are *guus* (mobilizing labor for peak farming seasons and labor intensive activities), *mag*-paying group (a collective responsibility for settling acts committed by, or against, their members) and collective herding (tending livestock jointly in group to graze and secure); (for their details see section: types, coordination and governance of collective actions). They have assisted communities in enhancing their social relationships, in fulfilling their economic requirements, in getting access to resources and in ensuring the security of the members. However, bringing such institutions into the domain of cooperatives, in Somali Regional State, has not gained adequate attention. It is very obvious that the transformation of the existing traditional institutions into viable cooperatives has not been explored.

Government Organizations

The Bureau of Livestock, Crop and Rural Development (LCRDB) of the Somali Regional State has the mandate of formulating agriculture related policies, coordinating regional development programs and projects, providing technical advices and training services to increase the technical competencies of extension staffs working at village level.

In the Somali regional state, the rangeland sector was organized as a team under the Animal Production, and Forage and Rangeland Development Department of the regional LCRDB. In addition, *weredas* have also Agricultural Offices with organizational structure similar to that of their regional counterpart and basically they function as branches or units representing the regional bureau at grass root levels. While the bureau has the mandate to initiate rangeland development policies and strategies through the responsible department, its development can however be undertaken by a range of stakeholders including the regional bureau and *wereda* Offices Agriculture (WOAs) as well as non-governmental organizations involved in livestock-related development interventions. In principle, development activities of the sector undertaken by the latter group should be in line with the regional rangeland development policies and strategies, and as the bureau is the government body responsible to ensure this requirement.

The Somali Regional Pastoral and Agro-pastoral Research institute (SoRPARI), established in 2002, also plays a significant role in rangeland development activities as it conducts research activities aimed at developing and managing rangeland resources. The regional LCRDB provides extension services that are intended to enhance management and development of rangeland resources based on the research outputs obtained from SoRPARI.

The *wereda* administration, the lowest constitutionally recognized government apparatus, is directly accountable to the zonal administration office and charged with

the power and authority to design *wereda* specific strategies which fall within the framework of the regional government policies and strategies, and monitor and evaluate their implementation. The *wereda* administration guides *wereda* specific development and natural resource management strategies through approving work plans and allocating budget for implementation.

At *wereda* level issues of agricultural and rural development in general and natural resource management in particular are organized under WOA. Within the office, the mandate of managing natural resources is that of the natural resource development team. The team works to insure the proper management and effective utilization of rangeland resources to meet the needs of the population without jeopardizing the interest of the future generation. The main activities conducted with regard to rangeland development by the team, especially with MERET Project, were rehabilitating degraded area through area enclosure and constructing traces on hilly areas and tie ridges on farming lands to prevent soil erosion and to increase water retention capacity of the soil in order to make more water available for pasture and crop growth; where farming communities traditionally dig furrows (called *mangad* or *moos*) to direct run-off water to channel water to their plots.

Kebele administration is the lowest in the hierarchy of the politico-administration structure next to the *wereda* administration, as we move down the structure. They issue operational guidelines regarding social, economic and political development of interest to the inhabitants of the *kebele*. The *kebele* is directly accountable to the *wereda* administration and their main activities are issues concerning the peace and stability of the *kebele*. Development activities at this level are carried out by extension agents of the WOA.

Non-government Organizations

A notable change, which has taken place concurrently with the increasing influence of the new 'participatory' outlook on pastoral development, is the growing

presence of non-government organizations in Somali Regional State. As government organizations redefined their interventions in the pastoral areas, the NGOs took over both social welfare and the development agenda and in many respects fill the void left by the regional development organizations of the government. The NGOs cannot directly replace government organizations, since they cannot assume the full range of responsibilities they had, but they operate on the basis of cooperation with grass roots communities targeting villagers and local problems. NGOs have also poverty and gender focus, large experience in facilitating participatory development, and have structural and financial flexibilities for working with service delivery institutions. Another important role of NOGs was the provision of training and materials to the local institutions to build the knowledge and skills needed. This particularly took the form of training extension agents and agro-pastoralists in natural resource conservation and veterinary service delivery. The NOGs that were actively working in Awbere *Wereda* are discussed below.

The World Food Program (WFP), since 1980, has supported rural land rehabilitation in the region through the MERET Project, The main activities of MERET Project were natural resources rehabilitation and development such as stabilization of hillsides, construction of farm land terraces, gully erosion control and rehabilitation, reforestation of degraded lands, water harvesting for small scale irrigation, construction and maintenance of feeder roads, area closure, etc. The Government's implementing partner of the MERET Project was Bureau of LCRD and activities are carried out at *wereda* level, including Awbere *Wereda*. WFP provides the food for communities involved in implementing the projects and also supplies tools, construction materials as well as expert advice to build local capacity, and teaches farmers/agro-pastoralists the latest techniques.

Lutheran World Federation (LWF) focuses on ensuring food security and sustainable livelihoods, managing natural resources in an ecological manner and developing skills and leadership in local communities. LWF runs participatory integrated community development projects in Somali Regional State in response to

local needs. Priorities include agricultural development, safe water access, natural resource management, empowerment of women, response to HIV and AIDS, capacity building, education and health services. In 2007 LWF began responding to the needs of Somali refugees in the Somali region living in the *Awbere* and *Sheder* refugee camps. The program focuses on providing water and protecting the environment.

Save the Children (SCF) in Somali Regional State is engaged in helping rural families get enough food, improving the quality of healthcare available to some of the poorest people, helping children who can't go to primary school get an alternative basic education, and raising awareness of HIV and AIDS.

SCF also had projects that focused on interventions for improving the livelihoods of agro-pastoral and pastoral communities. Interventions include veterinary packages that improve livestock health and nutrition, and train community-based animal health workers (CAHWs), since the vast majority livestock owners in rural areas lack veterinary services. The drought livestock redistribution or restocking project also serves as a means to accelerate the drought recovery. Restocking program was initiated due to increased number of returnees and reduced livestock holdings where people had no means to replenish herds to such an extent that traditional restocking was no longer possible.

Linkage between Organizations

Many organizations involved in development activities were focused on agriculture in general and rangeland development in particular. However, not all were equally relevant in intervening development problems with agro-pastoralists. Several actors were involved in specific tasks, some of which, Gos and NGOs, have already been mentioned. NGOs were important, but their contributions were limited to specific group of people in specific area. There has been very limited and ad hoc knowledge linkage between NGOs and the public research (e.g. researchers as resource persons for training, participation in workshops, requests for improved

inputs). While NGOs are often interact with public extension, but the intensity and quality of interaction varies. For example the partnership between SCF-UK and Awbere WOA for promoting CAHWs, and similarly WPF-MERET and Awbere WOA working in natural resource management can be mentioned. Their development projects usually play the key roles of financing and facilitation of linkages among key actors. These projects were being implemented mainly through the existing public organizations and, to a certain extent, in collaboration with NGOs. Whilst these various development projects interact occasionally, their engagement in continuous partnership was debatable. Cooperative Agency and private services had null interaction with research. But private services initiated by regional bureaus or *werada* offices in collaboration with NGO actors (para vets) had strong knowledge linkage with extension or seen as part of the public service, but no meaningful knowledge linkage exists with public research (see figure 3).

The institutional actors who played more general roles were extension and research. Their mandate concerned with the introduction of improved technologies to agro-pastoralists, thereby raising the living standards of the people in the rural area. Although, their development interventions have resulted increase in agricultural productivity, the level of development was not as expected. The main reason for this dissatisfaction was that development organizations work in isolation and the relative failure of research-extension services in increasing agricultural production for two reasons: first, the research problems being investigated were either not available in a form that is usable and accessible to agro-pastoralists, or generally not in accordance with the priority needs of agro-pastoralists; second, the knowledge and technologies generated at the research stations had not been effectively transferred to the producers. This indicates that there were weaknesses in the links between research and extension institutions as the major reason for both of these problems.

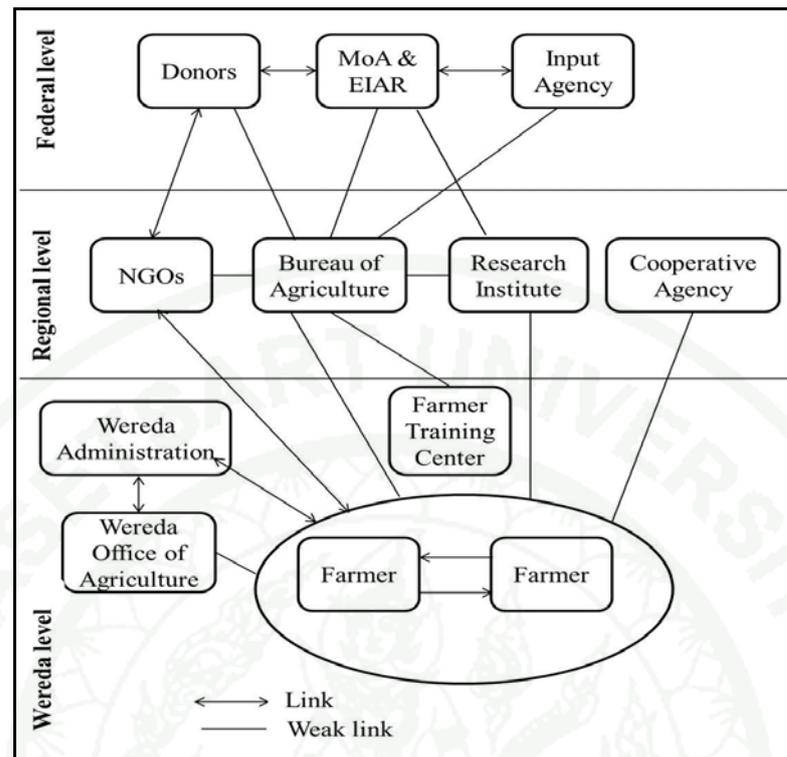


Figure 3 Linkage existed between development organizations in the Somali Region

The institutions themselves gave a low priority to linkage, since both research and extension activities were administered by separate institutions. As a result, research institution (SoRPARI) considered strategic research and technology generation to be its main activities, while extension institution (LCRDB) considered technology production and dissemination to be its main activity. In the process, linkage activities were neglected, or considered subsidiary by both. This had been caused by a tendency to provide the client with a predetermined package of researcher-designed technology instead of carefully adapting the technology to individual client needs. Moreover, none of the organizations had a systematic, well-structured mechanism for collecting and using feedback from agro-pastoralists participating in trials. Often feedback from extension was informal, based on casual observations and perceptions, where feedback took place on the occasion of personal contacts. But informal feedback mechanisms could never be systematic and complete. Therefore, neither research nor extension was sufficiently conscious of the need to

understand the constraints and potentials of the different farming systems as a basis for determining relevant technology and technology development requirements.

On the other hand, a top-down system was followed in generation and technology transfer, where researchers were expected to come up with better varieties and hand over them to extension for demonstrations and diffusion to agro-pastoralists, with little room for meaningful participation by agro-pastoralists. In this set-up, each function developed its own program more or less independently, leading to duplication of programs. This was not only a waste of resources but also created confusion among producers regarding which organization to approach. Moreover, the lines of responsibility were vertical within departments, and the authority of one department did not usually extend to other departments.

Despite this fact, the absence of effective linkage between research-extension-farmer has been raised repeatedly as one of the major problems in the Ethiopian agricultural research and extension systems in general and Somali Regional State in particular. As a result of which it became a concern among policy makers, researchers, development workers and funding organizations. This, therefore, calls for the organization of research and extension programs based on priority client needs and explore sources of knowledge, information and new technologies. To execute joint programs, both organizations developed a strategy to establish new linkages, for formalizing more effective collaboration, and for producing valuable synergy effects at the regional and zonal levels. Accordingly, the regional LCRDB and SoRPARI jointly established the Research-Extension-Agro-pastoralists Linkage Advisory Council (REALAC) in 2003 in order to create a forum of discussion and collaboration between the research and extension systems, as well as support organizations.

Linkages' roles included providing assistance to establish a network of partners to support agriculture and rural development, formulating appropriate policies and guidelines to deal with development, developing human resources at all levels, and designing effective development programs at the community level, and at

the same time taking agro-pastoralists' own knowledge and livelihood strategies more into account.

Generally, research-extension-agro-pastoralists linkage was expected to address issues that are related to institutional framework – focusing on linkages, coordination and power relations, dissemination of knowledge and information; support facilities (or enabling conditions); and individual/household or village level realities, but there was a persistent deficiency in linkage between actors to the extent in which no project addressed technology problems to meet agro-pastoralists' needs. The attempt by SoRPARI and LCRDB to stimulate multi-stakeholders platforms had been constrained by weak understanding of the importance of partnership by organizations in the region. Thus, led to linkages to be very weak, being limited to irregular informal contacts. The strategy document shows that research and extension organizations were keen to select and apply the linkage mechanisms, but on the other hand they seem to be less enthusiastic to an extent that neither council meeting nor joint program was organized. However, the linkage mechanisms that have been existed were limited to field days and workshops.

The field days and workshops organized by either LCRDB or SoRPARI, did not led to a better understanding of the importance of linkages by research and extension personnel. This was due to the fact that either extension organization or research institute was organizing forums of meeting while the rest organizations were participating on invitation bases and, hence, joint organization of linkage mechanisms was missing and priorities were not clearly defined to initiate joint activities. It appears that organizations were failed to take time to work out their roles and reach a degree of consensus on priorities.

Organizations' relations are described in terms of eight linkage types: funding, collaboration, friendship, work, visits, information flows, materials exchange, and workshops. Friendships and exchanges of information or assistance were more common than other types of linkages; each of these occurs in almost all relationships,

followed by exchanges of more tangible objects such as materials or reports. The less common were collaboration, visits involving research or training, and workshops. Working directly with an organization and relationships involving funding were the least common.

Constraints to Effective Linkage between Organizations

Discussion with research and extension people at different levels revealed that there were many reasons for the persistent and intractable nature of linkage difficulties. Some of the constraints dominating the regions' research-extension-farmer linkage were: (1) lack of defined, well formulated and institutionalized research-extension-farmer linkage strategy since the region lacks capacity in terms of establishing such institutions; (2) continual and frequent changes in leadership and decision-making, and organizational structure, which seriously affected the undertaking of activities planned earlier and it also led to the disruption of activities that have already been started; (3) inadequate communications and cooperation between the principal partners, and difficulties in bringing all members together for meetings; (4) insufficient financial, physical and human resources for linkage planning, implementation, monitoring and evaluation; (5) there was no involvement of pastoralists and agro-pastorals and other stakeholders in setting priorities for their immediate development needs; (6) little understanding of the social and environmental dynamics of the region to plan for appropriate intervention by extension agencies. This usually happened since extension activities in most case have not been initiated along with the suggestions and recommendations produced by research institute and NGOs; (7) inadequacy of information on traditional practices, beliefs and customs in the region and their influence on rural development that would help to identify the innovation gap for further research and intervention; (8) there had been very little emphasis in the government extension service to the rangeland development. Extension was targeted crop growing agro-pastoralists who are not representative of the region in terms of proportion and farming systems; (9) the technologies developed so far had not been prepared in the package forms to suit to

the pastoral and agro-pastoral production system; (10) there had been very little attempt made to practically demonstrate and popularize the research findings available merely due to lack of trained extension personnel; (11) inadequate early warning systems for vulnerable pastoral and agro-pastoral groups; and (12) linkage activities were totally considered as part time work because no incentive was there for committee members. Being a committee member of linkage council did deserve nothing except extra workload on top of the routine activities of the members for which they were employed.

Part 3: Types, Coordination and Governance of Collective Actions

Collective action activities are a common feature in rural areas of the Somali Regional State. Four types of collective actions are widely practiced in Awbere *Wereda*. These include construction and management of ponds and water wells, collective herding, labor sharing groups (*guus*), and *mag*-paying groups (a collective responsibility for paying blood compensation). Each of the collective actions consists of joint decisions, designing management rules and setting rules of conduct of group members, which are discussed in detail below.

Constructing and Managing Ponds and Water Wells

In the study area, there was no potable water for human consumption, and hence rural people depend on unclean surface water. So, people living this area used to harvest run-off water during rainy season by constructing ponds, and digging shallow wells near seasonal rivers for the consumption of both human and livestock. Moreover, where adequate groundwater is available, communities dig deep wells which become their main water supply after ponds dry-up during dry season. This practice was a persisted activity of the people for generations. Members of the community employ collective labor to construct communal ponds and engaged in the maintenance such as silt removal, channel cleaning and fencing (to prevent their use by unauthorized strangers). In case of water wells, they dig in depth and cover the

wall by wood to prevent the collapse of the well, cover the top of the well with strong materials such as bricks to prevent silt and sands entering into it during rainy seasons, and assign well monitors. Water well maintenance is easier compared to ponds except demanding frequent monitoring. Under effective management, ponds can retain water both for human and livestock use for about five to seven months after the heavy rainy season while water wells can sustain water for years.

In the course of constructing and maintaining ponds, the cooperation of all the able-bodied men of the settlements who use them is required. A day is appointed for the work and the men of the local settlements are called to assist. Men provide labor and women prepare meals and drinks for the working men. A failure to assist without a reasonable cause will result in verbal warning and in payment of fines in the form of live-animals. Warning follows a day absence from group work, but if a member is repeatedly absent, other members impose fines. Then, the absentee is forced to provide a live-animal which is slaughtered and eaten by all members who have been working on the pond. The sanction of slaughtering an animal from a man's herds for his non-cooperation is usually called *yakays*. Similarly, a household that fails to contribute to the common-pool of food which the laborers share at mid-day are liable to punishment.

Once the construction of pond or water well is finalized and water is accumulated, every member of the community has the right to water. A household who does not contribute in the entire period of construction or maintenance will be excluded. Members practice much in encouraging for contribution rather than excluding from utilization. For watering animals, usually a rule is developed by community elders. Mostly the common rule in prioritizing the watering is based on first-come-first-served. These arrangements are locally known as *Kaalaysi*. Such schedules are strictly followed by herders and any one violating it is punished. The punishment is usually in the form of temporary suspension of use rights. In case of members of another clan, other than the owners, come in search of water, they are given precedence in reciprocal arrangement established with their clan. Anyone

refusing to give precedence for the guests will face social exclusion from his clan members, branded as “ridiculous” and receive stiff punishments.

Disputes over access to the water-points, particularly in the dry seasons when water is scarce are common. These are normally settled by local elders and very rarely give rise to feuds between lineages except where the structural distance in agnation between the parties is very great and where reciprocal arrangement was not established. For all the people of the settlements sharing a common pond are concerned to maintain local peace. Breaches of the peace are judged and punished by the local elders.

Collective Herding

Collective herding is the formation of herd tending group in which a group of herders keep its livestock jointly to graze on the pastures, to prevent animals from predators attack and matching of available pasture resources at a particular site with animals. Collective herding is also serves for confronting and addressing security risks related to theft and conflict over resources. Thus, movement of animals is a classic strategy to exploit the special and temporal variation in resource availability resulting from uneven distribution of rainfall. When herds are moved opportunistically to follow the rains, they gain access to a more balanced pasture supply than if they were kept in one area. Collective tracking with livestock to feed and water is less costly than bringing feed and water to livestock, because of lower labor demand. Members share labor and the formed group moves with herd distant from the residence to graze livestock, sometimes move beyond their own grazing territory. The formation of the group creates the feeling of being secured.

Before going for collective herding, the herd is divided into two: the lactating and the non-lactating or dry animals. The lactating animals and young stock are left for the family under the supervision of female and young children, while the management of the remaining livestock is taken by young men i.e. the herding group

and move to where good pasture is available. This strategy allows the seasonal resting of dry-season pastures around the permanent residence. In case the household does not have a young man who joins the herding group, the responsibility of managing the herd is given to a hired herder. This procedure is known as *xidhaale*. A four-year-old camel is paid annually to the hired herder. He also receives full package of clothing (*arad bax*) consisting of a pair of shoes, shirts, and a sheet, which he uses for the period of herding in group.

Labor Sharing Group

The main task of men, in crop production, is ploughing, weeding and harvesting, and leading the daily activities of the household. Women do household activities like cooking and rearing children and help husbands in fields, especially in weeding and transporting grain from the farm field. Boys over 15 years old plough with their fathers and those who below often herd livestock. Hence, labor is provided by the household members but there are still traditional labor-sharing practices (*Guus*), which is established to help each other accomplish crop production and other activities.

Guus (a labor-sharing arrangement) is an informal network which involves a group of people, usually neighboring households, who are organized for a particular agricultural task like ox-ploughing, weeding, harvesting, threshing, and transporting grain from the farm field. A group of people pools their labor resources and/or material resources (oxen, hand plough tools, sickles etc.) to help fellow neighbors. Even though a farm household is usually framed around a nuclear family, its relationship with the extended family remains strong; this favors the formation of labor sharing group.

Household head, wife, and young men and girls will participate in the group productive activities including ploughing, weeding and harvesting according to their ability. Women, in the household that is calling and receiving the assistance, have also

the duty to prepare meals and drinks for the working group. The assisted household is expected to provide labor for the households that have participated in the arrangement at some time in the next activity of the other group members, meaning group members pay for the labor they receive with their own personal labor. Member household that has temporary difficulties because productive members have been incapacitated due to illness and the need to care for the sick is also assisted by the other group members through performing any agricultural activity on its land. Generally, group members in a community have a social obligation to comply with the request for their labor whenever it arises. Nevertheless, *guus* activities were decreasing since many people cannot afford the food and drinks, and few capable farmers rent tractor for ploughing their land.

The other form of *guus* is labor sharing for house (hut) construction and dismantling which is performed only by women group. It is established voluntarily and on mutual understanding to help each other through mobilizing labor to accomplish house construction during settling, and house dismantling during migration or shifting settlement. All households settling or migrating together have the responsibility to participate in the operations. The house is usually made of grass mats tied together and placed over a wooden frame structure. During the construction of new house, the women gather special grass from the woodland for weaving mats. The men usually gather the wood from the trees (*Galool*, *Dhumay* etc.) and then the women get to construction of the house.

Mag-paying Group

The use of natural resources is susceptible to conflict particularly when the resources are scarce. Conflicts over natural resources have many negative impacts among these loss of human life is included. When a conflict occurs, the traditional mechanism of resolving it is through agreements made between conflicting clan elders and paying compensation for the lives lost (i.e. conflict resolution on the bases of blood compensation). To pay this compensation, Somali people commonly

established collective blood compensation group known as *mag*-paying group. The *mag*-paying group is defined as a corporate agnatic group (*Jilib/Bah*) whose members are united in joint responsibility to collectively safeguard all matters of common interest. The *mag*-paying group is the most stable unit with a membership of groups of families ranging from a few hundred to more than a thousand. The *mag*-paying group is collectively responsible for the payment of compensation in the event of the death or injury of a member of another group at the hands of one of its members. It is also collectively entitled to the receipt of compensation in the event of the death or injury of one of its members at the hands of a member of another group. Moreover, the administration of *mag*-paying group has adopted the practice of electing an individual (*aaqil*) to represent them with power and influence.

The rate of *mag* is normally 100 camels for the killing of a man and 50 camels for a woman. In a violent natural resource based conflict, where members belonging to both of the clans are killed, then the total number of deaths on both sides is counted and the clan with more number of deaths receives compensation (*mag*) for the extra number as the equal death numbers cancel out each other. In cases where the number of deaths exceeds 10 men, 50 camels and a young girl with her complete household equipment is paid for each one of the deceased (*godobtir*). This has a double advantage, creating intermarriage relationship between the conflicting clans and reducing the burden of paying a huge number of camels.

If someone commits a murder deliberately with a minor disagreement with the deceased such as not following the time-table for watering animals or as a result of undermining the deceased or his clan, the *mag* is 120 camels. Similarly, when the killing happens between closely related lineages or an elder who enjoys respect not only from his clan but also from other clans is murdered, the compensation often exceeds the normal rate, in order to discourage the blood-shed. When the compensation is higher than the normal rate, the additional amount is paid for purpose of giving satisfaction or to effect conciliation (*samirsiis*) and the extra amount of compensation is payable directly to the victim. These cases, therefore, indicates that

the amount of compensation depends on the degree of damage and losses incurred. Furthermore, when anyone is killed or injured while engaged in acts of plundering will be treated as a dead donkey (*dameer bakhtiyay*) and hence no *mag* would be payable.

The *mag* is paid in two unequal installments. In the first installment, part of the *mag*, known as *rafisso*, 20 camels with very well physical condition are paid; and in the second installment, known as *mag dheer*, the remaining 80 camels are paid. In a condition where it might be difficult to find camels for compensation, the equivalent value in other livestock such as cattle, sheep and goats is preferred to payment in money. But in the case of Gedebursi and Isa clans, the compensation in terms of money is accepted. In payment of compensation, whether for killing or injury, the amounts are contributed by the members of the *mag*-paying group including the person who commits murder or injury.

The process of negotiation is taken place through all elders in a *mag*-paying group gathering in an assembly (*shir*) under a tree and taking, democratically, on important decision of common interest to them. Arbitrating panels vary in size. Often four or five elders are considered sufficient. But where *mag*-paying group elders hear a case themselves concerning members of their own group many men may take part as judges. Between *mag*-paying groups, the court's size tends often to vary with the magnitude of the case and the structural distance of the parties to the dispute. The more important the issue and the greater the structural distance between the parties, the larger the court is likely to be which hears the case.

The *mag*-paying groups also function as mutual aid groups during periods of emergency. Members have an obligation both to help those who are undergoing severe hardship during crises and to observe traditional wealth-sharing mechanisms. In times of crisis, each member is expected to observe an appropriate code of conduct. This manifests itself in activities such as mixed herding, loan sharing and giving

animals (*Xoola Goyn*). Such coping strategies can effectively limit individual risks and facilitate rehabilitation after periods of crises.

The *mag*-paying group is, therefore, an alliance of agnatic lineages and is thought of as having a dominantly male character. Daughters of the group leave it on marriage to join the lineages of their husbands. But married women are not fully incorporated into the *mag*-paying groups of their husbands. The responsibility for their safety and for injuries committed by them lies partly with their own agnates. This is consistent with the fact that a woman's ties to her lineage of birth are not fully severed on marriage. To some extent the practice varies from clan-family to clan-family. Amongst the Isak clan, if a married woman is killed whether or not she has borne children, her agnatic kin and her husband's agnates divide her blood-wealth equally between them. Similarly, when a married woman is guilty of homicide, her husband's agnates and her own contribute equally to the blood-wealth due. It is usually considered shameful if a husband is not prepared to meet small liabilities on the part of his wife. Moreover, if a wife kills her husband blood-wealth is paid by her agnatic kin to his agnates and the children of the deceased usually receive the largest single share.

However, a *mag*-paying group does not correspond to any specific level of the lineage structure. It is a contractually bound broad alliance of a number of lower segment units who, although for the most commonly blood-related group, do not necessarily follow the same line to the common primary lineage. It may even include other social groups who are not related to the broader group in terms of kinship, but who only develop with them the *mag*-paying social contract. Furthermore, the members of *mag*-paying group are not static and group members can join or leave the contract.

Part 4: Factors Affecting the Adoption of Improved Sorghum Varieties

Socio-economic Characteristics of Respondents

Out of the 180 households interviewed 37.2% were adopters and 62.8% were non-adopters of ISVs. Mean age of adopters was 32.46 years and of non-adopters was 41.36 years. The average age of non-adopters is larger by nine years over the adopters. Adopters were younger in age than non-adopters. It is generally accepted that younger farmers are more innovative than older ones. The age structure of the sample farmers shows that the largest proportion of the respondents, 73% of adopters were in the age group of 20 to 35 years and 75% of non-adopters were above 35 years.

The survey results showed that the average household size of adopters was 4.9 and non-adopters was 5.57 persons, showing a slight difference between adopters and non-adopters, but t-test statistics showed no significant difference. Doss *et al.* (2002) also did not find a clear relationship between household size and use of improved varieties.

Out of the adopters of ISVs, 65.7% were illiterate, and 34.3% were able to read and write. Only 8% non-adopters were able to read and write. This shows that adopters were more educated than non-adopters, and better educated agropastoralists/farmers show better positive response to improved technology adoption. The educational status of the household members shows that, 44.8% household of adopters and 46.9% household of non-adopters had at least a literate in their household. For instance literate members are able to read written information and explain information concerning farming to their illiterate household head. The existence of a literate in the household may enhance the technology adoption, since the information delivered by members of the household to the household head is highly accepted than other sources of information, because of the trust exists between them.

Table 4 Relationship between continuous variables and adoption of improved sorghum varieties

Continuous variables	Adoption (mean)		T-test	
	Adopters (n=67)	Non-adopters (n=113)	T-value	P-value
Age of household head	32.46	41.36	-6.758	0.000
Household family size	4.91	5.57	-1.635	0.104
Farm size in <i>Qodi</i> (1/4 ha)	19.82	12.63	4.834	0.000
Farming experience in years	16.16	24.45	-6.284	0.000
Distance to input market (km)	56.19	68.15	-7.933	0.000
Number of shoats	14.01	8.12	2.945	0.004
Yearly On-farm income	47.84	40.75	0.445	0.657
Amount of credit taken	348.15	287.18	1.181	0.241

In the study area, every farmer starts practicing farming at an early age of 15 years while living together with their parents. On the average, adopters had 16 years of farming experience while non-adopters had 24 years. The finding of this study, as the t-test statistics shows the adopters' and non-adopters' significant difference in their farming experience, is consistent with literature, which confirms that experienced and older farmers are reluctant to change their farming techniques. This study has identified that most of the adopters (61%) had a farming experience ranging from 11 to 30 years while most of the non-adopters (64%) had a farming experience ranging from 20 to 45 years.

The crop land holding of the sample respondents ranges from two to 50 *Qodi* (0.5 to 12.5 ha). The average crop land holding of adopters of ISVs was larger, by 7.19 *Qodi* (1.8 ha), than non-adopters of ISVs. Fifty one percent of adopters had crop land of 15 to 32 *Qodi*, whereas 70.8% of non-adopters had seven to 20 *Qodi*. More than 85% percent of the respondents were grown sorghum on land up to one hectare. This indicates that the great majority of farmers in the area were small-scale and

subsistence farmers; and farmers having larger farm land will decide to adopt new technologies by testing on a portion of land without worrying about endangering the family food security (Ramasamy *et al.*, 1999).

Sheep and goats are the most sold when farmers need cash to buy improved seeds, food for the family and clothes for children; whereas camels and cattle reared for milk production and prestige; and rarely sold. The average shoat holding of adopters is 14 heads whereas the average shoat holding of non-adopters is 8 heads. This indicates that the average shoat holding of adopters is larger by six heads over the non-adopters.

With respect to farm implements owned, there is no much difference between adopters and non-adopters, whereas the difference is observed in the type of houses owned. With regard to the type of house owned, 20.9% and 61.2% of adopters were live in corrugated iron and soil roofed house, respectively where as 49.5% of non-adopters were live in traditional house (only 8% were live in corrugated iron house). This indicates that adopters were living in better houses.

The sample respondents reported that the only source of income was from the sale of crop or animals. However, 81% of the respondents reported that they did not sell any type of farm produce during the year, and the reason given was unsatisfactory crop yield due to failure of rainfall of last cropping season. The annual average income of adopters and non-adopter was 47.84 Birr and 40.75 Birr, respectively (1 USD equals 12.6 Birr). This information seems exaggerated, which is due to the existence of food aid in the study area making farmers reluctant to tell their actual income.

Improved Sorghum Varieties Utilization

Sample farmers indicated that the main sources of improved seed were the office of agriculture (32.8%), own seed savings and from neighboring farmers (29.9

% each), and the rest was from the market. Farmers just want to buy a tiny quantity of seed of the new variety once to first test it and then multiply and maintain it by themselves to save costs or borrow from neighboring farmers who saved it.

Out of the sample farmers, 62.8% farmers do not used ISVs during the year 2009 main cropping season. The important reasons forwarded for non-adoption of ISVs, by all non-adopters, were less understanding and lack of improved seeds. Instead the local varieties used by non-adopters were *Aden gab* and *Ilmi jama*. Moreover, the perception non-adopters had with regard to the yield of ISVs was poor. About 63% of non-adopters did know the production potential of ISVs while 15% of them think its yield is inferior to local. About 21% of non-adopters knew that ISVs yield was superior to local and the reason for non-adoption was lack of access to ISVs. However, the adopters of ISVs had positive perception towards the yield potential ISVs. The response of adopters regarding yield perception of ISVs was 79.1% superior and 20.9% inferior (Table 5). The respondents who are said the yield of ISVs is inferior gave the reason that the forage yield of ISVs is much lower when compared to local varieties. The field observation and informal discussion with farmers indicated that most farmers did not seem to know about technology package recommendations. Even those farmers who were aware of the packages often lack the practical skills on how to implement them or may lack the ability to buy component of the package like fertilizers.

Sorghum yields are substantially higher for farmers who use inorganic fertilizer (Wubeneh and Sanders, 2001). The results of table 5 show that about 23.9% of adopters and 17.7% of non-adopters were used inorganic fertilizers in their field. This shows that only few farmers used inorganic fertilizers and the rest of farmers did not. The reasons given for non-use of fertilizers by farmers were cash shortage to purchase (12.8%), fertilizer is not available (29.5%), fertilizer is expensive and not available (22.2%), and cash shortage, expensive and not available (20.6%).

Institutional Factors

The distance taken to travel from home to the nearest input market place, sample farmers reported that they had to travel an average of 63.7 km. (adopters 56 km. and non-adopters 68 km. (Table 4)). This shows adopters were slightly near to the input market than non-adopters by 12 km. The nearest input market in the study area is Jijiga town, which is far away from most of the farmers. With respect to inputs, inputs had been distributed to farmer based on farmers' willingness, but recently improved seeds were not available on the needed time, and the distribution or sale of improved seeds to farmers was undertaken at office level, and very few demonstration and field days were conducted in the past three years (personal communication with extension agents).

The percentage of respondents who had access to credit (Table 5) was higher for adopters (68.7%) than for non-adopters (34.5%). The source of credit for the respondents is mainly from fellow farmers (23%), relatives (17.8%) and neighboring farmers (15.6%). The average credit amount taken over last year by adopters was 348 Birr whereas non-adopters were taken 287 Birr. Moreover, the result indicated that respondents did not had any access to formal credit sources.

Table 5 Relationship between categorical variables and adoption of improved sorghum varieties

(n=180)

Categorical variables	Adoption				Chi-square	
	Adopters		Non-adopters		X ² -value	P-value
	No.	%	No.	%		
Education of HH					21.906	0.000
Illiterate	44	65.7	104	92		
Read and write	23	34.3	9	8.0		
HH having literate	30	44.8	53	46.9	5.660	0.341
Yield perception					76.450	0.000
Unknown	0	0	72	63.7		
Inferior	14	20.9	17	15.1		
Superior	53	79.1	24	21.2		
Use of fertilizers					0.280	0.596
Yes	16	23.9	20	17.7		
No	51	76.1	93	82.3		
Type of house owned					19.635	0.000
Traditional	12	17.9	56	49.5		
Soil roofed	41	61.2	48	42.5		
Corrugated iron	14	20.9	9	8.0		
Use of credit					19.674	0.000
Yes	46	68.7	39	34.5		
No	21	31.3	74	65.5		
Contact with EA					1.605	0.000
None	50	74.6	91	80.5		
Once	15	22.4	21	18.6		
Twice	2	3.0	1	0.9		
Radio owning					11.556	0.001
Yes	31	46.3	32	28.3		
No	36	53.7	81	71.7		

With regard to information sources, farmers obtained information regarding the farm practices and technologies from various sources such as extension agents, office of agriculture, *kebele* administration, family members, radio, fellow farmers and market centers. Television and print media were not used due to lack of electricity and low level of literacy, respectively.

Table 6, results show that fellow farmers (96.7%) and market (88.3%) were the most used information sources by the respondents, followed by office of agriculture (81.1%), family members (76.1%) and radio (68.3%). However, the extension agent was the lowest among the information sources of the respondents. Few respondents (23.3%) mentioned NGOs as his source of information. This was due to low number of extension agents in the district and few NGOs working in limited areas. It is clear from Table 5 that the respondents used more than one source to meet their agricultural information needs.

Table 6 Distribution of the respondents according to their information sources

(n=180)		
Information sources	Number*	Percent
Extension agent	57	31.7
Office of agriculture	146	81.1
Kebele	92	51.1
Family member	137	76.1
Fellow farmers	174	96.7
Radio	123	68.3
Market	159	88.3
NGOs	42	23.3

*Multiple responses

Rank given to information sources, by farmers, in order of their importance is presented in Table 6. The results clearly demonstrate that fellow farmers (neighboring farmers) and family members were the most important sources of information. This

indicates a snowball effect in which few farmers are reached through initial efforts, and then more and more farmers will get the information, because communication with their peers seems to be one of the best sources of information at their disposal. The study conducted by Ali *et al.* (1992) shows similar results.

Table 7 Importance of different information sources based on rank order assessments (n=180)

Rank	No. of respondents						
	Extension agent	Office of agriculture	Kebele	Family member	Fellow farmers	Radio	Market
1	2	22	28	45	76	21	10
2	8	34	33	39	45	35	18
3	5	40	21	17	26	31	60
4	1	33	7	14	24	21	34
5	17	7	3	15	2	5	24
Total	76	439	355	469	688	385	394
weight*							
Rank position	7	3	6	2	1	5	4

*The total weight score is the sum of rank order frequencies multiplied respectively by 5 for the first position, 4 for 2nd position, 3 for 3rd position, 2 for 4th position and 1 for the 5th position.

The data further show that the information obtained from WOA and market were also important whereas extension agents and *kebele* administration were the least sources of information in the study area. Only 25.4% of adopters and 19.5% of non-adopters had contact with extension agents, indicating lower numbers of contacts (Table 5). This is due the WOA has given less emphasis on extension service delivery. The extension agents in the study area did not have transportation facilities (motorcycle and bicycle) to travel to *kebeles* far away from their base. Extension agents are then forced to travel few kilometers on foot to deliver extension

information and advice; due to this limitation most of the farmers never had any contact with the extension agents. So farmers are used to get information, when they require, through direct visit to agriculture office.

Among the mass media, radio was the only medium used in the study area. There are three radio broadcasting stations in the country, which air agricultural development program in Somali language such as Addis Ababa, Fana and Harar radio stations. Respondents who own radio constituted 37.8% (46.3% of adopters and 28.3% of non-adopters) of the sample (Table 5). About 62% of radio owners, even though broadcasting time is so limited, preferred listening to agriculture program broadcasted through Somali language (64% of adopters and 60% of non-adopters) by Radio Fana and Addis Ababa Radio once and twice a week, respectively. This can be a good opportunity to prepare extension information for farmers and broadcast through radio. The discussion made with group of agro-pastoralists was also revealed that they did not listen to Harar Radio since BBC and Harar radio are broadcasted at the same time. This means agro-pastoralists prefer listening BBC to Harar Radio. The listening culture is essentially individual but listening in groups may occur especially during 5:00 PM while listening to BBC Radio at tea shops.

In general, the adopters of ISVs were more educated, younger in age, had larger farm size, had more number of shoats, had better house, own radio and had positive attitude towards ISVs when compared to the non-adopters, which are statistically significant with chi-square and t-test as depicted in table four and five. Moreover, agro-pastoralists' low adoption rate for technology packages have arisen from a variety of causes such as inadequate information flow from extension agents to farmers, lack alternative appropriate technologies that can suit the various needs of dryland agro-pastoralists, lack of resources or input credits for undertaking the package program, and untimely delivery of production inputs.

Factors Determining Adoption

Before using logit model for hypothesized variables, it is necessary to test the problem of multicollinearity among the potential independent variables. Multicollinearity occurs when there is a perfect or exact linear relationship among some or all independent variables of a regression model. One of the reasons for multicollinearity may be that the independent variables included in the model share a common trend, that is, they all increase or decrease at more or less the same rate, leading to collinearity among these variables. When there is multicollinearity, the estimated regression coefficients of the fitted model can be highly unreliable. Consequently, any modeling strategy must check for possible multicollinearity at various steps in the variable selection process. As is the case in linear regression, model fitting via logistic regression is also sensitive to collinearities among the independent variables in the model (Kleinbaum and Klein, 2002). This may make it difficult or impossible to isolate the effect that each of the highly collinear independent variables has on the dependent variable. With multivariate analyses, the existence of a high pair-wise correlation (when a bivariate correlation is in excess of 0.8) among independent variables indicates a serious degree of multicollinearity (Hoshmand, 1999; Gujarati, 2004). Then the obvious practical remedy (and surely the most frequently used) is to drop one of the variables suspected of causing the problem from the regression (Salvatore and Reagle, 2002).

Accordingly, multicollinearity test was conducted and the correlation coefficient results demonstrated its existence between independent variables such as age and farming experience with correlation coefficient of 0.909. Therefore, farming experience was excluded from the model where age was retained.

Then nine independent variables that were hypothesized to have an influence on adoption decision of ISVs in the study area were included in the model, of which four variables (age, the size of farm land, type of house owned and distance to input

market) were found to have a significant influence on the adoption decision of ISVs, which are presented in the logit model results shown in the table below.

Table 8 Binary logit estimates of adoption of improved sorghum varieties

(n=180)

Independent variables	Coefficient	Wald statistics	Exp(B)	P-Value
Constant	4.535	1.894	93.228	0.169ns
Age	-0.183	10.211	0.832	0.001**
Education level	1.707	2.030	5.511	0.154ns
Farm size	0.072	2.744	1.075	0.098*
Distance to input market	-0.111	8.020	0.895	0.005**
Number of Shoats	0.028	0.553	1.029	0.457ns
Type of house owned	1.876	7.741	6.530	0.005**
Used Credit	0.002	2.416	1.002	0.120ns
Contact with extension agent	1.136	2.522	3.113	0.112ns
Own radio	0.156	0.046	1.168	0.831ns
Chi-square		63.111		
-2 Log likelihood		54.147		
Correct prediction of all samples (%)		83.5		
Correct prediction of adopters (%)		84.8		
Correct prediction of non-adopters (%)		82.1		

**, and *=Significant at less than 1% and 10% probability level; ns=Non-significant at more than 10% probability level.

Regarding the fitness of logit model, the chi-square of 63.11 appeared statistically significant, indicating that selected independent variables reduced the log likelihood ratio of the model. The classification table correctly predicted 84.8% of adopters and 82.1% of non-adopters, where as the model correctly predicted 83.5% of the observations.

The age of the household head was found to be negatively and significantly related to the adoption of ISVs, indicating the reluctance of the older farmers to change their farming techniques. This finding is similar with the studies of Million and Belay (2004), and Feleke and Zegeye (2006). Hence, Younger farmers are more optimistic and risk takers to adopt new technology where older farmers are pessimistic and resistant to change.

The other factor showed significant and positive influence was size of farm land, showing that larger farmers can experiment with new technologies on a portion of their land. This finding is similar to the results reported by Mariam *et al.* (1993), Huque *et al.* (1996), Nkonya *et al.* (1997), and Ramasamy *et al.* (1999). Hence, framers who have better economic status and resources (land and better house) more likely to adopt a new technology. Type of house owned had the highest odds ratio of adoption and had significant and positive influence on the adoption of ISVs, indicating that economically better-off farmers most likely to adopt ISVs.

Distance to input market was also found to be negatively and significantly related to the adoption of ISVs, indicating that farmers far away from market centers are less likely to adopt ISVs than those who are located near to input market centers. Tesfaye *et al.* (2001), Shiyani *et al.* (2002) and Feleke and Zegeye (2006) were reported similar finding in their study.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

This study has assessed the characteristics of pasture resource system and the pasture resource users; analyzed local level institutions both in their sense of rules-in-use and organization; explored the types, coordination and governance of the collective action; and analyzed the factors affecting the adoption of improved sorghum varieties. The purpose of this chapter is to give conclusion and recommendations by linking it with the main findings of this study.

Characteristics of Resource System and Resources Users

Common-pool rangeland resources (CPRRs) are natural or man-made resources used simultaneously or sequentially by members of a community or a group of communities. CPRs comprise all resources that are meant for common use of the villagers without any individual ownership rights. They include pasture (grasses and forests), inland waterways, and seasonal ponds. Pasture provides food, feed, fuel, construction materials and income to rural dwellers. Pasture resources, in the study area, have clearly defined boundaries, which primary users use to identify their territory from others. Moreover, the attributes that pasture resource exhibited also are high mobility and storage, which enable the resource users to reasonably ensure their livelihood. Although they exhibit such attributes, they put under pressure by population growth and agricultural expansion.

The nature of pasture resource is also affects its mobility. This is because of the wide spatial dispersion of the resources and the temporal fluctuations in their availability. To cope with this environment, agro-pastoralists have developed strategies of dispersing settlements in their entire territory and shifting grazing land to take advantage of these widely scattered and diverse rangeland resources. The

seasonal use of scattered resources also creates opportunities for mutually beneficial exchange relationships between various user groups.

In general, the attributes that the resource system exhibited define what type of resource they are and therefore dictate the property right systems that best ensure their sustainable management. Resources that exhibit the attributes of CPRs would most probably be managed better if put under common property right systems.

Resource users are those that affect and/or are affected by their own management decisions and actions by others. Five groups of participants have been identified as taking active role in the conservation and use of pasture resources. These were community, absentee livestock owners, traders, governmental organizations and non-governmental organizations. The communities shared similarities in some of the attributes they exhibited and differences in others.

Communities were found to have been similar in the livelihood strategies they pursued, which are crop farming and livestock rearing. They were entirely dependent on rangeland resources, had system of assessing the condition of their rangeland resources, trust each other, developed reciprocity arrangements, have autonomies to devise their own institutions (*xeer*) and have past experiences of self-organization (*mag*-paying groups, *guus*, and collective herding). Thus, agro-pastoralists, in the study area, have clearly defined boundaries, systems of monitoring resource condition, and rules that directly pertain to pasture resources conservation and utilization. On the other, they differed in such attributes as resource endowment (land, labor and livestock); and in the perception of the present physical condition of pasture resources (as a result of duration of stay in the area). The variations in some and similarities in others shape their resource utilization strategies. The design and implementation of any institutional measure aimed at improving the management of rangeland resources should therefore take these differences and similarities in attributes into account. Failure to do so may lead to the design and implementation of

institutional measures that enhance conflict among and between communities and outsiders rather than ensuring the sustainable management of rangeland resources.

Across the study area, CPRRs continue to be a significant component of the land resource base and are widely used by agro-pastoralists and other rural dwellers. However, changing land use as a result of population growth (including returnees and refugees), declining rainfall and expansion of area under cultivation has increased the pressure on production of CPRRs. In effort to overcome these problems, government and non-government organizations tried to manage and develop the unpredictable resources through modern concepts such as grazing enclosures, the establishment of deep bore water points and settlements of the mobile herders, but with little success. This is partly due to the failure to obtain the agro-pastoralists' participation in providing information, as well as limiting their involvement in decision making and development of planning processes. A fundamental understanding of the perceptions and traditional livestock–rangeland management practices of the communities in the *wereda* was also lacking. Any attempt at improving the living conditions of the agro-pastoralists should first incorporate a thorough understanding of the pastoralists' indigenous knowledge, traditional practices, goals and strategies. Moreover, adaptation to increased resource pressure requires innovative institutional arrangements and policies to reconcile the different resource use priorities of heterogeneous users to prevent resource degradation. Therefore, devolving rights to local communities, in order they can manage their common-pool resources by establishing resource utilization rules and regulations, and enforcing these rules, is only a necessary condition for successful community resource management.

Institution as a Rule-in-Use

There are many ways in which agro-pastoralists have adapted to the uncertainty of their environments, but a key feature is their strong social organization and customary institutions. In the drylands, where there is low and unpredictable rainfall, the only means of effective management system is an opportunistic one i.e. to

go where the resources are available. This means special flexibility (being mobile) and temporal flexibility (having variable herd size and risk management strategies).

Agro-pastoralists and pastoralists developed elaborated and complex mechanisms and institutions that enable flexibility and opportunism. The institutions govern mobility, resource use and redistribution, and have enabled agro-pastoral societies to withstand pressures of both their environment and their competitors. Customary institutions are integral to the social safety and shared claims over productive assets that characterize agro-pastoral system. Institutions facilitate social interaction by allowing individuals to cooperate and achieve common interest. In agro-pastoral societies, institutions are often not recognized by regional government, but are habitual ways through which society manages day-to-day affairs. Institutions are not mere traditions but are adaptive responses that have evolved over time, often based on kinship. These institutions are based on clan ties and social relations where clan chiefs, *suldaans* or *ugaases*, play coordinating roles in resource management, conflict resolution and administrative matters of agro-pastoralists.

The effective functioning of institutions, found in agro-pastoralists, relies on the ability of elders with authority to impose sanctions on those who break the rules. The use of rangeland resources is regulated and conflicts are resolved by well-established rules and norms called *xeer*. In areas outside the immediate control of regional state administrations, customary law (*xeer*) continues to be the predominant justice system. Thus, Somali have resorted to non-state traditional institutions and customary practices to manage conflict and security, and restore cooperative relationships. Clan elders have played an important role in conflict management and local governance, while *xeer* and *sharia* law have provided a moral and legal framework for dialogue, decision-making, settling grievances and the reinstatement of law and order, and forms of justice. The majority of *xeer* agreements binding communities relate principally to collective defense and security and to political cohesion in general. Thus, customary law (*xeer*) is concerned with ending violence,

restoring social and economic relations, the return of private property, resource sharing, and the creation of security services.

All *xeer* is localized, emanating from specific bilateral agreements between specific sub-clans that traditionally live adjacent to one another, and application of its rule is flexible and varies from place to place depending on circumstances and situations. However, the most significant principles of *xeer* are common across all Somali clans which include the general aspects of traditional clan law that regulate common day-to-day social interactions, civil affairs, and means of dispute settlement within a clan and between different clans.

The study highlighted some of the traditions of mediation, reconciliation, and consensus building that exist in Somali society and the rules and institutions for managing conflict and insecurity. In most cases, members of the clan show respect to customary regulations of resource use and conflict resolution decisions.

As stated above, *xeer* application is flexible and subjected to changes while *sharia* is not. The *xeer* is efficient for the regulation of inter-clan affairs, but less so between individuals and severely marginalize women in decision-making. Moreover, some rules of *xeer* are, in some cases, contradict with *sharia* rules; for instance demanding a very high dowry for marriages and women's right to inheritance. Those rules of *xeer* that contradict with Islamic *sharia* rules can be easily changed since Islamic rules are strongly accepted and a sin to try to change. Therefore, some changes in *xeer guud* must be required from the sense of human right and making it uniform across the region. The primary focus must be set on changing and formalizing the *xeer*; and then ensuring that new *xeer* are shared multilaterally between the clans on a regional basis. The objective must be to create change, not just by targeting the elders, but by enabling them to improve their traditional practices based on their *xeer*, and align them with human rights standards.

In doing so, resources should be channeled into facilitation of meetings (*shir*) between the elders of a region, or of larger clan groups – where workshops can be organized, and advocacy can be applied. The aim of such meetings would be similar to the traditional meetings (*shir*), where issues between clans or within clans are solved and new *xeer* may develop. Moreover, this forum can assist the elders to specify how the traditional authorities can function as development partners at regional as well as community levels. The government should have a commitment to enhance the capacity of traditional authorities to govern by giving legal backing to new *xeer* agreements. Furthermore, elders' training is required in order they understand the workings and principles of formal legal systems, and to enhance their ability to fashion new elements of *xeer* that would apply to new problems.

Institution as an Organization

Government and non-government organizations were found to have been important in managing and conserving rangelands at the local level. Politico-administrative structures such as *wereda* and *kebele*, and *Wereda* Office of Agriculture have been established and operational at local level to undertake development activities under the guidance of the regional policy and strategies. Non-government organizations (NOGs) take part in conservation and management of rangeland by bridging the gap created by the government organizations. The regional Bureau of Livestock, Crop and Rural Development (LCRDB) and Somali Regional Pastoral and Agro-pastoral Research institute (SoRPARI), other public actors playing the dominant role, are mandated to develop, popularize and disseminate technologies to agro-pastoralists. However, government organizations at all levels remained characteristically hierarchically structured with centralized rule making, lack transparency, poor coordination between them, and poorly organized; as well as lacked the necessary human, financial and physical resources. These traits have made the whole process of development and rangeland management to have the culture of bureaucratic decision making. Besides, the organizational structures were subjected to repeated and frequent restructuring.

A good agricultural technology development involves agro-pastoralists in research processes and sees agro-pastoralists as partners during decision making. However, in most cases the problem with research and extension was that they had a poor understanding of the knowledge of rural people. Their approach was top-down, with problem definition at the top, whereby technologies were developed somewhere and the agro-pastoralists were told what to do by the extension agents.

Another shortcoming with the extension and research in the region was that no functional linkage mechanisms were in place for facilitating collective learning, and disseminating successful experiences, because of the fact that extension and research activities have been carried out under different institutions with minimal coordination between them. Generally, research process and agricultural extension services in the region lack preferences, criteria and conditions of the agro-pastoralists, and interventions are carried out without much follow-up. Therefore, developing meaningful and useful relationships is another useful capacity, and seemingly central to collective learning and communication. It is assumed that improved learning and communication contributes to region experts' skills to better design intervention to the changing circumstances, and to local people's capacities to cope with challenges in their livelihoods, natural resources, and communities.

In an ideal world, linkage would be necessary for individuals and organizations that have a culture of working in isolation. In this situation, an organization is required to establish linkages both vertically and horizontally with organizations working in similar sector. Thus, all organizations and communities should be linked and establish a two-way dialogue, where there is an interactive interchange of information, ideas, techniques and knowledge, leading to improved understanding, shared knowledge, greater consensus, and identification of possible effective action. Communication, well-stocked with information of different types, have to take place in multiple and diverse linkages, in which all actors are both sources and receivers. Communicating organizations will have the opportunities to discover new insights, new ideas and to shape new approaches come to life.

Moreover, development organizations have to work jointly with willingness to achieve common goals (see figure 4). Clearly such an ideal world is theoretically a perfect linkage but very far away from reality. In reality, many agricultural development organizations live in very separate world and isolated from the wider experiences of others. Very often they tend to compete for power and resources, and fail to see themselves as part of a broader agricultural technology system.

The actors in the agricultural innovation theatre in the region were many. However, not all were equally relevant to developing and introducing improved technologies with agro-pastoralists. Several actors were involved in specific tasks, some of which are agricultural organization (extension), research institute, cooperative agency, non-government organizations. Extension and research were playing the dominant role in developing and disseminating technologies to agro-pastoralists. Cooperative for example was important, but its contributions were limited to specific group of agro-pastoralists. However, some important actors were non-existent such as input agencies (for farm inputs and implements) and farmer training centers (see figure 3).

An effective agricultural technology development and delivery system requires, above all, a good linkage strategy particularly between agricultural research, extension services and agro-pastoralists. Extension organisations, in this regard, could play a vital role in identifying agro-pastoralists' problems and thereby link them to the process of technology generation and transfer. They are often responsible for integrating research from different disciplines to find practical solutions as they often collaborate with agro-pastoralists who test the solutions on their farms and who may play an active role in further development and diffusion of the ideas. The strengthening of the research sub-system alone without giving due consideration to both the extension and utilizer sub-systems in general and the linkage among all in particular, however, will end up with the development and delivery system of ineffective technologies. It is, therefore, important that effective linkage be forged between research, extension and agro-pastoralists in order to ensure better and

effective technology generation and transfer process. Reason for the need for strong linkages is to evolve technology suitable for the prevailing socio-economic and ecological environment. Technology will be better accepted if it comes as response to agro-pastoralists pressing needs and problems. This condition will be met if agro-pastoralists are meaningfully involved in the process of technology generation.

This indicates that agricultural development has come to depend increasingly upon the combined activities of multiple organizations (actors), such as agro-pastoralists, farmer networks (seed multiplying groups), governmental organizations (research, extension, farmers training center, and cooperative agency), agro-based input suppliers (rural technology center), and non-governmental organizations (see figure 4).

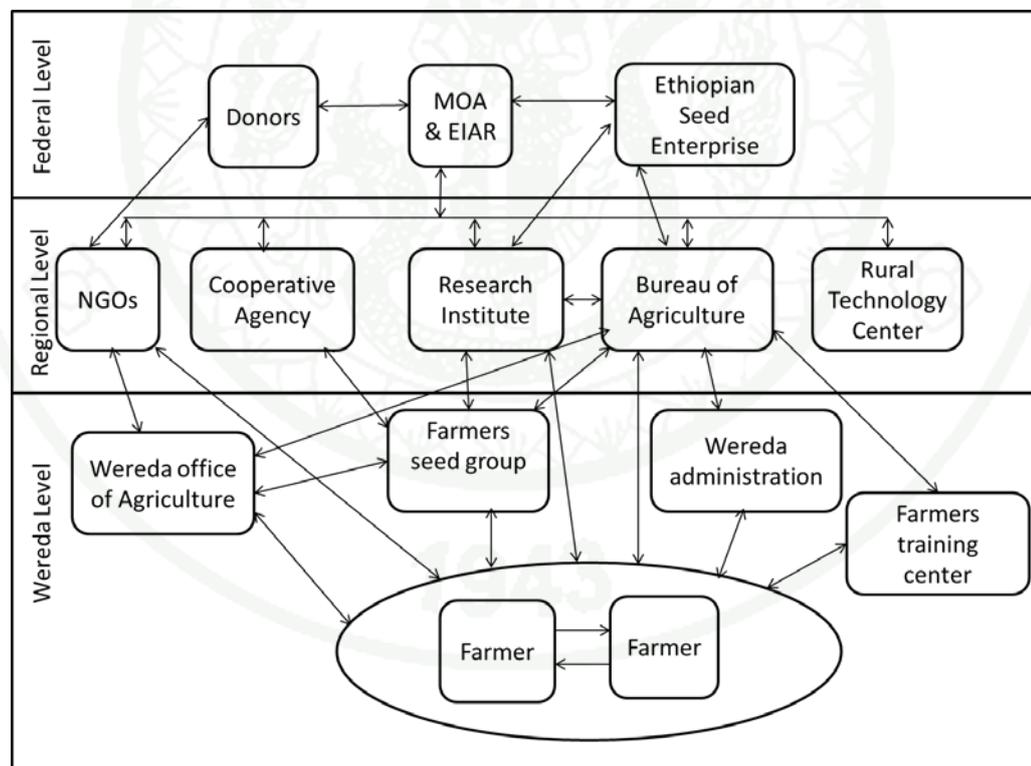


Figure 4 Linkage required between development organizations in the Somali Region

Improving linkages among organizations relevant to particular type of rangeland management can lead to improved performance. Linkage arrangement should emphasize on interests and concerns related to improvements in rangeland management through developing a shared culture, strategy and purpose; circulation of essential knowledge products; adjustment of internal and external communication and coordination mechanisms; organizing and managing organizational learning such as reporting and debriefing procedure, and in-service training programs; encouraging and facilitating feedback from agro-pastoralists; and allocating resources (physical infrastructure, human resource and financial funding) with an incentive system that rewards collaboration to alleviate constraints on linkage arrangements.

Linkages are facilitated when research institutions, extension agencies, education organizations, private and non-government organizations recognize the value of shared or complementary information and promote group or team approaches to problem solving. It is required also to internalize that agro-pastoralists are not recipients and reproducers, but creative managers and integrators of knowledge and information from a large number of sources including practical experiences of their own and that of friends and colleagues. The internal organizational pressures and cultures are often insufficient to assure that linkages take place. For these organizations to coordinate and integrate their activities pressure often must come from outside. So empowering agro-pastoralists is highly crucial to create external pressures. Their pressure and genuine participation in research priority setting and testing of different technologies will ensure the development of client-oriented, problem-centered and situation-specific technologies, help to capture relevant agro-pastoral innovations and make agro-pastoralists to feedback for steering the innovation process.

Experiences show that there is no readymade better alternative linkages menu to plan for joint programs operations. Menu of actions evolve during interaction, through conference, between actors while discussing on priority issues. Thus, the menu does not simply reflect an approach chosen by an actor rather illustrate the wide

scope of pertinent issues and the comprehensive well-rooted understanding of multiple actors. The menu also reflects a limitation inherent in focusing on particular issues, and using this to trace the use of knowledge and information, and other possible alternatives, which covers a wide range of interests. To serve the system well, linkage mechanisms must be relevant according to the function and the context, the size and the type of gap, accessibility to all actors, the financial capacity of the system, its components and the capacity of the mechanism to channel the needed information and/or resources. From this one may derive that flexibility is essential in choosing the mechanisms because different technologies and different sets of agro-pastoralists may require different types of mechanisms even for the same strategy. Careful selection, correct management and favorable linkage climate can avoid risks.

To sum-up, linkages as stated earlier are difficult to launch as they require the putting in place of a number of interconnected factors. This poses formidable challenges in the establishment of effective and efficient linkages and, hence, considerations should be given to these factors. Therefore, organizations need to establish clear objectives, which will determine their direction, their core activities, and type of organizations likely to be active members; need to welcome and encourage participation from a broad range of organizations concerned with the objectives; need to initiate concrete activities that are interesting and beneficial to members; need a committed active members who will take initiative and be responsible for coordination, management and logistics; need to make a delegation of linkage responsibilities to a variety of individual from organizations in order to avoid centralization of linkage coordination activities in a hosting organization; need to provide a relatively informal, non-threatening frame work for exchange, discussions, debate and cooperation between organizations to encourage the sharing and synergy that is fundamental to linkage success; need to anticipate, plan and secure for the funds and resources required to implement activities, and then members need to contribute in order to avoid vulnerability of linkage to domination if a single organization provide funding; need the support and trust of leaders to their own members; require to conduct regular and thorough monitoring and evaluation to

assess linkage progress and achievements; require to organize training courses relating to linkages; and last but not least, they need to develop appropriate incentives and effective accountability process to reinforce behaviors which are compatible with the inter-organizational collaboration.

Types, Coordination and Governance of Collective Actions

Four kinds of collective actions were identified with distinct rules of managing the collective activities. These were constructing ponds and water wells, collective herding, labor sharing for agricultural and social activities and *mag*-paying group. Each of these activities was conducted through provision of labor and contributions depending on the type of operation. The management of these operations is performed through distinct established agreed upon rules by the group members, which contribute substantially to effectively operate group activities as well as utilization of collectively provided water resources. Members, then, expected to obey the rules and non-obedient and non-contributors are subjected to punishment which is dependent on the level of defect. Generally, group members prefer to collectively encourage non-participants to contribute rather than exclusion since exclusion is difficult to enforce and costly. The members of the clan have the right to use the collectively provided resources such as ponds and water wells. However, others clans can get access to the resources through reciprocal arrangements, but non-contributors are restricted to access the water resources. The finding also shows that pastoralists design strategies to secure their livestock and create peaceful condition with other clans through collective herding and *mag*-paying group, respectively. With regard to blood compensation, the amount of compensation payable for homicide similar across Somalis but may vary from group to group depending upon the status of the person killed whether a killing is accidental or deliberate murder.

Even though members try to organize themselves and coordinate collective actions, the external support in providing technological facilities is necessary to increase benefits from collectively produced resources and operations. The effort of the

state in enabling the community to improve livelihood through collective action depends on the extent to which it provides an assistance to enforce their collective action efforts. Any development program and intervening organization (government organization or non-government organization) facilitating collective action in such societies where culture plays a great role in organizing joint activities needs to identify and examine the type of group action such as pasture management and rehabilitation activities or any other technological operations that can improve their livelihood in a sustainable manner.

Factors Affecting the Adoption of Improved Sorghum Varieties

In this study, demographic, socio-economic and institutional factors, which influence farmer's adoption decisions, were examined. Logit model results indicated that the adoption of ISVs is influenced by the age of household head, farm size, distance to input market and type of house owned.

The age of household head had an influence on the adoption of ISVs negatively and significantly. This was because of younger farmers are more likely to adopt a new technology, as they are more optimistic and risk takers than older farmers. Hence, introduction of new agricultural technology in the area may be successful if it focuses on younger farmers.

Farm size was also found to affect the adoption of ISVs positively and significantly. This was due to larger farmers can allocate portion of their land to test improved crop technology. Hence, targeting farmers owning larger farm size may enhance the adoption and facilitate the dissemination of new agricultural technology in the area.

Farmers' wealth as proxy by type of house owned may indicate the ability of farmers to purchase agricultural inputs as this variable shows positive and significant

effect on the adoption of ISVs. Hence, better-off farmers can easily take and adopt improved agricultural technology.

Access to information makes farmers to be aware of and get better understanding of improved agricultural technologies, which facilitate change in the behavior of farmers and ultimately leads to decision to take risk for technology adoption. Farmers who are nearer to market can obtain information regarding agricultural inputs, such as ISVs, which is clearly seen in the results of the logit model. Hence, provision of market information may facilitate the transfer of new agricultural technology in the area.

The survey result also revealed that a majority of non-adopters did not perceive the benefits of improved technology due to information deficits and non-availability of seed. There was also poor contact between extension and farmers. Diffusion of ISVs would be expected to increase as these non-adopters farmers obtain information and get access to improved seeds. Extension service is known to be an important source of information for farmers that significantly influence the adoption of improved seeds and fertilizer use. However, the low adoption of ISVs may be a result of lack emphasis on extension service delivery. Even though extension agents were assigned in many *kebeles*, their movements to different sites were become impossible due to mainly lack of transportation facilities. Therefore, increasing the frequency of extension agent visit is of paramount importance in order to provide effective agricultural extension services in the area. This will possible when extension agents have means of transportation that enable them to travel to various villages.

The other main factors that may reduce the adoption of ISVs were institutional factors, such as access to credit and mass media. A probable reason is that credit service was targeted on few progressive and resourceful contact farmers by assuming that more resource limited farmers will be able to benefit from the same technology in the long-run. This strategy has resulted in increasing the gap between those

progressive farmers and the others. Hence, credit delivery should target small scale resource poor farmers as well as ensuring local availability of production inputs.

Access to information makes farmers to be aware of and get better understanding of improved agricultural technologies, which facilitate change in the behavior of farmers and ultimately leads to decision to take risk for technology adoption. Among the mass media, radio can be a cost effective way of reaching a large population of farmers in rural areas. Therefore, policy makers and the state should support in establishing community radio stations in order to extend messages on new agricultural technologies. Producers need more than just technical information. Farmers need also information on markets, credits and consumer demands. But simply making information more readily available is not enough to ensure that it is used effectively. Farmers must themselves be able to analyze the constraints, seek out and test solutions, and make choices.

In line with above facts, local government, *wereda* administration and line departments, were weak institutionally and technically. Moreover, the research system in the region was not strong enough while the requirements for research outputs suitable for drylands are enormous. The research activities at present are not able to cover and address critical problems of dryland agriculture in the region. Therefore, capacity building can be a decisive measure to be taken to improve the capability of local institutions in terms of staff development as well as physical capacity and developing the management system and procedures. Thus, capacity building should consist of training, financial and material provision. In this regard, NGOs need to intervene with financial support to encourage the implementation of short-term small-scale research and development projects.

Strategic Actions to Improve the Situation

The results of this study clearly highlighted that, agro-pastoralists have developed rangeland resource management strategies through establishing

institutional arrangements and collective actions. The success of customary natural resource management strategies in managing resources and conflict often depends on the trust and obedience of communities, and enforcement capacities of traditional authorities. The roles of customary institutions indicate the capacity and strength in enabling agro-pastoralists to utilize resources to increase security of rights to livelihood resources. Customary institutions have strength in creating options at clan and household levels. Some of these options include shifting grazing area to prevent rangeland degradation, and the reciprocal grazing practices that enable herd diversification and maintaining livestock productivity. Agro-pastorals also shown that, they created strategies of resource monitoring and ways of living in harmony with neighboring clans through managing conflicts when it occurs between clans. Collective actions also enable them to overcome labor shortages and to secure both human and livestock from external enemies. Though customary systems encourage respect local rules, values and customs, and decision-making based on collaboration, with consensus emerging from wide-ranging discussions, fostering local reconciliation; they are male dominated.

On the other hand, often formal institutions were formulated in a unilateral mechanism through top-down and centralized management strategies. They did not take in to account the felt needs of the ultimate beneficiaries and highly biased towards food crops development. Livestock and rangelands needs to be seen as an integral part of conservation and development in Somali Region, since transhumance may even be a necessary precondition to sustainable development in arid lands. Moreover, government organizations were working in isolation and linkage existed between them was very weak. Past experiences shown that, development projects were ended-up without success, which was mainly due to interventions were formulated without adequate local community participation in all phases of interventions, and insufficient consideration given to anticipate outcomes. There is a convergence of opinion in that, the cornerstone of any project or program in the development is the active, effective and lasting involvement of members of a defined community in at least some aspects of project design and implementation. The other

important point is that, mobile pastoralism is not also a backward means of livelihood rather state laws, policies and procedures, since they do not recognize the ecological and economic value of mobile pastoralism.

The other lesson is that, the conflict has been existed between state laws and customary laws and the effort of elders brought the attention of the state to recognize the value of customary law. This was clearly demonstrated when a conflict occur – for example, between two villages. This could be addressed by local people using customary law. But if someone wants to use state law and the state tries to intervene, the conflict becomes more complicated. A structural conflict may arise because customary law and state law manage conflict differently; one is compensatory and the other punitive. Moreover, conflicts between official/statutory and customary tenure systems cause major concern. Even if the great majority of rural people obtain their rights to land through customary means, local land tenure arrangements often have an uncertain or insecure position within national/regional policy frameworks.

This study increases the understanding and provides some directions to the type of policy and interventions desirable for agro-pastoral development in the study areas, since improving wellbeing of agro-pastoralists requires the understanding of the various strategies they adapted to utilize resources in order to generate benefits. Moreover, as the economy of Somali Region tries to move forward, more and more challenges emerge and appropriate strategies are required to address the issues of economic growth and livelihood, particularly in rural areas. Therefore, strategies and opportunities for those who constitute the majority of the population should be placed among the region's list of priorities for development. The principal route towards improving the livelihood of rural people is through broad-based agricultural development. Increase in yield of livestock and crops require improved capacity in research and extension. Research and extension programs affect the agro-pastoralists' state of knowledge of available technologies and management practices as alternative to the traditional management systems.

Improvements to suit the need of the agro-pastoralists require consistent planning and carefully set priorities by the government and also non-government organizations with active participation of the agro-pastoralists to ensure the wide variety of viewpoints, define the problem, seeking a collective solution and thereby assist decision-makers in understanding the interlinked nature of problems the community facing and the alternative solutions available. Program components and priorities should also be monitored and evaluated. When there is no systematic monitoring and evaluation of natural resource management activities, it is more difficult to identify or address problems existing. The decision to adopt new technologies is an investment decision which involves uncertainty to the agro-pastoralist. Thus, an additional level of training affects the amount of knowledge that the agro-pastoralist has about how technologies might work and affects his choice of the type and amount of information to acquire. Hence, alongside research and extension work, promoting formal and informal training are most important step to help increase productivity, improve the livelihood of rural population, and communities can gradually develop their own human and social capital.

Local people have also shown that they are more capable of monitoring and enforcing resource management rules and maintain ecosystem balances. Collective action and local institution remains essential for developing a more just and inclusive society through one or more of principal types of objectives such as developing individual capacities (human capital); strengthening informal organizations; fostering social networking and collaboration; and reinforcing standards and values such as solidarity, reciprocity and trust, which are essential for achieving the proper utilization of common-pool resources. Thus, indicating a clearer understanding of common property regimes and a holistic analytical framework for pastoral development activities are also required, to build capacity, develop and strengthen rules and regulations for common property management as well as build the capacity of local elders; and promote community based organizations. This is possible if the regional state devolve natural resources governance to the local communities to ensure common property rights (the transfer of rights and responsibilities to local

communities, which depend largely on the resource base and have a stake in its conservation and sustainability for their food and livelihoods). These measures may ensure that a series of institutional structures are in place to accommodate the needs of agro-pastoralists and their common property rights. Legal frameworks and government enforcement mechanisms need also to support the rights of local users, respect their management institutions, and provide responsive backup.

Regional State is also need to recognize, resource users need to retain authority to grant temporary use rights to secondary users. Flexibility can be maintained by the legal recognition, which entails developing local administrative and judicial institutions to manage common property and recognize temporary rights of usage, establish — through local dialogue and participation — the principles and guidelines for judging claims, create the means and procedures for enforcing rules, and develop appropriate conflict resolution mechanisms that fill gaps left by disintegrating customary systems and inappropriate western systems.

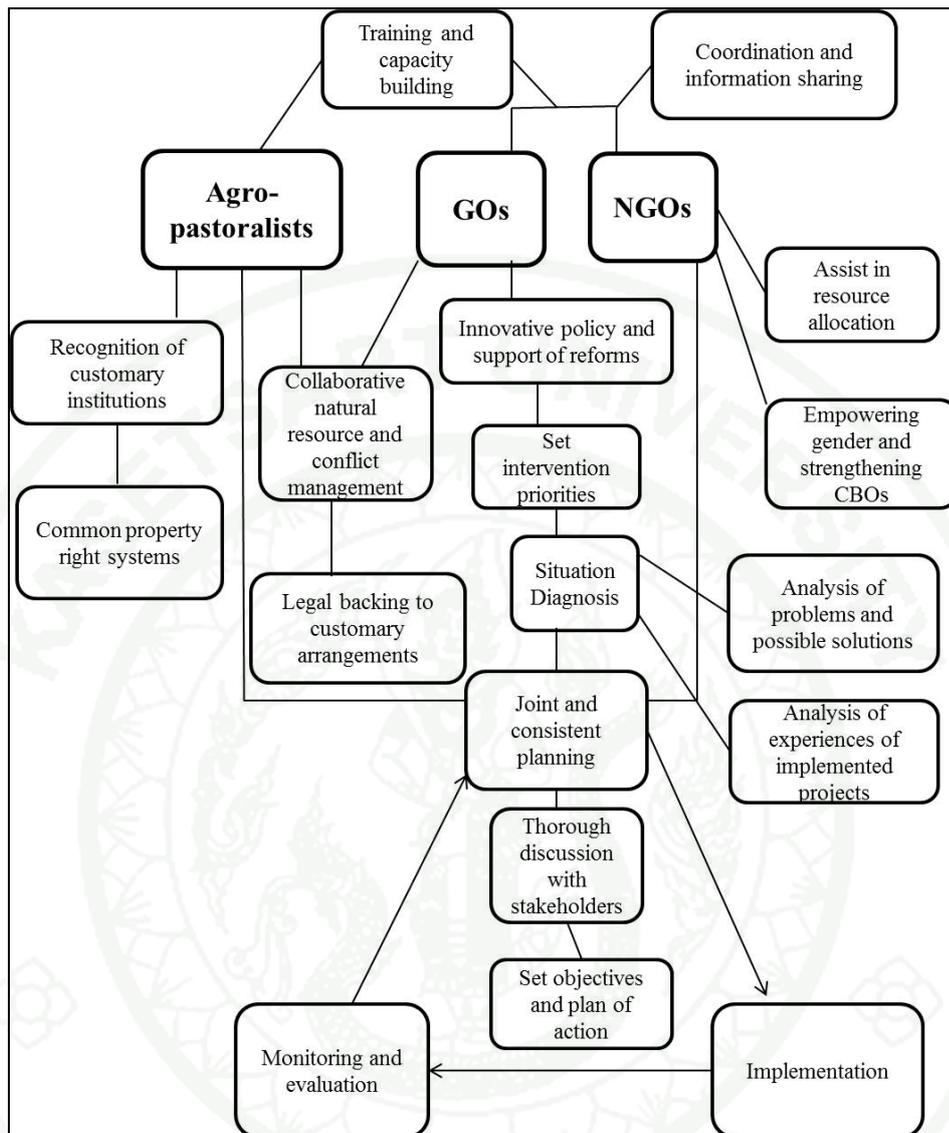


Figure 5 Strategic Activities to Improve the Situation

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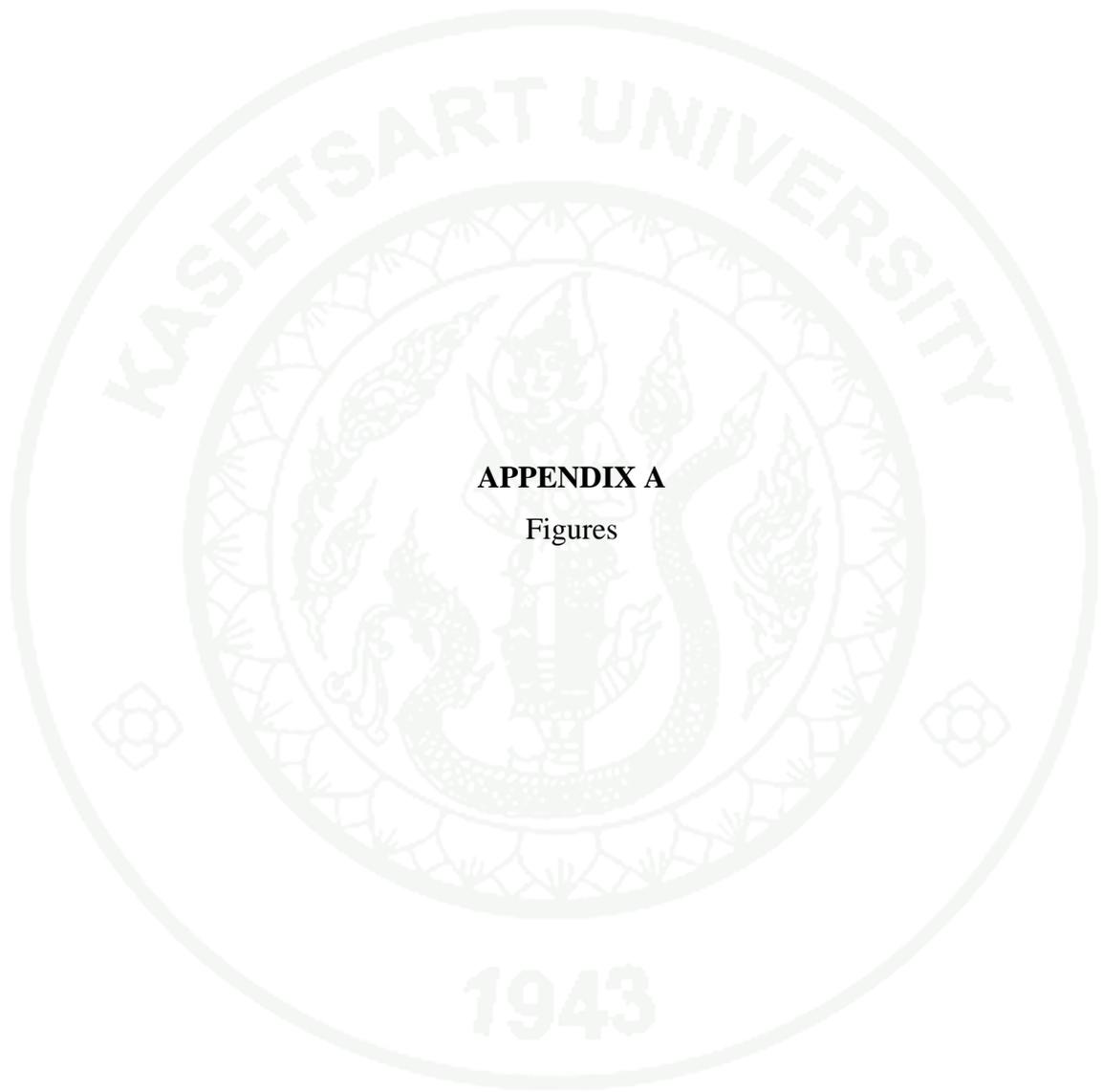
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APPENDICES



APPENDIX A

Figures



Appendix Figure 1 Grazing and browsing resources



Appendix Figure 2 Collective herding and watering point



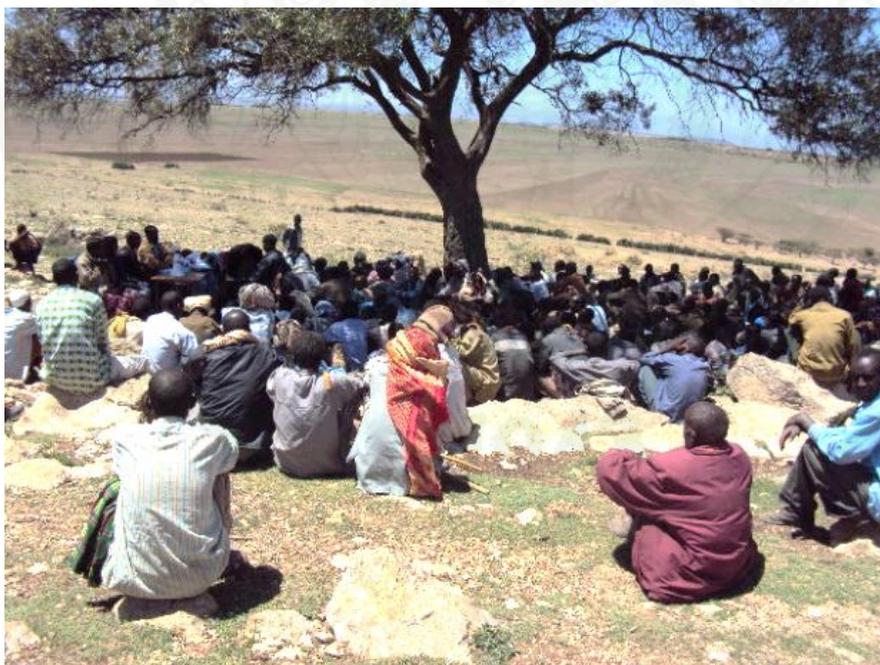
Appendix Figure 3 Collective house construction



Appendix Figure 4 Traditional ploughing method



Appendix Figure 5 Sorghum at farm field



Appendix Figure 6 Community meeting



Appendix Figure 7 Local elders



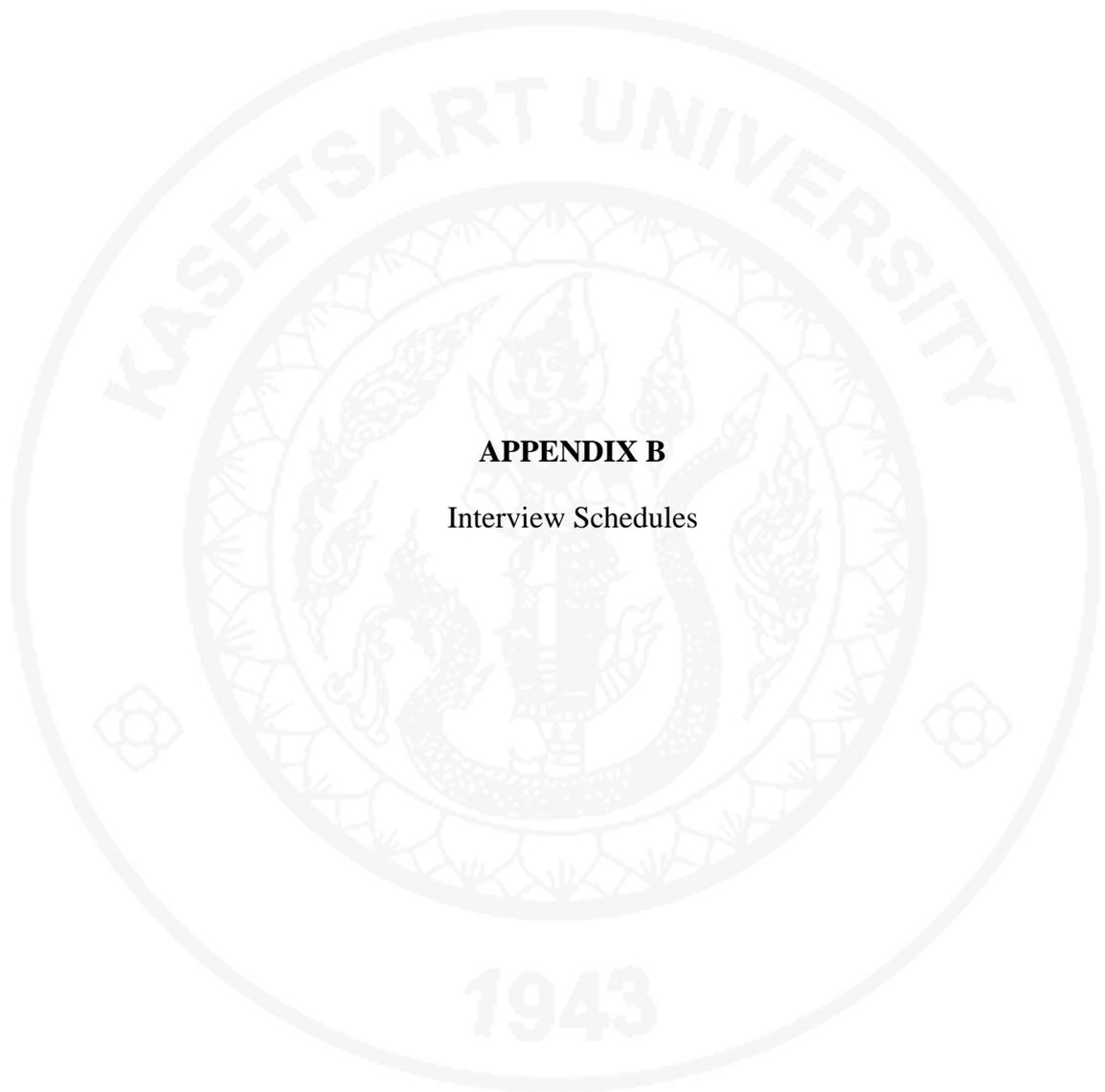
Appendix Figure 8 Woman skin a goat slaughtered from non-cooperator to feed the working group



Appendix Figure 9 Pasture rehabilitation (terracing)



Appendix Figure 10 Settlement of households



APPENDIX B

Interview Schedules

SEMI-STRUCTURED QUESTIONS TO COLLECT QUALITATIVE DATA

1. Characteristics of resources system

1.1. Resources size

How is it looks like your pattern of settlement? Is it differentiated from neighboring community or clan? How you can differentiate it? How you can monitor and exclude non-members resource users? (monitoring and exclusion activity is easy or difficult, and what makes it as such?)

1.2 Resource boundary

Are the boundaries of your settlement clearly known to you? (If yes, how do you recognize the boundaries and how are the boundaries formed? If no, why?) Can you recognize all members of your settlement?

1.3 Resource mobility and storage

What types of benefits you obtain from the pasture resource? How is the ease of utilizing available resources? Are resources you obtain enough for your household survival? Are resources getting to diminish or the resources available are abundant?

2. Characteristics of pasture resource users

2.1 Who are the people using pasture resources? (follow-up on: from different villages, differences in wealth, power, status or clan)

2.2 Dependency on the resource

How many households (as locally defined) in this locality depend significantly on the pasture for their livelihood? How much do the pasture resources contribute to the household's economy? Do you have any alternative sources of income? Do you have other alternative grazing area? If there is no pasture in the area, how will this affect you and what kind of strategy you have then?

2.3 Knowledge about the condition of the resource

How do you get information about the condition of the grazing land? How do you know where to find good pasture for the livestock? (especially in dry season). How do you know the amount of pasture available in your area? Over the last five years, has it been easier or more difficult to find good pasture?

How is the condition of the pasture? Is it in excellent, good condition, degraded or much degraded? When compared to the past ten years, is it the same or degraded? If it is degraded what is the cause? Is it overgrazing, weed infestation, deforestation or expansion of crop cultivation? Do your action contributed to overgrazing or deforestation? Why?

2.4 Trust and reciprocity

How would you characterize the levels of mutual trust among resource users?

How is your relationship with other pastoralists in the area? Do you allow your pasture to be grazed by animals of other pastoralists? Do you feel that you can be helped by other pastoralists if necessary?

2.5 Autonomy

Do you have the right to device your own institutions? Are there any restrictions from the government regarding devising your own institution?

2.6 Prior organization experience and local leadership

Have you been a member in any organization? Do you know of any organization in the area? Are there any organizations in the area in which you want to participate? What kind of benefits do you think a membership will give you? If you have never been a member, what is the main reason for that?

3. Institutions as a rule-in-use

3.1 What are the main customs and beliefs regarding the management pasture resources? How people communicate among themselves on the management issues?

3.2 What can you tell us about how the pasture (graze and browse resources) is governed? (follow up on: changes to this over time, how governing body is chosen – today and in the past, who is in governing bodies, what powers

governing body possesses? What does respondent think of the job the governing bodies do? Does respondent trust the governing bodies?)

- 3.3 Do you know any rules tied to pasture resource utilization and conservation? (follow-up on: violation of the rules, sanctions – what are they and who has the power to apply them? Are the rules/punishments proper? Monitoring pasture resources- who does it and how? Are monitoring and sanctioning activities low, moderate or high? If penalties are imposed, what is the level of compliance by the users?)

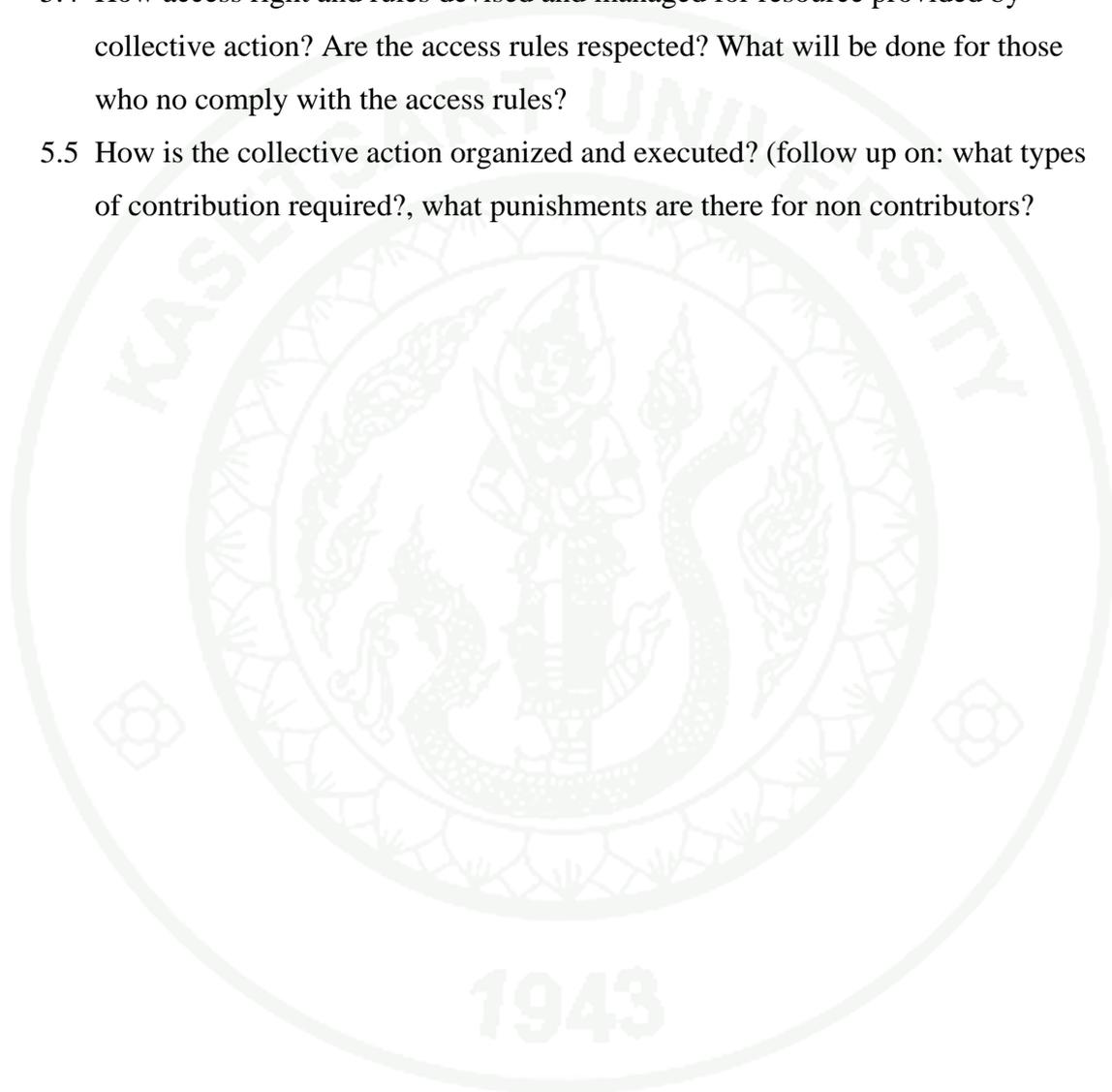
4 Institutions as an organization

- 4.1 How is the rangeland sector organized in public organizations? Which organizations have the mandate to the development of rangelands?
- 4.2 What other organizations exist in the region, which are engaged into activities related to the rangeland sector? What are their duties and what gaps and overlapping can be seen in their respective activities? How information is exchanged between organizations? (What type of resource coalitions and communication networks can be identified? Is there any joint work activities executed by organizations? Are joint work activities formal or informal? What types of linkage mechanism exist? (joint projects, periodic meeting, workshops, reporting, joint field visit etc.)
- 4.3 What are the most central features of the regional legislation that applies to the rangeland sector? What type of linkage strategy developed in the region? Is linkage strategy works in practice? What problems exist and how it can be improved?

5. Types of collective actions and its management

- 5.1 What types of collective actions exist? (follow up on: who facilitates, how it is facilitated, what types of resources required, What does respondent know about problems of collective action?)

- 5.2 Do you get information about assembly or collective activities? (If yes, how do you get it?)
- 5.3 Who are the people actively participate in collective action? Male or female, young or old, poor or better-off?
- 5.4 How access right and rules devised and managed for resource provided by collective action? Are the access rules respected? What will be done for those who no comply with the access rules?
- 5.5 How is the collective action organized and executed? (follow up on: what types of contribution required?, what punishments are there for non contributors?)



INTERVIEW SCHEDULE TO COLLECT SURVEY DATA

Serial No. of the interview Schedule _____

Part one: General Information

- 1.1 – Woreda _____
- 1.2 – Peasant Association _____
- 1.3 – Village _____
- 1.4 – Date of interview _____
- 1.5 – Name of the respondent _____
- 1.6 – Name of the enumerator _____ Signature _____

2: Characteristics of the Household

- 2.1 – Head of household: Sex _____
- Age _____
- Ethnic origin _____
- Marital status: 1. Single _____
2. Married _____
3. Divorced _____
4. Widow _____
5. Widower _____
- 2.2 – Education level of head of the household: 1. Illiterate _____
2. Able to read and write _____
3. Primary school _____
4. Secondary school _____

2.3 – Household composition

S. No.	Relationship to the household head*	Age	Gender 1: M 2: F	Education
1				
2				
3				
4				
5				
6				
7				
8				
9				

* 1: Household head 2: Wife 3: Son 4: Daughter 5: Relative 6: Raised 7: Other

3: Household resource endowment

3.1 – What is your total farmland? _____ Qodi (1/6 ha)

3.2 – Land holding: 1. Crop land _____ Qodi

Sorghum _____

Maize _____

Cash crops _____

2. Grazing land _____ Qodi

3.3 – When did you start your own farming (year)? _____

3.4 – Number of shoats owned by the household

1. Sheep _____

2. Goats _____

3.5 – List of farm implements owned by the household

1. Plough _____

2. Spade _____

3. Hoe _____

4. Sickle _____

5. Axe _____

3.6 – Would you please tell me the number of houses you have? _____

- 3.7 – Type of house: 1. Traditional tent _____
 2. Soil roofed house _____
 3. Corrugated iron house _____

Part two: Pastoralists perception on attributes of resources and resource users

What is the distance between your home and pasture? () km.

On average, how far do the individuals in the user group live from this pasture?

1. Individuals live in, or within 1 kilometer of, this pasture
2. Individuals live in, or within 1 and 5 kilometer from this pasture
3. Individuals live between 5 and 10 kilometers from this pasture
4. Individuals live more than 10 kilometers from this pasture

How long do you have to travel to and from the pasture for animal grazing?

- () Minutes () Hours

How would you characterize the levels of mutual trust among appropriators?

1. High level of trust
2. Moderate level of trust
3. Low level of trust

How individuals who are not member of the community prevented from using your pasture resources?

1. Very easy
2. Somewhat easy
3. Somewhat difficult
4. Very difficult

What is the size of your pasture resource?

1. Very large
2. Large
3. Relatively small
4. Small

To what extent the boundary of your pasture resources is known to you?

1. Very clear
2. Somewhat clear
3. Somewhat unknown

How do most individuals in the user group rank the condition of the pasture?

1. Very Sparse
2. Somewhat sparse
3. About normal for this ecological zone
4. Somewhat abundant
5. Very abundant

How is the dynamics of your pasture resources overtime?

1. improved
2. the same
3. relatively degraded
4. very much degraded

Is your actions resulted degradation of your pasture resources?

1. Yes _____
2. No _____

If the resources are degraded, what are root causes of resources degradation?

1. Rapidly increasing population pressures on natural resources
2. Expansion of agricultural land
3. Lack of technologically
4. Irrationalize exploitation of natural resources
5. Lack of rule-in-use
6. Others, Specify _____

In your observation do individuals in the user group follow the rules for using pasture resources?

1. Rarely or never
2. Sometimes
3. Most of the time
4. Almost always

If penalties are imposed, what is the level of compliance by the users?

1. No one complies with the penalties imposed on them
2. Few users comply with the penalties imposed on them
3. About half the users comply with penalties imposed on them
4. Most users comply with penalties imposed on them
5. Almost all users fully comply with penalties imposed on them

How often do individuals in the user group interact with respect to monitoring and sanctioning?

1. Year around
2. Seasonally
3. Occasionally
4. Never

Part three: Factors affecting adoption of improved sorghum varieties

1. Crop Management Practices

1.1 – Seed

1.1.1 – Have you ever used improved sorghum seed? 1. Yes _____ 2. No _____

1.1.2 – If yes, when did you start using improved sorghum seed? _____

1.1.3 – If no, which type of local varieties are you using?

1. Aden gab _____
2. Ilmi Jama _____
3. Others, specify _____

1.1.4 – Did you use improved sorghum seed last year? 1. Yes _____ 2. No _____

1.1.5 – If no, why?

1. Seed was not available on time _____
2. The price was expensive _____
3. The production was labor intensive _____
4. Others, Specify _____

1.1.6 – Land allocated for sorghum varieties in last season (2001 EC)

Variety	Land area (Qodi)	Yield obtained
Aden gab		
Ilmi Jama		
Improved sorghum		
Others		

1.1.7 – From where do you usually get improved sorghum seed?

1. Office of Agriculture _____ 2. Own _____
 3. Market _____ 4. Neighbours _____
 5. NGO _____ 6. Others, specify _____

1.1.8 – Is improved sorghum seed usually available on time? 1. Yes ___ 2. No _____

1.2 – Fertilizer

1.2.1 – Have you ever used Fertilizer? Yes _____ 2. No _____

1.2.2 – When did you start to use commercial fertilizer? _____

1.2.3 – For which crop and how much fertilizers in kilogram/ha have you applied this crop season?

Fertilizer type	Kg/ha				
	Sorghum	Maize	Wheat	Others	Total
1. Urea					
2. DAP					
Total					

1.2.4 – Is fertilizer usually available on time? 1. Yes _____ 2. No _____

1.2.5 – Can you purchase the amount of fertilizer that you need every year?

1. Yes _____ 2. No _____

1.2.6 – If no. why?

1. Not available _____ 2. Too expensive _____
 3. Cash shortage _____ 4. Late arrival _____
 5. No credit _____ 6. Others, specify _____

1.2.7 – From where did you purchase fertilizer?

1. Office of Agriculture _____ 2. PA _____
 3. Local market _____ 5. Others, specify _____

1.2.8 – Which technological package are you using?

1. Aden Gab fertilized _____ unfertilized _____
 2. Ilmi Jama fertilized _____ unfertilized _____
 3. Gov. Sorghum fertilized _____ unfertilized _____

1.3 – Farmers' perception

1.3.1 – Which sorghum variety do you and your family prefer for home consumption?

1. Improved Sorghum _____
2. Aden Gab _____
3. Ilmi Jama _____
4. Others, specify _____

1.3.2 – Which type of sorghum seed do you think results more harvest?

1. Improved sorghum seed
2. Local variety seed

1.3.3 – How do you rate the yield of improved seed?

1. Higher than local varieties
2. No difference
3. Lower than local varieties
4. Not know

1.3.4 – Do you plan to continue use improved sorghum variety in the future?

1. Yes _____
2. No _____

1.3.5 – If no, why?

1. No favorable price _____
2. Delayed or no supply of improved seed _____
3. Timely inaccessibility of the input _____
4. Lack of transportation _____
5. Unavailability of credit _____
6. Financial constraint to acquire the input _____
7. Lack of knowledge on use and application of the input _____
8. Fear of rain failures _____
9. Market problems _____
10. Other reasons, specify: _____

2. Access to infrastructure

2.1. Access to information

2.1.1 – Which source of information is important to you? Please, rank them.

<u>Source of information</u>	<u>Rank</u>
1. Development agent	_____
2. Family member	_____
3. Neighbors	_____
4. Peasant Association	_____
5. Office of Agriculture	_____
6. Radio	_____
7. NGO	_____
8. Market	_____
9. Field day	_____

2.1.2 – Have you ever been advised by development agent? 1. Yes ____ 2. No ____

2.1.3 – On average how many times in a season did you consult the development agent during the last crop season? _____

2.1.4 – What types of extension message given by the agents:

1. Fertilizer use: _____
2. Insecticide use: _____
3. Improved seeds use: _____
4. Manure use: _____
5. Land use practices: _____
6. Home economics: _____
7. The use of appropriate technologies: _____

2.1.4 – Did you find the advice helpful to your farm practice? 1. Yes ____ 2. No ____

2.1.5 – Do you often adopt recommended practices?

1. Yes, very often: _____
2. Yes, sometimes: _____
3. Yes, seldom: _____
4. Not at all: _____

2.1.6 – If no, give reasons:

1. Too expensive _____
2. Too technical _____
3. Too risky _____
4. No need for it _____
5. Not available _____

2.1.5 – Have you ever attended any Farmers' Demonstration or Field Days' arranged by development agent? 1. Yes _____ 2. No _____

2.1.5 – If yes, how many demonstrations or Field Days are you attended? _____

2.1.6 – Do you have a radio/tape? 1. Yes _____ 2. No _____

2.1.7 – If yes, which program do you listen?

1. Agricultural program _____
2. NEWS _____
3. Drama _____
4. Music _____

2.1.8 – How many days do you listen to agricultural news per week? _____

2.1.9 – If not agricultural program, why not? _____

2.1.10 – Rank of programs

<u>Program</u>	<u>Rank</u>
1. Agricultural program	_____
2. NEWS	_____
3. Drama	_____
4. Music	_____

2.2. Access to Market

2.2.1 – What type of crop and how much did you sell and /or consumed at home last year?

Crop	Time of sell*	Total production	Amount sold	Price

* 1. Immediately after harvest

2. After storing for some months

2.2.2 – If you sell sorghum immediately after harvest, what are the reasons?

1. When production is more than the capacity of storage _____
2. In case of household problems _____
3. To pay credit _____
4. Others, specify _____

2.2.3 – Did you face any marketing problem last year with respect to sorghum?

1. Yes _____
2. No _____

2.2.4 – If yes, what are the problems?

1. Low market price _____
2. No market nearby _____
3. Lack of transportation _____
4. Others, specify _____

2.2.5 – How many km you travel to sell your produce? _____ km.

2.3. Access to Credit

2.3.1 – Have you ever used farm credit? Yes _____ No _____

2.3.2 – If yes, amount of loan taken last year? _____

2.3.3 – Sources of credit

1. Relative _____
2. Local lender _____
3. Friend farmer _____
4. Peasant association _____
5. Neighbor _____
6. Office of Agriculture _____
7. Others, specify _____

2.3.4 – Purpose of borrowing?

1. To buy seed _____
2. To buy fertilizer _____
3. To buy farm implements _____
4. To buy food for consumption _____
5. Others, specify _____

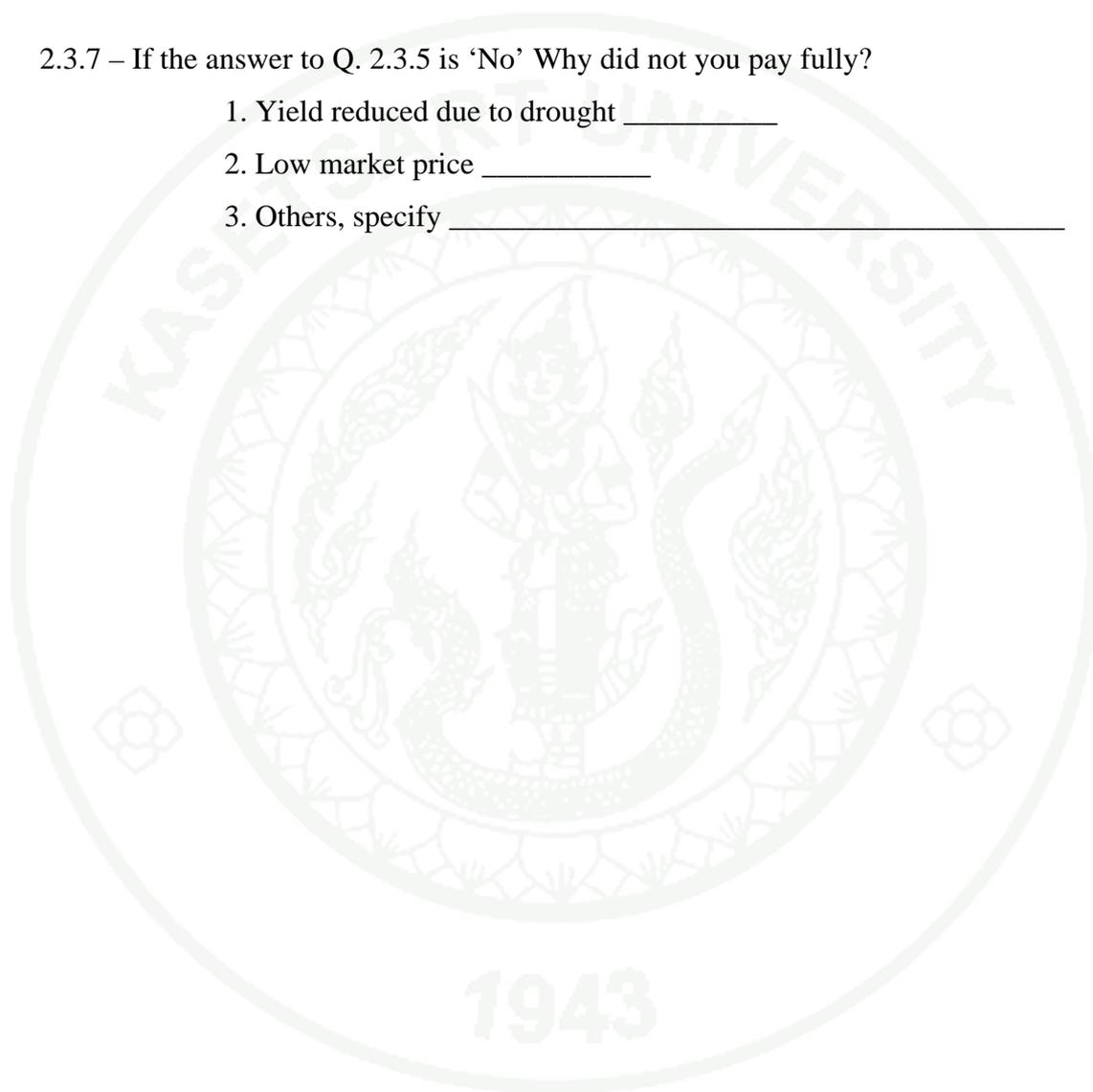
2.3.5 – Have you paid back your loans? Yes _____ No _____

2.3.6 – If the answer to Q. 2.3.5 is yes, from which sales you made payment?

- | | |
|------------------------------|-----------------------------|
| 1. Cereal crops sales _____ | 2. Cash crops sales _____ |
| 3. Large animals sales _____ | 4. Small animals sale _____ |
| 5. Off-farm income _____ | 6. Others, specify _____ |

2.3.7 – If the answer to Q. 2.3.5 is 'No' Why did not you pay fully?

1. Yield reduced due to drought _____
2. Low market price _____
3. Others, specify _____



BIOGRAPHICAL DATA

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EDUCATION	: <u>YEAR</u>	<u>INSTITUTION</u>	<u>DEGREE/DIPLOMA</u>
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	1997	IPC Livestock	Diploma (Dairy Farm M.)
	2002	Haramaya Univ.	B.Sc. (Agri. Extension)
	2005	Haramaya Univ.	M.Sc. (Agri. Extension)

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