Addis Ababa University
School of Graduate Studies

Smallholders' Irrigation Practices and Issues of Community Management: The Case of Two Irrigation Systems in Eastern Oromia, Ethiopia.

A Thesis Submitted To The School Of Graduate Studies of Addis Ababa University In Partial Fulfillment Of the Requirements of The Degree Of Master Of Arts In Regional And Local Development Studies (RLDS).

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Abstract

The purpose of this study has been to assess the role of smallholders' irrigation development and issues of community management with special reference to Doni Kumbi and Bato Degaga irrigation systems in eastern Shoa zone of Oromia Region. Both irrigation systems are located in the arid and drought-prone areas where crop failure is a recurrent phenomenon due to insufficiency and erratic rainfall. The study has been focused on examining the social and technical aspects of irrigation by which the benefits and constraints of irrigation has been investigated. In order to undertake this research household survey, focus group discussion and key informants were interviewed to collect primary data. In addition, relevant literatures and essential documents were reviewed that was useful for the study.

The finding of this study show that smallholder irrigations are very important especially in those areas where insufficient and erratic rainfall is a recurrent phenomenon as a result rain fed agricultural production is not a dependable enterprise. For instance, of the available income sources, the average household income obtained from irrigation cultivation constituted 69.18%, 76.15% and 75.92% during the three years period (2001-2003) in Doni Kumbi SSI. In Bato Gegaga SSI, there was no irrigation in 2001 because of failure in electric power supply. After the irrigation system re-operated in 2002 and 2003, the average household income obtained from irrigation cultivation was 75.49% and 61.49% as compared to other sources of income respectively.

However, as the study revealed, there are many technical, institutional, policy and management problems that constrain irrigation performances. Despite the existing weaknesses of irrigation water use associations (IWUAs) , lack of support is very crucial. The IWUAs were registered and became legal entity but this did not give them any advantage since they were not different from those who did not get the legal entity. For instance, they do not get facilities such as credit and market information because the agricultural policy gives priority to

farmers that rely on rain fed cultivation. Generally, the result of this study shows that the development of irrigation canals by it self can not bring about significant change. Together with, it is important to consider the social aspects in order for irrigation systems to be successful.

Key Words:- Small-scale irrigation, Food security, Community irrigation water management, Cash crops, Food grain crops, Market information system, Market oriented cropping pattern, Agricultural products price policy, Input and output marketing, Farm land leasing, Water pricing policy, Linkages of irrigation**.**

Dedicated

To: The Beloved Mother, Ayetu Dukem
Rest in a peace

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Acknowledgements

First of all, I must thank the almighty God who helped me to bring this work to the end.

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List of Acronyms

ADLI	Agricultural Development Led-Industrialization
BWMERD	Bureau of Water, Minerals and Energy Resources Development
CRDA	Christian Relief and Development Association
CSA	Central Statistics Authority
FAO	Food Agricultural Organization
IDD	Irrigation Development Department
ILRI	International Livestock Research Institute
IWMI	International Water Management Institute
IWUA	Irrigation Water Users Association
MNRDEP	Ministry of Natural Resources and Environmental Protection
MoA	Ministry of Agriculture
MoWRD	Ministry of Water Resources Development
NGO	Non Governmental Organization
OADB	Oromia Agricultural Development Bureau
OESPO	Oromia Economic Study Project Office
OIDA	Oromia Irrigation Development Authority
SSI	Small Scale Irrigation
WVE	World Vision Ethiopia

Abstract

The purpose of this study has been to assess the role of smallholders' irrigation development and issues of community management with special reference to Doni Kumbi and Bato Degaga irrigation systems in eastern Shoa zone of Oromia Region. Both irrigation systems are located in the arid and drought-prone areas where crop failure is a recurrent phenomenon due to insufficiency and erratic rainfall. The study has been focused on examining the social and technical aspects of irrigation by which the benefits and constraints of irrigation has been investigated. In order to undertake this research household survey, focus group discussion and key informants were interviewed to collect primary data. In addition, relevant literatures and essential documents were reviewed that was useful for the study. The finding of this study show that smallholder irrigations are very important especially in those areas where insufficient and erratic rainfall is a recurrent phenomenon as a result rain fed agricultural production is not a dependable enterprise. For instance, of the available income sources, the average household income obtained from irrigation cultivation constituted 69.18%, 76.15% and 75.92% during the three years period (2001-2003) in Doni Kumbi SSI. In Bato Gegaga SSI, there was no irrigation in 2001 because of failure in electric power supply. After the irrigation system re-operated in 2002 and 2003, the average household income obtained from irrigation cultivation was 75.49% and 61.49% as compared to other sources of income respectively. However, as the study revealed, there are many technical, institutional, policy and management problems that constrain irrigation performances. Despite the existing weaknesses of IWUAs, lack of support is very crucial. The IWUAs were registered and became legal entity but this did not give them any advantage since they were not different from those who did not get the legal entity. For instance, they do not get facilities such as credit and market information because the agricultural policy gives priority to farmers that rely on rain fed cultivation. Generally, the result of this study shows that the development of irrigation canals by it self cannot bring about significant change. Together with, it is important to consider the social aspects in order for irrigation systems to be successful.

CHAPTER ONE: Background of the Study

1.1. Introduction

Agriculture plays a decisive role in the economy of the developing countries. The sector makes great contribution in providing food for the human population, raw materials for domestic industries such as cotton and food processing and also exports items that generate foreign exchange. However, the performance of the sector has been so disappointing that it is unable to produce sufficient food. The picture for Ethiopia is more severe and serious as the country's food production per capita is below the average for Sub-Saharan African countries. Despite its dominance, the performance of the agricultural sector has been disappointing in Ethiopia (R. Rose, 1993) since the problem of food security is still very serious.

The poor performance of the sector and the problem of food security is exacerbated by the rapid population growth and hence of the rapidly increasing demand for food.

According to FAO (1995:28), the population density has reached around 50 persons per square kilometer, against an average of 24 persons per square kilometer for the whole Africa. About 80% of the total population (that is about 50 million peoples) of the country is concentrated in the highlands of Ethiopia, which represents only 40% of the total land mass and 90% of all cultivated lands. The land over this area is severely degraded caused by water erosion and over grazing.

Generally, among the major factors behind the poor performance of subsistence farming of the Ethiopian Agriculture are diminishing farm size and severe soil degradation, inadequate and variable rainfall, weak agricultural research base and extension system, lack of financial services, imperfect agricultural markets and poor infrastructure (Mulat, 1998).

In Ethiopia, rapid population growth can be a significant factor in worsening the environmental, economic and social problem. Overgrazing and rapid depletion of the forest cover for fuel and housing have resulted in an alarming rate of soil erosion.

Lack of adequate rainfall combined with variability in the onset and duration of rain remains a major threat to agricultural production. The rainfall problem is not expected to improve so long as environmental degradation continuous unabated. A strategy to cope with the weather problem should be based on multidimensional considerations including the promotion of conservation-based farming systems, introduction of effective land use plan and expansion of irrigated farming (ibid).

According to Addis (1991), Smallholders if assisted properly, can be the engine of growth that provides the surplus needed for economic development of the nation. Neglecting their welfare could actually jeopardize the success of economic policies that would otherwise have every chance of success. The increase of smallholders' agricultural production particularly of those in the drought prone areas of the country can be achieved through the development of small-scale irrigation systems if it is properly managed and well assisted (ibid).

According to FAO (2000), smallholder irrigation development has shown throughout the developing world that it can be used as a key drought mitigation measure and as a vehicle for the long-term agricultural and macroeconomic development of a country. Successful smallholder irrigation schemes can result in increased productivity, improved income and nutrition, employment creation and food security. However, socio-economic evaluation of smallholder irrigation systems is very essential in order to be able to derive lessons from the

past experiences and also to help policy makers in formulating sound policies for further irrigation development.

Currently, the government of Ethiopia is developing master plans for various types of irrigation, including diversion/gravity schemes from major rivers, pumping from rivers, and small storage reservoirs by giving priority to low cost small-scale irrigation systems. (OIDA, 2000).

As explained by Rosegrant Cai and Cline (2002), sociologists should interface closely with technical specialists in agronomy, livestock/pasture, irrigation, etc. Sociologists and technical specialists should work together to understand poor household's land and labor allocation strategies, their way of minimizing risk and their constraints for adopting proposed technologies. Together they should weed out solutions, which are technically possible but unlikely to be adopted and make judgments about the estimated rate of adoption and the number of households likely to benefit from each component (ibid).

Generally, according to Uphoff (1989, in mollinga 2002), irrigation requires the integration of both dimensions that are social and technical. Without the incorporation of institutional and other social relations such as human interest, rational decision-making, power relations, conflict, etc. to the technical irrigation discourse, it limits the comprehensive understanding of irrigation. It can thus be seen that the proper development and management of irrigation is a complex and comprehensive undertaking, requiring attention too much more than hydraulics and agronomy.

As Woldeab (2003) noted, in irrigation development more emphasis is given to the construction of infrastructure while the management aspect of irrigation is often neglected. For

the community based small scale irrigation systems to be successful, the interaction of both human and physical aspects of irrigation is very important.

This study is therefore aims at assessing the contribution of irrigation in households income and the condition of irrigation management by emphasizing on two irrigation systems found in east Shoa administrative zone of Oromia Region, namely; Doni Kumbi and Bato Degaga Small Scale Irrigations (SSI). It intends help to generate information and increase understanding to assist in future planning and development of smallholder irrigation..

1.2. Statement of the Problem

According to MOA (1998), the objective of agricultural development in Ethiopia comprises assurance of staple food supplies for the rapidly growing population and promotion of foreign exchange earnings for accelerated growth of the overall economy. However, the sector has not met its primary objectives and consequently the country faces chronic and serious economic crises, which manifests themselves through food shortages, general unemployment, industrial stagnation and debt accumulation.

Agricultural production in Ethiopia is largely rain-fed, which increasingly depends upon erratic and often insufficient rainfall. To cope with both an average of 3% annual population growth and the limitation of rain fed agricultural productivity, irrigation development is needed for food security and alleviating rural poverty. In this regard most small-scale irrigation systems that involve effective management and institutional support from the local government are likely to be successful in contributing to poverty reduction and household food security (ibid).

However, many obstacles constrain rapid development of small-scale irrigation. Although there are many perennial rivers, seas, lakes and ground water resources in the country, other conditions may not be conducive to irrigation development such as unfavorable topography, soils, distant markets and inadequate infrastructure, lack of credit, lack of market information and other socio-cultural factors.

Doni Kumbi and Bato Degaga SSI are found in the arid agro climatic zone where drought and the resultant famine and food insecurity are dominant features. Hence, the use of irrigation water is an essential component for sustainable agricultural production to the communities concerned. However, According to the report summarized by Oromia Irrigation Development Authority (2002), most beneficiaries of Doni Kumbi and Bato Degaga SSI are still dependent on relief assistance same as non-irrigators found in the area. Although the two irrigation systems have been operating for the past ten years, the majority of irrigation user farmers are not still self-sufficient in food production. Making irrigation more effective in enabling year-round food security is therefore the primary challenge addressed in this research.

1.3. Research Question

The main research question is “What is the contribution of small-scale irrigation practices in household income and improving their livelihoods

The specific questions are;

1. How do farmers manage irrigated agriculture?
2. What is the contribution of irrigated agriculture to household income?
3. What are the problems encountered by the irrigation systems?

1.4. Objective of the Study

The overall objective of this study is to examine the contribution of irrigation practices in households' income and its benefits to improve the livelihoods of farm households in Doni Kumbi and Bato Degaga irrigation schemes.

The specific objectives of the study are:

1. To examine the management of small-scale irrigation systems
2. To assess the role of irrigation practices in improving households food security,
3. To assess the problems encountered in irrigated agriculture

1.5. Significance of the Study

In addition to the long-standing tradition, small-scale irrigation often flourished with the help of regional governments and direct and indirect involvement of other NGOs. Therefore, this study will contribute information regarding the condition of small-holders irrigation operation, management and policy options that could help guide smallholders' irrigation development.

CHAPTER Two: Research Methodology

This research is basically a survey case study focused on two community-based small-scale irrigation systems, namely Doni Kumbi and Bato Degaga SSI. The reason for the selection of these irrigation systems is that both are found in the semi-arid areas where insufficient and erratic rainfall is a recurrent phenomenon that causes crop failure. In this respect, water use for agriculture by smallholder farmers is an appropriate choice. Therefore, I became interested to see the implication of irrigation whether it helped to curve the consequences of drought and its contribution to food security. Accessibility of both irrigation systems is also another factor for their selection.

Generally, data have been gathered through survey methods, focus group discussion, and interview with key informants and from secondary sources. Statistical tools such as percentage and mean have been used for the analysis.

2.1. Primary Data Collection

Primary data have been collected by the use of formal and informal survey methods. Formal surveys have been carried out with the help of standard questionnaire designed to obtain information from selected sample households. The content of the questionnaire prepared to interview sample survey includes personal household data, household resources and means of livelihoods, issues related to irrigation practice, organization and management, available infrastructure, and institutional facilities.

Discussion has been made with key informants including committee members of irrigation water user's association, executive members of peasant associations, development agents and Boset and Adama District Irrigation Development Desk representatives and experts from

cooperative desk. The leading questions prepared to guide the discussion with the focus group emphasis on policy issues, external support for the schemes, institutional and managerial issues, major problems and future plans to further develop the irrigation systems. Personal observation has been also employed.

2.2. Sample Selection and Sampling Techniques

The total household heads that are using irrigated agriculture at Doni Kumbi and Bato Degaga small-scale irrigation systems are 72 and 120 respectively. Although the size of population of the two study sites differ, equal number of sample households selected from each for the convenience of the study. According to the focus group discussion, the local administration classified farmers in to lower, middle and high levels of income groups for different purposes such as for food aid distribution. The classification was made based on the size of households' farmland holding and possession of livestock. Accordingly, I adopted this grouping to select the sample households. This would help to obtain different insights, thoughts and attitudes from farmers having different income background concerning the practice of irrigation. Once the households had been stratified into three groups depending up on their economic status, simple random sampling technique has been employed to select 10 household heads from each group in both study area.

2.3. Designing Questionnaire

Before designing the questionnaire, the two irrigation systems were repeatedly visited in July and August 2003 summer season. During those periods a number of informal discussions has been conducted with the beneficiaries, development agents and local government officials and the irrigation farm has been thoroughly visited. Based on the information gathered and

personal observation, interview questions has been developed and then pre-tested before it was administered.

In order to conduct the household survey, enumerators who have completed 12^{th} grade and able to speak the local language, Afan Oromo, were recruited from each study sites. The enumerators were also trained by the researcher before launching the survey to make them understand the purpose of the survey and to be familiarized with the questionnaire. The interviews were then conducted with the close supervision of the researcher.

2.4. Focus Group Discussion and Key Informants

The primary data collected from sample farmers need to be further enriched by additional information gathered through focus group discussion. Group discussion was held with committee members of water user's associations, peasant association executive committee members, development agents and Adama and Wolenchiti District irrigation development desk. Individuals were also selected who were believed to be knowledgeable about the past and present history of the two schemes and interviewed by the researcher.

2.5. Secondary Data Collection

In addition to primary data collection, secondary data were collected from different sources. The data collected from the secondary sources include necessary documents, studies and other useful written materials needed for the study. Organizations contacted during the survey period were Ministry of Agriculture, Ministry of Water Resources Development, Oromia Irrigation Development Authority, CARE Ethiopia, World Vision Ethiopia, International Livestock Research Institute (ILRI) and International Water Management Institute (IWMI) country representatives and Christian Relief and Development Association (CRDA).

2.6. Limitations of the Study

The following conditions can be considered as a limitation factors during field stay for data collection.

- The fact that this research was conducted in the specified period obliged the researcher to limit the sample population to sixty irrigation households in both study sites. As compared to the study population of 192 irrigation households, the sample household limited to 60 may affect the degree of representation.
- Weak recording system of IWUAs, Development Agents, and Adama and Wolenchiti District Offices regarding the history of the two irrigation systems
- Problem of getting time series data since farmers' ability to recall was not strong.

2.7. Organization of the Paper

The paper is organized under six chapters. The first chapter includes background information statement of the problem, research question and significance of the study. Chapter two deal with the methodology of the study. Chapter three gives theoretical overview on smallholders' irrigation development. Chapter four deal with the description of the study area. Chapter five elaborates survey findings and discusses the results. Finally, chapter six gives conclusion and presents recommendations.

CHAPTER Three: Literature Review

3.1. Theoretical Review

The main concern of this chapter is to provide the conceptual basis for the analysis of socio-technical aspects of community-based small-scale irrigation practices. Farm-system theory is found to be relevant since it particularly refers to the integration of technical and social perspectives in the practice of agriculture.

According to Kast and Rosenzweig (1974, in FAO 2003), system is an organized unitary whole consisting of a set of interrelated elements, components or subsystems, each of which is related directly or indirectly to every other element, component or subsystem in the system. The basis of systems theory is that, by their nature, systems can only be properly considered qua systems (ibid).

One of the farm management theories is farm-system theory with it conceptualization of the farm as a purposeful system. As far as this study is concerned, this theory is considered as the base for the analysis since it constitutes a way of looking at the farm and provides a checklist of aspects of the farm that should be the concern of management (ibid).

Huppert (1989, in Mollinga 2002) explained that irrigation is not simply a technical task of delivering water to crops. It is also a human activity and social undertaking. Rural households operate within a larger historical, socio-cultural, economic and institutional and policy environment that makes the need for the linkages very important. In the context of small farms, there are different kinds of theories of farm management derived from modern management theory.

Dillon (1992, in FAO 2003) asserts that farm system theory view a farm as a unique goal setting having a major aim of generating income (in cash or kind) for its stakeholders through agricultural production. Generally, a farm system is complex rather than simple. Its purposefulness is ensured by its human and social involvement, which enables the system to vary its goals under a given environment.

Any farm system is a mixture of abstract and concrete elements. The concrete elements refer to physical activities and processes that occur on the farm while abstract elements relate to the managerial aspects of the farm. To be more specific, the concrete elements involve technical resources such as technology, knowledge of cropping system or the irrigation system and opportunity that is useful for irrigation. The abstract elements relate to the entire farm system through the farm management activity of setting goals, developing long and short-term plans, specifying organizational structure, deciding on enterprises, choosing technology, allocating resources, seizing opportunities, establishing control processes, harmonizing relations between sub-systems relevant to the farm (ibid).

According to Freeman and Lowermilk (1991), the integration process of subsystems (social and technical) should be recognized and managed as a purpose-driven system rather than as just a set of disjointed parts of farm system. For instance, exclusively social scientists, technical professionals or farmers operating independently of each other cannot solve the problem of water control at the local level.

FAO (2003) also summarized that the interaction and interdependence of these subsystems (concrete and abstract) are the building blocks to form a purposeful whole in farm activity i.e. for the farm system to function effectively, its management must pay close attention to these

integrating processes. These are leadership, decision-making, and information flow and control mechanism to guide and direct performance.

Uphoff (1986, in Mollinga 2002) noted the importance for the combination of social and technical aspects in irrigation. Both human and physical aspects interact continually and profoundly in irrigation agricultural activities. Enterprises, so a hyphenated construct of irrigation as a socio-technical process seems appropriate.

Huppert (1989, in Mollinga 2002) also supported the above argument by supplementing that agricultural activities including irrigation systems are socio-technical systems, i.e. they embrace both social and technical system components and subsystems. According to him the essential attributes of socio-technical systems include;

- Close interrelationships between structural, social and technological features,
- Openness of the system to their system environments,
- An emphasis on conversion processes in which inputs imported from the system environment are transformed in a conversion process through input and exported to the system environment as outputs.

Mollinga (2002:18) concentrated on a perspective called the social shaping or social construction of technology to investigate the social dimensions of irrigation artifacts. The basic idea of Mollinga is that irrigation technologies not only mediate people's relationships with biophysical processes, but also shape the people-people relationships that are part of irrigation. He noted that the social dimension of irrigation could be specified in three points that includes;

- In order for the technologies to work properly, particular social conditions that fits to it should have to be fulfilled,
- The development of irrigation technology requires social construction in which different stakeholders interact (communicate, negotiate, take decisions, struggle, etc.),
- Irrigation technologies have social effects. i.e. through its effects on crop production, people's health, etc., irrigation can affect people's livelihoods,

According to FAO (1992), proper integration of sociological analysis is crucial that involves analysis of constraints and opportunities taking in to consideration both internal factors (goals, resource endowment) and external environments (physical, socio-cultural, policy, institutional) with the understanding the rationality behind farm practices.

Generally, the analysis of this research is conducted on the basis of the above discussion, which binds social and technical aspects of irrigation and facilitates their interaction and interdependence to form a purposeful whole.

3.2.Empirical Review On irrigation

Irrigation is categorized as small, medium or large-scale depending on the area irrigated, scale of operation and type of control or management. But the criteria for this category may vary from country to country. For example, in India the irrigation scheme of 10000 ha. is classified as small while in Ghana the largest irrigation is 300 ha. (Smith, 1998).

The three-scale classification of irrigation was established in Ethiopia during the *Derg* regime (Dessalegn, 1999). Accordingly, large-scale irrigation schemes are those, which hold over

3000 hectare of irrigation area while medium scale cover an area of 200-3000 ha. Small-scale irrigation schemes involve those with the total area of up to 200 ha.

According to Wyss (1999, in Woldeab 2003), the practice of small scale irrigation schemes operated by traditional methods have been passed down from antiquity. However, the importance of small irrigation development as a means for socioeconomic transformation has been considered since the Second World War (Vincet1994 in Woldeab 2003).

The history of irrigation water use for agriculture dates back to the early civilization of mankind. However, as noted by Peter Stern (1979), irrigation developed during the first half of the twentieth century was universally beneficial. He also explained that the importance of small scale irrigation development have got some attention on a seminar sponsored by FAO in 1970 in the Philippines. The seminar concluded that more attention has to be given by government to the development of small irrigations. The strongest argument in favor of this idea is that it easier than large scale development because the problem of human management reduced to a manageable scale.

Rosegrant, Cai and Coline (2002) pointed that there have been significant cutbacks in rain fed agricultural production due to frequent occurrences of drought and erratic rainfall especially in the Sub-Sahara African countries. In this regard, in order to tackle with the problem, irrigation helps smallholder farmers to be free from dependence on rain fed agriculture by providing the capacity to produce crops twice or three times in a year.

FAO (2000:16) concluded that smallholder irrigation has brought many successes to farmers, among others are;

- It enabled farmers to grow high value crops and increase their income hence improve their livelihoods.
- The schemes helped in reducing the rural to urban migration by offering the rural population an alternative source of employment.
- In arid areas where drought is frequent phenomenon irrigation helped as strategy to cope with the problem.
- With a more integrated approach smallholder irrigation can be the basis for other rural infrastructure to be developed in areas, which could otherwise have remained without roads, telephones, schools and clinics.
- Smallholder irrigators have developed a commercial mentality
- Crop yields and farmer incomes have gone up manifold.

FAO (1997:17) also pointed out although many Sub-Saharan countries have realized the critical role of irrigation in food production there are also a number of constraints that have been responsible for a relatively slow rate of irrigation development in this region. These constraints are:

- Inadequate physical infrastructure and markets.
- Poor investments in irrigation.
- Lack of access to improved irrigation technologies.
- Lack of cheap and readily available water supplies.
- Poor resource base of farmers.

- Fragmented and small size of landholdings.
- High interest rates.
- Poor transportation and marketing facilities.

Rahmato (1999) explained that in response to severe droughts that hit Sub-Saharan Africa in the 1970s, many countries opted for irrigation development and made huge investments in government-driven irrigation projects with the support of international donors. Many drought prone countries of Africa, whose population is relatively high and can not be adequately supported by rain-fed agriculture alone, expanded irrigation schemes to stabilize agricultural production and promote food security. But many of these water projects were performing poorly and unable to meet their objectives. For instance, in Ethiopia both in terms of choice of technology and scale of operation, the emphasis was on costly investments that required high management and maintenance costs. Most of the state run water projects appeared during that period were poorly operated and poorly managed (ibid).

On the other hand, those smallholder farmers who practiced traditional irrigation were denied proper support from government in order to upgrade irrigation systems. It was only when the severe drought that occurred in the 1980s caused unprecedented food shortage convinced the military regime to encourage the establishment of new irrigation schemes and strengthening the existing traditional schemes.(ibid).

However, these attempts were also failed because the irrigation systems were guided by undemocratic guidelines, which were characterized by strong top-down approach. The Ministry of Agriculture put all irrigation systems under its responsibility and direct supervision. As a result, small-scale irrigation systems were denied operational autonomy and

also the collectivization principle further destroyed the sense of ownership on the part of peasants. This in turn discouraged the participation of irrigation members on production activities (ibid).

After the collapse of the military regime, community owned small-scale irrigation schemes were allowed to enjoy their autonomy. But still they suffer by multifaceted problems manifested in different aspects among others; management and organizational problems, financial management of irrigation, access to credit, input provision and market facility, diversification of crop production, integrated management of natural resources, etc. (ibid).

Basically, irrigation water development needs to be analyzed from the perspective of costs, benefits and impacts to the community in relation to rural development, increased household food security, increased social service utility, etc. In order to meet these objectives sustainable production increases must be achieved from irrigated agriculture (ibid).

As FAO (1997) pointed, today there is much more to small commercial farm than large ones. This is because, in any agriculture based economy, the development is frustrated if the smallholders are not provided with the means of increasing their productivity, income and thereby their standard of living. Therefore, as one of the means of ensuring sustainable food self-sufficiency and poverty alleviation, irrigated agriculture continues to play significant role in the country.

In recognition of this fact, during the past few years of the country's agricultural development program (ADLI), establishment of small-scale irrigation was considered as one of agricultural development strategies to maintain sustainable growth of the sector. However, as noted by Woldeab (2003) the performance of irrigation is far from satisfactory in the country. For

instance, as Dejene and Yilma (2001) pointed in their study, in most cases problems arises from giving more emphasis to technical aspects and less emphasis to the managerial and institutional aspects that has led to inefficient and underutilization of available capacity of the irrigation project.

CHAPTER Four: Description of the Study Area

4.3. Doni Kumbi and Bato Degaga Small-Scale Irrigation Systems

4.3.1. Location

Doni Kumbi SSI is found in Boset District, East Shoa Zone of Oromia National Regional State. It is about 33 kilometers from Awash Melkasa Research Center southeast of highway from Addis Ababa to Asella, on the left bank of the Awash River. Batu Degaga Small-scale Irrigation scheme is also found in Adama Woreda, East Shoa Zone of Oromia National Regional State, seven kilometers of Sodere resort center on the road that leads to Tibila state farm on the left bank of the Awash river.

4.3.2. Climate

The area of Doni Kumbi Small-scale Irrigation (SSI) is found at the elevation, around 1220 to 1250 meters above sea level. According to the meteorological data obtained from the nearest Awash Melkasa meteorological station, which is about 33 kilometers far from the study area, the annual mean rainfall distribution in the area ranges between 500mm to 900mm and the potential evapotranspiration is 1650mm per annum. Monthly mean temperature ranges from 17 degree centigrade to 23 degree centigrade.

According to World Vision Ethiopia (1992), based on the climate data of Wonji Sugar Estate, the rainfall in the region is recorded to vary between 700mm to 760mm while evapotranspiration can be expected to be much higher than the rainfall amount (though no exact data were available). The elevation of the project area is recorded 1372 meters above sea level.

Both Doni Kumbi and Bato Degaga irrigation systems lie in similar agro-climatic zone classified as drought prone areas of the region. There are two rainy seasons in both study areas in which the long rainy season starts from June and ends at the end of September. The short rainy season covers the period from February to April. Unreliability of rainfall is a common feature for both schemes. For instance, the drought and its resultant famine occurred in 2003 is the recent sad memory for the people living in both study areas as it passed causing the total loss in crop production and the death of large number of domestic animals.

4.3.3. Topography

The topography of Doni Kumbi area is dominated by alluvial plain and the land unit is classified as flat to rolling of which some parts of the flat land is exposed for flood as the Awash River overtops its bank especially in the month of August (CARE, 1991). The soils are fine-textured dominated by sandy loam content that has good drainage capacity, which is suitable for irrigation. There are also medium-textured soil and gravel in some places.

On the other hand, according to the project design report by World Vision Ethiopia (1990), Bato Degaga area is severely dissected and is made up of tertiary basalts. The soil texture is described as clay loam to sandy clay loam of dark brown to dark reddish brown color. The soils are generally considered to be suitable for crop production.

4.3.4. Water Source

The Awash River is the source of water for both Doni Kumbi and Batu Degaga irrigation systems. It is one of the main rivers in the country suitable for large and small-scale irrigation.

The irrigation potential of the Awash River is 185,000 hectare (Dessalegn, 1999). It is a perennial river having reliable water discharge through out the year as a result there is no

water constraint from the source. The current tendency by the government to expand modern small scale irrigations as one of the major components for agricultural sector development strategy and the past positive experience of irrigation experience in the Awash River basin attracted rural development actors, and for instance, Doni Kumbi irrigation system developed by the NGO known as CARE and Bato Degaga by World Vision Ethiopia.

4.3.5. Vegetation

Currently, there are widely open trees and shrubs dominated by poorly scattered ruminants of Acacia species in both study areas. Rural families in the study areas cut trees, reducing forest cover, and sell fuel wood and charcoal to generate income. In addition, lack of or insufficient environmental awareness and motivation to plant trees among local people is other important factor that contributed to the degradation of the natural conditions (Oromia Socio-Economic Profile, 2002).

4.4. The Development of Doni Kumbi SSI

Doni Kumbi SSI project is located on the road to Tibila state farm on the left bank of the Awash River, north east of Doni rural town which is 47 kilometers far from Adama town, capital of East Shoa Administrative Zone of Oromia Regional State. Doni area is categorized as one of the drought prone areas of the region. Insufficient rainfall and food shortage is a common feature of Doni area. On the other hand, there is abundant water resource and suitable agricultural land that is conducive for crop and vegetable production. This circumstance makes the use of irrigation technology more appropriate to overcome the long standing problem of drought and food insecurity in the area.

Initially, a private investor developed Doni Kumbi irrigation project during the imperial period in the late 1960s. Using the natural stream course of the Awash Rive, the investor constructed a low head gravity weir to divert the river artificially. The length of the main canal was about 3 kilometers long from the source to the irrigable land.

According to Bahru (1992), the overthrow of the monarchy by military coup followed by the nationalization of rural land in 1975, confiscated the investor's newly developed irrigation farmland and it then transferred to producers cooperatives that was organized on the basis of the socialist principles. However, the performance of the irrigation scheme under the socialist cooperatives management was less efficient. This was due to the fact that very little attention was paid to small-scale irrigation schemes constructed and managed by peasant farmers.

According to Rahmato (1999), the economic development motives of the *Derg* regime in the agricultural sector were to promote high technology water development schemes managed by state controlled agro-industrial and agricultural enterprises. The emphasis to small-scale irrigation development was given only in the second half of the 1984, when the country greatly affected by devastating famine occurred in 1984/85. However, the scheme operation and maintenance under the management of producer's cooperatives was very poor to keep it functional and productive. Therefore, no significant progress was exhibited during those periods as the military regime was fully occupied by war affairs until it was overthrown in 1991.

Followed by down fall of the military regime and the dissolvent of procedures cooperatives, the irrigation land at Doni again redistributed among the individual farmers who were members of Doni peasant association. At this point, the scheme was almost collapsed and

stopped functioning. Almost all water conveyance structures were destroyed and canals completely silted up. Therefore, maintaining and operating the scheme by those individual farmers who distributed irrigated farmland among themselves was a very difficult task (CARE, 1991).

As a result, they requested the assistance of CARE Shoa Project for rehabilitation and further development of the schemes capacity. The request accepted by CARE Shoa Project in 1994 and rehabilitation and upgrading of the irrigation was completed in 2001.

As the information obtained from Wolenchiti IDA during the survey period, the rehabilitation and upgrading of the deteriorated irrigation structure was undertaken in two phases. The first phase of the project was completed at Doni Kumbi PA site in 1997 and currently 72 households are becoming beneficiaries. In the second phase of the project, it was planned to extend the scheme to the adjacent peasant association known as Sifa Dhenke to bring 110 hectare of arable land under irrigation that would benefit 150 households. But CARE Shoa Project left the area before the completion of second phase of the project and currently not more than 40 peasants are practicing irrigation on less than 30 hectares of land at Sifa Dhenke village.

There is irrigation water users association established at Doni Kumbi and the members are 72 peasants currently. Before the introduction of the scheme, the peasants in the area cultivated cereal crops such as maize, *teff*, haricot bean and sorghum. But they have changed their pattern of cropping as a result of the schemes development. They started producing cash crops such as onion and tomato that enabled them to supplement their income. Few farmers also adopted producing food grain crops such as Maize and haricot bean by using irrigation. Cash crops are

also produced for sale to increase household income. The cash income obtained from the sale of cash crop support farmers to purchase food crops from near by market when they face food shortage.

4.5. The Development of Bato Degaga SSI

Batu Degage small-scale irrigation scheme has been developed by a non-governmental organization, World Vision Ethiopia in 1992. The fact that the area was a drought affected dry land where both human and animal population suffered from severe food shortage attracted World Vision Ethiopia, to intervene and do something for the improvement of the livelihood of farmers in the area.

Accordingly, World Vision Ethiopia prepared a feasibility level project document by engaging Associated Engineering Consultants (AEC) to carry out both technical and the economic feasibility of the Bato Degaga irrigation scheme in 1990. At the time there were two types of farming community in the area. On the one hand, there were a group of peasant farmers who were expelled from their original habitat by the sugar estate at Wonji and resettled at Bato Degaga peasant association and the original inhabitant on the other.

The development intervention intended to change the difficult condition of the farmers in the area was not an easy task at the start. This was due to the fact that peasants lack trust in suspicion of appropriation of their land as they learnt it from their past experience. Therefore, the realization of the scheme demanded strong and continuous efforts by all stakeholders to build trust and confidence on the part of the peasants in the area.

Finally, having settled the problems by changing the attitude of the peasants, Bato Degaga SSI developed with full material, financial and technical supports from WVE Adama project in

1992. Farmers also participated in the development of the irrigation scheme by giving their land and labor to the project.

When the irrigation project started operation in 1992 having irrigation capacity of 140 hectares, the beneficiaries were estimated to be 280 family heads of 1400 household members enabling them to cultivate vegetables, fruits and cereal crops. The support of WVE in covering the cost of administration such as settling the electric power bill was not discontinued until 1996. However, when the support of WVE stopped in 1997, the performance of the irrigation scheme declined from time to time and the operation was collapsed totally in 2000. The scheme was made to re-operate in 2002 after WVE again settled the accumulated electric power bill used from 1997-1999.

The irrigation water supply for Bato Degaga farm was made available by pumping from the Awash River by installations of electric motors, pumps, transformer, main supply pipeline and construction of pump house. The IWUA of Bato Degaga was registered as a legal entity by the Cooperative Bureau of the regional government in 1999 having by-laws being an official document of the association.

Before handing over the project to irrigation users in 1996, technical training and practical demonstration have been conducted by the project staff with supports from the staff of line ministries and other relevant organizations. A Development Agent also assigned permanently at the site to provide technical supports.

4.6. Socio-Economic Environment

4.6.1. Land Tenure and Land Use Pattern

According to Bahru (1992), during the imperial era the country's land ownership system was extremely complex. A mixture of several types of feudal land ownership system existed in various parts of the country such as *Rist, Gult, Rist-Gult, Semon* and also land owned by the emperor and his court. But after the take over of the political power by the military regime in 1974, the ownership of land was transferred to the state in accordance with the "Rural land proclamation of March 1975". To this effect, farmlands were divided in to 800 hectare blocks, and a peasant association was to be organized in each block. Members of a peasant association, given a common right to use the land block, were respectively allotted a farming plot not exceeding 10 hectare (ibid).

According to the Oromia Region's economic study profile (2002), most large-tracts, formerly privately owned lands, were transformed in to state farms, while other expansive private lands were claimed by state as settlements and tracts for producers' cooperatives. Although citizens were accorded with illegal right over land, they were prohibited from selling, leasing, renting and mortgaging the lands (ibid).

After the collapse of the military regime in 1991, EPRF established the federal form of state structure. Nevertheless, the country's land ownership system has not changed basically from that initiated by the military government although some modifying proclamations have been issued regarding investment.

The data obtained from Development Agents Offices at Doni Kumbi and Batu Degaga indicates that the total land area of the peasant association is 1615 hectare and 1700 hectare

out of which 1345 hectare and 1425 hectare are utilized as cultivated agricultural land respectively. The rest are used as homestead, grazing, bushes and shrubs covered, and left as wasteland due to galley formation, rocky land and soil degradation (ibid).

The size of farmland holding varies among farmers in the study area. Especially the youngsters who formed new families after land distribution took place in both areas plough small plot of land which they got either by inheriting from their parents or contracting as share croppers.

4.6.2. Agriculture

Agriculture is the principal economic activity that employed majority of rural households in the study areas. Except few farmers that are privileged to use irrigation, the rest majority of farmers rely on rain-fed agriculture of which the distribution is often erratic. Despite the fact that these two study areas are always affected by severe drought and famine caused by recurrent climatic irregularities, the production methods used by farmers are also very traditional characterized by subsistence mode of production. Major farm products in the intensive study area are *teff*, maize, haricot beans, and sorghum. Vegetables such as onion and tomato and fruits such as papaya, mango and banana are grown using irrigation.

In addition to crop production, livestock production is another important household income source in these areas. Much of livestock income is derived from the sale of cattle, goat and sheep.

According to the information obtained from Boset and Adama District Agricultural Development offices, the major constraint of agricultural production in both study areas are of similar type. i.e. insufficient agricultural production resulting from moisture stress,

degradation of soil fertility as a result of weak or no fallow period and soil erosion, crop disease, meager or no application of modern farm inputs such as chemical fertilizers and improved seeds, inadequate and/or inappropriate provision of extension service, poor linkage among agricultural research, extension and farmers, and low prices for agricultural produce specially low price for cash crops that discourage farmers motivation.

4.6.3. Social Services

Education: - At Doni Kumbi there is one public elementary school having classes up to sixth grade. In Bato area, there is one elementary school having classes up to sixth grade. Both schools attract students from Doni and Bato and from adjacent villages.

Health Services: - There are two health posts located in Doni and Bato and the prevailing diseases in both areas are malaria, water born disease, skin diseases, and diarrhea and eye diseases.

Regarding transport and communication infrastructure there is an all weather road that leads to Tibila state farm that connects with Addis Ababa-Asella Asphalted road by crossing the villages of the two irrigation schemes. Communication network, which operates in its early stage of development, is only available at Doni rural town while Bato village do not get the service.

Lack of potable water supply is also a problem in both villages. The population in both areas uses unprotected water for their drink from the Awash River and seasonal wells.

Chapter Five: Results and Discussion

5.1. Social and Economic Profile of the Study Area

Doni and Bato areas were totally inhabited by the Oromos ethnic group Jille until the late 1950s, and when the imperial government took the first initiative in water resource development in the second half of the 1950s. In the Awash valley as part of the agro-industrial enterprises, many non-Oromo people from the northern and central part of the country transported in to the area to work on the newly established large scale irrigation fields. When the monarchical regime removed and the military junta assumed power, some of the workers continued being employees of state enterprises and became individual farmers. Many of the relatives of the first migrants also joined them through long time series and marriage relationships.

This is particularly true in Doni area. When a land lord designated by the emperor established the irrigation scheme at Doni, he brought with him almost all labour required from other place that eventually remained in the area being individual farmers. Currently, they live mixed with the native Oromos who lived in the area for centuries.

5.1.1. Family Composition

Of the total sample farmers about 90 percent were male headed and 10 percent female headed at Doni and 93 percent male headed and 7 percent female headed at Boto study site. In this case the female to male proportion is too small to be representative (Table 1). This shows that women's access to productive asset or land is very limited. Lack of women's access to rural economic resources mostly emanates from their exclusion, which is deep rooted in the socioeconomic, religious and cultural relations.

Table 1: Family Information of Sample Households

	Doni Kumbi			Bato Degaga		
	Mean	Min.	Max.	Mean	Min.	Max.
Household size	6.67	3.00	14.0	6.43	3.00	12.00
Male household	3.3	0.0	9.0	3.13	1.00	6.00
Female household	3.37	1.00	7.0	3.30	12.00	8300

Source: Survey Results

According to the data obtained from sample households' survey, the average family size of household at both Doni and Bato is 6.67 and 6.43 respectively (Table 1). As per the practice in the area economically active populations are those within the age group 12-60 years and this account 74% and 55.5% in Doni and Boto respectively (Table 2). This figure indicates that the household labour source in Doni Kumbi SSI is much better than Bato Degaga. Due to this, irrigators' use more hired labour to supplement scarce family labour in Bato Degaga SSI. Definitely, such marked difference of age group between the two irrigation systems needs further investigation. All members of the household that are found between the age group from 12-60 including male and female participate in the agricultural activities though the skill and efficiency could actually be different. In Bato Degaga SSI, age category that contains family members found between 12 and 60 years is low as compared to that of Doni Kumbi. As explained by the respondents, irrigators use more hired labour than do in Doni Kumbi. Their hired labour source is mostly from the surrounding peasant association.

Table 2: Households Family Size and Age Distribution

Household Characteristics	Doni Kumbi	Bato Degaga	Total	Mean
Aggregate household members	200	193	393	6.55
Male	99	101	200	3.33
Female	94	99	193	3.22
Household age <12 years	52	82	134	2.23
Age 12-17 years	46	26	72	1.20
Age 18-60 years	102	85	187	3.12

Source: Survey Results

Obviously family labour is very important resource on small farms. All family members except the very young (less than 12 years old) and very old (more than 60 years old) can supply productive labour. But the actual available supply is often difficult to measure because family labour has quantity, quality, time and often-custom dimensions. Difficulty in measurement arises from the fact that the different family age/sex population classes often generate different amount of labour service (e.g., as differentially provided by young men, women, older children and grandparents), and that some irrigation farm operations/tasks are labour-type specific while others can use any class of labour.

5.1.2. Education

The performance of primary education in both study area is not satisfactory. Majority of people are illiterate who did not get the opportunity of primary education. There are two government owned elementary schools (1-6 grades) at both study sites. It serves all pupils that come from Doni, Bato and the surrounding peasant associations. As compared to the size of

population, the number of schools and the grades level is very low to meet the demand in the area. Generally, the performance of formal education is not satisfactory (Table 3).

Table 3: Educational Status of Households in the Study Area

Educational Status	Doni Kumbi		Bato Degaga	
	Number	Percent	Number	Percent
Illiterate	98	49	131	68
Read and Write Only	55	27.5	30	15.5
Elementary	27	13.5	29	15
High School Complete	20	10	3	1.5

Source: Survey Results

5.1.3. Household Farm Resources

According to FAO (1997), farm resources generally fall into two broad categories. The first category is fixed resources that provide services over a number of years or at least over a period longer than the production cycle of short-term (seasonal, annual) crop or livestock enterprises. Common examples of this are land, machinery, and an irrigation system.

In this category, land is typically the most important that will usually provide its service indefinitely. As it is generally observed in both study area arable land is neither abundant nor scarce. There is of course uneven or skewed land holding among the farming community. This is due to the fact that land was redistributed only in 1975 following the overthrow of the imperial government. Farmers plot size varies from 0.44 -3.06 hectares and from 0.5 - 5.13 hectares in Doni and Bato SSI respectively. Those farmers who own more land grow different

crops using both rain fed and irrigation water in both study area. There are also farmers who solely depend on irrigated farming. These types of farmers are those who possess very small size of farmland. With regard to irrigation land redistribution, an exceptional practice is observed in Bato Degaga irrigation scheme, which is not the case yet in any schemes found in the region.

In the case of Bato SSI, same as rain fed farmland irrigable land was also evenly distributed of which some farmers hold large size and others very small during the first two years of the project period. But later on, when it was learnt that the capacity of the irrigation scheme can not go beyond 60 hectares, 140 hectares was lessened to 60 hectares and redistributed among 120 farmers each of which received equally 0.5 hectare.

Those farmers who lost their extra land within the new irrigation boundary have been compensated with the same land size from other place in the peasant association. Such effective solution was born and implemented by the concerned farmers themselves with slight technical support from external bodies. The current irrigation land holding at Doni Kumbi SSI is different from that of Bato Degaga. The distribution of irrigable land is still much skewed.

Generally, the average farmland holding that equals 1.33 hectares in Doni Kumbi and 1.56 hectares. in Bato Degaga SSI is a little higher than the national average land size that equals 0.95 ha. The figure for national average land size is based on the statistical abstract explained by the Central Statistics Authority (CSA, 1999). The maximum farm plot holding indicated in both study areas cannot be said large. But the existing difference between the maximum and minimum plot holding can be good reason for production and income variation among farmers (Table 4).

Table 4 :-Household Land Resources (N=30 in each study area)

	Doni Kumbi			Bato Degaga		
	Mean	Min.	Max.	Mean	Min.	Max.
Total land size (ha)	1.33	0.44	3.06	1.56	0.5	5.13
Land under cultivation (ha)	1.24	0.38	3.00	1.37	0.25	5.00
Fallow land (ha)	0.01	0.00	0.25	0.01	0.00	0.13
Grazing land (ha)	0.00	0.00	0.00	0.05	0.00	1.00
Homestead (ha)	0.08	0.06	0.25	0.14	0.06	0.25

Source: Survey Results

Other examples of farm resources in this category are irrigation systems and farm sheds generating their services over 20 to 30 years. The livestock sub-sector, which is an integral component of the farming system, has a significant share in the asset base of farmers.

As indicated in the Table 5, households' livestock possession is not large. But according to the information obtained from focus group discussion and physical observation of the researcher, the figure could have been more than what was reported. The reason for farmers under reporting of their asset is fear for additional government taxes. In addition, farmers believe that if they genuinely tell what they have, they may be excluded from food aid eligibility, which mostly distributed during the drought period.

The productivity of livestock population was constrained by the multiple of highly interrelated factors such as poor feed in quality and quantity, the prevalent of rampant diseases, poor genetic breeds and poor management in both study areas. As it is the case in the entire of the

Oromia Region, livestock in the study area are kept to meet the demand for draft power, milk, meat (to a lesser extent because they use to sell than to consume), as a store of wealth, and as means to debt relieving mechanism. The mean distribution of oxen among the irrigation community is about 2 for both Doni Kumbi and Bato Degaga SSI. But the mean distribution can not clearly show the extent of oxen shortage as there are some families without owing a single ox. Table 5 demonstrates available livestock population and means distribution in the two schemes.

Table 5: Livestock Population in the Study Area

Types of Animals	Doni Kumbi		Bato Degaga	
	Count	Mean	Count	Mean
Oxen	48	1.60	55	1.83
Cows	32	1.07	55	1.83
Heifers	11	0.37	33	1.10
Bulls	11	0.37	27	0.90
Calves	21	0.70	24	0.80
Sheep	52	1.73	118	3.93
Goats	24	0.80	206	6.87
Horses	1	0.03	0	0.00
Mules	0	0.00	1	0.03
Donkeys	14	0.47	40	1.33
Camels	1	0.03	0	0.00

Source: Survey Results

The second farm resources category that includes items such as improved seeds, fertilizers and pesticides are essential inputs for increased agricultural production and productivity.

Obviously, the rate of production and productivity both in irrigation and rain fed agriculture is generally determined by the amount of money available to buy them. But it is not an easily accessible resource for farmers of Doni and Bato SSI whose farm operating objectives is mostly based on family sustenance. This issue is of course crucial which will be discussed in the forthcoming chapters in detail.

5.1.4. Household Source of Income

Access to productive resources such as capital, land and family labour is the determining factor for the households' income. But these factors were unevenly distributed; as a result there is high-income difference among the farming community. There are different sources of household income in the study area although there is variation in the number and amount of their contribution.

As far as this study is concerned, sources of household income in both schemes can be classified into four main groups that includes; income from grain production (rain fed and irrigated), income from cash crop production, income from sales of livestock and livestock products and income from non-farm sources.

5.1.4.1. Food Grain Production

The production of food grain crop includes maize, *teff*, sorghum, haricot bean and horse bean in both irrigation systems. The sizes of farmland cultivated under rain fed for the production of grain food crops is larger than farmland cultivated by applying irrigation water. For instance, the average farmland cultivated by rain fed for the production of food grain crops for the three years period (2001-2003) is 1.02 hectares and 1.74 hectares in Doni and Bato SSI respectively. This shows farmers' largely use rain fed cultivation to produce food grain crops

than producing under irrigation. The major grain crops grown by using irrigation water are maize and haricot bean. The two crops can be considered as the strategic crops for future development of both irrigation systems. Maize is a major source of food /staple food/ and at the same time it is the most important source of animal feed than any other crop items. It is also easy to apply irrigation water to maize than other food grain crop types.

On the other hand, haricot bean is a useful crop, which is produced mostly for the market. This is due to its relatively better demand and good market price that encourages producers. Its water application and other field operation is not difficult to farmers.

The climate and soil are also very conducive for the production of these two crops. Local seeds that are appropriate for the climate are available in both study area. In this case, it would be easy to increase the contribution of these two crops provided that certain technical and institutional constraints are removed or at least minimized. That means, in order to make the irrigation systems more effective, adequate public infrastructure of both physical and institutional nature should be well addressed. Market access is probably the most important infrastructure. Institutionally, the government needs to ensure a mechanism in which irrigation farmers are accessible for credit, transport, storage, market, research and other services. The data in Table 6 shows area cultivated under rain fed and irrigation for the production of various cereal crops.

Table 6: Area Cultivated Under Rain Fed and Irrigated Agriculture

Type	Year	Doni Kumbi			Bato Degaga		
		Number	Mean	Total	Number	Mean	Total
Rain fed (ha)	2001	28	1.04	29.25	27	1.30	35.19
	2002	18	1.01	18.25	5	2.05	10.25
	2003	28	1.02	28.50	23	1.87	43.00
Irrigated (ha)	2001	12	0.43	5.13	0	0.00	0.00
	2002	9	0.42	3.75	24.00	0.39	9.31
	2003	9	0.44	4.00	12.00	0.47	5.69

Source: Survey Results

As shown in Table 7 below, farmers largely concentrated on the production of food grain crops under rain fed cultivation. For instance, of the sample households interviewed in Doni Kumbi SSI, only 12, 9 and 8 farmers applied irrigation water for the production of cereal crops during the years 2001, 2002 and 2003. Farmers use irrigation water for the production of cash crops than for the production of food grain crops.

The production of food grain crops under irrigation cultivation per hectare was slightly better than the production under rain fed cultivation. The reason for low difference between the two production systems was that crops affected equally by the existing input constraints. The rain fed agricultural performance of the year 2002 is also very low or it can be said none especially for Bato Degaga SSI. This is because crop production was totally damaged as a result of severe drought that occurred in the area during the specified period.

Table 7: Grain Crops Production from Rain fed and Irrigation Agriculture (Qt)

Type	Year	Doni Kumbi			Bato Degaga		
		Number	Mean	Total	Number	Mean	Total
Rain fed (ha)	2001	28	11.29	316.00	25	15.84	396.00
	2002	18	1.33	24.00	0	0.00	0.00
	2003	28	9.11	255.00	23	20.85	497.50
Irrigated (ha)	2001	12	7.42	89.00	0	0.00	0.00
	2002	9	6.56	59.00	24	9.75	234.00
	2003	8	7.00	56.00	12	9.54	114.50

Source: Survey Results

The importance of irrigation as a means to cope with drought has been proved particularly during the year 2002 as the severe drought caused total crop failure under rain fed cultivation in both study areas. As indicated in Table 8 below, the estimated mean income obtained in the year 2001 and 2003 from rain fed cultivation was higher than production gain under irrigation cultivation. The reason for this variation was (as indicated in Table 6) the size of farmland cultivated under rain fed was much higher than the land cultivated by using irrigation water _. The income obtained from food grain crops and cash crops production was based on farmers' estimation of market price during the study periods.

On the other hand, the trend of food grain crop production by using irrigation water did not increase. This is due to farmers' preference of cultivating by rain fed at time when there is no shortage of rainfall. i.e. farmers lack commitment to engage themselves in irrigation activities that requires more labour and time. For instance, the share of income obtained from rain fed food grain crops production as compared to income from irrigated food grain crops produced in 2003 was 72% and 75% in Doni Kumbi and Bato Degaga SSI respectively.

Table 8: Household Income Obtained from Rain Fed and Irrigated Grain Sells (Br)

Type	Year	Doni Kumbi			Bato Degaga		
		Number	Mean	Total	Number	Mean	Total
Rain fed (ha)	2001	28	1486.07	41610.00	25	1691.80	42295.00
	2002	6	613.33	3680.00	0	0	0
	2003	28	1510.00	42280.00	23	2583.26	59415.00
Irrigated (ha)	2001	12	766.67	9200.00	0	0	0
	2002	9	917.78	8260.00	23	1401.74	32240
	2003	8	587.50	4700.00	12	862.08	10345.00

Source: Survey Results

5.1.4.2. Cash Crop Production

As far as this study is concerned, cash crop refers to vegetable crops produced through irrigation for the purpose of market to increase household cash income. Therefore, farmers in both irrigation systems produce high value horticultural crops such as onion, tomato and pepper. Papaya and mango are also grown around homestead especially in Bato SSI. But in both cases the major cash crops are onion and tomato.

According to the survey, most farmers do not cultivate their irrigable plots all in all by using irrigation water. Many reasons were raised during household interview and focus group discussion among which are; shortage of water and/or waiting for long days to get turn for watering, lack of capital to purchase farm inputs, inconsistency in market prices and low commitment on the part of irrigators themselves. The maximum cash crop production intensity is two in very rare case which otherwise once in a year in both irrigation systems.

As indicated in Table 9, the average farmland cultivated for cash crop production through out the three years was constant in Doni Kumbi while it has been decreasing in Bato Degaga SSI.

As noted by the informants, there are two reasons for this. First, the use of irrigation water in Doni Kumbi is cheaper and its supply is much better than Bato Degaga SSI. Second, Farmers in Doni Kumbi SSI has better experience in cash crop production than farmers in Bato Degaga SSI. Because irrigation practice in Doni Kumbi is longer as compared to Bato Degaga SSI.

Table 9: Cultivated Area for Cash Crop Production (ha)

Year	Doni Kumbi			Bato Degaga		
	Number	Mean	Total	Number	Mean	Total
2001	29	0.52	15.00	0	0.00	0.00
2002	28	0.51	14.38	17	0.40	6.75
2003	26	0.52	13.63	3	0.33	1.00

Source: Survey Results

The size of farmland cultivated for the production of cash crops relates to the experience and technical management skills of individual farmer. The financial status of a farmer is also another important factor to limit farm size. Some farmers do not pay enough attention for their irrigated plot instead they grow low value grain crops once in a year by waiting for the rainy season. Because cash crop production requires high capital and farmers strong commitment to fully engage themselves in farm activities all along the production season.

According to the discussion held with committee members of irrigation water user's associations, those who use to apply irrigation demands more labour than rain fed cultivators. The reason is irrigation requires more labour than rain fed cultivation. That means with rain fed cultivation it is possible to leave the farm from time to time to participate in other non-farming activities, as no great harm comes to the crops. But under irrigation, water must be

applied when it is due, and under harsh climatic conditions a day or two of delay in watering may result in serious crop losses. Most of irrigation farm household members are therefore much more tied to their land when it is irrigated.

Table 10: Types of Cash Crops Grown and Cultivated Land in Percentage

Crop Types	Doni Kumbi			Bato Degaga		
	Area cultivated 2001	Area cultivated 2002	Area cultivated 2003	Area cultivated 2001	Area cultivated 2002	Area cultivated 2003
Onion	83%	91%	93%	_	95.5%	95%
Tomato	17%	9%	7%	_	2.4%	_
Pepper	_	_	_	_	2.1%	5%

Source: Survey Results

As shown in Table 10, the production of onion takes the lion's share in both irrigation systems. The negative aspects of such high degree of production concentration on one crop item (onion) create competition among producers for market, which in most cases excess production results in price decline. Farmers reported the following reasons why the production of onion is most preferred.

- ☞ The local seed of onion is easily obtained
- ☞ Irrigation water application and field management of onion crop is relatively easier

- ☞ Onion is less perishable crop and it is easy to harvest and transport as compared to tomato which is the second highly produced cash crop in both study areas.

- ☞ It withstands diseases as compared to other crops

On the other hand farmers noted that they do not grow perennial horticultural crops because requires long time for maturity and production and this is not tolerable for subsistence farmers whose livelihood is highly dependent on fast growing seasonal crops. That is why only very few farmers planted mango and papaya to a lesser extent around the backyard and scarcely on the borders of their plots. The volume of production is also very low therefore it is mostly consumed in the household. The average household income obtained from sale of cash crop shows an increasing trend in Doni Kumbi SSI while in Bato Degaga it remained constant. This was due to bad experience of Bato Degaga SSI that the scheme failed to operate for two years from 2001-2002. The relative high cost of irrigation management in Bato Degaga SSI combined with unreliable market price discouraged farmers to increase irrigated cultivation for cash crop production. The average cash income obtained by the producers of the two irrigation schemes has shown in Table 11, below.

Table 11: Average Income from Sells of Cash Crop Products (in Birr)

Year	**Doni Kumbi**			**Bato Degaga**		
	Number	Mean	Total	Number	Mean	Total
2001	29	4640.17	134565.00	0	0	0
2002	26	4816.92	125240.00	17	6245.81	106178.75
2003	26	7512.65	195329.00	3	6320.00	18960.00

Source: Survey Results

5.1.4.3. Livestock and Other Farm Products

In arid zone where crop failure is frequent, farmers consider livestock as an essential for their survival. Generally, income from livestock include sales of animals such as oxen, cows, goat, donkeys, etc. and also livestock products like butter. Other farm products such as hens and eggs are sold to raise income to purchase food crops and other industrial products used for household consumption. The drought occurred during the year 2002 highly affected the stock of animal population. Many of them sold at very low price because their physical conditions were not good. Some of the animals were died by the lack of fodder grass. As the informants explained, the contribution of irrigation in providing fodder to animals in the form of weeds and residue was not underestimated. The following Table 12 summarizes income derived from livestock and livestock products for the last three years.

Table 12: Income from Sells of Livestock and Livestock Products (Birr)

Year	Doni Kumbi			Bato Degaga		
	Number	Mean	Total	Number	Mean	Total
2001	7	614.29	4300.00	9	1456.17	13105.50
2002	17	587.74	9991.50	16	1182.72	18923.50
2003	17	470.15	7992.50	17	559.13	9505.25

Source: Survey Results

5.1.4.4. Off- Farm and Non-Farm Activities

There are different types of non-farm and off farm activities undertaken by some farmers to supplement their household income. The households' income indicated in Table 13 was obtained from different types of off-farm and non-farm activities such as sells of local

beverages, sales of firewood and charcoal, petty trading, wage labour and hiring out oxen. Families that are engaged in such activities are mostly poor whose agricultural income is not enough for their annual consumption. The food aid received by farmers during the drought year (2002) also included in this category of the households income.

The selling of local beverages is widely spread in both study area because the number of farmers who use to drink increased from time to time. According to the information obtained from both IWUAs, temporary shelters constructed all along the rural roads for the sell of the local beverages only on market days has been changed in to permanent. The researcher also observed that most farmers spend their working hours by enjoying in those places.

Table 13: Income from non-Agricultural Sources (Birr)

Year	Doni Kumbi			Bato Degaga		
	Number	Mean	Total	Number	Mean	Total
2001	4	307.50	1230.00	11	1736.36	19100.00
2002	28	593.76	16625.20	26	1301.26	33832.80
2003	5	590.00	2950.00	8	1270.00	10160.00

Source: Survey Results

5.1.4.5. Comparison of Households' Source of Income

As discussed earlier, there are different sources of household income in the study area. The degree of contribution of each source of income depends upon the economic situation of individual farmers. But as one can see from the Tables 14 and 15 below, the share of cash crop is significantly higher than any other income source. This shows even under the existence of

various constraints, the production of cash crop seems very important to the irrigation communities. In this case, if both irrigation systems manage to apply high crop intensity (growing two to three crops per year) combined with market oriented cropping pattern, the effect would be tremendous. Table 14 and Table 15 compare households' income by sources for the three years period.

Table 14: Comparison of Average Household Income by Sources in Doni. (in Birr)

Source of Income	2001		2002		2003	
	Mean Income	Per cent income	Mean Income	Per cent income	Mean Income	Per cent income
Cash crop (Irrigated)	4640.17	59.38	4816.92	63.97	7512.65	70.41
Irrigated Grain Crop	766.67	9.8	917.78	12.18	587.5	5.51
Livestock and Livestock Products	614.29	7.86	587.74	7.81	470.15	4.41
Non Agricultural Sources	307.5	3.94	593.76	7.89	590.00	5.52
Rain fed Grain Crop	1486.07	19.02	613.33	8.15	1510	14.15

Source: Survey Results

The average household income obtained from sales of cash crops shows that there is an increasing trend in Doni Kumbi SSI through out the three years period. It indicates that farmers are becoming more interested in the production of cash crops as they are becoming aware of its importance.

Both Tables 14 and table 15 indicates that during the drought period of 2002, irrigation helped much as a coping mechanism to mitigate the problem of food security. For instance, the

average income of three years study period obtained from irrigated food grain crop and cash crop production together constituted 73.75% and 68.72% as compared to other sources of income in Doni Kumbi and Bato Degaga SSI respectively

As shown in Table 15, in Bato Degaga SSI, there was no household income from irrigated grain crop and vegetable crops in 2001.Because there was no power supply to abstract water from the river for the use of irrigation. This was due to the failure of IWUA of the scheme to pay the electric bill.

Table 15: Comparison of Average Household Income (Birr) by Sources in Bato Degaga.

Source of Income	2001		2002		2003	
	Mean Income	Per cent income	Mean Income	Per cent income	Mean Income	Per cent income
Cash crop (Irrigated)	0	0	6245.81	61.65	6320	54.51
Irrigated Grain Crop	0	0	1401.74	13.84	862.08	7.44
Livestock and Livestock Products	1456.17	29.81	1182.72	11.67	559.13	4.82
Non Agricultural Sources	1736.36	35.55	1301.26	12.84	1270.00	10.95
Rain fed Grain Crop	1691.80	34.64	0	0	2583.26	22.28

Source: Survey Results

5.2. Households' Food Security

Obviously high proportion of households food supply is generated from own agricultural production. But there is also low level of dependence on other non agricultural sources as a

means to fill the gap of food shortage. This shows though the contribution of own agricultural production is significantly high, it is not yet sufficient to cover households' food requirement.

This was further proved by the fact, when the majority of irrigators received food aid during the drought period of 2002 equally with those farmers who didn't get the opportunity to apply irrigation water to their farmlands. Of course, the selection criteria for food aid eligibility could have its own shortcomings. Nevertheless, there is no doubt that majority of irrigators are not still food self-sufficient. The following Table 16 shows the condition of households' food security for the last three years in both irrigation schemes.

Table 16: Condition of Household's Food Security (2001 to 2003)

Households Level of Food Security	Doni Kumbi		Bato Degaga	
	Frequency	Percent	Frequency	Percent
Excess production	1	3.3	1	3.3
Sufficient for one year	3	10	8	26.7
Sufficient for six month only	15	50	19	63.3
Sufficient for less than 6 months	11	36.7	2	6.7
Total	30	100	30	100

Source: Survey Results

5.3. Management and Institutional Issues of Irrigation Systems

According to Peter H. Stern (1988), where several farmers are carrying out irrigated cultivation on adjacent farms or plots of land using a common source of supply and draining to a common drainage system, certain tasks and activities should be properly coordinated. This

would help to ensure the smooth running of the irrigation systems to avoid conflicts that could possibly arise among irrigation users.

Generally, insufficient attention to the institutional environment in which irrigation takes place creates built-in defects in operation and management. As Peter H. Stern noted where issues of organization and management of irrigation are not well considered problems may arise such as:

- Existence of indefinite regulations or instructions about the share of responsibilities,
- Lack of coordination between different work groups,
- Absence of common meeting point for discussing and settling differences,
- Absence of an effective association to represent the irrigators interests,

The performance of crops and pasture in the study area has been significantly below the requirement in previous years. Copying mechanisms of these agro-pastoral communities increasingly become fragile that minor irregularity in rain fall distribution often results in famine, which in some instances the cause of death for many animals and even human beings.

The strategy designed to improve such circumstance through the development of community based small-scale irrigation systems is appropriate for both study area. However, the problem of food insecurity is not yet removed. This is because the performance of irrigation did not reach the level it is expected to maintain households' food security.

The problem of inefficiency in irrigation systems can be emanated from technical and non-technical factors. Therefore, it is essential to accord due consideration for these issues in order to properly address the problems and to design correct operational strategy.

Obviously, irrigation systems managed by the community should have full responsibility that involve some kind of organizational and management mechanisms that help to insure efficiency and sustainability. This would help to analyze possible constraints that can arise due to policy, institutional and social factors in the implementation and operation of irrigation projects.

5.3.1. Irrigation Infrastructure

The irrigation water application method of Doni Kumbi SSI is diversion by using natural gravity. Besides the opportunity to use perennial water resource, diversion conveyance method is the best option for the irrigation users. The topography of the catchments area is plain surrounded by hills and has high slop at the most up stream and lowers at the down stream. This feature of land facilitates high run-off, which result in soil erosion and silt problems in the command area. In this case although intensive catchment's treatment is required, farmers use to clean the area only once in a year in the form of campaign. The capacity of the conveyance canal decreases during the dry season to allow the free flow of irrigation water in to the intake canal and there is backing up of water to the river.

As farmers noted, there are irrigation water users at the end tail of the command area that are not registered as members of the irrigation system and also a branch of Tibila state farm. Both irrigate their farmland using water from same canal source. Since they are not members of IWUA, they are not included in crops watering time schedule. Therefore, they irrigate their crops by cutting the main canal illegally.

According to the information obtained from Doni IWUA, the total farmland cultivated by those non-IWUA members and the state farm is estimated to be more than 20 hectares, which

is nearly quarter of the command area. In this case, the illegal users not only cause damages on the canal but also create immense water shortage especially at time when water is low from its main source. This problem remained unsolved and becomes main source of contention among these different irrigation water user groups.

In Bato Degaga SSI, the technology in use is different from Doni in that the irrigation water supply from the source made available by using electric motor pump. The pump discharges water to a concrete sump provided at the top of the raised earth embankment. In-farm water application is through furrows parallel to the contour of the area by gravity using conventional tertiary and field canals.

As far as the pump site is concerned, there is no significant problem except minor crack is observed on a concrete sump that needs to be repaired. The critical problem with this irrigation system is low quality of planning and design. Initially, when the project was designed the plan was to develop 140 hectares of farmland. But even after the operational capacity is minimized to 60 hectares, there is still shortage of water. The reason is farmers fear to operate with the obsolete motor pumps for long hours including day and night. Therefore, the motor pump operates only for not more than ten hours during the day time. The repair cost of the motor pumps and the charges for electric consumption is increasing from time to time. The major concern of the irrigators is therefore if the motor pump fails at peak period when they need water for their crops.

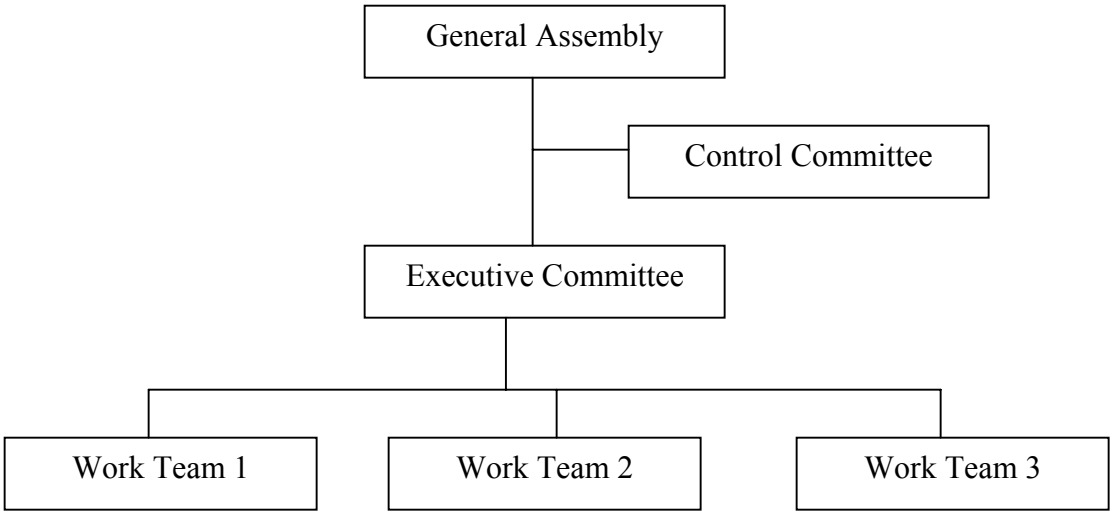
Another problem with Bato SSI is that in the initial construction time much work was confined to head work and major distribution. Little was done to carry those improvements down the irrigation fields. As a result there are some plots which are found to be difficult to

watering crops. Within the 60 hectares of farmland there are some plots in which its topography hinders access to irrigation water. Besides, absence of continuous maintenance of secondary and tertiary canals causes loss of the limited irrigation water.

5.3.2. Irrigation Management Issues

The Irrigation Water Users Associations (IWUAs) at Doni and Bato have obtained registration certificate in 2000 and 1999 respectively (Figure 1). The byelaws were formulated by the executive committee with the support of project staff and experts from extension organizations of two districts (Boset and Adama).

Figure 1. Organizational Structure of Doni and Bato SSI



Source: Offices of Development Agents of Both Study Sites

As shown in the above chart, the organizational structure of both irrigation system is similar that comprises General Assembly, Executive Committee, Work Teams and the Controlling Committee.

The general Assembly is the highest body in which all members of the irrigation systems collectively discuss the highest-level issues and give the final decision. This body meets twice a year and if necessary the Executive Committee can call urgent meeting. There are also other responsibilities of the general assembly that are indicated in the by laws of both irrigation systems.

The executive committee is a body elected by the general assembly, which is responsible to undertake day to day activities of the general assembly. Generally, the committee is responsible for the following major activities.

- Takes care of physical structures such as water gates, canals and other properties of the association.
- Monitoring pump operation
- Supervising water distributions and execute other related issues specified in the by-laws.

Organizational functions further decentralized to the work teams in order to make the schemes operation more effective. Accordingly the irrigation land has been divided into blocks that constitute a work team and all members of the association are grouped in one of it. Every team elects its own team leader, accountable to the executive Committee in any matter concerning their respective team. The most important function is distributing irrigation water for the team members and ensures the activities are under taken in accordance with the established water use schedule.

There is also a control committee elected by the general assembly which is accountable to it. The over all responsibility of these committee is to monitor the activities of the different bodies of the association whether they are operating in accordance with the by laws.

Farmers' were given assistance during the periods of the two NGOs intervention such as inputs provision and training by the project developers after which it has been weaned. Therefore, irrigators through their IWUAs collectively raise funds to carryout the organization and management work necessary.

There is a slight difference in the sources of income and expenditure items between the two IWUAs of Doni Kumbi and Bato Degaga SSI. The sources of income for Doni Kumbi SSI includes registration fee, two percent charge from the total income of the sales of irrigated crops from each harvest season and penalties. According to the information obtained from the records of Doni IWUA, the expenditure of the Association is limited to canal maintenance, perdiem and stationary.

The sources of income for Bato degaga include

- Income from penalties
- 240 birr charge per farmer per 0.5 hectare per year for irrigation water use
- 200 birr contribution by each farmer per year for the repair and maintenance
- 40 birr contribution from each farmer per year for guards salary and other hired labour

The expenditure item of this scheme is also a little wider including

- Electric energy bill
- Salary

- Repair and maintenance
- Service fee for mechanics
- Stationery and perdiem

The main reason for the variation in sources of income and expenditure items between the two irrigation systems is the fact that Doni abstract water from the source by gravity that incurs low cost while Bato Degaga uses electric motor that incurs relatively higher costs.

Bato Degaga SSI has bad experience in irrigation water use. When the support from WVE totally stopped in 1999, IWUA of Bato Degaga SSI became gradually weak and later on, the IWUA was unable to pay the electric bill including the cost of hired labour. As a result, the scheme operation totally stopped when power supply disconnected by the Ethiopian Electric Power Corporation.

Finally, Adama District Administrative council formed a committee selected from different organizations including WVE Adama District to study the problem of the scheme and propose solutions. According to the committee, the following points were reported as the main reasons for the failure of the irrigation system.

- Variation of irrigation land size among irrigation users and the indifference of charges in the amount of water used discouraged many members to fulfill their duties.
- Inefficient and misuse of irrigation water by members highly increased the electric bill.
- The irrigation capacity of the scheme was assumed to be 140 hectare by the project. But it was an over estimation.

- The farmland of some scheme members was not leveled as being suitable for irrigation use.
- Lack of members of the association to clean irrigation canals frequently, lack of experience and tendency of dependency, lack of interest of the schemes committee to fulfill their management responsibility.
- Market problem especially for vegetable products etc.

The committee also proposed the following solutions to restart the operation of the scheme and enable it to re-function sustainable.

- Reduce the irrigation farmland from 140 hectare to 60 hectare only.
- Limit the irrigation farm size of one peasant to 0.5 hectare and redistribute the land for 120 households accordingly
- Increase farmers' awareness on the use of irrigation through continuous training, technical support and field tours.
- Improve price condition of vegetable products by providing market information.
- Improve the conditions of providing modern farm inputs such as chemical fertilizers, pesticides and improved seeds.
- Request the support of WVE Adama Project to settle the electric bill that the scheme failed to pay amounting 28,000 Birr

Based on the recommendation proposed by the investigation committee some measures has been taken by the District Administration Council to help the irrigation scheme restart its operation. To this effect;

- The irrigable land size decreased to 60 ha.
- The farmland redistributed among 120 with the maximum of 0.5 ha. for each farmer and,

- The WVE Adama Project agreed and settled the bill and made the account of the association free from debt.

At present, Bato Degaga IWUA has got the status of legal entity and undertakes the operational as well as management affairs by its own.

The costs of organization and management at Bato were reported to be eroding some poor farmers' income as evidenced by the failure of some of them to contribute towards the costs of energy and maintenance on time. This is happened not because the contribution of individual farmer is high, rather the inefficiency of irrigation water management combined with some institutional and policy constraint. For instance, there are no financial institutions that provide credit to farmers that are used to purchase the necessary inputs. With regard to policy, the local government gives priority to those farmers registered in package program for rain fed agriculture.

On the other hand, there is relatively serious problem on the equity of water distribution in Doni than in Bato. Although there is high variation in irrigated farmland holdings in Doni SSI, there is no difference in the amount of charges. That means contribution of money is not based on the amount of water used. For instance, there is no difference with irrigation time schedule between those farmers who possesses large or little land. At the same time there is no difference in labour contribution during canal maintenance.

Informants noted that no body is interested to be elected to the committees of IWUAs. The reason is there are lots of management problems of which the solution is not easily reached. If one is elected to the committee he/she is expected to work some hours in a day for the purpose of the association at his/her own expense. One committee member in Bato SSI explained the

extent of the problem by saying "it is better to hire committee members than to elect". The committee members do not enforce the bye-laws to make sure that organization and management works are adequately done and in time. Both irrigation systems are therefore in a bad state in this respect. In order to fill the gap development agents who were assigned to both irrigation systems to provide technical assistance obliged to spend much of their time in undertaking routine administrative works of the IWUAs.

Better management of irrigation water was observed in Bato Degaga SSI. This can be attributed to the fact that the farmers themselves pay energy or electric power charge. Therefore, fetching of water for human use and watering animals from irrigation canals is forbidden. The violation of this rule leads to punishment. As a result the charge compels farmers to be more careful in using irrigation water for agriculture. There are of course water losses due to technical problems such as water logging, seepage, flood and lack of knowledge of crop water requirement by irrigators. On the other hand, irrigation water management at Doni Kumbi SSI is very poor since irrigators do not take care to prevent water losses. This is because farmers do not pay for irrigation water they used.

According to IWUAs regulation, leasing out of irrigation land is forbidden. But this rule remained only on paper since there are many members who practice leasing. For instance, in Doni there are 25 farmers or 35% and in Bato 15 farmers or 12.5% of the total IWUA members who leased out their land. The following conditions are main reasons for farmers' decision to lease out of their irrigable farm plots.

- Shortage of finance:- Farmers who cannot afford to purchase the necessary farm inputs and unable to hire labour lease out the land. Absence of credit facility in both study area is reported as the bottleneck.

- Farmers risk aversion mentality:- Since irrigation farm requires relatively high operational cost, farmers do not want to take the risk of spending their limited financial resource for the purchase of the necessary inputs. The incidence of price decline that has been observed frequently in both irrigation systems was also an important factor for farmers' weak motivation to invest their limited financial resource for cash crop production.
- The relative high price for irrigation farmland is also one of the important factors that encouraged farmers to lease out their irrigable land. i.e. the price of 0.25 hectare of irrigable plot is between 1000-1200 birr for a single production season. This is much higher price than the same plot size of farmland cultivated under rain fed, which its average price is not more than 100 Birr.

Irrigation practice is not a long year's tradition especially in Bato Degaga SSI. As a result, majority of irrigation farmers do not have skill training on irrigation practices. Irrigation is a recent phenomenon that came in to being as a means to combat with the recurrent drought prevailed in the area. Therefore, farmers are not yet accustomed with irrigation practices that require intensive hard field work. This means most of the farmers' carryout irrigation operation based on their traditional knowledge. Majority of farmers who are engaged in leasing out of their irrigation plot also observed in spending most of their time by going to markets, local drink houses and occupying themselves in other social, cultural and religious functions.

Key informants who were contacted during the field work reported the following reasons as the disadvantages of leasing out land.

- Contractors do not take much care for the land and soil since they work on it for only limited production season.
- As observed from practice contracting out land does not bring about much change in the livelihoods of the farmers rather it negatively affects them. The type of leasing practiced in the schemes is mainly based on full contract for the specified period. This is due to contractors preferred it more as they believed it gives them more advantage.
- Farmers do not have the opportunity to feed plant residues for their animals.

5.3.3. Agricultural Extension

According to Van Den Ban and Hawkins (1988), the main aim of extension program is to initiate change to bring about sound agricultural development especially on the part of smallholder farmers. It offers them technical advice and also supplies with the necessary inputs and services. Agricultural extension is therefore used as a tool for rural development. On the other hand, extension work is not an arbitrary activity. In requires systematic planning in order to bring about the desired change.

Farmers practice irrigation without essential technical know-how on crop water management, water application methods and irrigation intervals. For instance, according to the estimates of farmers producing tomato, the production lose is about one third because of farm level mismanagement and post harvest mishandling. That means on farm level farmers do not apply the technique of keeping the tomato plant on the raised bed to prevent its fruits from attaching to the ground, which causes decrease in its quality. Farmers lacking of proper knowledge on irrigation water management also resulted in wastage of water, intensified salinity and water logging problems.

In this case, the major role of Development Agents should be to enlighten and equip farmers with sufficient and appropriate knowledge in order to change their attitude in a certain desirable direction. There are of course two development agents trained in general agriculture assigned to both irrigation systems. But they don't have special training in irrigation water management that enables them to provide proper advice to farmers.

The development agents also complain that they have no clear job description. In addition to their conventional agricultural extension activities they engage in different tasks such as farm inputs distribution, collection of loans including land use taxes, participation in various administrative and political committees. They believe that this creates suspicion on the part of farmers in relation to DAs role. This would erode DAs confidence of becoming the trusted advisors.

The existing cropping pattern has been found to be ineffective and the cropping intensity is also below the expectation. In most cases, majority of farmers produce once in a year by using irrigation water. From the study it was understood that farmers tend to concentrate on dry land farming during the rainy season and not paying enough attention to their irrigated plot. As it has been clearly indicated in table 6, some farmers do not want to cultivate all of their irrigable land even under the condition where there is no shortage of irrigation water. Lack of adoption of inter-cropping, weak cropping intensity and absence of market oriented cropping pattern are serious problems that reflect weaknesses of the existing extension service. Experts of Wolenchiti and Adama Districts agricultural offices and other concerned organizations explained major constraints that have been discussed below.

- The extension workers assigned at different levels are pre-occupied in executing the regionally and nationally designed extension package programs that is usually undertaken in the form of campaign. The regional or national extension program is not area specific problem solving approach and it is often too hierarchical. From past practices it has been learnt that any attempt to comment on the program is considered as negative. Therefore, every expert should obey and do what has been told from the above regardless of one's professional ethics.

- There is severe budget shortage. Most of the time district level experts including Development Agents are obliged to cover cost of their field work by themselves no matter how much they stay out. For instance, in addition to absence of perdiem payment, experts are also required to pay for the maintenance and fuel cost of the motor bicycles from their own pocket that will not be reimbursed. This condition discourages them to carry out fieldwork.

- The inconsistency in organizational set-up and its frequent restructuring was also one of the constraints that hindered the provision of sustainable extension service to the farmers. The motivation of staff is also a key factor that may determine the success or failure of the extension program. A motivated individual will be more effective in motivating small group of people, with whom one is working closely. However, as understood from the discussion and practical observation in the field, the reality on the ground is far beyond the principle of extension. The staff salary is not competitive. Therefore, there is high turnover of qualified and well experienced extension staffs.

5.3.4. Input and Output Marketing

Related to the production of high value horticultural crops, both input and output side of marketing is considerably important. In light of various market constraints, inaccessibility and small size of market is the very important limiting factor for both irrigation systems.

From the study it was discovered that acquisition of inputs from local market (Doni and Bofa) could not meet the demand of farmers. Therefore, farmers be it irrigators or rain fed cultivators relay on outside dealers. For instance, in spite of fertilizers high price most of the time it is not available or the supply is untimely. The condition of fertilizer application by irrigation farmers is shown in Table 17, indicated below.

Table 17: Rate of Fertilizers Utilization in Doni Kumbi and Bato Degaga SSI.

Fertilizers Application	**Doni Kumbi**		**Bato Degaga**	
	Number of Users	**Percentage**	**Number of Users**	**Percentage**
Apply less than recommended rate	28	93.3%	26	86.7%
Do not apply	2	6.7%	4	13.3%

Source: Survey results

All farmers that use fertilizer as an input for the production of high value horticultural crops and low value food grain crops do not apply the recommended rate. Therefore, the amount of production depends on the amount of fertilizer used provided that all other factors remained same. Among reasons mentioned by farmers for not using recommended rate of fertilizer was

cash shortage that accounts 92% (55farmers) and the rest 8% (5 farmers) said that fertilizer is not available. Generally the application of fertilizer corresponds with farmers' ability to purchase fertilizers.

On the other hand, although the existing stocks of animal population in the study area provide the opportunity to utilize manure to increase soil fertility, the practical application is very low. Among the reasons for not using manure is its alternative use as fuel and lack of commitment on the part of the farmers. That means farmers are not willing to transport manure from home to farm plots although 95% (57 farmers) reported that they believe the land belongs to them (Table 18).

Table 18. Number of Farmers Apply Manure

Application of Manure	Doni Kumbi		Bato Degaga	
	Number of Farmers	Percentage	Number of Farmers	Percentage
Apply	9	30%	4	13.3%
Do Not Apply	21	70%	26	86.7%

Source: Survey Results

There are no institutions, government or private that are responsible for the multiplication of horticultural crop varieties for transfer to end-users in the region as a whole. This reality obliges farmers to depend entirely on low yielding local crop varieties, which are susceptible to pests and diseases.

The provision of pesticides is also not better than other inputs. Until the collapse of the Military regime the provision of pesticides was fully controlled by the government. Currently there are individual dealers who retail pesticides. But the problem with the individual dealers is that they mix pesticides with other things to increase the quantity, which of course decreases or totally neutralizes its medical value. Traders involve in such illegal activities to get more profit at the expense of poor farmers.

On the other hand, although irrigation demands more input that requires high finance, the local government gives priority to rain fed cultivators embraced by extension package program. Extension intervention program which is usually known as "package" was initially designed and implemented by SASAKAWA Global 2000 and later adopted by the national and regional governments to be implemented on a wider scale (OADB, 1995). This program is based on the assumption that there exists a sufficient improved technology to increase crop yields of the participating farmers. Those farmers who are selected to be embraced by the package program will be provided the privileges such as credit service and technical assistance with close farm supervision (ibid). However, irrigation farmers are not yet considered in to the package program by the regional government.

In relation to output marketing, even though both schemes are not far from the main road that access to major towns like Adama, Mojo, Bushoftu and Addis Ababa, the marketing system is not well organized. The near by local markets do not have the capacity to absorb the perishable produce of farmers. At the same time the price received by farmers in the primary markets is relatively lower than what they could have received in other big markets. Market information on the part of farmers is non-existent. As a result, farmers do not have the

bargaining power to determine the price of farm produce; instead they accept the price given by the traders.

5.3.5. Credit Service

Irrigation farm management requires more financial input than rain fed agriculture do. But the majority of irrigators in both study area are not capable to meet capital requirement needed for the production activity. Although majority of farmers needs credit to purchase farm implements (especially those which are used for irrigation operation), oxen and other chemical and biological inputs, absence of credit service is affecting irrigation performance. There is no micro-financial institution that provides loan to farmers in the study area.

There are of course very few farmers who become self-sustained in fulfilling productive capital requirement provided that production and market conditions are conducive for them. The Irrigation Water Users' Associations (IWUAs) of the two irrigation systems are also not in a position to provide credit to members. For instance, as it is indicated in Table 19, of the major constraints, lack of credit facility was rated as the first crucial constraint by both irrigation systems. Therefore, the financial constraint considerably weakened irrigation efficiency as a whole.

In the absence of formal credit service, informal credit sources can be used as an option to generate capital that help to invest in a productive activity though it demands high rate of interest. Even in that case there are no individual lenders who want to lend money to farmers. There are two reasons for the absence of private lenders. First, there are no farmers emerged being financially strong and capable to lend for others. Second, since irrigation cultivation is

undertaken at the lower scale and rain fed agriculture is not dependable business, people fear to lend their money under such risky situation.

5.3.6. Training in Irrigation Management

According to the information obtained from the respondents, in Doni 57% and in Bato 73% farmers were trained in topics related to irrigation water management. Farmers trained by project holders (CARE and WVE) in collaboration with the concerned government organizations during the period of handing over the project. Till then no training was given for the irrigators. Training should be a continuous process. A one-time training cannot bring about a desired effect on the production and productivity of irrigation agriculture. The survey also revealed that low level of capacity building in terms of training and exchanged visits has contributed to the inefficiency of irrigation farmers.

5.4. Constraints in Irrigation Water Management

As briefly discussed earlier, Doni Kumbi and Bato Degaga farm type is a small subsistence oriented farm, which have at least some element of commercialization. Farmers generate some amount of cash by selling their horticultural crops for the purchase of essential items. However, there are a number of constraints encountered that challenges farmers' better performance in the process of production.

As noted by the key informants, farmers produce under difficult conditions that prevailed from Table 19 illustrates the extent of the problem of both irrigation systems as rated by the farmers themselves.

Table 19: Critical Problems Affecting Irrigation Performance as Rated by Farmers

No	Factors	Doni	Bato
1	Irrigation water shortage	7	4
2	Lack of credit facility	1	1
3	In availability and high cost of modern input	3	2
4	Market problem for cash crop produce	2	3
5	Shortage of oxen	4	5
6	Lack of skill training of irrigation	5	6
7	Lack of farm implements used to undertake irrigation operation	6	7

Source: Survey Results

5.5. Linkages of Irrigation

The idea of linkage in relation to this discussion refers to the development of different aspects of production activities and services created and/or facilitated as a result of small-scale irrigation development. Evaluating the existing linkages is certainly very important to show the contribution and socioeconomic impact of irrigation systems in local economic development.

Hirishman (1958 in Ray 1998) explained that there are various linkages that connect different fields of activities whether it is manifested in the form of backward and forward or in one of it. Forward linkages are essentially facilitators in that they increase the viability of other economic activity from the point of view of production, from the supply side. Backward linkages increase the demand for the product of another sector.

As far as this study is concerned, four types of linkages of irrigation have been identified although the level of its strength is very low. These are production linkages, consumption linkages, investment linkages and employment linkages. The elements of these linkages are manifested either in the form of forward and backward linkages or by any one of it as discussed below.

5.5.1. Production Linkages

With this type of linkages the modality of forward linkages has not been observed since there are no small-scale processing industries that use farm products as raw materials. What have been observed were only backward linkages in both study area. The increased income obtained by farmers because of irrigation in turn created high demand for modern farm inputs such as (improved seeds, fertilizers, pesticides, veterinary drugs etc.) and farm implements that are used specially for irrigation farm operation.

5.5.2. Consumption Linkage

With this type of linkage modality, cereal crops such as maize, *teff*, haricot bean, sorghum, etc. are sold by farmers in the near by markets. Doni and Bofa are market towns and serve as centers for collection of these cereal products brought from the two irrigation systems and the surrounding farmers as well.

Both Doni and Bofa are small market towns where the sells of crops are generally carried out in the open air, as "open markets" without any permanent shelters or retail shops. The out flow of the traded cereal crops to these markets and the surrounding market place is very limited and unreliable. This is because rain fed agriculture in both areas is affected by long-run problems that pose huge challenge to farmers, such as recurrent draught and famine.

Regarding cash crops such as onion and tomato, most part of the products are sold in distant markets like Addis Ababa, Adama and Dire Dawa. Only very little of these vegetable products are sold in the surrounding market places and also consumed by irrigation farm households'. In most cases farmers sell their cash crop products on the farm before harvest for traders who come from the above-mentioned towns. But this does not mean farmers always get good price for their cash crops since the undeveloped market infrastructure do not allow them to look for other options.

Backward linkages of the consumption linkage modality is reflected by the farmers increased consumption of various types of industrial goods like food oil, kerosene, salt, soap, sugar, cloths, etc. Irrigation has increased households income as a result the ability of irrigation users to spend on different social services such as education and health also increased.

5.5.3. Investment Linkages

Hirishman (1958 in Ray 1998) explained that the higher the saving rate the greater the investment capability and the higher the growth rate. The rate of saving and investment in both human and physical capital has a growth effect. Accumulation of capital by an individual will make workers very productive and increase the productivity of capital and other workers in the economy. This means that there are complementarities among action of agents in way one agents of choice of action increases the incentive for other agents to take some sort of action.

As far as the two irrigation schemes are concerned, the forward aspects of investment linkage is very weak as most of the irrigators are yet found at subsistence level with only few of them saves at small rate. In this case no significant progress has been observed in investment.

The positive implication of irrigation on investment observed more or less on the backward linkage modality. One aspect of this linkage is the prevalence of expanding investment in hotels, Kiosks, butchery, Burberry, local drink houses, tea rooms, shops, etc. It is much more flourished in Doni and to a lesser extent in Bofa town. Almost all the owners of the above petty trading and services explained during the interview that they believe irrigation played a vital role in creating favorable condition to strengthen their business. They also confirmed that irrigation farmers are among others their major customers. In addition, traders that come from Addis Ababa, Adama and Dire Dawa to buy vegetable products are other important costumers. As a result, most hotels have already increased their capacity in quantity and quality of services.

5.5.4. Employment Linkages

The employment linkages are relatively strong in both irrigation systems. For instance, Job opportunity has been created of which many landless young people specially poor women subsist as farm labourers. Irrigation farms are the only significant source of employment. There are also many women and young girls who are engaged in the selling of local beverage (*tella*) and bread of which most of it sold to those daily labourers.

Other obvious groups of external beneficiaries consist of village traders, whole sellers, brokers and local governments as taxing authorities. For instance, broker is a new kind of job created in both areas as a result of cash crop markets. There are about ten brokers at Doni Kumbi and four at Bato Degaga SSI who earn 75 percent of their annual income from this deal. According to the information received from focus group discussion, the average annual income of these brokers range from 5000-10,000 Birr depending upon good condition of cash crop production and better price.

Another important advantage of irrigation is its contribution to minimize the out migration of landless poor people to other places for the search of temporary job. Irrigation being the main economic activity helped the surrounding poor people to work and earn either to supplement their low income or as a means of sole income generation.

5.7. Policy Issues of Smallholders Irrigation Development

In principle local and the national governments are expected to provide regulatory frame works, policies and public goods that are useful to facilitate smallholder irrigation development. For instance, the input and output side of marketing is considerably important for irrigation systems to grow. Agricultural marketing is considered to consist all activates that link farm producers with consumers. The macro-economic policy environment can determine this linkage. One aspect of such policy is the agricultural price policy, which contains the type and form of the government intervention in the markets of agricultural produce. There is a high price fluctuation of agricultural production and leaving it to the interplay of market forces result in the set back with the overall rural economy. In this regard, there is no clear policy that enables farmers to get reasonable price for their produce.

Although both government and private companies import chemical fertilizers, the provision remained insufficient during the past three years. Those farmers even who are able to pay the full price of fertilizers at one time didn't manage to get it. Due to this reason, majority of farmers obliged to shift from the production of high value crops to low value food crop production. As respondents noted, vegetable production cannot be profitable with out the use of fertilizers.

Facilities like credit service are non- existent in both study area, which clearly indicates weaknesses on the part of the local government. Institutional linkages to be established between Doni Kumbi and Bato Degaga irrigation systems on the one hand and research center and state farms on the other is either weak or none since the local and national governments have made no effort.

Although water pricing may involve some technical, administrative and political constraints, water pricing is essential to tackle with increasing water scarcity and declining financial resources available for irrigation and water development. There is no policy in the region as a whole that entails about water right and entitlement. Water is rather considered as common property resource. Nevertheless, there should be water-pricing system based on water rights that would introduce incentives for efficient water use and recover at least organization and management costs.

5.8. Livestock and Irrigation

According to Berhanu and Peden (2002), in mixed crop-livestock system the opportunity that irrigation provides is not only enabling intensified crop production, but also increase animal feed through increased crop residues of food-feed crops, which may reduce the pressure on grazing lands. If farmers well manage and utilize fodder that can be grown by the use of irrigation, livestock productivity can increase hence household income can be achieved.

Obviously, livestock production is one of the very important aspects of income generation for households in both irrigation systems. They are closely integrated with the range of purposes such as direct production, draught power, transport, and manure production to sustain soil fertility and as a store of wealth.

Livestock products that are mostly consumed in the household such as milk, butter, cheese, are sources of good quality of proteins. Traditionally, selling of livestock product especially milk is not widely undertaken because of cultural taboo. Therefore, it is consumed mostly in the household. The consumption of this food item is very useful especially for children for their better growth and health.

Small animals such as goats and sheep are kept mostly for sale at time money is crucially needed for the settlement of different household's financial commitments. They are also used as the major source of meat for the household though they are rarely slaughtered. The feed requirement of these animals is not as big as larger animals since their feed is usually depend on grazing and browsing.

According to the respondents, the impact of irrigation development on livestock is not as high as crops in the study area. One of its few positive impacts is the attempt to grow improved variety of fodder plants at Doni Kumbi on the course of primary, secondary and tertiary canals that is used to feed animals all the year round.

In addition to crop residue, weeds are also important source of animal feed. Usually irrigators weed their farm once or twice depending up on the intensity of weed. According to the irrigators, as far as they collect weeds from their farm for the feed of their animals, they do not use herbicides so that they can save money which otherwise costs them high.

With regard to livestock, one woman was interviewed in Bato Degaga SSI to give suggestion whether irrigation helped her to get increased amount of milk from the cow she is currently milking. She responded in smiling face that after the introduction of the irrigation system, her family diversified their crops and succeeded to harvest up to two times in a year. She adds, the

advantage of irrigation to her family is not only limited to benefiting high income from cash crop but the volume of milk she gets from her cow also increased. As she witnessed, in the absence of irrigation she use to milk quarter to half litter of milk per day for only six months duration. But now, thanks to irrigation, she managed to get one up to one and half litter of milk per day from the same cow. If all things go normal, she is confident that she would continue milking with the same volume of milk for a year.

Of course, this may not be the case in all irrigation families. But good experience of this woman explained above can have a demonstrative effect on other women in both study areas.

It is observed that most irrigators did not increase the number of their livestock. This is due to their inability to engage on cultural undertakings known as "GODANSA" in which farmers use to keep their livestock for some few months to a distant place in the search of animal feed and other cultural values.

Informants reported that the practice of "GODANSA" did not match with irrigation cultivation that requires intensive labour throughout the production season. As a result, most irrigators, specially farmers who has less family members did not increase the number of their livestock even some of them minimized to the size it is manageable together with irrigation activity.

The extension service in relation with livestock production is very weak. The development agents assigned in both study area only looks after farmers' crop production neglecting the livestock part. This shows there is no appropriate mandate and integration between crop and livestock production. Although Adama and Wolenchiti district agricultural offices undertake different activities such as distribution of improved cattle breed, artificial insemination service, forage seeds and health service, little or non was implemented in the study areas.

There are few fodder plants on the course of irrigation canals in Doni SSI. Vaccination and diagnosis of sick animals was undertaken at lower level while the rest activates was not totally carried out. Neglecting livestock and concentrating only on crops obviously affect farmers whose source of income is essentially depend on crop livestock integration.

In this respect, irrigation should also benefit the livestock sector. For instance, livestock provides the most valuable and cheaper farm in put, manure, which is very essential to maintain soil structure and fertility. The out put of livestock products such as milk, milk products, meat, hides and skins can also be significant source of income if the benefit of irrigation properly channeled to this sector.

Generally, the livestock production in the study area is hampered by multiple factors such as feed shortage, low productivity of local breed, disease prevalence, insufficient veterinary services, poor animal husbandry practices and undeveloped market infrastructure.

Chapter Six: Conclusion and Policy Implications

6.1. Conclusion

Today, the issue of food security is a serious concern especially in arid and semi-arid regions, which is vulnerable to climatic instability and frequent droughts. In these regions, there are usually little doubts about the need to use water for agriculture, where traditional rain fed farming is a high risk enterprise to ensure stable production.

A brief historical account shows that irrigation has played a key role in enabling sustainable food production where it is well managed by lowering the risk of crop failure. Irrigation also helps to prolong the effective crop growing period in areas with dry seasons by permitting multiple cropping per year where only a single crop could be grown otherwise. Furthermore, irrigation reduces the risk of expensive agricultural inputs like fertilizers from being wasted as a result of crop failure caused by shortage of water.

As briefly discussed in the main body of this study, Doni Kumbi and Bato Degaga SSI are found in one of the most drought-prone and food insecure areas in the region. Until recently, both study area were identified as food insecure and receive food aid distributed by the regional government. In this regard, although irrigation is not a long tradition in the study area, its role as coping mechanism to mitigate the effects of draught can not be under estimated. The majority of irrigators' farmland is under rain fed cultivation and little is only cultivated by applying irrigation water. This is due to shortage of water as well as inefficient irrigation water management.

As compared to other household sources of income the average income obtained from irrigation agriculture accounts 69.18%, 76.15%, 75.92% in Doni Kumbi and 0.00, 75.49%, 61.95% in Bato Degaga SSI during the past three years. This may signify the need for smallholder irrigation development as a key draught mitigation measures and improvement of household food security in the study area.

For instance, of the 30 farmers interviewed in Doni Kumbi SSI, 23.3% (7 farmers) said that irrigation highly increased their access to basic needs while 76.6% (23 farmers) responded that irrigation moderately improved their livelihoods. Accordingly, in Bato Degaga SSI, of the interviewed 30 farmers, 43.3% (13 farmers) said that the contribution of irrigation in increasing households access to basic needs was high while 56.7 (17 farmers) responded that irrigation improved their livelihoods moderately. Therefore, the finding of this study shows irrigation contributed to the increase in households' income and improved their livelihoods in both study area.

With regard to the impact of irrigation development in the economic life of people in the study area, the result of the survey has shown that different economic linkages emerged that helped people inside and around the study area. There are different linkages created because of irrigation though they are in the infant stage of development. These linkages are production linkages, consumption linkages, investment linkages and employment linkages. These linkages prevailed either in the form of backward and forward modality or in one of it in each case. For instance, the production of cash crop created job opportunity for many land less young people especially poor women that subsist as farm laborers. The increased income obtained by farmers as a result of irrigation created high demand for modern farm inputs and farm implements. Farmers demand for non agricultural products such as food oil, kerosene,

salt, soap, sugar, cloths, etc. increased with the increase of their income from irrigation. The expanding investment in hotels, kiosks, butchery, Burberry, tea rooms, shops, etc. in Doni and Bofa villages are also the outcomes of economic effect created as a result of irrigation development.

The vital task of increasing and stabilizing food production in draught-prone regions requires the development of well-managed small-scale irrigation systems that involves improved on-farm water management, organizational and other infrastructural development. One of the most important aspects of small scale irrigation development is to know how the irrigation systems operate and how communities undertake irrigation management. As the study revealed, there is difference in the methods of water abstraction from the source (Awash River) in the two irrigation systems. Doni Kumbi uses natural gravity to abstract water from the source which gives a scheme the advantage to lower the cost of irrigation water supply while the use of electric motor pump for Bato Degaga highly increased its cost. This situation is further aggravated by the inefficiency in water management, which is of course a serious problem in both SSI. The cropping intensity in both irrigation systems is similar. i.e., in both irrigation systems more than 90% of vegetable production is concentrated on onion production that causes competition for market among producers. In most cases farmers do not have the power to bargain with traders since they deal individually. As a result, they remained price takers. There is no practice of inter cropping and crop rotation that contributed to under utilization and production inefficiency in both study area.

There are irrigation water users associations in the two irrigation systems which have got the status of legal entity. But committee members are weak to undertake their responsibility properly. As the survey result revealed, legal entitlement of IWUAs did not help them to get

special advantage than other schemes that did not get this title. For instance, the legal entitlement did not make the schemes to be provided with facilities such as credit, input and market information. In both schemes there are no organized marketing strategies in which farmers can combat with the negative effects of irrigation as a group.

The study revealed that the main problems of irrigation development in both schemes have been challenged by a number of constraints among which are agronomic, organization and management, institutional and policy related constraints are very severe.

Currently, the Oromia Regional Government seems to consider smallholders irrigation development as a strategy to improve food security and contribute to overall growth of the local economy. The establishment of OIDA as an independent government institution, which is responsible for the development of smallholder's irrigation systems is the indication for the attention given by the regional government. As a result investments in irrigation have been accelerated and many new of them flourished in addition to the existing ones.

Although this is a well-come situation for the region where the rate of agricultural growth lags behind the population growth rate, yet there are a number of management problems from inside and outside of the irrigation systems that have to be well addressed to make them more efficient.

Generally, the result of this study summarizes that given the limitations posed by institutional, managerial and other infrastructural constraints removed or at least minimized; both irrigation systems can be vital instruments to protect against the adverse draught effects and to switch from low-value subsistence production to high value market oriented production. In order to attain this goal, integrated effort of different stakeholders and other relevant institutions is

very important. This is for the fact that the development of irrigation canals by itself cannot bring about a significant change in the improvement of the livelihoods of poor farmers. Together with, it is of paramount importance to consider the management issues in order for community-based irrigation systems to be successful. Assessment of critical social issues helps to learn why there have been successes or failures and consequently enables to design more effective approaches for water management in agriculture.

6.2. Policy Implications

- The production of high-value vegetable crops could be attractive business in agriculture if it could help farmers to obtain high returns from it. But this achievement is not only the result of good harvest. Market is the most important factor that determines whether to continue or quit the business. The government should not leave farmers agricultural products to the interplay of market forces since it is often affected by the fluctuating market price. In this regard, there should be clear policies that support farmers to get reasonable price for their perishable vegetable produce to stay and invest more in the sector. Relevant and timely information has increasing value as the business of irrigation becomes more complex and volatile. Therefore, establishing effective information system can do much in improving time and situation specific information. The market information net-work can be materialized by creating access to computer service at the site, which may not require high cost.

- In spite of short supply of modern agricultural inputs, the regional government gives priority to peasants distinguished as “package farmers”, those who cultivate under rain fed agriculture. Due to this, most irrigators especially those who are financially vulnerable, cultivate without the application of these inputs or use below the

recommended rate. This contradicts with the policy of Agricultural Development Led-Industrialization (ADLI) that says in drought-prone areas agricultural production among others, can be increased through small scale irrigation by providing them the necessary farm inputs, credit facilities and extension services by the government. OIDA also considers irrigation as strategy to ensure food security in draught-prone areas. Therefore, improvement in the supply of inputs like fertilizers, improved seeds and pesticides would help much to accelerate technology use and consequently improve the productivity of irrigation.

- Irrigated agricultural production requires the use of modern inputs, appropriate farm implements and oxen that involves high cost. But these are very expensive and difficult to be possessed by most of irrigators. The regional government therefore should take prompt measure to avail credit service to irrigators on short and medium term basis.

- In both study area livestock are closely integrated with crop activities and provide significant source of livelihood. The climatic change that causes recurrent draught results not only crop losses but it also affects the production and productivity of livestock sector. In majority cases, the animals subsist on grazing and crop residue that do not provide adequate feed throughout the year. According to the survey, all respondents who possess livestock said that there are severe feed shortages specially during the dry season. Overcoming the feed constraint through appropriate intervention is very crucial to effectively manage the existing livestock potential as one of the strategies to transform the agricultural sector. Therefore, the benefits of irrigation should also be directed towards livestock. For instance, there is only few fodder plants

in Doni Kumbi SSI, rarely found on the tertiary irrigation canals. In this case, it is possible to grow improved forage seeds all along the irrigation canals. In doing so, crops can not be harmed or water shortage can not be caused. Therefore, this should be undertaken in a wider range including other methods that help to increase animal feed by using irrigation water.

- The role played by the two NGOs namely; CARE Ethiopia and World Vision Ethiopia in the development of Doni Kumbi and Bato Degaga SSI has been decisive, without which the present irrigation systems may not be in place. However, it is observed that both NGOs did not fully implement the project as per the intended plan. For example, according to the project design of CARE Ethiopia Shoa Project, the plan was to develop 110 ha. of farmland at Sifa Dhenke peasant association of which only 40 ha. was developed. In this case, out of the intended 150 beneficiaries only 30 farmers were able to use irrigation water. Similarly, World Vision Ethiopia Adama Project planned to develop 140 ha. of farmland in Bato Degaga that could benefit 280 households. But the capacity of irrigation found to be only 60 ha. Benefiting only 120 farmers. On the other hand there was no a mechanism that enables beneficiaries to know whether the budget assigned for the project was genuinely used for the purpose. Lack of transparency would affect the trust in the part of farmers. Therefore NGOs should be committed to implement the project design and be able to be transparent in the process of program implementation.

- Adjacent to the two irrigation systems, there are four large –scale commercial farms collectively known as “Upper Awash Agro-Industry Enterprise”. They are producing horticultural and vegetable crops for export and domestic consumption. The agro-

processing plant found at Tibila farm site is one of the competent processing enterprise in the country. It provides processed and packed vegetable and horticultural products to the large markets all over the country. Although this is a big opportunity for the two irrigation systems, nothing has been done so far to establish some kinds of cooperation that could be helpful for their common benefits. For instance, the agro-processing plant can provide inputs to farmers including other technical assistance to enable them produce regular and higher quality products that can be used as the raw material in the agro-processing enterprise. The condition of technical support could be on production techniques such as timing of planting and harvesting, amounts of fertilizers to be used, spraying programs, etc. In this case, farmers can get good production and reliable market and the state farms also benefits in one way or another from such kind of cooperation. Therefore, the concerned government body should facilitate to create linkages between them.

- According to the information obtained from Adama and Wolenchiti district IDA offices; shortage of transportation is one of the major constraints that limit mobility of extension workers to provide extension service to farmers. The fact that there are about 180 districts in the Oromia region, the government may not afford to supply the required motor bicycles to be used for field works. Therefore, in order to minimize the existing critical shortage of transportation, the regional government of Oromia should import the number of motor bicycles to be sold for the extension workers. The sale should be on credit basis to be deducted from their salary on long time series (the selling price could be reduced to encourage extension workers to buy them either by subsidizing or by importing them free of duty). This mechanism would give three

advantages; first, it helps to minimize shortage of transport and increase the mobility of extension workers and second, the extension workers can keep the motor bicycles curiously since it is their own. This again helps to reduce the cost of maintenance. Thirdly, it minimizes the cost of administration. Therefore, the regional government should prepare and implement pilot project to check its effectiveness.

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Annex I

QUESTIONNAIRE

RESEARCH TITLE

Smallholders' Irrigation Practice and Issues of Community Management: The Case of Two Irrigation Systems in Eastern Oromia, Ethiopia.

The OBJECTIVES OF THE SURVEY

- To assess the role of smallholders' irrigation development in increasing income hence, improve the livelihoods of the irrigators.
- To assess issues and problems of community-managed irrigation systems

DEAR RESPONDENT!

The result of this study, which includes suggestions of the respondents, will help different stakeholders and policy makers to take appropriate measures to further improve the irrigation management. Therefore, you are kindly requested to provide with genuine responses.

Survey area (District, kebele) _____
Enumerator _____
Date _____

Thank you!
Lemma Dinku, Survey coordinator

I-Personal Data (household Characteristics)

1.1. Indicate the household size _____
1.2. Sex composition of the household 1= Male ____ 2= Female ____ Total ____
1.3. Age composition in the household
1= below 12 years 2= 12-17 years 3= 18-60 years 4= above 60 years
1.4. Literacy level of the household 0= illiterate ___ 1= read and write only ___
2= elementary ___ 3= high school complete ___ 4= diploma and above ___
1.5. Marital status of the respondent 1= married 2= widowed 3= divorced 4= unmarried
1.6. Ethnic background 1= Oromo 2= Amhara 3= Gurage 4= others
1.7. Religion 1= Orthodox 2= Islam 3=Wakefeta 4= Protestant 5= Catholic
6= others
1.8. Position of interviewee in the household?
1= head of household 2= member of household
1.9. Since the last 5 years your household size has 1= increased 2= no change
3= decreased
1.10. how do you categorize your household size?
1= small 2= enough 3= large 4= excessive
1.11. Who is the main economic provider for the household? (put in order of importance)
1= husband 2= spouse 3= son/daughter 4= relatives in the household
5= relatives some where else

Household Resources and Means of Livelihood

Agriculture

2.1. Total land size _____ (you can use hectare or local measurement)
2.2. Land under cultivation _____
2.3. Fallow land _____
2.4. Grazing land _____
2.5. Do you possess plots (homestead) 1= yes 2= no
2.6. If yes, explain the size _____
2.7. Explain the agro ecological zone of your Kebele
1= dega 2= woina dega 3= kola
2.8. How do you evaluate sufficiency of rain fall of the area for crop production?
1= excess 2= sufficient 3= insufficient 4= very low
2.9. Patterns of rain fall in the area 1= decrease 2= increase 3= no difference
2.10. Is there any record of crop failure in the area due to shortage of rain fall?
1= yes 2= no
2.11. If yes, indicate the years _____
2.12. what kind of crops do you produce? 1= grain 2= vegetables 3= fruits
4= 1&2 5= 1&3 6= 2&3 7= all 8= others _____
2.13. What is the major occupation of the household?
1= crop Production 2= mixed farming 3= livestock 4= vegetable 5= others
2.14. Do you have additional income that supplement your major occupation?
1= yes 2= no

2.15. If your answer is yes, state all in order of their importance.

1= sales of crop production 2= sales of animals 3= sales of livestock products
4= sales of vegetables 5= earnings from daily laborer 6= Petty trading
7= sales of local drinks 8= sales of honey 9= sales of chickens and eggs
10= sales of pottery 11= selling fuel wood and charcoal 12= remittance/gift
13= others (specify) _____ 2.16.

How was your agricultural production for the last three years?

1= excess for annual household consumption
2= sufficient for annual household consumption
3= sufficient for six months only
4= sufficient for less than six months

2.17. If your household faced food shortage, what do you think was the reason? (rank in order of importance)

1= land shortage 2= oxen shortage 3= labor shortage 4= poor productivity
5= farm implements shortage 6= crop failure due to erratic rain fall
6= Others (specify) _____

2.18. What do you do to cope with the problem? 1= rent farm land 2= borrow money
3= borrow cereals 4= assets sale 4= involve in off farm activities
5= others (specify)_____

2.19. Which crops are the major source of food (staple food) for your household?
_____

2.20. Indicate the number of meals per day in your household? _____

2.21. Annual Income From Grain Production

Crop Item	Rain Fed						Irrigation			Total Production			Total income (Birr)		
	Area cultivated			Total Production			Area Cultivated								
	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003
Wheat															
Maize															
Sorghum															
Teff															
Barley															
Pulses															
Oilseeds															
Millet															
Others															
Sub Total															

2.22. Annual Income From Vegetable Production

Crop Item	Rain Fed						Irrigation			Total Production			Total income (Birr)		
	Area cultivated			Total Production			Area Cultivated								
	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003	2001	2002	2003
Onion															
Tomato															
Potato															
Pepper															
Cabbage															
Garlic															
Others															
Sub total															

2.23. Annual Income From Other Farm Products (Animals, Poultry, Beekeeping)

Items	Totally Owned			Quantity Sold in the year			Total income from sell (in Birr)		
	2001	2002	2003	2001	2002	2003	2001	2002	2003
Oxen									
Cows									
Bulls									
Calves									
Heifers									
Sheep									
Goat									
Donkeys									
Horses									
Mules									
Camels									
Dairy products (milk butter, cheese)									
Chicken									
Eggs									
Honey									
Others									
Sub-total									

2.24. Non-agricultural sources of income

No **Item**	**Annual income**		
	2001	**2002**	**2003**
Wage labor			
Petty trading			
Weaving			
Pottery			
Sale of local beverages			
Sale of firewood/charcoal			
Sale of crop residue (straw, hay, stalks)			
Assistance from relatives			
Food for work			
Food aid			
Hired out oxen			
Others			
Sub-total			

2.25. Household Expenditure (2003)

Expenditure Item	Monthly Consumed	S o u r c e s				
		Own Production	Purchase From Market	Food For Work	Food Aid	Support From Relatives
I- Expenditure on Food						
A- Cereals						
1. Wheat						
2. Maize						
3. Sorghum						
4. Teff						
5. Barley						
6. Pulses						
7. Oil seeds						
8. Millet						
9. Others						
Sub Total						
B- Vegetables						
1. Onion						
2. Tomato						
3. Potato						
4. Carrot						
5. Pepper						
6. Cabbage						

7. Garlic						
8. Others						
Sub Total						
C- Other Food Stuff						
1. Fruits						
2. Spices						
3. Others						
Sub total						
D- Meat & livestock Products						
1. Meat						
2. Milk						
3. Cheese						
4. Butter						
5. Chicken						
6. Egg						
7. Honey						
8. Others						
Sub Total						
II- Non Food Expenses						
1. Medical Expenses						
2. School Expenses						
3.Expenses on industrial commodities (sugar, salt, gas, etc						
Social expenses (e.g. edir)						
Others						
Sub Total						
Grand Total						

2.26. How do you view the quality of your farm land?
1= fertile 2= adequate 3= poor 4= very poor

2.27. If your response is poor or very poor, indicate factors that contributed.
1- soil erosion 2= the land is inherently poor 3=
3= continuous cropping/grazing 4= little or not using fertility inputs
5= Others _____

2.28. Do you apply manure on your farmland? 1= yes 2= no

2.29. If your answer is no, why? 1= shortage of manure 2= alternative use of manure
3= labor shortage to handle & transport manure 4= others _____

2.30. Do you apply fertilizer on your farmland? 1= yes 2= no

2.31. If yes, do you know the recommended rate? 1= yes 2= no

2.32. Do you apply the recommended rate? 1= yes 2= no

2.33. If no, why? 1= cash shortage 2= fertilizer is not available
3= recommendation rate is not profitable
4= others (specify) _____

2.34. Have you ever used an improved seeds? 1= yes 2= no
2.35. If you do not ever used improved seeds, why?
1= too expensive to buy 2= not available 3= not better than the local ones
4= not heard or not aware 4= others (specify) _____
2.36. Do you use veterinary drugs for your livestock? 1= yes 2= no
2.37. If no, why?
1= too expensive 2= not available 3= not heard or not aware
4= others (specify) _____
2.38. Have you ever used pesticides? 1= yes 2= no
2.39. If not, why?
1= too expensive 2= not available 3= not heard or not aware
4= others (specify) _____
2.41. Do you feel secure that the land belongs to you? 1= yes 2= no
2.42. Describe the condition of your house. 1= corrugated iron roofed and one hut
2=corrugated iron sheet roofed 3= two grass roofed hut
4= one grass roofed hut 5= others (specify) _____
2.43. Do you have the following household goods and valuables?
1= Radio 2= wrist watch 3= metal bed 4= fanos 5= kerosene stove 6= others

B. Livestock

2.44. Do you have currently livestock? 1= yes 2= no

2.45. If your answer is yes, indicate type and number

		Number
Cattle	Oxen	
	Cows	
	Heifers	
	Bulls	
	Calves	
Sub Total		
Sheep & Goat	Sheep	
	Goat	
Sub Total		
Equines	Horses	
	Mules	
	Donkeys	
	Camels	
Sub total		
Grand Total		

2.46. What are the sources of your animal feed? (circle as many as apply)
1= communal grazing 2= around the backyard 3= own grazing land
4= weeding plant 5= crop residue 6= cut and carry grass or fodder plant
2.47. Do you face shortage of animal feed? 1= yes 2= no
2.48. what do you do to cope with the problem? 1= limit number of livestock

2= purchase additional fodder from other sources 3= live the problem as it is
4= others_____

2.49. Do irrigation has brought any significant change in relation to fodder availability?
1= yes 2= no

2.50. Do the oxen you possess enough for your farm operation? 1= yes 2=no

2.52. If no, means to get additional oxen. 1= exchange with labor 2= hire
3= oxen sharing 4= others (specify) _____

2.53. Have you attended any training on livestock management? 1= yes 2= no

III. Issues Related to Irrigation Practices

3.1. Are you applying irrigation on your farm? 1= yes 2= no

3.2. What is the type of your scheme? 1= traditional 2= modern

3.3. Who developed the scheme? 1= community 2= government 3=NGO 4=1&2 5=1&3

3.4. Who is the owner of the scheme?
1= community 2= government 3= NGO 4= 1&2 5= 1&3

3.5. Do you have any specialized training on irrigation? 1= yes 2= no

3.6. For how long (years) you practiced irrigation? _____

3.7. Do the scheme has been constructed with the consent and full participation of the target beneficiaries? 1= yes 2= no

3.8. if yes, in what aspect did you participate
1= simply attending discussion assemblies about the project
2= attending discussion assemblies and actively expressing feelings, ideas, views, etc.
3= acting as an informant

3.9. Explain the type of contribution you made for the project
1= money 2= labor 3= material 4= land 5= 1&2 6= 1&2&3
7= 1&2&3&4 8= 1&2&3&4&5 9= others _____

3.10.What source of water do you use?
1= river/stream 2= shallow dug out 3= others (specify) 4= natural pool/pond
5= artificial pond/dam 6= others (specify)

3.11. What type of water delivery system is used from the source?
1= motor pumps using electric power 2= motor pumps using diesel power
3= diversion using gravity 4= others (specify)_____

3.12. How many households use same irrigation scheme in common? _____

3.13. How many hectares of your cultivated land is accessible for irrigation? _____

3.14. Do you irrigate all of your irrigable land? 1= yes 2= no

3.15. If <u>not</u>, why? (circle as many as apply)
1= shortage of water 2= low productivity
3= getting sufficient produce by rain feed agriculture
4= poor quality of irrigation 5= poor maintenance
6= others (specify) _____

3.16. Is there a mechanism of water pricing for irrigation users?
1= no, water is provided as a free service
2= yes, water is provided by charge but does not vary with the quantity of water used
3= irrigation water charge is based on the volume of water used
4= others (specify)_____

3.17. How many times you produce annually by applying irrigation? _____

3.18. What are the major agricultural cash crops you produce using irrigation? _____
3.19. Why do you prefer to grow such cash crops? 1= better price 2= good production
3= easy to operate 4= high disease tolerance 5= seeds availability
6= others (specify) _____
3.20. Which of the food grain crops have you adopted through the use of irrigation?
_____
3.21. If there are any, why do you choose them?
1= household demand 2= requires less labor 3= appropriate for the climate
4= easy to apply irrigation 5= others (specify) _____
3.22. Have you ever faced a problem of crop failure when using irrigation? 1= yes 2= no
3.23. If yes, why? (circle as many as apply)
1= water shortage 2= crop disease 3= poor irrigation maintenance
4= over flooding of the farm and consequent erosion
5= others (specify) _____
3.24. Are there any problem during the application of irrigation water? 1= yes 2= no

3.25. If yes, what are they? (rank them) 1= down stream conflict _____
2= shorter time allowed for irrigation water flow ____
3= water use administration problem ____ 4= lack of maintenance ____
5= lack of operational skill/training ____ 6= others_____
3.26. How many months of the year you are engaged in irrigation activities? _____
3.27. Do you have labor shortage in operating your irrigation farm? 1= yes 2= no
3.28. Are you able to apply as much water as you would like to your crops? 1= yes 2= no
3.29. What constraints affect you in using the scheme efficiently? (put in order of importance) 1= lack of input financing 2= unavailability of inputs 3= shortage of labor 4= lack of rural access road & high transportation cost
5= conflict in water utilization with users 6= lack of marketing for produce
7= water shortage 8= others_____

3.30. What type of labor do you use for the following Irrigation activities

(Please indicate all types used)

Activity	Self	Spouse	Other household members	Hire Labor	Other
Land preparation					
Planting/transplanting					
Weeding					
Applying agro-chemicals					
Watering					
Harvesting					
Transporting & Storing					
Others (specify)					

3.31. If you hire labor fill in the following

Activity	Total man days	Cost/day (Birr)	Total cost
Land preparation			
Planting/ transplanting			
Weeding			
Applying agro-chemicals			
Watering			
Harvesting			
Transporting & Storing			
Others (specify)			

3.32. Did the payment for hired labor increased because of irrigation? 1= yes 2= no

3.33. If you do not hire labor why?

1= have enough family labor 2= too expensive 3= no available labor to hire

4= others (specify) _____

3.34. Explain the impact of irrigation on forest and land utilization (put in order of impo.)

1= minimize deforestation 2= minimize the demand for land 3=

3= contribute to soil conservation 4= no change in the trend

3.34. What positive impacts of irrigation have you observed? (rank in order of importance).

1= change in the number of meals eaten per day

2= Change in the type and variety of food eaten

3= Change in the amount of money spent on education, health, clothing, etc.

4= change in the ability to cope with draught

5= change in coping strategies during times of food shortage

6= reduce in crop failure and increase production

7= change in the amount of products sold for income

8= increase employment opportunity during irrigation season

9= diversification of crop grown

10= others (specify) _____

3.35. Rank the following important factors which most inhibits your irrigated production at present

Factors	Rank	Extent of the problem		
		Simple	Modest	Considerable
Water				
Land				
Input				
Credit				
Market				
Transport				
Crop damage				
Competition				
Absence of gov. support				
Lack of skill				

IV. Market

4.1. How do you sell your produce? (circle as many as apply)
1= take produce to the market. Where? _____
2= traders buy from the field. Where do they come from? _____
3= traders buy from the field. Where do they sell? _____
4= contract with an institution. Which? _____
5= others (specify) _____

4.2. How far is the market you mentioned from your plot? _____kms.

4.3. How do you sell your produce? 1= as an individual
2= as a member of an informal group 3= as a member of cooperative
4= others (specify) _____

4.4. Do you face a problem in selling your produce? 1= yes 2= no

4.5. If your answer is yes what type of problems? 1= low price 2= lack of transport
3= low demand for the produce 4= others (specify) _____

4.6. How are the prices of your agricultural products at local markets during harvest season? 1= very cheap 2= cheap 3= competitive 4= expensive

4.7. What are the prices of your agricultural products at local markets during the non-harvest periods? 1= very cheap 2= cheap 3= competitive 4= expensive

V. Credit Facilities and Duties Payment Conditions

A. Credit Facilities

5.1. Is there micro-financial institution in your area? 1= yes 2= no

5.2. If your answer is no, what other credit source do you use? 1= individual lender
2= relatives 3= friend 4= bank 5= NGO 6= cooperatives 7= others (specify)

5.3. Do you borrow money? 1= yes 2= no

5.4. If yes, why?
1= to purchase oxen 2= to purchase farm implements
3= to buy modern farm inputs like fertilizers 4= to construct house

5= others (specify) _____

5.5. Do you have experience of default on your repayment before? 1= yes 2= no

5.6. If yes, what options do you have for the credit repayment?

1= selling of livestock 2= selling of house furniture 3= renting out of land

4= borrowing from friends and/or relatives 5= others _____

5.7. If you do not borrow, why not?

1= fear of being in debt 2= high rate of interest 3= fear of failure to repay

4= I don't need credit 5= others (specify) _____

5.8. Do you save? 1= yes 2= no

5.9. If yes, in what form do you save? 1= ikub 2= save in the form of livestock

3= save in the Bank 4= _____

B. Duties Payment Conditions

5.8. Indicate the type of taxes and contributions you pay per annum and its amount

	Type	Amount
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

5.9. What do you do to pay those taxes and contributions?

1= sell crops 2= sell animals 3= borrow money from other sources

4=others (specify)_____

VII. Support Issues

6.1. Have you ever visited by an extension agent? 1= yes 2= no

6.2. If yes, during which operation?

1= land preparation ____ times 2= planting/transplanting ____times

3 = weeding ____ times 4= applying agro chemicals ____ times

5= watering ____ times 6= harvesting ____ times

6.3. Is there near by government/private owned large scale irrigation? 1= yes 2= no

6.4. If yes, do you have any relation with them? 1= yes 2= no

6.5. If yes, what are the fields of your cooperation?

1= field day or demonstration 2= on-farm verification

3= market facilitation 4= input provision

5= others (specify) _____

6.6. Do you have any relation with any research center? 1= yes 2= no

6.7. If yes what advice/support do they provide?_____

6.10. What kind of institutional support do you need in relation to the scheme?

1= organization and management 2= increase the scheme's capacity

3= maintenance 4= others _____

Thank you!

Interview guide for key informants

1. What were the trends of food security in the past three years?
2. How do you view the strength and weaknesses of the irrigation systems? (in relation to technical and social aspects
3. What are the existing policies in relation to agriculture in general and irrigation in particular and how do you view them?
4. How do you view the role played by CARE and World Vision Ethiopia in irrigation development?
5. What were important coping strategies to food insecurity in the area?
6. What are the indicators for wealth ranking according to the local community standards?
7. What are the cultural and religious factors that affect the household's economic activity? and their holdings?
8. What is the agro-climatic condition of the study area?
9. Discuss the following issues in your PA; access to basic school facilities, health facilities, drinking water (for humans & animals), irrigation services, road infrastructure, credit facilities, access to grazing land, access to modern farm inputs (fertilizer, improved seeds, pesticides, herbicides, veterinary drugs).
10. What harmful cultural practices are common in the area?
11. What are the major social organizations in the area and what are their roles?
12. What are off farm activities available in the Ana?
13. What were the major events of food insecurity in the area for the last ten years and how much it was serious?
14. What do you think are the major environmental problems in the Ana?

Thank you!