THE SOCIO-CULTURAL ASPECT OF IRRIGATION MANAGEMENT: THE CASE OF TWO COMMUNITY-BASED SMALL-SCALE IRRIGATION SCHEMES IN THE UPPER TEKEZE BASIN, TIGRAY REGION

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in a Partial Fulfillment of the Requirements for the Degree of Master of Arts in Regional and Local Development Studies (RLDS)

June 2004

Addis Ababa

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

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ACKNOWLODGEMENTS

I would like to express my deepest gratitude to my university advisor, Woldeab Teshome (Ph. D) for his marked role in restructuring my work and guiding me through to recent approaches in the study theme. His insightful comments for the betterment of the whole work were appreciable.

I would like to thank ***ILRI,*** the ***APPIA Project*** and *Comprehensive Assessment of water Management in Agriculture (CA)* under IWMI for financing my research project. I am also grateful to Dr. Don Peden (ILRI), Mr.Philippe Lemperiere (IWMI), and Dr. Girma Taddesse (ILRI) for advising and giving constructive comments and suggestions from the very inception of the work. My special thanks go to Dr. Mintesinot Behailu of Makale University for his unforgettable help in commenting up on my work and for his roles in getting me along with the whole contexts of my work in Tigray. I would to thank Dr. David Molden of CA project coordinator for his strong support CA Projects in Ethiopia.

I am indebted to my wife, Lemlem Mulugeta, for her patience during the time of my study when she was over burdened with the household responsibilities and the care for children. I appreciate her decisions to forgo her other possible opportunities while bearing these responsibilities, and her dedication of her personal property in order to cover my expenses during my study time in this program. I am also indebted to my children, who experienced my paternal disregard in many respects, and to my parents who tolerated my disregard for their old age care during my study time.

My brothers Engineer Aberra Ambaye and Zemach Gum'a had been on my side in various requirements for the livelihoods of my self and my dependents. I am grateful to them.

Last but not least, my special thanks go to my friend Ato Mitiku Habenne for his material and spiritual support during the data analysis, Ato Banti Messelu (Makale College of Teacher

Education), Ato Solomon Abreha (Makale College of Teacher Education), Ato Ataklti and Ato Berhanu (Tigray Regional Bureau for Water Resources Development), Agricultural experts, Extension Workers and farmers at the study areas for their hospitality and their help, without which this research could not have been come up to this state. Ato Wagnew and Ato Mulugeta (ILRI, Addis Ababa) have helped me with the computer formatting of the material for the thesis presentation. I thank them from the bottom of my heart.

Darout Gum'a

June 2004

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ACRONYMS AND GLOSSARY OF LOCAL TERMS

CoSAERT – Commision for Suatainable Agriculture and Environmental Rehabilitation in Tigray

MU – Makale University

REST – Relief Society of Tigray

Abbo-mai – A person elected by water users for the purpose of carrying out the task of water distribution among users. A word-for-word translation of the term gives the meaning “water father.”

Belg – The major rainy season

Birr – The Ethiopian Currency

Dergue – The council of the military government, which reigned Ethiopia before the present government

Gujele – group

Injera – Thin bread used as a major food type in many parts of Ethiopia

Kiremti – The major rainy season

Kushet – village

Tabia – An administrative tier that is taken as ‘sub-district’

Tella – Local beer

Tsimdi – Local unit of land measurement equivalent to 0.25 ha.

Woreda – An administrative tier that is taken as ‘district’

ABSTRACT

This study attempted to find out irrigation management problems in two community-based small-scale irrigation projects of government intervention in the Upper Tekeze Basin. The analytical frame of the study was based on the definition of irrigation in the organizational sense. The central arguments of the research are that irrigators should not be taken as passive recipients of external intervention as to simply follow pre-planned and laid-down rules, and that irrigation technologies are socially constructed, have social requirements for use and social effects. The objectives of the study were to identify irrigation activities that are associated with problems in irrigation management performance; and to find out socio-cultural contexts that entail management problems in irrigation activities.

Secondary data review, key informant interview, focus group discussion and household interview survey were used as methods of data collection. The data were collected in two stages ____ reconnaissance and second round visit to the study area. Both qualitative and quantitative research methods were used for the data analysis. Readily quantifiable data (most of the information from the close-ended questions of the survey questionnaire) were entered into the SPSS program, and the output was seen using tabulation and cross tabulation with values of percentage. Most information from key informant interviews, focus group discussions and open-ended questions were analyzed by using qualitative description. The major findings are the following: Irrigation activities associated with major problems in managing the socio-cultural issues in the two study schemes are operation, maintenance, water allocation, water distribution, decision-making and conflict management whereas socio-cultural contexts entailing management problems in irrigation activities are land rights, labour shortage linked with gender of household heads and religion, shortage and inappropriate usage of supporting services, problems in input and output market, and local institutions.

Key Words – Abbo-Mai, activities, allocation, conflict, construction, contexts, decision, distribution, effect, head-end, irrigation, management, small-scale, socio-cultural, tail-end, water

DECLARATION

I, the under signed, declare that this thesis, my original work, has not been presented for a degree in any other university, and that all sources of material used for the thesis have been duly acknowledged.

Name _____

Signature _____

This thesis has been submitted for examination with my approval as a university advisor.

_____

Woldeab Teshome (Ph. D)

June 2004

Chapter One
Introduction

1.1. Background

Ethiopia depends on the rain-fed agriculture with limited use of irrigation for agricultural production. Within such a context, highly variable rainfall, and lack of means to store water in times of plenty place Ethiopia at risk of drought and chronic food shortages (CARE, 1998). Rapid population growth and consequent encroachment of food crop farming on environmentally sensitive areas (forests, grazing reserves and steep lands) has set in motion a vicious cycle of erosion, declining wood supply, low crop yields, food shortages, progressive land degradation, reduction of areas under fallow, increased use of dung and crop residues for fuel instead of replenishing soil fertility, and greater exploitation of marginal areas. With declining productivity in rain-fed agriculture and with the need to double food production over the next two decades, water has been recognized as the most important factor for the transformation of the agrarian system, and effective and efficient irrigation is of paramount need (UNDP/ECA/FAO, 1994).

In light of this, the Agricultural Development Led Industrialization Policy of the Ethiopian government gives a prominent place for the role to be played by irrigation development, and several regional governments have established their regional development organizations geared towards attaining sustainable agriculture and environmental rehabilitation. Regarding this, CoSAERT (Commission for Sustainable Agriculture and Environmental Rehabilitation in Tigray) has been established with the mandate of study, design and construction of irrigation schemes in the Tigray National Regional State. However, although it is CoSAERT that takes the

lion's share of the role in irrigation scheme development in the region (since its establishment), bodies like REST (Relief Society of Tigray), and BoANR (Bureau of Agriculture and Natural Resources Development for Tigray National Regional State) play important roles.

CoSAERT was engaged in developing community-based small-scale irrigation schemes, and most of these are located within the geographical range of "The Tekeze Basin". The total area irrigated by 2002 in Tigray was 4773 ha or 0.44% of the total arable land (BoANR, 2003). In some unpublished reports, the total irrigated area was stated as 6500 ha (Leul, 2003). The fluctuation in size of irrigable area from one year to the other could be due to the drying of water sources following drought or shortage of rainfall.

There is large spatial and temporal rainfall variability to the extent of causing low agricultural production in the Tekeze basin. The variability of annual rainfall ranges from 20% in the highlands of Western Tigray to 40% in Eastern Tigray (UNDP/ECA/FAO, op. cit.). In rain fed agriculture, 70% - 90% of the rainfall during the growing season occurs in July and August. This explains that rain-fed agriculture suffers from moisture deficiency especially during the last two months (September and October) of the normal growing season. According to unpublished information from the Disaster Prevention and Preparedness Bureau of Tigray, a large number of people depend on food aid. The number of food insecure people in a given year positively correlates with the rainfall shortage (Leul, op. cit.).

On the other hand, the possibility of using ground water for irrigation in Tigray is very remote. Geological surveys indicate that 75% of the region is covered by igneous and basement rocks (Ibid.). According to this author, igneous rock is known to have some potential ground water

sources. But the igneous rock covering 54% of the region (in the West of Tekeze River) has little or no fractures and weathering, thus depicting little or no possibility of yielding water. The same author maintains that the basement rock, which covers 21% of the region, has no potential ground water source. The remaining part of Tigray, which is about 25% of the region, is covered with sedimentary rock, which is believed to be relatively better water bearing formation. However, the ground water recharge in the indicated area is adversely affected by low and/or intensive rainfall condition (300-550mm), ruggedness of the topography and absence of surface vegetative cover (Ibid.).

The Tekeze River in Ethiopia has a catchment area of 68751 Km^2 as measured from a 1:1,500,000 map (MoWR/NEDECO, 1996 in MU 2003). According to these sources from the Ministry of Water Resources, the low land part of the Tekeze basin holds about 1500 Km^2 area, which is almost flat land. About 70% of the basin lies in the highlands at an altitude of over 1500 masl. The arable land in the highland part of the basin is found in the plateaus and valleys. The total annual volume of water draining from the basin is 7.36 million m^3 with peak flow rate in July and August (MoWR, 2001). However, as there is a significant elevation difference between the major riverbed level and the agriculture fields in the highlands, it is difficult to use a significant portion of this volume of water for irrigation except in the low land bordering the Sudan. Thus, harvesting of the seasonal surface run off is the strategic option to promote irrigation in the upper Tekeze basin (UNDP/ECA/FAO, op. cit.).

1.2. Problem Statement

While many techniques are available for the 'hardware' component of development projects, this is not the case for their institutional components, which, in no way, are less important for the projects' ultimate success. In light of this, there has been over-reliance on physical engineering and technical aspects of water projects to solve development and conservation issues, resulting in the condition that most of the important decisions have been made solely by technical experts (Dessalegn, 1999). As a result, many of the major dams and reservoirs under water development programmes in Sub-Saharan Africa in the last three decades are performing poorly and have failed to meet their original objectives (Ibid).

In Ethiopia, water development is a priority for agricultural transformation, but poor practices of irrigation management relegate efforts to improve livelihoods, and expose people and environment to risks. Because of lack of skills and institutions to manage common property resources, irrigation infrastructure quickly falls into a state of disrepair, and conflicts over access to water constrain smallholder farmers (ILRI, 2002). Among the four categories of irrigation common in Ethiopia, namely traditional schemes, agro-industrial state-owned schemes, modern communal schemes and private commercial schemes, only the agro-industrial state-owned schemes of sugar plantations are well managed (WAPCOS, 1990; Estifanos, 1996; Dessalegn, op. cit.). According to IDD (1992), irrigation projects have been failing mainly because of insufficient participation by beneficiaries and insecurity of land tenure. Socio-economic, socio-cultural, religious and gender-related issues pose a problem to full and equal participation by beneficiaries (ILRI, op. cit.). Besides the poor performance of irrigation in the

country, systematic and holistic evaluation of irrigation management in general and of small-scale irrigation in particular is lacking (Dessalegn, op. cit.; MU, 2003).

The cases in the upper Tekeze basin are no exception to these phenomena. Most of the perennial streams in the highland part of the Tekeze basin and some springs are already used for irrigation (Leul, op. cit.). In the period between 1996 and 2001, 46 community-based small-scale irrigation reservoir dams with a cumulative storage capacity and irrigable areas of 49.91 million m^3 and 3115 ha respectively, have been constructed (CoSAERT, 2001). However, the performance of the reservoirs was diminished, and very little has been done in improving the water management practices. Underutilization of the harvested water in the reservoirs due to underestimation of water efficiencies, increased malaria, and other water-borne diseases are among the main problems associated with irrigation management in the area (Leul, op. cit.; MU, op. cit.).

According to results of a reconnaissance visit made by the researcher of this study from September 15/2003 ___ October 10/2003 on 14 community-based small scale irrigation schemes in the area, problems in input and output market, labour shortage on behalf of female-headed households, conflicts over water distribution, significantly varied motivation among irrigators for structure maintenance were observed as problems prevailing in the management practices of the schemes.

This study attempts to find out irrigation management problems in two community-based small-scale irrigation schemes, namely Mai-Nigus and Gum-Selasa (Figure 1), in the upper Tekeze

basin, with particular reference to socio-cultural aspects. The study intends to propose socially desirable and gender-sensitive strategies for effective management of the irrigation systems.

1.3. Study Objectives

The general purpose of the investigation is to assess the socio-cultural aspect of irrigation management in two community-based small-scale irrigation projects in the upper Tekeze basin while the specific research objectives are to:

1. identify irrigation activities that are associated with problems in irrigation management performance;
2. find out socio-cultural contexts that entail management problems in irrigation practices.

1.4. Research Questions

The central question is "How are irrigation practices managed in the two community-based small-scale irrigation schemes?" In order to get the answer to this question, the investigation will be working towards answering the following specific questions.

1. What irrigation activities are associated with problems in irrigation management?
2. What are the socio-cultural contexts affecting management of irrigation practices; and how do they affect them?

1.5. Study Significance and Scope

The study is believed to contribute to the efforts working towards attaining socially desirable and gender-sensitive management options for water; to the initiatives striving to identify better strategies for mixed crop-livestock production; and to the local attempts in environmental protection. These contributions will have application to already irrigated and further irrigable land in the areas, and the ultimate beneficiaries of the research findings are primarily the poor small holders and women.

In light of the fact that irrigated land currently supports only a very small fraction of agricultural production in Ethiopia (MoA, 1998), a country which has been regularly hit by drought, there is doubtless need for irrigation to increase. Hence, this study will also provide a good input at times of planning for future irrigation projects aimed at supporting small holders.

In other words, the study will contribute to:

- more efficient water utilization by the irrigators as a result of efficient and effective management practices;
- mutually supportive crop-livestock production through reasonably integrated crop-livestock mixed farming systems management;
- increase in women's and poor farmers' access to irrigation benefits and supporting services; and
- improved bargaining power of the whole irrigators through organized actions.

CHAPTER TWO

THEORETICAL AND CONCEPTUAL FRAMEWORK

Irrigation occupies a prominent place in the Agricultural Development Led Industrialization Strategy of Ethiopia targeted at attaining rapid national development through pursuing rural development as the core of endeavors. Under this programme, irrigation in most cases is planned to be introduced and implemented in areas where agro-ecological matters are in harmony with the intervention (ADLI doc., 2001). It is unavoidable for such an intervention to come into a kind of social and ecological systems that pre-existed in a certain form, which has its own complex ways of undertakings; and sociological theorization of development and social change has contributed much in conceptualizing the interaction between a kind of intervention and the eco-social system that hosts it.

The two dominant structural models of development ___ modernization and neo-Marxist theory ___ "see development and social change [as] emanating primarily form centers of power in the form of intervention by state or international interests and following some broadly determined developmental path, signposted by stages of development or by the succession of dominant modes of production" (Long and Ploeg, 1994:63). According to modernization theory, development is achieved through increased involvement in markets and through interventionist approaches involving the transfer of technological and material resources and organizational forms from the developed world or sector of a country to the developing parts. In such a way, 'traditional' society is expected to be propelled into a modern one, and gradually, its economy and social patterns acquire the values of modernity. This model admits that there will be some

institutional hiccups in the process, and these are often considered as social and cultural obstacles to change (Ibid).

Whereas neo-Marxist theory, which contains within it a variety of schools of thought, stresses the exploitative nature of the so called 'development' processes (as mentioned in the modernization theory), “attributing [these processes] to the inherent expansionist tendency of world capitalism and to its constant need to open up new markets, increase the level of surplus extraction and accumulate capital” (Ibid: 63). Countries are forced to join the brotherhood of nations on terms determined not by themselves but by their wealthier, and politically more powerful, industrial partners. In essence, the central message of different schools of thought under neo-Marxist theory is “that the patterns of development can best be explained within a generic model of capitalist development on a world scale” (Ibid: loc. cit.).

Despite the fact that they represent opposite positions ideologically and have obvious differences in theoretical trappings, the above discussed structural models of development contain paradigmatic similarities. They “are tainted by determinist, linear and externalist views of social change” (Ibid: loc. cit.).

On the other hand, the actor-oriented paradigm has always been a kind of counterpoint to structural analysis of development. According to the actor-oriented paradigm, social life is not so unitary as to be built upon one single type of discourse, and it follows that, however restricted their choices, actors always face some alternative ways of formulating their objectives and deploying specific modes of action (Ibid.). The linear and externalist conception the structural models have for development a process has no place here. Thus, all forms of external

intervention necessarily enter the existing life-worlds of the individuals and social groups affected and in this way, are mediated and transformed by these same actors and local structures. Of course, large-scale and remote social forces can alter the life-chances and behaviour of individuals, but they can do so only through shaping, directly or indirectly, the everyday practices and perceptions of the individuals concerned (Ibid).

All societies have a repertoire of different lifestyles, cultural forms and rationalities which their members utilize in their attempts to cope up with conditions of life, and which they themselves play a part in adopting or reconstructing. "It is at this point that the individual is transmuted metaphorically into the social actor, which signifies the fact that social actor is socially constructed rather than simply a synonym for the individual or member of Homo sapiens" (Ibid: 67). The values of human agency may seem to be embodied in the individual, but single individuals cannot be taken as the only entities that reach decisions for actions. Capitalist enterprises, state agencies, political parties and church organizations "are examples of social actors: they have means of reaching and formulating decisions and acting on at least some of them" (Hindess, 1986: 115).

As given by Giddens (1984) and Long and Ploeg (1994), social actors are not simply seen as disembodied social categories or passive recipients of intervention, but active participants who process information and strategize in their dealings with various local actors as well as outside institutions and personnel. They attempt to solve problems, learn how to intervene in the flow of social events around them, and monitor continuously their own action observing how others react to their behavior and taking note of the various contingent circumstances (Giddens, op. cit.). In general terms, as social agents, social actors are attributed the capacity to process social

experiences and to devise ways of coping with life, even under extreme forms of coercion (Long and Ploeg, op. cit.).

When coming specifically to irrigation, "Irrigation systems are socio-technical systems, which embrace both social and technical system components and subsystems" (Huppert, 1989:27). In the socio-technical approach, the investigation of irrigation technology is based on a perspective called "social shaping of technology" (Mollinga, 2003:17). This perspective investigates the social dimension of irrigation. According to the same author, the basic idea of the perspective 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" (Ibid.: 17-18). The three concepts comprising the social dimension of irrigation, and providing the basis for defining irrigation systems in terms of socio-technical systems, as given by the above author, are **social requirements for use**, **social construction** and **social effects**.

The concept of '**social requirements for use**' refers to the fact that there are demands created by irrigation technologies on the management structure. In other words, to be put in use, the technologies require management structure of the irrigation system in which they are used. "This means that particular social conditions have to be fulfilled for the technologies to work effectively, and the different technologies require different enabling conditions" (Ibid: 18).

The second concept (**social construction**) can be theoretically formulated and generalized as follows:

> … irrigation technologies are socially constructed. This means that (i) technology development and design are social processes in which different stakeholders interact (communicate, negotiate, take decisions, struggle, etcetera), and (ii) that the nature of the process and the different perceptions and interests of the stakeholders shape the technical characteristics of the technologies [together with the properties of the material used and the nature of the (bio) physical mechanisms involved] (Ibid.: 19).

Regarding **social effects** as a concept of the socio-technical approach to irrigation, the author states that irrigation technologies have social effects. In a more elaborate way, it means that peoples' livelihoods are affected by irrigation technologies because they have effects on crop production, peoples' health, and other things.

The establishment of the socio-technical nature of irrigation being as given above, its analytical framework can be seen as follows. Irrigation systems refer to structurally embedded irrigation activities at different system levels (Mollinga, op. cit.). Uphoff (1986:38-40, 42 in Mollinga, 2003) has distinguished three types of irrigation activities:

1. Control structure activities (design, construction, operation, maintenance);
2. Water use activities (acquisition, allocation, distribution, drainage); and
3. Organizational activities (decision-making, resources mobilization, communication, conflict management).

Like what has been discussed in the actor–oriented paradigm above, "… irrigation activities are not self contained, isolated activities, but they are part of wider processes. There are material and social conditions of possibility [for these activities to exist]" (Mollinga, 2003:23).

The different conditions of possibility for irrigation activities can be generically classified in three categories.

1. The ago-ecological system and technical infrastructure (climate, weather, vegetation, soil topography, technologies other than the irrigation system itself)
2. The agrarian structure (market for labour, land, technology, credit, inputs and outputs, and social relations like class, caste, gender, ethnicity, religion and kinship at household, village/ community and other levels).
3. The state and institutions of the civil society (government line agencies like the irrigation department, the legal system, policy making institutions, development NGOs, social movements, education and training institutes, international donor and lending agencies, local government institutions and others (Ibid, 23 – 24).

The conceptions of Actor-Oriented Paradigm and Socio-Technical Approach are suited to the study theme of this research, hence taken as the conceptual and theoretical models. Irrigation as a new technology introduced to an established community will have to bear the constraints or opportunities of the socio-technical contexts in which the system operates. Normally, social actors acting in such a context carry out intentional and purposeful actions, but their actions are rarely performed in the ways planned. They may not lead to the intended outcomes because they are influenced and modified by each other's actions as well as by the socio- technical arrangements forming the context of their actions.

Irrigation is a major concern in rural development, which is one of the spheres of social life where economic, political and cultural elements markedly overlap (Yeraswork, 2000), especially with reference to agrarian change. Applied to the understanding of agrarian change, the actor oriented approach stresses the importance of giving weight to how farmers themselves shape the patterns of agrarian development. Although their choices are often limited by a lack of critical resources, they are not to be seen as passive receivers or victims of planned change, or are not so simple as to follow laid-down rules or conventions. They devise ways of dealing with problematic situations and creatively combine material and non-material resources, especially practical knowledge driven from past experience in order to resolve such situations (Long and Ploeg, op. cit.). They also try to bring in their own interests so that they might benefit from, or, if need be, modify intervention by outside groups.

Therefore, irrigation projects initiated by external agencies enter the existing social context (I drop other contexts here as my study theme deals with management from the socio cultural point of view) where the farmers' projects from experience are operating dominantly with their own objectives. "Irrigation management… in the organizational sense, thus, is about the regulation and control of human behavior, particularly with regard to the forms of cooperation necessary to make irrigation systems function" (Mollinga, op. cit.: 36).

Thus, irrigation activities and conditions of possibilities, which are related to the organizational human behavior in terms of irrigators in the study schemes and their immediate environment, are concerns of assessment to this study. They include

construction, operation, maintenance, water allocation, water distribution, decision making, resource mobilization, communication, and conflict management, markets for labour, land, supporting services (credit, savings, and extension), inputs and outputs, gender, ethnicity, religion, development NGOs and local government institutions.

CHAPTER THREE
REVIEW OF RELATED LITERATURE

3.1. Irrigation Categories

Irrigation development could be defined as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping (EVDSA, 1996). Regarding the ways of supplying water, flood irrigation, furrow irrigation, sprinkling or spray irrigation and drip irrigation are identified (Nigussie, 2002). With respect to the area irrigated, scale of operation and type of control or management, irrigation is categorized either as small, medium or large scale (Seid, 2002). Irrigation may also be categorized using other criteria such as ownership, economic objective and modernity.

Although tank irrigation, small dam irrigation and shallow or deep tube well irrigation are generally termed as small-scale irrigation schemes (Smith, 1998), some considerations of the criteria of classifying irrigation in terms of scale may vary from country to country. For example, In India an irrigation scheme of 10,000 hectares is classified as 'small' while in Ghana, the largest irrigation scheme is 3000 hectares (Smith, op. cit.). However, in most cases, large-scale schemes are formally planned and typically managed by government departments delegated with necessary authority for fairly comprehensive control while small scale schemes are mostly user managed (Dessalegn, op. cit.; Seid, op. cit.).

Dessalegn (1999) gives the three-scale classification adopted during the Derg in Ethiopia as follows. Large-scale irrigation schemes are those which have over 3000 hectares of area. Medium- scale schemes cover an area of 200-3000 hectares while small-scale irrigation schemes involve those with total area of up to 200 hectares. Dejene and Yilma (2003) confirm the definition that small-scale irrigation is an irrigation project set up on a command area of up to 200 hectares.

3.2. Institutions for Irrigation Management

The terms 'Institutions' and 'organizations' are often used interchangeably. However, some writers maintain some difference between the two concepts. For instance, Synne Movik (1999), citing Uphoff (1986), writes, "An organization comprises structures of actors bound by a common purpose." On the other hand, he defines institutions as complexes of rules, norms and behavior that exist over time, because they are valued as well as useful.

Hayami and Ruttan (1985) define institutions as the rules of society or organizations that facilitate coordination among people by helping them form expectations, which each person can reasonably hold in dealing with others. According to Pejovich (1995), institutions are legal, administrative and customary arrangements for repeated human interactions. For Nee, institutions, defined as webs of interrelated rules and norms that govern social relationships, comprise the formal and informal social constraints that shape the choice set of actors (Nee, 1997 in Dejene, 1997).

Others provide a broader definition to the term 'institutions', and maintain that institutions comprise not only the arrangements of rules, norms and customs but also the organizations providing these arrangements. Nabli and Nugent (1989a), for example, say that formal organizations such as labor unions and employers' organizations are institutions because they provide sets of rules governing the relationship both among their members and between members and non-members. Clague further maintains that broadly defined, institutions can be organizations or sets of rules within organizations (Clague, 1997). However, an adhoc group that forms itself to achieve a single short-term objective and then dissolves is not an institution (Merrey, 1997).

From the above, it may be observed that an organization is not necessarily an institution, and vise versa. An organization is taken, as an institution when it provides social constraints that shape the choice set of actors in a form of legal, administrative or customary arrangements that exist over time for they are valued as well as useful. Thus, the term 'institution' refers to both such organizations and the sets of rules governing the social relationships.

Strong local level development organizations comprising both governmental organizations and non-governmental organizations, cooperatives, credit and saving groups, community-based organizations, and self-help groups are critical generally in local level social development (Alila, 1998 in Tegegn and Asfaw, 2002). "The role of organizations becomes even more crucial when government services and market resources are not accessible to all members of the community" (Tegegn and Asfaw, op. cit. :26). In such cases, the community must have its own organizations which are capable of initiating their own projects to replace or supplement the

services delivered by the government and market, and provide the resources and services needed in the community.

There is a growing body of evidence that such organizations are productive. For instance, among the different World Bank Projects, the success of the Muda irrigation Project in Malaysia was attributed to the grass-roots institutional development which carefully and patiently established the water users' organization while the negative rate of return in the Hivini agricultural development project in Benin was mainly caused by the disintegration of the network of cooperatives that had been designed as the institutional support project promoted activities (Cernea, 1987). The World Bank Study of 25 completed agricultural projects reported by the same author found local grass- roots organizations to be a prime factor contributing to the long term sustainability of project benefits, while their absence was identified as an important cause of non-sustainability (Uphoff, 1991). Further more, Greenhill (1995), in a study of Brazilian Coffee, demonstrates that institutions improve efficiency by reducing uncertainty in exchange arrangements. Seid (2002), in his local study for M.A thesis, reports that poor coordination between institutions dealing with irrigation development in three schemes in North Wollo has resulted in management failure.

Irrigation systems are highly interdependent as the ability of individual farmers to appropriate water is greatly influenced by the behaviour of other farmers in the area. Where irrigation water serves more than a single person, patterns of social interaction govern the use of those facilities (Coward, 1991). Here comes the importance of "**social requirement for use**" as a concept of the socio-technical approach. Realizing that irrigation water is a community property, and, therefore needs communal management, can become the impetus for farmers to organize

(Pradhan, 1992); and community management of irrigation often involves the formation of organizations of formal user groups known as Water Users Associations, or WUAs (Gyasi,2003).

Most of the new initiatives for forming WUA's and management strategies do not evolve from the traditional systems. Instead, the structure of WUA's is largely imposed by government agencies and the donor community (Ibid.). The long-run sustainability of these institutions often remains questionable. In general, it seems desirable to use existing local organizations. If existing organizations are insufficient or inadequate for the purpose, careful analysis should lead to the design of facilitating organizations congruent with local culture (Cernea, 1991).

Institutions for governing irrigation usually have some basic features in common. Meinzen Dick and Cernea (1994), state that the common features found in many successful institutions for water management have been those of: role specialization, i.e., the members of the management committee having clear duties and responsibilities that pertain only to their position; accountability – the organization is accountable to its members and federations, if there are any. The organization design must provide specific means to fulfill the four functions of any irrigation organization: non-routine construction and rehabilitation; water allocation and proper disposal of unused water; routine maintenance, and management of conflicts (Freeman and Lowdermilk, 1991).

The power of any organization lies in the agreement among members that rewards and punishments will be employed in certain specific ways to get members to do what they would

not do if detached from the network. The joint agreements about the use of rewards and punishments in the collective interest are critical for at least two reasons:

1. such agreements on joint action constrain brute coercive force
2. they constrain the use of money to its proper sphere in the market place and prevent it form unjustly distorting the distribution of non-market resources through corruption, connections and political exchange

(Ibid: 123).

As a formal institution, the WUA's will have organizational charter, which must be defined and accepted by the users of the irrigation before operation begins. According to Freeman and Lowdermilk (1991), it is always disastrous to proceed with the physical technology to get the water flowing with only vague notions about what joint agreements should be devised for rehabilitation, allocation, maintenance, and conflict resolution. The reason for this is that when water flows, some farmers are in better initial positions than others to take advantage of the resource. They quickly employ their good fortune to consolidate disproportionate advantages, and then oppose later attempts to reform the situation usually with success because of their hold on critical resources. The same authors add that the social organization of an irrigation system must provide for a local council or water court capable of adjudicating the interests of members and managers. This judicial council must interpret and apply organizational rules in specific cases of conflict and then pass on its interpretations to organizational executives for implementation. Members of the council should be from the local community; and access to the council must be cheap, quick and easy (Ibid).

Water users' associations are usually responsible for matters related with water allocation, water distribution, maintenance, and conflict management. However, these are not the only issues to be managed in irrigation. Matters like those with input and output marketing conditions are decisive for success. Thus, a further strengthening of water users' associations so that they can accomplish the management of such issues, or else, establishment of independent cooperatives is critical.

3.3. Community-Based Irrigation and Property Rights

Water, as used for community- based irrigation, is a common resource pool; and its users are, thus, interdependent. The interdependence of irrigation users creates an environment in which each user loses a little bit of his or her individual control over farm practices (Bromley, 1982). "As control over water diminishes, farmers find it necessary to use increasing quantities of water whenever it is available to meet minimum crop needs," (Freeman and Lower milk, 1991). This results in inefficient water utilization eventually leading to over irrigation and associated problems.

Garrette Hardin's (1968) concept of "Tragedy of the commons," in which rational beings seek to maximize their own benefit at the cost of the community, remains the dominant paradigm of overexploitation of common property resources as a consequence of common ownership. Common or collective ownership, in this context, implies a lack of well-defined property rights of the co-users (Singh and Ballabh, 1996). "A right is the capacity to call upon the collective stand behind one's claim to a benefit stream," (Bromley, 1991:15).

According to Yeraswork (2000: 18-21), there are four major types of property rights regime:

1. Absolute Private Property Rights Regime-

> Under this regime, the rights of the owner are to a great extent specified, completely exclusive, transferable and enforceable…. The owner can by and large put to use his asset in any way he chooses while more or less completely excluding all others.

2. Modern Associational or Collective Rights regime –

> An association, whether professional, occupational, religious, local communal, etc., entails distributed rights and rights on multiple levels:
>
> i) the rights of the group or the association as a whole to exclude non-members and other collective agents from access to group property;
>
> ii) the rights of individual members to obtain allotments and/or use of association commonage.
>
> In the case of allotment, the individual has the right to exclude even other members from his [/her] allotment while at the same time enjoying the right, like the others, of access to the commonage.

3. Customary Communal Property Rights Regime-

> This regime is based on inalienable … rights shared by members of a social group_____ usually a decent group _____ that are normally defined and enforced by custom, with a local authority exercising administrative rights.

4. Public Property Rights Regime-

> Here, the state or local government is the primary agent, a type of guardian. Certain rights of control are concentrated in a " public representative" or the state….

In the past, there reigned a deep-rooted pessimism about preserving common property resources other than through centralized state control or privatization (Hardin, 1968 cited in Synne Movik, 1999). The property Rights School (PRS) economists strongly argued in this line. They said that it was unlikely that collective owners of a common property resource could reach an agreement that would lead to optimal long-term use. Hence, they concluded that the most efficient way for dealing with the problem of externalities is internalization through the creation of exclusive private ownership rights (Demsetz, 1967; Johnson, 1972 cited in Yeraswork, 2000).

However, recent years have emphasized the merits of community-based management, thus constituting something of a reversal of the previous thinking. Currently, local control in irrigation and water management schemes is widely held as being the preferable strategy _____ in contrast to state control or privatization _____ to avoid the tragedy and externalities portrayed by Hardin and PRS economists (Blair, 1996).

The ardent opposition on the 'tragedy' concept focuses upon Hardin's and the PRS economists' failure to distinguish between open-access and common property regimes. The opposing school of thought maintains that common property regimes are not synonymous with open-access in which the resource is nobody's property. Thus, the counter argument to the 'Tragedy' parable holds that

1. the common property regime denotes exclusivity of rights for a bounded group which it exercises over a well delineated object, to the exclusion of all outsiders save for its invitee; and
2. the bounded group has a social mechanism for regulating the utilization of the commons and for sanctioning its regulations(Yeraswork,2000, 51).

It is commonly argued that individual actors are tempted to overexploit commonage when they are uncertain regarding each other's actions in terms of utilizing it. Thus, adoption of co-operation becomes a necessity. This calls for institutionalized control strategies or social controls that emerge in or are devised by groups to prevent or resolve collective action problems (Burns, et. al. 1985). There is a common argument that collective action is possible when the problems of free riding and lack of trust are resolved through the advent of enforceable rules or institutions.

3.4. Community-Based Irrigation and Popular Participation

Activities like operation and maintenance of an irrigation system requires commitment, coordination and collective action on the part of the user group (Tang, 1992; Gyasi, 2003). These tasks as part of local-level development program can be promoted by the efforts of the formal and informal institutions at the local level and popular participation at the grassroots level, within a broader frame of decentralization that strengthens and empowers these institutions (Tegegne and Asfaw, 2002). Oakley and Marsden (1984) give the following list of definitions or interpretations of participation.

1. Participation is a voluntary contribution by people;
2. Participation is a means to increase the receptivity and ability of people to respond to development programs, as well as to encourage local initiative;
3. Participation is the active involvement of people in decision making processes;
4. Participation is an active process, by which a person or a group takes the initiative and asserts its autonomy to do so, and
5. Participation is an organized effort on the part of excluded groups to increase control over resources and regulative institutions in given social conditions.

On the concept of participatory development, Yeraswork writes the aggregate of the above views and gives three strands of thought ____ the *Mobilist*, the *Instrumentalist* and the *Radical* models of participatory development. According to this author,

> The Mobilist model (1 and2, above) conceives people's participation in development in terms of their material and labor conditions [contributions].

> According to the Instrumentalist view (3 above), popular participation is to be sought mainly for its instrumental value in raising the efficiency and the probability of success of development projects and programs. …, instrumentalists hold that people's participation is to be sought on the grounds that it can help the job done (Hopgood, 1969; Montgomery, 1988; Uphoff et.al., 1979).

> According to the Radical model (4and 5 above), on the other hand, participation … is not merely a means of making existing programs and projects efficient, but more importantly, a process by which capabilities are enhanced for further and more meaningful participation. [For these people, participation is a means in itself] (Yeraswork, 2000: 37-38).

In participatory development planning, man is conceived not as recipient of pre-planned project; rather he is seen as a knowing subject capable of achieving a deepening awareness of the sociological reality, which shapes his life and his capacity to transform the reality (Gran, 1983 cited in Dejene and Yilma, 2003). Hence, empowerment has become a central concept conveying a fuller meaning of people's participation as given by the radical view advocates in the above discussion (Yeraswork, 2000; Dejene and Yilma, 2003). This is because empowerment creates conditions for self-reliance and sustainable development.

A comparative impact study on participatory and non-participatory irrigation systems in Philippines indicated that in the participatory systems, substantial benefits were reaped from the small investment in institutional activities, including more functional physical structures, greater increases in rice yields, larger increases in dry season irrigated areas, and stronger irrigators associations (Bagadion and Korten, 1991).

Thirteen out of twenty-five World Bank financed projects were found to be non- sustainable (according to a re-evaluation). Among the primary reasons for their non-sustainability were factors of a socio cultural nature (mainly the lack of farmer organizations and participation) neglected during project formulation and implementation (Cernea, 1991). Such examples

confirm with economic facts that financially induced growth interventions stand a high risk of being less effective than well planned ones, or of failing altogether, if they neglect to build up the socio-cultural structures like popular participation for development.

CHAPTER FOUR

METHODOLOGY

4.1. Study Design

The universe of inquiry for this study includes two community-based small-scale irrigation schemes in the Upper Tekeze Basin, and their communities (Figure 1). The researcher found the case study design to be suitable for the investigation. In line with this, the process of study employed both qualitative and quantitative research methods, in which the schemes have been chosen on the bases of their long service experiences (both with above seven years' service). The relevance of service experience for site selection is in relation with the fact that, for some kind of management to be assessed, there should be some experience in which the kind of management has operated. Household typology was developed on an inclusive criterion that encompassed socio- economic conditions, and sex of household head.

4.2. Data Collection Methods

Both primary and secondary data have been gathered and used for the study. The secondary data included information mainly from formal sources. Documents from formal institutions like REST, CoSAERT (now Regional Bureau of Water Resources Development), Regional Bureau of Agricultural and Natural Resources Development, Regional Bureau of Finance and Economic Development, Tigray Agricultural Research Institute, and 'tabia' centers have been assessed for general and background information about the study sites. Different literature from different

sources has been gathered for information related with the theme of the study. The primary data sources included key informant interviews, focus group discussions, and household interview survey.

The first step in the data collection task was a rapid reconnaissance, whereby the researcher has been able to form scheme typology, and familiarize himself with the study area. Key activities done during reconnaissance were looking for available documents on scheme service and performance, identifying key informants for further use and stratifying schemes on age of service and performance bases. The researcher used his summer vacation time for reconnaissance, in which he gathered general information about community based small-scale irrigation schemes in Tigray, and visited 14 schemes in the Upper Tekeze Basin. The following information was gathered as major findings of the reconnaissance visit.

- There have been both well performing and poorly performing schemes in the study area, as reported by experts in the study and design department of Tigray Regional Bureau of Water Resources Development (the former CoSAERT).
- Eight or more typical schemes could be identified in terms of each of well and poor performance parameters.
- When further investigated by the researcher through field visits, the parameter "poor performance" attributed to some schemes by the irrigation experts was found out to be mainly because of water shortage or its outright lack.
- According to village elders from scheme using communities, there were people who lost their farmlands or were dislocated from their ancestral residences during the construction of micro dams.

- ✶ It was observed that labour shortage on behalf of female-headed households, conflicts over water distribution, varied motivation among irrigators for infrastructure maintenance, problems of output and input market, less interest to engage in irrigation practices (by some users), and a general shift to increased production of maize instead of vegetables proposed for irrigation cropping were prevalent in the performances of the schemes.

The reconnaissance step comprised methods of secondary data reference, key informant interviews and focus group discussions.

The second step was conducting second round key informant interviews and focus group discussions at each scheme. The key informant interviews and the focus group discussions gave the researcher a general picture of the affairs pertaining to the theme of the study like the history of the farming systems before and after irrigation introduction and management practices of the irrigated system. Moreover, some activities at this step provided relevant information for household typology development.

Lastly, household survey was conducted. Thus, the data collection methods have been triangulated into four forms: secondary source reading work, key informant interviews, focus group discussions and household interview survey.

4.3. Sampling Design

Purposive sampling and two-stage stratified sampling techniques have been employed as the major methods of sampling. In addition, random sampling methods have been used to draw sample households for interview survey from the two-stage stratified sampling frame.

The purposive sampling techniques have been used for the selection of schemes, key informants and focus group discussion members. The selection of the schemes depended on the data from reconnaissance results. During his reconnaissance visit, the researcher had discussions with Agricultural Experts, Development Agents and irrigation users with reference to each scheme visited. The schemes visited are spatially distributed along the region. The two schemes selected for the study are Gum-Selasa and Mai-Nigus (Figure 1).

For the key informant interview, the agronomist or irrigation expert from each Woreda Agricultural Office, the PA chairperson, one 'Abbo-Mai' (see glossary for meaning) and the head of water committee, two irrigation users initially affected because of dam construction and a development agent working on irrigation development at the 'Tabia' of each scheme have been met.

Regarding the focus group discussion, village elders (6 males and 6 females), who were believed to be knowledgeable about the pre–irrigation and post-irrigation circumstances of the village including the socio-economic conditions of the community were identified and included in the discussion. Separate sessions of discussion were arranged for male and female household heads so that the groups should be able to speak out their feelings freely and more comfortably.

Each group included 2 individuals from each of the higher, middle and lower socio-economic status of the community. Three of the six individuals in each sex category were from irrigators presently using irrigation whereas the other three were from farmers having land in the command area but not presently using irrigation because of water shortage.

The selection of sample population for the household interview was carried out through two-stage stratified sampling followed by the random sampling technique. The list of irrigation users at each scheme (presently) was used as a sampling frame, and the users were first stratified by sex of household head and then categorized as 'higher,' 'middle' and 'lower' in terms of their socio–economic conditions. To do this, after a brief talk with village elders and authorities, the elders were asked to rank each household as with higher, middle, or lower socio-economic condition.

For classifying households in terms of socio-economic conditions, the elders used livestock number and type as main criteria. The criteria in both communities were almost the same. Thus, the classification and its criteria were as in the following in Table 1.

Table 1: Household classification criteria in terms of socio-economic conditions

Socio-economic condition	Number of Oxen	Number of Cows	Number of Donkeys	Remarks
Higher	> 2	> 3	$\geq$ 2	May Have Camel/s
Middle	$\leq$ 2	$\leq$ 2	$\leq$ 1	
Lower	1 or none	1 or none	None	

Elders also pointed out that almost all female-headed households fall in the lower socio-economic condition. Therefore the classification for female-headed households was carried out by comparing them among themselves.

Now that the households have been stratified down to the desired two stages (in terms of sex of household head, and socio-economic condition), a total of 50 irrigation user household heads (15 female and 35 male) were selected from each scheme through random sampling (the lottery) method. Thus, the total sample size of the household interview survey was 2 x 50 = 100.

This sample size was based on the researcher's intention to include at least 20% of the irrigation using household heads in the sample population. The total number of households using irrigation at Mai-Nigus this year is about 250, and that of the Gum-Selasa users is about 200. Hence, 20% of the 250 users at Mai-Nigus are 50, but 20% of the 200 Gum-Selasa users becomes 40. Instead of taking this exact calculation, the researcher found it more useful to increase the percentage for Gum-Selasa up to 25%, and make the sample size from each scheme 50, as this kind of difference in irrigators' number is only seasonal, not permanent.

Having done this, the share of female-headed households in this number was worked out according to their total number in the number of users. The total number of irrigation using female-headed households in Mai-Nigus this year is 77, which is about 30% of the total number of users. In Gum-Selasa, the total number of female-headed household users this year is 65, which is about 32%. Therefore, the researcher decided to include 30% of female household heads in the whole sample population.

The total sample size for household interview survey, its selection criteria, and sample allocation to the criteria have been summarized in Table 2.

Table 2: Total sample size for household interview

Sex of Household Head		Socio-Economic Conditions			Total	
		Higher	Middle	Lower	N	%
Male		21	24	25	70	70%
Female		10	10	10	30	30%
Total	N	31	34	35	100	100%
	%	31%	34%	35%	100%	

4.4. Instruments

Semi-structured interview questionnaire with sufficient room for probing "second generation questions," a detailed interview guide with a complete list of topics to be covered, and structured interview survey questionnaire, all organized in a logical order of presentation have been used as instruments of data collection. The semi-structured interview questionnaire was used for key informant interview whereas the interview guide for focus group discussion and the structured questionnaire for the household interview survey.

For the purpose of mediating key informant interview and focus group discussion, two interpreters (one male and one female) were recruited on the bases of command of Amharic, English and the local language (Tigrigna), knowledge of the local people and their ways of life as well as relevant knowledge of the study theme. Likewise, for the purpose of gathering

household interview survey data, four enumerators were recruited using similar criteria. Both the interpreters and the enumerators were trained how to handle their jobs.

In addition, both the key informant interviews and the focus group discussions have been tape-recorded. The interview survey questionnaire was translated into Tigrigna for administration.

4.5. Data Analysis

The data gathered have been analyzed in terms of the study objectives already designed, and the findings have been considered at each methodological level first. The findings from household interview survey have mostly been seen in an aggregated form of the two schemes'. These in turn, have been seen in relation with the focus group discussion and key informant interview results. Finally, the whole aggregated and synthesized results have been used for the inference of the conditions in the schemes.

The process of analysis has been carried out by using qualitative description and descriptive statistics. The portion of data that is readily quantifiable (information from the close-ended questions of the questionnaire) has been entered into the SPSS program and the output has been discussed using tabulation and cross-tabulation of variables with percentage values in descriptive statistics. Readily non-quantifiable data (information from open-ended questions, key informant interviews, and focus group discussions) have been discussed through qualitative description.

CHAPTER FIVE

THE STUDY AREA

5.1. Gum Selasa

5.1.1. Location

Gum selasa is located in the southern administrative zone of Tigray, in the woreda called Hintallo-Wajerat. It is at an altitude of 2061m above sea level, situated at 4 km east of Addi-Guddem (the woreda capital), which is 39 km to the south of Makale on the Addis Ababa-Makale road (Woldeab, 2003: 85). The Gum-Selasa irrigation system encompasses parts of the territories of Addi Guddem, Hidmo (Alemsegeda) and Arra communities (Figure 1).

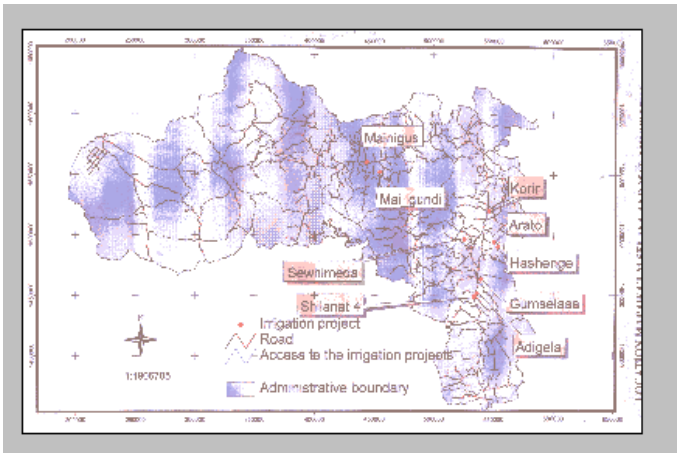

Figure 1. Location of the study area.

5.1.2. Rainfall

In general, two rainfall seasons can be distinguished in Tigray: the 'Belg' or small rains, which generally occur from March till May, and the ‘kiremti’ or big rains that take place from July to September. Irregularity of the rainfall distribution within a growing season and the variability of

the onset of the rainy season are main constraints for the dry land crop production (Mintesinot, 2002). Drought periods of several weeks during the rainy season are also frequent and affect the final yield of crops largely. Rainfall at Gum selasa area tends to be unimodal with more than 85% of the rain falling within the period of four months from June to September. The yearly average is 511mm (Figure 2).

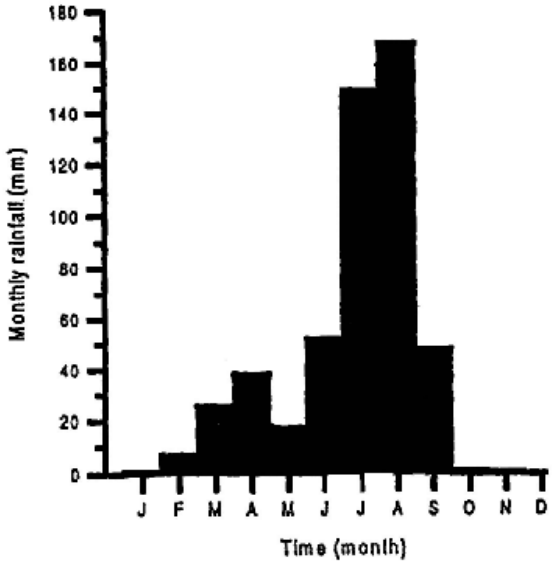

Figure 2: Average monthly rainfall for Addi-Guddem (18 years)

Source: Addi-Guddem meteorological station adopted by Corbeels, et. al. (1998)

5.1.3. Command Area History

The construction of the Gum-Selasa micro dam was completed in 1995 (Mintesinot, op. cit.). The dam axis has a length of 400m and a height of 13.5 m with a water holding capacity of 1.92 million m^3 and was designed to irrigate 120 ha of land (SAERT, 1996).

The presently inundated area was mainly cultivated land, and a small part of it was an area where livestock used to graze and drink water. The cultivated land belonged to 83 individual peasants from Arra community whereas the water point and the grazing land were communal. The presently irrigated area was also cultivated land where 78 individual peasants from both Arra and Hidmo communities practiced rain-fed agriculture. Whereas the total command area initially proposed for irrigation (the 120 ha) was under rained agriculture used by 368 peasant farmers from all the three communities (Tibebu et. al., 1999, Woldeab, op. cit.). Table 3 shows the land holdings of each community in the command and reservoir areas before dam construction.

Table 3: Breakdown of Land Holdings of each tabia in the command and reservoir areas before the construction of the Gum Selassa Dam

TABIA	Description of area	Number of land holders	Plot size range (tsimdi)	Average plot size (tsimdi)	Total area (tsimdi)
Arar	Reservoir	83	1- 6	3.5	285.5
Arra	Command	55	0.5- 4	2.1	112.5
Alem segada [Hidmo]	Command	90	n.d	2	176.3
Addigudem	Command	140	0.5-2.5	1.2	161.0

Source: Bedini, et. al. (1996:5) in Woldeab (2003: 88)

n.d = not determined **1 tsimdi ~ 0.25ha**

At the beginning, the regional government set up a five-man committee in order to develop guidelines for land reallocation and the selection of irrigators in two systems, namely Gum-Selasa and Adha (Woldeab, op. cit.). The study committee carried out a land holding inventory to identify the size of individual land holdings and the number of farmers who were cultivating land in the reservoir and command areas prior to the construction of the micro-dam.

- The committee (Bedini, et al. 1996:3-4) made the following key assumptions to determine the upper and lower limits to irrigable plot size that a household could cultivate.

- Input requirement for irrigated crops should include: seeds, labour, draught animals and inorganic fertilizer;
- A household was composed of 5 people;
- Rain fed land holding was 3 tsimdi;

- Minimum annual grain requirement for a family of 5 was set at 11.5 quintal[s]
- The household would directly utilize [sic] all of its land, i.e. would neither sharecrop nor rent out land (emphasis added.)

The committee recommended that a minimum of 0.2 ha and a maximum of 0.25 ha of irrigable and 0.75 ha of rain fed plot should to [sic] be allotted to [a] farmer to achieve food security at household level (ibid: 6). The regional government approved 0.2 ha irrigable land and 0.75 ha rainfed to a household (Woldeab, 2003: 88-89).

According to the same author, the command area initially planned for the Gum-Selasa irrigation system was 120ha. This area was thought to be divided among 600 farmers by using a 0.2 ha land allocation to a household criterion. Two groups of potential irrigators were identified by the study committee: the 368 farmers who lost land in the reservoir and command areas, and farmers who cultivated land close to the irrigation system. The latter group comprised 232 farmers from Addi Guddem tabia, who were believed to have the ability to indirectly compensate the losers from Arra and Alem Segeda (Hidmo) tabias with the 0.75 ha rain fed land (Ibid).

For the implementation of the redistribution, a new committee at woreda level (chaired by the woreda administrator) was established. Using a lottery system, this committee carried out the redistribution of 110 ha land pooled from the three tabias to 550 farmers in the first round. The rest 10 ha land was to be distributed to the remaining 50 farmers in a second round. In this process many, who had land in the reservoir and presently irrigated areas were made to get land in the remote tail-ends of the system, which are lands of Hidmo and Addi Guddem people. In

the reverse, many farmers who had land in the remote tail-end parts of the Hidmo and Addi Guddem lands were made to get land in the presently irrigated area.

In the beginning the people opposed the introduction of irrigation assuming that the government would take their lands. More over, as these farmers did not have prior experiences in irrigation, they complained that the 0.2 ha land would not be adequate for agricultural production (Ibid). As a result, they claimed their rain fed land, which was bigger in size. The average rain fed land holding of a household in the three tabias was 1.6 ha for Arra, 1.23 ha for Hidmo, and 0.85 ha for Addi Guddem (Bedini, et. al., 1996 in Woldeab, op. cit.).

> Thus it was not an easy task for the land redistribution committee to 'convince' the farmers. There was a strong opposition particularly from farmers in Edmo [Hidmo] Kushet. The committee had several meetings with the displaced ferments over a period of one month to get them to accept the irrigation project and land redistribution. In the meetings farmers opposed the inclusion of farmers from Adigudom tabia in the intended irrigation system. The option of inter-tabia compensation and land allocation could exclude farmers of Adigudom tabia . This was due to plot size in Adigudom, both in the rainfed and command area, being on average smaller that [sic] those in the other two tabias and so having little capacity to compensate (…)?. Another reason for this exclusion springs form Adigudom being in a separate tabia from that of Arra and Alem segada [Hidmo] under the new political boundaries. This would imply that Adigudom would not bear any of the costs of compensation (ibid.) (Woldeab: 2003: 90).

5.2. Mai-Nigus

5.2.1. Location

Mai-Nigus micro-dam is located in the central administrative zone of Tigray, Lae-lay Maichew woreda, Dura 'Tabia'. Geographically, the site lies between latitude of 14^0 07' 00" and 14^0 09' 20" N, and 38^0 38' 00" and 38^0 49' 09" E longitude about 7 km west of Axum (the zonal capital) on the all weather gravel road leading to shire (the capital of the Western Administrative Zone). The elevation at the dam axis is 2080 m above sea level.

5.2.2. Rainfall

Mai-Nigus area has a unimodal rainfall pattern, in which the main rainy season is during the period from June to August. The remaining months are dry (Makale University, 2003). The mean annual rainfall in the area is 662.7mm (Table 4).

Table 4 : Monthly Rainfall Average in Mai-Nigus Area

	Months											
	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall(mm)	6.7	3.1	17.9	27.6	25.5	60.6	227.7	211.3	47.4	14.8	19.1	1.3

Source: Axum meteorological station as adopted by CoSAERT, 1999 (Soils and Agronomy Feasibility Study Report on Mai-Nigus scheme

5.2.3. Command Area History

The Micro-dam with water holding capacity of 2.38 million m^3 was constructed in 1995. The reservoir was believed to irrigate 123 ha of land under full season irrigation making 615 households beneficiary (CoSAERT, 1999: Soils and Agronomy Feasibility Study Report). Originally, the Mai-Nigus river (now draining into the reservoir) served as source of potable water, water for washing clothes and water for traditional irrigation. Out of the total inundated area, about 15.5 ha was cultivated land used by 70 households. Of this about 4 ha was under traditional river diversion irrigation. Moreover, 10 households were displaced from their residence due to reservoir construction. Eight of these people got urban residential land in Axum town and the rest two were given wheat and agricultural land in the 'Tabia' as compensation.

Like the case in Gum-selasa mentioned above, the irrigable land portion of the scheme, which originally belonged to individual peasants was divided into more than 600 parts, and each household was give 0.2 ha of land. The rain-fed agricultural land was redistributed by using household size, age of household members and land fertility as criteria. Here, the difference of the irrigated land redistribution in Mai-Nigus from that of Gum-selasa was that land in Mai-Nigus was redistributed among the original community members; no irrigators from other communities were given land and no members of the Mai-Nigus (Dura) community were made to leave the original land of their community and have it from other communities' land.

5.3. Common Features

5.3.1. Agro-Climatic Zoning

Agro-Climatic Zones are determined by temperature and moisture regimes. Because of high correlation between temperature and altitude, the thermal zonation in Ethiopia is in fact an altitude zonation (Corbeels, et. al., op. cit.).

According to the local classification, the areas of Gum-selasa and Mai-Nigus belong to the 'Woyna Dega' agro-climatic zone. The altitude for this zone differs slightly according to different sources, but in general it ranges between 1500 and 2300 m (De Pauw, 1998). The zone has a single short growing period, adequate to meet the full water requirements of short maturing crops in most years, but with a substantial risk that subnormal rainfall may result in end-season drought and yield reduction. The growing period extends from 3 to 3.5 months (Ibid.).

5.3.2. Potential Evapotranspiration

Evaporation rates in the two sites remain high during the dry period. Rain fall exceeds potential evapotranspiration only in two months of the year, i.e, July and August (Mintesinot, op. cit.; Leul, op. cit.). The evapotranspiration varies little from one year to another, especially in the dry

season. It is known to be largely determined by solar radiation, which is also fairly constant between years.

5.3.3. Farming Systems

A. Rain-fed Agriculture

The areas of Gum-selasa and Mai-Nigus have mixed (crop and livestock) farming system with emphasis on subsistence crop production. During the 'Belg' season, the rains are very rare, and farmers mostly use these rains for land preparation. During 'Kiremti,' the main rainy season, farmers mostly grow cereal crops such as teff, barley, wheat, maize and millet. Legumes are also grown. Crops are harvested starting from mid October. This cropping pattern is mainly based on the feeding habits of the farmers and limited farm land size (CoSAERT, 1999: Soils and Agronomy feasibility study Report).

B. Irrigated Agriculture

Mixed farming system characterizes irrigated agriculture, too. As farmers can grow crops twice in the irrigation sites a year, they have to prepare two different seedbeds relatively in short period of time. Most farmers start seed bed preparation for the irrigated crops in the early December. By the end of December or the first week of January, all tillage operations for the irrigated crops are completed.

Most of the crops proposed for irrigation production by project designers are cash crops, especially vegetables. This is because there has been a belief that there exists great demand for such crops in nearby towns. According to soils and agronomic feasibility study report (CoSAERT, 1999), the farmers must give priority to cash crops. This indicates that the recommendation is fully based on an assumed demand of urban consumers, not on farmers' demands.

Table 5 shows types of crop proposed for dry season irrigation production and their percentage area coverage.

Table 5: Crop types proposed for dry season irrigation production and their percentage area coverage

Crop Type	Percentage of Area Coverage
Onion	25
Pepper	20
Cabbage	10
Tomatoes	20
Maize	15
Field peas	10

Source: Soils and Agronomy Feasibility Study Report (CoSAERT, 1999)

The Soils and Agronomic Feasibility Study Report (CoSAERT, 1999) further recommends the following procedures for preventive maintenance of the irrigation schemes to be carried out regularly.

1. Desilting and weed removal of secondary canal would be 4 times in a year (at beginning and end of irrigation season.)

2. Desilting and weed removal of tertiary and field canals 6 times in a year (every 3 irrigation term).
3. Desilting and weed removal of field drains 6 times in a year (every 3 irrigation term).
4. Upstream and downstream stone protection of irrigation structures to be inspected and maintained twice in a year (at the beginning of wet and dry season irrigation).
5. Cleaning of gates and groves, greasing of structures, and refilling of voids to be done twice in a year (at the beginning of dry and wet season irrigation).

5.3.4. Irrigation Management practices

Operation, maintenance and water distribution activities are controlled by a local water committee under strong dictation of government agricultural extension workers. The committee comprises a total of 9 persons, four of whom are responsible for the governance of every day practices. The committee members are elected from among the beneficiaries by the beneficiaries. The committee has a formal meeting twice a month and can call a meeting once in a month for all water users (Mintesinot, op. cit.).

There is a system of punishment for users when they fail to respect regulations.

The following pattern of punishment has been developed (Mintesinot, 2002) .

1. 10 birr for those who are absent in a meeting;
2. 20 birr for those who are found repetitively damage furrows;
3. 30 birr for those who do not prevent their cattle entering the irrigated fields, and

4. 50 birr for those who break irrigation turns or who divert water to their fields by breaking canal.

CHAPTER SIX

DATA ANALYSIS AND INTERPRETATION

6.1. Irrigation Activities

6.1. 1. Construction and Operation

The results of focus group discussions, key informant interviews and data from secondary sources indicate that the construction of the Gum-selasa and Mai-Nigns community based small-scale irrigation schemes was initiated by CoSAERT (Commission for sustainable Agriculture and Environmental Rehabilitation in Tigray) under coordinated action with the Tigray Regional Bureau for Agriculture and Natural Resources Development and the Woreda Agricultural Ofices. After the sites had been identified among the areas that were found to be suitable for construction of reservoir micro-dam in the whole region and other official works have been carried out, the communities were contacted and asked to give their representatives for the purpose of deciding exactly where to construct, how to deal with matters of asset loss, compensation and resource mobilization.

The representatives discussed with the project designers first. After having the gist of the matter, they discussed with the community mainly on matters like the right place for irrigation in relation with issues like additional water source to surface run off. Then, the project designers, the representatives and the public at large decided up on the proposals presented by the designers and the representatives, even though there were oppositions. The major subjects of the decision were place of construction, resource mobilization and compensation for asset losses during construction.

Following this, the communities contributed 22-day free labour (which is assigned to every farmer at regional level for soil and water conservation structure construction) to the construction of the micro-dams. They carried soil and stones for the bulldozer-aided construction, an activity with heavy punishment (up to 100 Birr) upon those who were absent. After the completion of the 22-day free labour obligation, the communities contributed labour in the form of food for work.

The operation of the schemes is managed by a local institution known as water committee. This committee is normally elected every year by the water user community from the water user community. This committee embraces four 'Abbo-mais' (Water fathers in Tigrigna, the local language), who are responsible for the every day operation of the schemes. The election of Abbo-mais is based on willingness: only those who are willing to serve as Abbo-mais are elected as long as they are eligible in the eyes of the community. The motive behind being willing is economic benefit. Community members who are with relatively weak economic backgrounds are usually willing because they are interested in supporting their livelihoods with the income paid to them in a form of salary. In Mai-Nigus, each irrigator contributes 3.50 birr every month to pay for services of Abbo-Mai, and each Abbo-mai is paid 200 birr per month. Whereas in Gum-selasa, each user contributes 10 birr per year and the total sum of money is divided among the four Abbo-mais who are responsible for the everyday water distribution and scheme guarding practices.

Salary is paid to the Abbo-mais, who are always in the scheme controlling the practice of water distribution. Both the water committee and the Abbo-mais are aided and supervised by

extension workers of the 'Tabia' in carrying out their duties.The responsibilities of the water committee are water distribution, resource mobilization for maintenance, and conflict management while water allocation is usually carried out by the extension workers.

Being accountable to the community at large, the water committee refers conflict management cases beyond its capability to the "tabia' administration and the community court. The community court, which is responsible for managing almost every type of conflict in the community is said to be supporting the water committee with resolution of high level conflicts over water use. However, the committee complains that the community court is too busy, and too slow in deliberating and delivering verdict that the rules and regulations of water use are not being enforced as they should be.

The rules for operation and water management were formulated by the communities together with the Woreda Agricultural Offices. These arrangements were written, but documented only at the Woreda Agricultural Offices. Neither the communities nor the water committee have the written document of the rules. They run the operation simply as a commonly understood convention, and recall punishment rates as the specific cases occur. Even the documents at Woreda Agricultural Offices are only provisions of arrangements in the form of punishments for committing certain identified actions rather than being provisions of how practices should go (see the rules for Gum-Selasa on page 44, chapter 5, for example). In other words, the managing body does not have organizational charter.

As household interview survey results show, the majority of the respondents don't know what exactly the rules for controlling water distribution breaches say. Their responses are summarized in Table 6.

Table 6: Users' knowledge of the contents of the rule for controlling water distribution breaches

Responses	N	%
There is punishment in money ranging from 10-50 birr, but I cant distinguish	52	52 %
Water should not be wasted; it should be used properly	14	14 %
Water should be distributed in turns	30	30 %
Defaulters are denied their watering turns	1	1 %
Water should be allocated according to crop type	1	1 %
Non-response	2	2 %
Total	100	100%

Source: Household Survey

The following arrangements can be extracted from the results of interviews with water committee members; users' responses in household interview survey, and secondary data analysis together:

1. Every user has the right to use his/her 0.2 ha irrigation land for irrigation in accordance with the government objectives of irrigation (priorities proposed by designers).
2. Every user should use water properly with adequate care to avoid waste.
3. Crop type should be a criterion in allocating water for distribution to individual plots.
4. Water should be distributed in turns following spatial sequences of the plots.
5. Water distribution should be controlled by Abbo-mai.

6. Conflicts should be managed by water committee; if they are beyond the capability of the committee, they should be referred to community court.
7. Every user should participate in structure maintenance.
8. Every user should contribute to the payment expense for Abbo-mai salary.
9. Water committee should be responsible for resource mobilization for maintenance.
10. Every user should take care that his/her livestock shouldn't be allowed to cause damage in the irrigated system.
11. Users who do not respect the above arrangements should be punished according to the following procedures**:**

    a. 10 birr for those who are absent in a meeting;

    b. 20 birr for those who are found repetitively damage furrows;

    c. 30 birr for those who do not prevent their cattle entering the irrigated fields;

d. 50 birr for those who break irrigation turns or who divert water to their fields by breaking canal.

6.1.2. Water Allocation and Distribution

Water management in irrigation systems requires collective action, and forms of joint action can hardly be optimum if they must operate in a context of distorted resource distribution. The concept of "share" is central; members of the organization for joint action possess shares of water resources. To exert demand on the organization for water service, one asserts a right to that service based on shareholding rules (Freeman and Lowdermilk, op. cit.). According to these authors, a share is always two-sided: it confers a resource within certain prearranged rules, and it imposes a cost or assessment on the user to pay costs of local water control. The concept of

share therefore unites two essential aspects of organizational life: the gathering of revenues through assessments and the delivery of water to the members (Ibid.).

The question is, then "What joint actions should be organized by the charter for the management of shares?" Organizational charters, according to the above authors, can specify water shares in some combination of the following depending on local circumstances:

1. Fixed percentage allotments by volume or by time period rotation;
2. A priority system based on location (near the head or the tail of the channel), farm characteristics (time of settlement), or economic value of the crop;
3. User demand placed on a surface reservoir or on ground water (Ibid.: 132).

Water allocation for distribution to each plot in the two study schemes of this research is said to be based on crop-water requirement rates. During the interviews, extension workers said that originally the agronomic rates of water requirement for each crop type were set taking the soil type and other parameters in to consideration. Then, the time to meet this requirement at the irrigated plots (0.2 ha) was worked out using agronomic calculations, and this was practically tested through some period of time. This result became a standard and was practiced under close supervision of the extension workers. After the Abbo-mais have been familiarized with the rate (in terms of time length for a crop type), they have been left free to operate by themselves. Presently these practices are said to be routine activities to each Abbo-mai.

The crop water requirement rate is reported to take in to consideration not only crop types but also stages of growth. For example a farmer who is planting and one who is working inside his/her standing crops are not equally treated. The one who is planting is in a greater need of

water. So, priority is given to such cases. As reports indicate, it is not only the Abbo-mais that are equipped with the knowledge of these requirement rates. Almost every irrigator is said to know what type of crop needs how much time of watering on the 0.2 ha plot.

According to the requirement rates set for the 0.2 ha plots, maize needs 6 hours watering in a week's time. If water is so scarce, the time of stay without getting water can be extended to 10 - 11 days for maize. Each crop has such a standard of its type. Out of the total number of interview survey respondents, 96% said that they know and use crop-water requirement rates. Nevertheless, interviews with extension workers revealed that users always try to over-irrigate their fields thinking that more water results in more yields. Absence of full rule enforcement practices has also been observed to create loophole for committing breaches like over-irrigation.

Water in Gum-Selasa and Mai-Nigus is normally allowed for dry season irrigation. Protective irrigation is not usually allowed. For that matter, it is never allowed and practiced in one of the schemes (Mai-Nigns). 90% of the interview survey respondents (with 10% non-response) in both of the schemes said that they don't use water for protective irrigation because the extension workers do not allow them to do so saying that wet season rains are sufficient for rain-fed production. In interviews with extension workers, the extension worker at Gum-selasa said, "We allow water for protective irrigation only at times of significant rain failure; when we believe the condition will cause significant yield reduction. Other wise, protective irrigation is not allowed."

On the contrary, the extension worker at Mai-Nigus 'tabia' said that protective irrigation is never allowed in the scheme even at times of severe rain failure. According to him, during the wet season, irrigators must not be treated in any way different from the ways rain-fed producers are

treated. He justifies his position by asserting, "Irrigation production and rain-fed production should be calculated and reported separately in order to identify the impact of irrigation on livelihood." He further argues that if protective irrigation is used, it would be difficult for statistics and reporting.

Regarding distribution, water is distributed in turns following spatial sequences of plots. 7-12 plots are watered every day. The difference arises from the types of crop and the width of canals. Canals are not uniform in their width in different blocks. Wider canals allow quicker flow of water in a higher volume and decrease the time taken for watering and vice versa. As survey results show, the great majority of respondents believe water is shared fairly among users who are beneficiaries at present.

Table 7: Users' feelings about fairness of water share

Responses	N	%
Fair	94	94%
Unfair	5	5%
Non-response	1	1%
Total	100	100%

Source: Household Survey

Data in Table 7 shows that 94% of the respondents believe water share is fair in the schemes, and 5% believe it is unfair (with 1% non-response). The 5% users believing that water share in the schemes is unfair have given head-end/tail-end differences as reason for the unfairness. In

addition, these respondents (the 5%) said that they are among users who get less share of water because they are tail-enders. The fairness of water distribution (with some attempts of breach) has also been witnessed by interviewees and discussion members.

Head-end/tail-end discrimination is common in irrigation systems as the more one proceeds towards the tail of irrigation channels; the more one is vulnerable to:

1. losses due to leaks, seepage and evaporation;
2. self interested manipulations of others towards the head as the number of irrigators intervening between farmer x and the head increases; and
3. non routine breakdowns in the system (Freeman and Lowdermilk, op. cit.: 135)

These authors report that case studies of Pakistani, Indian, Sri Lankan and Thai rotational water delivery systems show that they reinforce and solidify the head/tail discriminations. Allotting water by time and location reinforces what engineers and geography have already done; it creates a fundamental difference in interest between irrigators at head and tail portions which inevitably threatens the solidarity of any local farmer organization (Ibid).

Some attempts to commit water distribution breaches are observed among users in Gum-Selasa and Mai-Nigus. There is a rule for controlling water distribution breaches (see page 44). 35% of the respondents believe there are weaknesses in enforcing the rule in the way formulated whereas 56% of them believe the rule is enforced in the way formulated (with 9% non-response). Results of interviews and focus group discussions also showed that there are weaknesses in rule enforcement.

Irrigators in Gum-selasa and Mai-Nigus pay charges for maintenance and for salary expenses of the Abbo-mais. This payment is uniform throughout the users. The differences in amount of water and tail-end/head-end differences are not considered. With regard to the charge, focus group discussion members pointed out that tail-enders usually complain that they shouldn't be charged equally to head-enders, who benefit better.

Writers on irrigation management advise water charge be in relation with the amount of water used. For instance, Perry (2001) suggests that the price of water must be directly related to the volume delivered in order that an incentive for efficient water use could be achieved and complaints demanding differential charge would be met. Conceptually, according to the author, this is identical to an electricity meter where the consumer can decide to switch off or switch on particular device, and experience a directly proportional response in the electricity bill.

6.1.3. Maintenance

There are no water users' associations in the schemes. Maintenance that needs community level participation is organized by the water committee. Water committee mobilizes resources and fixes times of maintenance. Resources for scheme maintenance are from three sources: income from punishment, community labour and community fund contribution. For example, in Gum-Selasa, focus group members and key informant interview respondents reported that the community recently contributed 45 birr at household level, and paid for cement purchase and builders' wage in order to get the crack of the primary canal maintained. In Mai-Nigus, the

community contributes 2 birr each year at each household level for maintenance of the cemented part of the scheme.

In other cases, the community members (all users) are said to contribute labour for maintenance of damages that have effects on wider areas. For damages with effects on small area coverage, maintenance is done in blocks. The users in the block are responsible for maintenance of damages in the block. Moreover, simple damages at the very vicinity (proximity) of an individual irrigator don't need organized action; It has been reported that every individual is committed to maintain such damages.

According to the responses by water committee members, there is no problem with labour mobilization for maintenance. Every user is equally committed to the affairs. However, the researcher's personal observations during reconnaissance revealed that tail-enders usually have to contribute more labour than the head-enders. A case demonstrating this issue was that of two irrigators in Mai-Nigus scheme. These men were cleaning the canal covered with weeds during the wet season, the time when irrigation is not practiced. In order to prepare the structure for irrigation at the dry season, farmers do the cleaning every year. And, the two irrigators mentioned above reported that they were tail-enders cleaning on the head-end part of the scheme. According to their report, the agreement is that beginning from the uppermost part of the scheme, every user has to contribute labour until the lower-most canal that serves for a common use of any group of irrigators has been cleaned. But what is practiced in reality is that the head-enders usually flee maintenance work once the head-end part has been done. The rest of the work is up to the tail-enders.

This may be an indication that relying fully on farmer labour for maintenance has some drawbacks. According to Freeman and Lowdermilk (1991), relying only on farmer labour allows much opportunity for 'free riding.' It may appear rational for certain individual farmers to schedule other activities during the time that labour is to be mobilized so as to avoid contributing their labour share. A study of forty water course commands in Pakistan, in which these authors participated, found a generally low level of maintenance. Everywhere, large landlords and other village influential individuals could escape maintenance duties and the quality of maintenance was low. Sanctions against a free rider who wished to use irrigation water without providing a fair proportion of labour were divisive and difficult to enforce.

The other problem with commitment for maintenance is the perception of the users towards the ownership of the schemes. At around the beginning it was CoSAERT that maintained every damages in the schemes. As the interview results with the extension worker at Gum-Selasa rightly show, this practice gave many of the users the idea that the scheme belongs to the government, and it should be the government who is responsible for the maintenance. This feeling has been maintained until recently even after the withdrawal of CoSAERT; hence it lessened the commitment of the users for scheme maintenance. Table 8 shows the perception of the users towards scheme ownership.

Table 8: Ownership of irrigation structure as perceived by users

Responses	N	%
The government's	66	66 %
The Community's	16	16 %
The government and the community's	17	17 %
Non-response	1	1 %
Total	100	100%

Source: Household Survey

As the data in the table show, only 16% of the respondents believe that the structures belong to the communities, 17% of them believe as if the structures are common properties of the government and the communities where as 66% of the respondents believe the structures to be the properties of the government (an external body). This might cause differential commitment among users towards maintenance, as experiences from other schemes indicate this. Habtamu Gessesse (1990), in his paper presented at the national policy and strategy workshop, reports that the peasantry didn't consider themselves as owners of the schemes, and this caused poor commitment of the users to the maintenance of the structures.

Differential commitment is also observable from the users' responses regarding the frequencies of their participation, and the parts of scheme where they participate in maintenance.

Table 9: Approximated frequencies of users' participation in structure maintenance

Responses	N	%
1-3 times in a year	21	21%
4 - 6 times in a year	52	52%
7 - 10 times in a year	9	9 %
Non-response	16	16 %
Total	100	100 %

Table 10: Parts of scheme users participate in maintenance

Responses	N	%
On my own plot and on canals leading to my field	76	76 %
At any point of damage in the scheme	14	14 %
Non-response	10	10%
Total	100	100%

Source: Household Survey

Table 9 shows that only 9% of the users participate in the highest frequency meaning (7-10 times in a year), 21% in the lowest frequency (1-3 times in ayear) and 52% in the medium (4-6 times in a year) with 16% non-response. This difference may be due to different commitment level of the different users to maintenance. Complementary to this, table 10 shows that only 14% of the users are committed to maintenances at any point of damage in the scheme whereas the 76% of the respondents are committed only to maintenance at points of damage that they think have a significant effect upon their fields (with 10% non –response). Out of the users in the non-response category 4 responded that they never participate in maintenance because of health issues or because they always give their fields for sharecropping. In addition, as could be easily seen from the frequencies in table 9 above, the frequencies of preventive maintenance proposed by project designers in feasibility studies are too far from being met (see chapter 5 page 44-45).

Interviewees and discussion members reported that, the main causes of structure damage in the schemes are sedimentation from flood, weed growth on the canal walls and floors, erosion caused by flood, and livestock, in a descending order of importance. They said that all of these

causes are severe in the wet season. Sediments from flood deposit in the reservoir dams; gravels from the flood accumulate in the canals and cultivated fields (particularly in Mai-Nigus); erosion breaks structures; and livestock damage scheme structure as they are customarily allowed to feed on remnants on irrigated fields at around June. In such cases, irrigation practices face challenges in complying with traditions pertaining to livestock because animals are likely to cause damage on irrigation structures, and land degradation through soil compaction. Writers report that in northern Ethiopia including Tigray, fallow lands and cultivated lands after harvest are considered as grazing lands without access restrictions (Berhanu, pender and Girmay, 2002; Yeraswork, 2000).

The sediment deposit in the reservoir dams is becoming a critical challenge to the performance of the schemes. As reported by extension workers, in both schemes, the reservoir is highly silted up. There is a sort of confusion regarding the responsibility for desilting the reservoirs. The sediment has never been excavated since construction. Now that the schemes have been handed over to the communities, it seems likely to be that the communities are responsible for the matter. However, the fact that the communities have their labour as an only affordable resource (seen in relation with the amount of work) makes the work unlikely to be carried out by the communities because it is beyond the capability of community labour ____ it needs machinery aid.

Regarding sediment removal from reservoir dams, the agronomist in Hintalo Wajirat Woreda Agricultural Office said, “It is the responsibility of the Regional Water Resources Development Bureau, which replaced CoSAERT for it was CoSAERT that was responsible.” The Mai-Nigus ‘tabia’ extension workers, on the other hand said, “Presently, there is a plan to construct soil and

water conservation structures in the watershed in order to prevent further entry of sediment to the reservoir, but we don't know what should be done for the already deposited sediment."

6.1.4. Organizational Activities

A. Decision Making

In this study, farm decisions are seen from two angles: decision to undertake irrigation practices or to give up irrigation land for contract or sharecropping, and decision in cropping pattern, in which irrigators may prefer planting certain crops to others. The first type of decision will show us who is making use of the benefits of irrigation, and who is missing the opportunity. Whereas, the second type will answer the questions "Do the priorities of the producers comply with the priorities of project designers? Or do the irrigators as actors in the intervention have their own projects diverging from the priorities of the project designers? Why do irrigators prefer planting certain crop types to the others, if they do?"

As the results of focus group discussions and key informant interviews indicate, lack of capital (low socio-economic status), gender-related shortage of labour, and problem of oxen are the main causes for deciding to give up irrigation practices and to lease out irrigation land in the schemes (for statistical data, refer to table 13). Whereas the positive impacts of irrigation upon the livelihoods of irrigators are acting as motives to practice irrigation further. With regard to irrigators' giving up irrigation, members of the discussion reported that the prices of inputs like fertilizer, herbicides and pesticides are so escalating that economically weak irrigators cannot afford. They gave fertilizer (chemical) as an example whose price has increased 50 birr per

quintal in a year's time. They also verified that inputs like fertilizer are a must for irrigated production, and the irrigator who can't afford the price has leasing out his/her land as an only alternative decision.

With a particular reference to female household heads, most of them who don't have male children that are mature enough to carry out man-labour in irrigation, lease out their lands. These women lack man labour, which is so important in ploughing and other irrigation activities culturally. In most cases neither do they have oxen nor the money to hire man labour. This condition was proved during the time of stratifying the households in the study schemes into higher, middle and lower socio-economic conditions for selection of sample population. The village elders ranked almost all of female household heads into the lower socio-economic condition, a condition that forced the researcher to rank female households in relation with themselves. Therefore, most of female households also lease out their irrigation lands due to the facts that they are with lower socio-economic conditions, (in which they lack capital for labour hiring), and that they lack man labour at household level.

On the other hand, irrigators leasing in plots and enjoying the increased benefit from irrigation (mainly due to their access to and control of key resources like capital and labour) are expanding their bargaining power by practicing irrigation on their own lands and on lands they get through contract or sharecropping from economically weak households. Such cases are known to happen in irrigation projects. Even though irrigation projects may increase crop production and decrease absolute poverty, a fact of life is that they are more likely than others to simultaneously widen income disparities. Kottak gives the case of a Madagascar project as evidence. In Madagascar's Lake Alaotra Irrigation Project, many large-scale and "noble"

landlords were identified in the initial ex post evaluation as drawing disproportionate benefits. Later, however, sociological in-depth analysis (during impact evaluation) ascertained that they were clan leaders holding estates in trust for numerous dependents (Kottak, nd. in Cernea, 1991).

As reported by the discussion members, many of the irrigators have benefited much from irrigation. They said almost all of the community members were food secure only up to June after rain-fed product harvest. But many of the beneficiaries presently are now food secure through out the year due to additional household income from irrigation. Further more, irrigation income has enabled most households to send their children to school. Before irrigation, they reported, "Most children used to engage themselves in wage labour in order to support household income."

Survey results also show that irrigation in the schemes has fairly positive impact on irrigators' livestock holding. Of course, there are different views regarding the relationship between irrigation development and livestock holding of households. Fuad (2001) says that irrigation of any scale has a negative effect on livestock production because of the competition for land. For example, irrigation projects might take away communal or private grazing lands, which, especially, “are important sources of livestock feed in developing countries (ILRI, 1999)”. On the other hand, there is a view that cash income generated from irrigation farming will be an important source of investment on livestock, and crop residue from irrigation production is a supplementary source of animal feed during the time of feed shortage (Seid, 2002).

In this study, 65% of the respondents said that their livestock number has increased due to irrigation introduction while 30% of them said there has been no change in their livestock number, and 3% said their livestock number has decreased due to irrigation introduction (with 2% non-response). The 3% respondents who reported that their livestock number has decreased said the reason for the decrease is shortage of grazing land.

Table 11 shows the frequency distribution of the responses concerning the cause for increase in irrigators' livestock number.

Table 11: The root cause for users' livestock number increase

Responses	N	%
Increase in animal feed from crop residue	18	18%
Increase in animal feed from grass types introduced together with irrigation	11	11%
Increased income from irrigation to buy more animals	4	4%
Increased income from irrigation for better veterinary service attainment	2	2%
Increase in animal feed from both crop residue and grass types introduced together with irrigation	30	30%
Non-response	35	35%
Total	100	100%

Source: Household Survey

Totally 65% of the respondents said their livestock number has increased because of the four causes above, which are results of irrigation introduction in the schemes. The combined effect of increase in animal feed from crop residue and that from grass types introduced together with

irrigation has contributed to increase in livestock number of the 30% respondents; increase in animal feed from crop residue alone has contributed to the 18% whereas increase in animal feed from grass types introduced together with irrigation alone has contributed to the increase in number of the 11% respondents' livestock. Thus, it could be concluded from the data that the root cause for the increase in most of the irrigators' livestock number is increase in animal feed from the two sources mentioned here.

In the household interview survey, the vast majority of the respondents 90% said that, with the introduction of irrigation, there came a change in the way they used to get water to their livestock. This change is an advantage because it has brought about easy access of their livestock to water just from the nearby reservoir dam. 6 % of them said there is no change in the way mentioned (with 4 % non-response).

These benefits, namely, the benefits through increase in household income, improved food security and the increase in livestock holding of the irrigators capable of running irrigation could be said to be motivating the decision of these producers to increase adoption of the technology further. Here, the fact that some are becoming out of the game and others are accelerating with the enterprise might become a major threatening **social effect** that income disparities among the households in the communities would widen.

A cross tabulation of users' experiences in practicing irrigation all dry seasons as long as water is available with household head type gives better information on who practices irrigation and who doesn't.

Table 12: Users' experience in practicing irrigation all dry seasons as long as water is available seen in relation with household head type

Household Head Type		Responses				
		1.Yes, I do	2. No, I some times hire out my plot	3. No, I some times give my plot for share cropping	2 & 3	Total
Male with higher socio economic conditions	N	20			1	21
	% within the household head type	95.2%			4.8%	100%
Male with middle socioeconomic conditions	N	19	1	1	3	24
	% within the household head type	79.2%	4.2%	4.2%	12.5%	100%
Male with lower socioeconomic conditions	N	19		5	1	25
	% within the household head type	76%		20%	4%	100%
Female with higher socioeconomic conditions	N	7		2	1	10
	% within the household head type	70%		20%	10%	100%
Female with middle socioeconomic conditions	N	6		1	3	10
	% within the household head type	60%		10%	30%	100%
Female with lower socioeconomic conditions	N	6		2	2	10
	% within the household head type	60%		20%	20%	100%
Total	N	77	1	11	11	100
	%	77%	1%	11%	11%	100%

Source: Household Survey

As it is clear from table 12, the trend in practicing irrigation every dry season decreases with decrease in socio-economic status of households: with regard to males, 95% of the household heads with higher socio-economic condition, 79.2% of those with middle socio-economic condition, and 76% of those with lower socio-economic conditions practice irrigation all dry seasons as long as water is available. Concerning female household heads, 70% of those with higher socio-economic conditions and 60% of each type of those with middle and lower socio-economic conditions practice irrigation all dry seasons.

It is also obvious, here, that the level of practice (Percentage of adoption) is lower with the female headed households. This might be because of the worse socio-economic conditions of female headed households in the areas (mentioned above) and because of the fact that they are short of labour. Thus, it could be said that gender is also one determinant of adoption level of irrigation technology at household level.

The determinants for non-practice of irrigation in the schemes can further be squeezed out as follows.

TABLE 13 : OUT LEASING USERS' REASONS FOR HIRING OR GIVING OUT IRRIGATION PLOTS FOR SHARECROPPING EVEN WHEN WATER IS AVAILABLE

Household Head Type		1.Shortage of labour	2.Problem of ox/oxen	3. Presence of other source of household income	1 and 2	Total
Male with higher socio economic conditions	N		1			1
	% Within household head type		100 %			100 %
Male with middle socio economic condition	N		3		2	5
	% Within household head type		60%		40 %	100 %
Male with lower socio- economic conditions	N		1	1	4	6
	% Within household head type		16.7 %	16.7 %	66.7 %	100 %
Female with higher socio-economic conditions	N	1			2	3
	% Within household head type	33.3 %			66.7 %	100 %
Female with middle socio-economic conditions.	N	1	3			4
	% Within household head type	25 %	75 %			100 %
Female with lower socio-economic conditions.	N		2		2	4
	% Within household head type		50 %		50 %	100 %
Total	N	2	10	1	10	23
	%	8.7%	43.5 %	4.3%	43.5 %	100 %

Source: Household Survey

In Table 12, we have identified that the total number of respondents that do not practice irrigation every dry season (those who hire or give out irrigation plots for sharecropping or who do both) is 23. Out of the 23, 12 are male household heads whereas 11 are women. This means that 17.1 % of male-headed households and 36.7% of female-headed households lease out their irrigation plots.

As to the reason of these 23 house hold heads for leasing out their lands, table 13 shows that 8.7 % lease out because of labour shortage, 43.5 % because of ox /oxen problem, 4.3 % because of presence of other income source to meet household needs whereas 43.5 % because of problem of both labour and oxen. Thus, the determinants significantly affecting irrigation plot leasing out by household heads are problem of oxen or shortage of labour, and problem of labour and oxen together as the largest share of percentage (43.5% each) goes to these factors.

Concerning the second type of farm decision, i.e., cropping decision, project designers of government agencies usually take their projects for granted or interpret them as expressions of universal processes. They define the mechanisms through which the projects operate as representing a "MODUS OPERANDI" with the power to determine or shape farming practices (Long and Ploeg, op. cit.). Hence, the poor are often assumed to be passive and grateful recipients of benefits as planned by government programs, thereby also becoming loyal followers (Uphoff, 1991). The analysis of cash flows of farm budgets aims at demonstrating that the adoption of project proposals brings about attractive returns to the producers either through an increase in total returns of labour or in terms of financial rate of return. These returns have been declared sufficient evidence that farmers will participate in the projects as proposed, on the basis of the consideration that they would profit from them (FAO, 1992).

However, experiences suggest that relatively high financial rates of return on investment may not be sufficient to motivate households to respond to new technology priorities. Conversely, activities with lower financial returns may be preferred for other reasons such as lower risk or better reliability of yields. Schluter and Mount (cited in Barlett, 1980) found in one Indian district that though groundnuts are both more profitable and more labour intensive, families with

a high worker/land rates preferred cotton production because it was less risky. Farmers' behavior is also a function of household members, objectives (FAO, 1992). Small farmers may be interested in generating cash from sale of crops only after their annual food and household maintenance requirements have been ensured.

In this study, users in the two schemes are partly free to decide on the types of crop to be planted. Partly they are dictated by the extension workers. Focus group discussions and key informant interviews reflect both opposing ideas, namely that users are free to choose the types of crop to be planted and that they are not free to do so. Focus group discussions at gum-selasa during reconnaissance and interviews with woreda agricultural experts show that irrigators plant their fields at their discretion, and they do so by monitoring the market.

On the contrary, focus group discussions during the second round visit and interviews with extension workers reflected that irrigators blame extension workers for not letting them free to choose the crop types to be planted, and the extension workers blame the irrigators for not obeying the proposed pattern of cropping for irrigation. Extension workers reported that irrigators 'waste' water by cropping crop types that could be produced in the rain-fed agriculture. According to them, irrigation is for cash crop production promotion, but irrigators are not doing so. In the irrigators' words, extension workers are threatening them that they would be denied of using water, and their lands would be confiscated if they don't follow the cropping pattern proposed by the project designers.

The quantitative evidence from household interview survey data will help in making the matter clearer. Table 14 below shows how much the irrigators are free to choose the crop types to be planted.

Table 14: Users' discretion in choosing the crop types to be planted and the size of land to be devoted to them

Responses	N	%
I follow the proposed cropping pattern, and that is on my discretion because I am convinced	69	69 %
I am forced to follow the proposed cropping pattern	31	31 %
Total	100	100 %

Source: Household Survey

The struggle between irrigators and extension workers (mentioned above) is clearly implied in table 14 above; 69 % of the respondents, who might be running full adoption of expert recommendations by monitoring the market (as mentioned by the woreda experts), said that they follow the proposed cropping pattern, and are cropping their fields on their own discretion. The rest 31 %, who might be resisting adoption of recommended priorities and making differences from the recommendations, believe they are forced to follow the proposed cropping pattern, and are not cropping their plots on their own description.

This phenomenon (the struggle going in adoption performance) is clearly observed in the cropping patterns of the schemes presently being practiced. Table 15 and 16 below show this year's crop- types and their area coverage in the two schemes in comparison with the proposed cropping pattern by project designers.

Table 15: comparison between the actual cropping pattern (this year) in gum selasa and that recommended by project designers

Site	Total area irrigated at present (in ha.)	Crop Type	Area cove rage at present (in ha)	% out of total area irrigated at present	% of recom mende d area	Differen ce %
Gum-selasa	40.2	Maize	28.6	71.14	15	+ 56.14
Gum-selasa	40.2	Onions	9.6	23.9	25	- 1.1
Gum-selasa	40.2	Garlic	0.4	0.99		
Gum-selasa	40.2	Tomatoes	0.8	1.99	20	- 18.01
Gum-selasa	40.2	Cabbage	0.15	0.37	10	- 9.63
Gum-selasa	40.2	Lettuce	0.05	0.12		
Gum-selasa	40.2	Chick peas	0.2	0.49		
Gum-selasa	40.2	'Guayya'	0.2	0.49		
Gum-selasa	40.2	Barley	0.2	0.49		

Table 16: comparison between the actual cropping pattern (this year) in mai-nigus and that recommended by project designers

Mai- nigus	51.2	Onions	9	17.57	25	- 7.43
Mai- nigus	51.2	Garlic	2.35	4.59		
Mai- nigus	51.2	Pepper	8.15	15.92	20	- 4.08
Mai- nigus	51.2	Tomatoes	2.975	5.81	20	- 14.19
Mai- nigus	51.2	Lettuce	0.175	0.341		
Mai- nigus	51.2	Broccolis	0.225	0.439		
Mai- nigus	51.2	Carrot	0.175	0.341		
Mai- nigus	51.2	Cabbage	0.075	0.146	10	- 9.854
Mai- nigus	51.2	Potatoes	0.025	0.048		
Mai- nigus	51.2	'Abesh'	1.7	3.32		
Mai- nigus	51.2	Maize	25.8	50.39	15	+ 35.39
Mai- nigus	51.2	Chick peas	0.55	1.074		

Source: soils and agronomy feasibility study report (saert, 1999) and documents from gum-selasa and mai-nigus da centers

As could be easily observe from Table 15 and 16, the irrigators in both schemes produce a diversity of crop types, especially cash crops, even many more types than were recommended by the project designers. This might be because of the fact that the irrigators planned to avert risks ____ risks of both crop failure and price failure. On the other hand, the experts' recommendation could be said incomplete. Any way, one thing easily noticeable is that, apart from their practice of cropping non-cash crops in the irrigated fields (example, barley and 'guayya') irrigators are devoting surprisingly much more area of land to maize production than was recommended by the experts. In Mai-nigus, the area coverage of maize exceeds the recommendation by 35.39 % and in Gum- selasa it exceeds by 56.14 %. The area coverage for all other cash crops or vegetables involved in the recommendation of the experts is below proposal.

With regard to devoting much area of land to certain crop types, irrigators identified onions, maize and tomatoes as their highly ranked crops. Their responses as 1st ranked crop were 29 for onions, 27 for maize and 4 for tomatoes. The responses as second ranked crop were 22 for onions, 23 for maize and 10 for tomatoes whereas their responses as 3rd ranked crop were 3 for onions, 10 for maize and 8 for tomatoes. Thus, their devotion of much area is for onions, maize and tomatoes in descending order. Their reasons for devoting wider areas for their high ranked crops are given in Table 17.

Table 17: the reasons of users who are convinced-to-follow proposed cropping pattern for devoting much area of their irrigation land for their high ranked crops

Responses	N	%
Household consumption	16	23.2%
Livestock feed.	12	17.4%
Cash income source	31	44.9%
Less labour	6	8.7%
Draught resistance	1	1.4%
Land size	3	4.3%
Total	69	100%

Source: household survey

The first three ranks of these irrigators' reasons for devoting much area of land for their high ranked crops are given to cash income source, household consumption and livestock feeding respectively whereas the whole range of the reasons includes less labour demand, land size and drought resistance in addition to the high ranked reasons.

On the other hand, out of the 31 irrigators who believe they are forced to follow the proposed cropping pattern, twenty four (77.4 %) said that they would plant other types of crop than they do now if they were let free to choose. According to their responses, four of them (16.7 %) would crop teff, 16.7 % of them wheat, 16.7 % of them sorghum (all for household consumption); 16.7 % of them would crop barley, six of them (25%) maize (both for household consumption and livestock feed); and two of them (8.3 %) would crop peas for land fertility replenishment.

Reasons discussed above are in compliance with what the results of interviews with extension workers revealed. The extension workers summarized the factors determining resistant cropping pattern decisions in the two study schemes to be as listed below.

1. Accessibility of seed
2. Less labour demand
3. Drought resistance quality (risk aversion)
4. Usability for household consumption
5. Usability for livestock feed

These experts reported that, producing cash crops requires the purchase of seeds, fertilizer and other chemicals to meet the higher care these crops need. Many irrigators are not interested in bearing these duties and expenses because it is much easier for them, for example, to produce maize as its seed is easily accessible at home or from a friend; it is less labourious; it is less water demanding, and is a good source of household consumption and animal feed.

B. Conflict Management

The different interests of different people involved in irrigation and affected by it may translate into conflict and or tragic events, or they may not (mollinga, op. Cit.). Activities like operation and maintenance of an irrigation system require co-ordination, and collective action problems arise easily when each farmer has the incentive to use more water and invest less in the system (tang, 1992). For example, farmers in india and pakistan appropriate all ways possible that will allow them a minimum of water control. Such control comes sometimes through 'deviant' behaviour like illegal purchases and trade, water theft, and bribery of officials to source concessions (freeman and lowdermilk, op. Cit.).

According to Desalegn (1999; 14), conflicts in irrigation projects may include:

1. Conflicts among water users over water allocation, land rights, or maintenance issues;
2. Conflicts between users and the authorities responsible for the project over inappropriate design of infrastructure, peasant relocation, water charges, or management issues;
3. Conflicts between project beneficiaries and non-beneficiaries.

With regard to conflict management in the study schemes, as already discussed, the responsible body for conflict resolution is water committee under supervision and aid of extension workers, 'tabia' administration and community court (see part 6.1.1). As irrigation technologies are **socially constructed** phenomena, the construction of the micro-dams entailed a major type of conflict. In mai-nigus, the inundated area was originally grazing land, source of potable water from a spring, private plantation of perennial trees (eucalyptus), rain-fed agricultural land, land of traditional river diversion irrigation, and residential area at its different parts. Many of private asset owners in the area strongly opposed the dam-construction. Particularly, those who were asked to leave their residential places brought about a stiff opposition saying that they would rather have been rolled and moulded into mud by the bulldozer than have left their ancestral places of residence. There had been bullet firings and forcible pulling downs of houses with bulldozers.

Eventually the case was settled down through arbitration and compensation in forms of wheat; other plots of agricultural land and urban residential land (see chapter five, page 40). The responses regarding issues with private asset loss will be given in following sections.

In Gum-selasa, before irrigation, the reservoir area was cultivated land, water point to livestock and communal grazing land at its different parts. People strongly opposed dam construction, and there had been many dealings of the designers with the people in order to convince them. For details, see chapter 5 page 35 - 38. Any way, eventually they agreed as long as they got compensation in the form of wheat, and they were promised the 'sweetest' effects of irrigation in the future.

Table 18: Users' loss of their own assets due to scheme construction

Responses reporting asset lost	N	%
Cultivated land	15	15%
Perennial trees (eucalyptus)	2	2%
Grazing land and cultivated land	4	4%
Grazing land and residential house	1	1%
Cultivated land and residential house	1	1%
Cultivated land and perennial trees	1	1%
Grazing land, cultivated land and residential house	1	1%
Cultivated land, residential house and perennial trees	1	1%
I lost no asset of my own	74	74%
Total	100	100%

Table 19: Asset losers' responses to their loss

Responses	N	%
I accepted my loss assuming future benefits	20	77%
I internally opposed; however, i eventually yielded to as i didn't have the power to proceed	6	23%
Total	26	100%

Source: Household Survey

From Tables 18 and 19, we observe that 26 % out of the whole (100) respondents lost assets of their own during micro-dam construction. The highest number of them (15) respondents (58%) lost cultivated land, the second highest number (4) respondents (15%) lost both grazing land and

cultivated land, and the 3rd highest number (2) respondents (7.7%) lost perennial trees (eucalyptus) with the total of other 5 respondents (19.2%) each losing either cultivated land, perennial trees, grazing land, residential house or some combination of these. Out of the 26 losers, 77 % accepted their loss assuming future benefit and 23 % internally opposed even though they eventually yielded in.

To further scrutinize the lasting effect of such oppositions, the internally opposing respondents were asked how the conflict between opposition and construction was resolved, and whether their original feelings were changed after implementation of irrigation. Their responses show that the conflict with 33.3 % of them was not resolved as the project designers went on construction; that with 33.3% of them was resolved by giving them compensation; and 33.3% of them feel that they were given compensation, which they didn't agree upon, and they were driven out. In a further scrutiny of changes in such feelings, 83.3 % of them are now convinced that irrigation has brought them better advantages whereas 16.7 % still feel insecure even after irrigation implementation. However, none of these respondents said they would give up irrigation use if they could regain their original assets.

Nonetheless, all of these respondents are presently irrigation beneficiaries though there always exists the challenge of head-ender /tail-ender conflict even between those who are using irrigation at the moment. The worst kind of conflict among the users prevailing in the schemes is that between the users who are cut off because of water shortage and the woreda agricultural office as well as the users who are made to benefit as the result of their head-end plot position. Tail-enders in both schemes are always asking for reforms of water share arrangements. They

raise the question of planting crop types that demand less water requirement and sharing the water equally, or shifting (exchanging) the head-end and tail-end land users.

This issue is even worse in Gum-selasa linked with the historical backgrounds of land redistribution and asset loss. As discussed above, the inundated area and the presently irrigated area belonged to 161 peasants in Arra and Hidmo communities. At the beginning, the scheme was planned to irrigate not only the presently irrigated area, but also the plots in the Addi-guddem and Hidmo community lands, which are at the right and left tail-end margins of the command area. The overoptimistic designers of the project promised the communities that the micro-dam would irrigate all the command area (120 ha). On the contrary socio-technical realities showed that it had been the scheme's destiny to perform much lesser than promised. Every year, as water availability declined more irrigators from the tail-end are cut off. Meteorological realities (shortage of rainfall) and technical failure in the structure (considerable loss of water through seepage) are among the causes of water shortage. Water shortage, in turn, combined with inappropriate technical recommendation taken by woreda agricultural offices when allocating available water for certain irrigable area is the reason for cutting off of more farmers from irrigation use. It is reported that the woreda agricultural offices and the extension workers usually don't take technical calculations into consideration.

Woldeab (2003: 98) gives the trends in water allocation decision for irrigable area in Gum selasa.

> Every year the woreda irrigation committee was expected to decide on the area to be irrigated based on co-SAERT's measurement of the quantity of dam water. However,

the size of irrigated plots did not correspond to Co–SAERT's estimation between 1998 and 2002 production years (Table 20).

Tale 20: Co-SAERT's Estimation of Irrigable Land and irrigated land in Gum Selassa Irrigation System

Year	Estimate irrigable Lnad (inha.)	Irrigated land (inha.)	Not irrigated land in percentage	No.of plot holders of not irrigated land
1996/97	110	16	85.5	470
1998/99	113	8.6	92.2	507
1999/00	83	64.6	22.2	92
2000/01	85.5	69.4	18.8	80.5 [sic]
2001/02	85.5	79.9	6.5	28
2002/03	121	86.2	21.6	119

Source: CoSAERT and Hintalo Wajirat Agriculture Department in Woldeab(2003: 98)

Which community members are those who are cut off because of water shortage? Surprisingly they are from all the three communities, including even the original users of the presently irrigated area, who are from Arra and Hidmo communities. This is because after scheme construction, thinking that every plot in the 120 ha command area would be irrigated, designers and administrators dispossessed every land user of his /her land and chopped up the command area in to about 600 pieces of 0.2 ha size. Then 550 farmers from all the three communities drew lots to have a 0.2 ha land in the command area. The rest 10 farmers were kept to be given land in a second round land allocation, which hasn't been materialized. In this process, many of

the original users (farmers from Arra and Hidmo) were made to have land from the tail end margins of Addi-guddem and Hidmo communities' areas.

These people, who were original users of the presently irrigated area, but who are usually cut off for they were given the Addi-guddem and Hidmo lands at the tail-end margins are always raising complaints that they should have been among the prior beneficiaries as it is their original land that is being used for irrigation. They say they feel that the government has purposefully dislocated them in order to benefit the urban elite from Addi-guddem, who can challenge it. Thus, these people feel irrigation has come not to benefit them but the urban elite. It was also reported in the discussions with focus group members that due to such feelings, the dislocated people consider the new comers from Addi-guddem who are making use of irrigation as their bloody enemies. They are even said to let their livestock in the irrigated crops knowingly. They are also claiming their original rain fed land, which was larger in size. This is one of the negative social effects of irrigation in the schemes.

Another form of conflict between irrigators and the government bodies is the case of the 22-day free labour soil and water conservation structure construction work each farmer in the region is obliged to do. This work is always done between the months of Tahsas (December) and Meggabit (March). But this time is the peak period for irrigation labour with irrigation producers, and irrigators bitterly complain that the soil and water conservation work competes for labour.

The researcher had an interview with the soil and water conservation expert at Laelay Maichew woreda agricultural and natural resources development office regarding how the mentioned

work is carried out and why it is only at the mentioned time. According to the expert, every farmer in the region has to contribute a 22-day free labour every year to soil and water conservation structure construction. The duration of the work is usually from December to march. It usually takes a community a two months time from start to finish.

It is often planned based on the proposal of the 'tabia' representing the community. First, the 'tabia' representing the community proposes a period of time, which would suit its community for the work. This proposal is seen in relation with the proposals from other 'tabias' in the woreda office, and the woreda reschedules the whole work on woreda basis based on the realities determining its decisions.

The conservation work is at both irrigators and non-irrigators lands. The time between december and march is preferred because the rain-fed agricultural work gets over at around the end of november, and farmers are more or less free at this time.

New phenomena emerged after irrigation are also sources of conflict between irrigators and non-irrigators. Kinds of bird never seen before irrigation in Gum-selasa invade ***teff*** and other cereal crops on the cultivated lands, and fly back and rest on the water body. These birds are spoiling both the irrigators' and non- irrigators' crops indiscriminately, but the complaint is higher with non-irrigators as the cause to the problem is irrigation introduction and they are not beneficiaries of it. In Mai-nigus, mosquitoes are proliferating, and many people are falling sick with malaria, which was never reported to have existed before irrigation. No chemical spray has taken place so far. Malaria also attacks both irrigators and non-irrigators, but the complaint with

the non-irrigators is bitter as the problem is caused due to irrigation introduction and they are not beneficiaries of irrigation.

There is also conflict between priorities of farmers' projects and government project. Extension workers, who are government functionaries, have the priority of promoting cash crop production in the two schemes but the irrigators have some other priorities apart from cash income. Thus, there is a struggle between these two parties over cropping decision. For details see decision making part in section 6.1.4.

Water allocation is another source of conflict between extension workers and irrigators. At times of sub-normal wet season rainfall, farmers are in need of supplementary irrigation. However, extension workers (especially those in Mai-nigus) do not allow any irrigation at wet season. Farmers also ask for water during times of ploughing land in order to prepare for irrigation. This is because the areas are dominated by vertic soils, whose hardness when dry makes tillage difficult.“ farmers feel that ploughing vetisols causes injuries to the shoulders of their oxen, and asks for much labour and time to accomplish the ploughing activity” (Mintesinot, op.cit.).

Nevertheless, the extension workers never allow water for ploughing. In Mai-nigus, the farmers after having had much disputes over requisitions for water for ploughing with extension workers, demonstrated the case in crowd to the woreda administration. The woreda administration ordered the “tabia” with an official tetter, after which the extension workers allowed some water for ploughing.

There are also complaints usually going that reflect that Abbo-mais detain water more than normal at lands of irrigators who have some special relations with them; or they take away water from other irrigators' plots before time. Such complaints also occur between irrigators themselves saying that one of them detains water at his/her plot. In the interviews with Abbo-mais, it was indicated that though these complaints are frequently raised, they remain feeble as water committee members jointly act against them as a committee.

A good account of conflict between Abbo-mai and the users in Gum selasa is given in woldeab (2003).

> There are instances where the Abo mai is involved in unfair water distribution through bribes such as invitation for some drink or getting grain. Farmers may not be bold enough to expose corrupt Abo mais since they fear that they may not get water. One irrigator observed unfair distribution of water. He said, 'Abo mai sometimes gives water without turn to farmers who invite him to ***tela*** (local beer). He tells the farmer who wants to irrigate his plot illegally, 'just irrigate your plot, I will tell the farmer who asks for water that you are irrigating due to an overflow. You should say the same thing. If he complains about the distribution of water, I will tell him that he was not at home when I went to inform him about his turn.' I asked him,' what would be the reaction of farmers who do not get water according to their turn?' He said, 'those who were denied water enter into conflict with Abo mai. However, usually elders or friends are involved in settling the conflict. In addition, suing and getting compensation is not common in our community (Ibid: 72).

Some kinds of water distribution breaches are reported to take place with the rule to control such breaches not fully enforced. These breach types include diverting water to one's own field and over irrigation of fields. It is reported that irrigators try to over use water if they get the opportunity to do so. As already discussed irrigators think much water results in much yield. Such water overuse could be related to the gist of hardin's tragedy of commons (hardin, 1968), as discussed under property rights in the literature review.

6.2. SOCIO-CULTURAL CONTEXTS FOR IRRIGATION ACTIVITIES

6.2.1. The Agrarian Structure

A. Land

Regarding land tenure, constitutionally land is owned by the government in the name of the public in the whole country. Farmers are given land under use rights. In Tigray region every farmer has been given lifetime use right certificate for the land he/she is using. This right includes the rights to contract out, to exchange and to inherit. But land sale and purchase are not allowed, as the landowner is the government, not individuals.

Irrigation land in the study areas was distributed in 0.2 ha size to a household irrespective of household size. According to interview results with agricultural experts in the Regional Agricultural and Environmental Resources Development Bureau and administrative officials

in the woredas, the allocation of 0.2 ha size of irrigation land to a household was based on technical, equity and management grounds. These could be summarized as follows.

1. Every household in the communities where the scheme has been constructed should be given the opportunity of being irrigation beneficiary.
2. Plots of irrigation should not be less than 0.2 ha size for further fragmentation curtails construction of scheme structure.
3. Irrigation plots under peasant household use should not exceed the size of 0.25 ha for further enlargement curtails management capability of peasant households.

The irrigation land redistribution system based on these considerations has been well established among the users, and no complaint has been reported at the data collection time for the research. The problem observed in relation with land distribution is with the dislocation of original land users from presently irrigated areas, and with the decrease in the original land users' land size in the command area part, which presently is out of irrigation use. Non-beneficiary farmers in the command area always raise the question of regaining their original land size before dam construction. They say that the o.2 ha land given under the unfulfilled promise for irrigation is too small for rain fed agriculture operation. As already mentioned, the original land users at the presently irrigated area but who were given land at the non irrigated part of the command area are always claiming the right to benefit prior to new comers.

Another problem related to land is that government functionaries are threatening the users saying that users who don't obey the dictations of these people would be confiscated of their irrigation plots. In an interview with the rural development office head of Hintallo Wajirat Woreda, it was reported that land has been practically taken off in some schemes from users

who cover their plots with cereals like maize, which can be produced at rain-fed agriculture. The whole scheme is confiscated and given to investors in order that investors could demonstrate how to produce cash crops to the peasant.

Due to these threats and other reasons, some of the irrigators don't believe that land will stay under their use title throughout their life times.

Table 21: User's feelings concerning whether they believe they would maintain their land under their/their families' title through out their lives

Responses	N	%
Yes	62	62%
No	37	37%
Non-response	1	1%
Total	100	100%

Source: Household Survey

The data in the Table 21 indicates that 37% of the respondents are still suspicious of their life long use rights of the land under their title irrespective of the insurance promised through the use right certificate. Whereas 62% of them believe that they are insured of lifelong use rights of their lands. The suspicious feeling with the 37% might reduce the concern of these users towards caring for productivity of their lands. A further inquiry during the household interview survey resulted in the following responses (Table 22).

Table 22: Impact of lifelong land use insurance on users' attempt to improve land fertility

Responses	N	%
It motivates me to improve land fertility and conserve soil.	8	12.9%
It assures me of the fact that land is mine, and I have to take every care of it.	1	1.6%
Both of the above	51	82.3%
Non-response	2	3.2%
Total	62	100%

Source: Household Survey

As clearly given in table 22, out of the 62 respondents who said they believe land will stay under their title through out their lives, 82.3% said that this feeling of theirs both motivates them to improve land fertility and conserve soil as well as assures them of the fact that the land is theirs, and they have to take care of it. Whereas 12.9% said it only motivates them to improve land fertility and conserve soil, and 1.6% said it assures them of the fact that land is theirs, with 3.2% non-response. Both responses show that lifelong land use right insurance has a positive impact on users' motivation to improve land productivity.

Regarding the questions forwarded the other way round, i.e. to see the impact of uncertainty of lifelong land use insurance on the users' attempt to improve land productivity, out of the 37 users who responded that they do not believe their lands would stay under their titles throughout their lives, only 18 users gave responses to the question. Nine of them said that because they are not sure that the land is theirs, they don‘t bother much about care for land, and are not motivated to improve land fertility. The rest nine said even through they are suspicious of their lifelong

land use rights, they care for the land as long as it is under their use. This measure might be in relation with their seasonal benefit for, at least, they can be sure that they can use the land for the season they started operation. It might not be in relation with long lasting land productivity, as the clause "…as long as land is under their use" rightly shows this condition.

Other empirical research findings also support the argument that tenure security (certainty in lifelong use right in this case) has a positive impact on endeavors to improve land productivity, whereas absence of certainty has a negative impact. For instance, Teferi Abate (1995) in his study on two communities (Tawa and Wayu) in North Ethiopia reports that repeated redistribution of land in Tawa made individuals take less interest in investing on the lands. Formerly, farmers planted less valued but nitrogen fixing crops such as beans, peas, chick peas and the like in a given year, anticipating better production of more valued crops such as teff and wheat in the future. When they were not sure of keeping the same plot for the coming crop years, however, they focused only on immediate returns. According to this author, the harmful effect of uncertainty was even more pronounced in respect of activities like manuring, terracing and other conservation measures.

On the other hand, in one of the communities (Wayu), where land redistribution was officially phased out as early as 1980, tenure security seemed to have enhanced. As a result, farmers were observed practicing a wide range of conservation techniques, including manuring, gay (burning the soil to restore its fertility), fallowing, crop rotation, and terracing.

B. Labour

Labour as a factor affecting user's practice of irrigation in the two study sites is mostly related to gender with respect to household head. According to the results of interviews and focus group discussions, many of the female-headed households lack male labour, which is culturally decisive for practicing irrigation known for its high labour demand. Such circumstances are common in many cultures. In many societies, due to gender- typing of tasks, separate peaks occur for male and female labor, and labour bottlenecks cannot be overcome by substituting one for the other (FAO, 1992). A household needs both male and female labour, and its well-being is dependent on the number, age and sex composition of the family (REST, 1999).

In addition to this, as some writers argue, lack of male labour renders women household heads face a triple burden: along side their reproductive roles and care for children and for other dependent household members, their responsibility as household heads places income generation as additional burden on them (Bert, 2001). Apart from this, women often will have to maintain the social status of the household in the locality, take care of social and neighborhood networking and assume community management activities (Ibid).

Therefore, many female-headed households lacking man labour usually will have to quit irrigation practices, and lease out their plots in a form of contract payment or sharecropping; hence they are forced to give up some part of benefit from irrigation.

The problem of labor as a hindrance on practicing irrigation also seems to be linked with socio-economic conditions of household heads. In table 13, household heads with socio-economic

status below the "male with higher socio-economic condition" category in this study reported that shortage of labour is among their reasons for contracting or giving out irrigation plot for sharecropping. In the table, 54.5 % of the male non-practicing respondents in the middle and lower socio-economics conditions gave this response. Similarly, 54.5% of the female non-practicing respondents also responded the same. (It is to be recalled here that, according to village elders' rankings, all female-headed households in the communities are with lower socio-economic conditions, except when ranked with each other.) Whereas none of the respondents in the "male with higher socio-economics condition "category said labour problem curtails their irrigation practice.

Regarding labour market, labour can easily be found from neighbouring villages for hiring. But lack of the money to pay for it is a problem with many of those who don't practice irrigation because of shortage of labour. According to responses, concerning irrigators' ability to hire labour at peak periods, 57 % of the respondents said they are able to hire and 38 % said they are unable (with 5 % non-response).

Table 23: Users' ability to hire labour at peak periods.

Responses		Male with higher socio-economic condition	Male with middle socio-economic condition	Male with lower socio-economic condition	Female with higher socio-economic condition	Female with middle socio-economic condition	Female with lower socio-economic condition	Total
Yes	N	16	12	13	7	5	4	57
	% within household head type	80%	57.1%	54.2%	70%	50%	40%	60%
No	N	4	9	11	3	5	6	38
	% within household head type	20%	42.9%	45.8%	30%	50%	60%	40%
Total	N	20	21	24	10	10	10	95
	% within household head type	100%	100%	100%	100%	100%	100%	100%

Source: Household Survey

Table 23 above gives a further indication that socio-economic status has a straightforward impact on households' ability to hire labour at peak periods. As socio-economic conditions decrease, the number of respondents who are able to hire labour decreases. Conversely, as socio-economic condition decreases, the number of respondents who are not able to hire labour increases. Thus, socio-economic condition of households in the study areas could be taken as a determinant factor in hiring labor during peak periods.

As has been reported during the focus group discussions, labour short households in the areas make use of traditional labour aid practices. These practices are locally known as Wofera and Rofedit (Amma in Gum-Selasa area). In Wofera, an individual farmer requests community members with some kind of acquaintance to him/her to help him/her with some kind of work on some day. The help-seeking farmer prepares a major kind of traditional food like '*injera*' and *'tella'* for the helpers in response to their help. In Rofedit, the help-seeking farmer does not have to prepare a major type of food. Only minor type of food like '*qolo*' (roasted cereal) may suffice.

Help providers, in both practices come in group and perform the wanted activity together. In Wofera, they perform the help provision during the morning part of the day. Whereas in Rofodit, they come in the afternoon, usually after having done some work somewhere else.

Peak periods in the irrigated system of the study areas are also characterized by labour competition. The soil and water conservation structure construction work regionally assigned to every farmer as a 22-day/ year free labour obligation takes away time and labour highly needed in irrigation practice. All the key informant interviews, focus group discussions and the

household interview survey have shown that the irrigators bitterly blame this program for disregarding their irrigation enterprise during the dry season.

With regard to labour competition, the survey results have also shown that religious practices are taking away much time that could have accommodated substantial amount of labour in irrigation. The majority of irrigators in the schemes must not be engaged in irrigation work for 5-11 days each month due to religious observances of Saints and Martyrs' days in the Ethiopian Orthodox Church. A study by Yonas (1996) indicates that being Orthodox Christians, farmers in Tigray observe up to 10 days a month. Almost in the same way, the responses in my study show that the least number of days observed by some irrigators is 5 and the highest number is 11. This range of difference is due to inter village as well as inter- household variations in the degree of concern to each observed day and its events. It is not all people, nor all villages that observe a certain day with its events. Some people and some communities value some days more than others due to certain reasons. A few of these reasons are:

1. proximity of a church named after a certain Saint, angel or Martyr;
2. the individual's responsibility in the church;
3. a special case in the individual's life connected with the Saint, Angel or Martyr or with the day observed in its name.

The days of the month observed among the two communities' members and their respective Saints, Angels or Martyrs are given in table 24 below. Due to multiple responses the number of days given in the table is 17 including Saturdays and Sundays, which are always free of labour whether they are or not days of a certain Saint, Angel or Martyr. However, the range of the

number of monthly-observed days given above does not include Saturdays and Sundays. Inclusion of the weekends would raise the number of holidays.

Table 24: days of the month and Martyrs, Saints or Angles the days are observed for

Date of Month	Name of Martyr, Saint or Angel	Meaning
3	Baata	Entrance of St Mary to the Temple
5	Abbo	St. Gebre-menfes –kidus
7	Sillasie	Trinity (The three Godhead)
8	Kiros	Kiros, The Martyr
12	Michael	Michael the Angle
13	Egziabher Ab	God the Father
14	Gebre Kiristos Aregawi	Aregawi, the Servant of Christ
16	Kidane Mihret	Covenant or Mercy (Mary)
18	Yostantinos	St. Yostantinos
19	Gabriel	Gabriel the Angel
21	Baale Mariam	Assumption of the Holy Virgin
23	St.George (Giorgis)	St.George
24	Tekle Haimanot	Tekle Haimanot, the Martyr
27	Medhanialem	Saviour of the world
29	Baale –Egziabher	Festival of God
Saturdays		
Sundays		

Source: Dates and Names from Household Interview Survey : Meaning from Teshome Wagaw (1971), Woldeab Teshome (2003) and household Survey

Out of the whole household heads taken in the sample population for this study, 67% said that they are never engaged in part or whole of irrigation work on the days they observe because they are sincere in their Christianity. Moreover, 62% of the respondents said that it is not only themselves that mustn't be engaged in irrigation work on those days. In addition, members of their household mustn't, either. Only 5% said that even though they must not be engaged in irrigation work on those days, their wives and children could carry out light activities like watering and looking after the irrigated crops.

These 67% respondents, who claim to be sincere Christians, were asked what they would feel if they saw some one labouring at his/her irrigation work on those days. 37 respondents (55.2 %) of them said they would feel nothing as it is up to the individual to respect or not to respect the religious values, whereas 30 respondents (44.8 %) said they ostrasize that individual. This indicates that the observances of the days have impacts not only upon the observers but also upon non - observers as a social value spill over. Religious values' impact on labour in the study areas in particular and in Tigray in general is also mentioned in other works. For example, the people of Gum Selassa are predominantly orthodox Christians. These people "do not carry out the primary agricultural tasks of ploughing, sowing, weeding, harvesting and threshing at weekends or on Saints' days," (Woldeab,op. cit.: 124). "Time and labor shortage are partly due to the rules related to the domination of religion in the region" (Minitesinot , op. cit.).

In Mai- Nigus, malaria is also a challenge in labour availability. Many household members fall sick with malaria, and labour availability for irrigation is deterred. The impact of malaria in labour availability cannot be undermined as other empirical research findings also show its adverse effects. According to a study report by Dejene and Yilma (2003), during peak malaria times, a considerable labor force is out of productive works in small-scale irrigation practicing communities in North Wollo.

C. Supporting Services

The path to irrigated agriculture, for a farmer who has participated in rain-fed farming all his/her life can be long and financially painful if he/she is left to his/her own device and to the "trial and error" methods of learning (FAO, 1992). A significant factor affecting irrigation project

performance is inaccessibility of the rural poor to information, capital, and agricultural inputs. The elite might monopolize the benefits aimed to the more vulnerable_____ the poor, rural women and children. Often the poorer groups see no point in competing with the more affluent to services and benefits which contacts with outside agents bring. Thus, provision of supporting services like credit, savings and agricultural extension (training, education and technical support) is a key to success in irrigation projects.

Woreda agricultural office experts in the areas of this study reported that there is a monthly program of training and orientation to irrigators on various subjects related to contemporary irrigation practices. In the household interview survey, 51% of the respondents said that they have taken training /education for irrigation on subjects like practices of irrigation production, irrigation management and output marketing. Whereas 48% of the respondents said they have never taken such training/ education. This shows that even through there are training / education programs for irrigators, their outreach might be limited to only some portion of the users.

The woreda agricultural office experts added that the office provides the irrigators with every input type. They said that farmers get these inputs via the extension workers at the ‘ tabias,’ who are the representatives of the office. The provision is carried out in two forms: on cash and on credit. Farmers that cannot afford the money organize themselves in groups and use the group credit service provided by REST [DCSI (Dedebit Credit and Savings Institution)]. However in the household interview survey, only 54 % of the respondents said they can get inputs easily, whereas 42 % said they can’t get them easily (with 4 % non- response). The reasons for difficulty in getting inputs, according to the responses, are high price of fertilizer as well as both

high price and provision unavailability of pesticides and improved seeds. These problems are more intense in Mai-Nigus than in Gum-Selasa.

Regarding accessibility and irrigators usage of credit service, 93 % of the respondents said the REST's (DECSI's) credit service is available in the areas. However only 31 % of the whole respondents said they use credit for irrigation, 66 % said they don't use (with 3 % non-response). Out of these 66 % who said they don't use credit for irrigation, 49% said they don't use it because they have their own sufficient money whereas the 51 % give the following summarized list as their reasons for not using credit:

1. Because the interest rate is high;
2. Because they couldn't secure the collateral;
3. Because the group credit system gives difficulty;
4. Because they know bad experiences of taking credit.

Respondents also indicated that they know bad experiences of taking credit that happened to their fellow community members. Some members of the communities bought sheep, seed and or fertilizer with the credit money. Others bought food for household consumption. However many of them were not able to repay the loan with its high interest rates. In some cases all the sheep died out, the crops failed and even people who took the credit passed away without having paid the loan, meaning inheriting the loan to their descendants.

A good account of the problems with taking credit in Gum-Selasa has been given in Woldeab (2003: 182-183).

Although Tigray has a remarkable loan repayment rate at regional level, farmers complain about the loans provided by DESCI. One major source of complaint is the Megojele (Grouping) system, which imposes collective responsibility on group members who are expected to pay back defaulter's shares. Many customers are therefore more willing to take a loan individually than to participate in the group scheme. Moreover, farmers found it difficult and time consuming to recruit creditworthy borrowers to their groups.

The loan repayment schedule coincides with harvesting time, which, as I described earlier, usually forces farmers to sell their products at a low price. Farmers also sell oxen to repay their loan because the income received from the crop sales is not normally sufficient to settle the debt.

Credit field officers of the Adigudom DECSI branch office reported the following complaints from borrowers:

Borrowers are not interested in taking credit by forming gujeles (groups) because of the risks with joint liability. While the loan repayment time set by DESCI is short, they are forced to sell their crops immediately after harvest which normally fetches a low price. During droughts the loan repayment time should be extended because of crop failure. The increase of the interest rate form 12.5 to 18% has affected their ability to pay back loans. The decision made by DESCI that borrowers who took loans for the purchase of oxen should pay in two installments rather than once in a year has forced many farmers to sell their oxen in order to pay back the loan.

The credit field officers are in close contact with borrowers and know how borrowers settle their debts. The officers estimated that 20% of the borrowers pay cash form their own pockets; 40% pay by selling their property or oxen; and 40% pay by taking loans form individuals. If the latter are local moneylenders then the interest charged per month will amount to 5 to 10 % interest per month.

As worked out from the household interview survey data, only 5 % of the respondents practice saving their irrigation income. 4 of these people save their money in a form of *"iqqub"* whereas one saves in the form of private deposit in bank. 93 % of the respondents said they don't have any form of savings for their irrigation income (with 2 % non-response). This indicates that the great majority of the users are not saving their incomes. By implication, many of them would not be able to pay for input purchase and labour hiring.

With regard to output market, irrigators sell their products by taking to the nearby market places as individuals. There is no cooperative to organize and facilitate marketing, nor are there any other forms of organized activities concerning market. Only 6 % of the respondents said they have any experiences of farm gate marketing. And 67 % of the respondents reported that they have output marketing problems while 31% said they don't have this problem (with 2 % non-response).

Focus group discussion members reported that many of the irrigated crops get cheap in the market because other schemes' irrigators also produce similar crops in similar seasons. Wise irrigators cope up with this situation by producing relatively long growth period crops which get ripe at around July, a practice in which they reap good income. Secondly, such irrigators crop early (around December) so that their crops get ripe for the Major Ethiopian Orthodox Christian fasting period, and they also reap good income. However, most of the irrigators in the schemes crop their plots in January and February, and crops get cheap in the market.

Another strategy irrigator's use as a market management technique is planting long lasting crops and keeping them in store until there is scarcity in the market. But these practices are

usually undertaken only by the well to do producers, as irrigators in the lower socio-economic conditions are likely to use their irrigation income for their immediate household needs. Apart from socio-economic conditions, lack of storage facility also inhibits the practice of keeping product for long time. Only 7 % of the respondents said they have storage facility whereas the rest 93 % said they don't have the facility. The 7 % who have the facility also added that the store is their own.

A serious problem with output marketing is a condition that prevails as a source of conflict between the Mai-Nigus irrigators and the municipality of Axum. With its aim to maximize municipal revenue with taxes from farm product retailers, the municipal administration forces the producers to sell their products on wholesale basis to the retailers. The workers of the administration chase away the producers who sit and sell their products in the market place to consumers. Or else, these workers do not allow the producers to sell until the products with the retailers are sold out. As a result, the producers are forced to sell their products at cheap prices either to the retailers or to consumers after retailers get theirs' sold out.

In an interview with a tax collector of the Axum Municipal Administration, the man said the complaints the irrigators forward are true except that the case was a past history. According to him, the producers were forbidden to sell for consumers unless they paid the tax retailers paid. But presently they have been given a place in one part of the market place in order to sit and sell their products.

The users' report, however, makes the tax collectors' statements a lie. They said, "The tax collectors still chase us and do what they used to do before." What the irrigators reported as a difference is that they have been given the said place, but selling in this place exposes them to attack from thieves. Moreover, the usual prohibition by the tax collectors until retailers finish what they have is always practiced.

Theft of product from fields is also reported to have been observed in both schemes. The respondents said that the stealing is practiced by young gamblers and non-irrigators.

6.2.2. Local Institutions

All the key informant interviews as well as the focus group discussions revealed that there are no formal water users' associations. Nor are there forms of co-operative with the emphasis on promoting irrigation performance. Respondents said that there had been continuous talks and discussions on the need of such institutions and the ways to establish them but many irrigators are suspicious as to who is going to benefit from these institutions. This feeling has its historical ground from the bad experiences of collectivization during the Dergue regime. It is within the memory of farmers that producers' co-operatives during the Dergue times dispossessed the peasants of their benefits through the product quota and price control systems. Therefore, a considerable number of the irrigators in the schemes do not want to contribute to the establishment of such institutions though some are now becoming aware of their benefits, especially with respect to their roles in input and output market management.

As shown in table 25, the responses of users regarding extension workers as helpers are by far higher than that to the woreda agricultural offices. The majority of the respondents (92%) believe that extension workers help them in irrigation whereas only 46% of them said the woreda offices help. Even the 51% of the respondents said that the woreda offices don't help them or even if they do, the help is not significant. This might be due to the fact that the woreda office workers are not normally seen as frequently as the extension workers at times of practicing irrigation activities. This, in turn, could be because the extension workers are more responsible for the duties at the schemes representing the woreda offices.

But as a response for an open ended question, the irrigators said that the woreda agricultural offices help them in their irrigation practices, especially in relation with matters like provision of fertilizer, pesticides, seeds; provision of training and creating forums for discussion as well as motivating well performing irrigators by rewarding as models of role. On the other hand, irrigators also blame the woreda agricultural office for imposing the 22-day/year free labour for soil and water conservation activities during their peak periods of irrigation labour. Irrigators also complain that the woreda office is harassing them by saying it would confiscate their irrigation plots if they don't obey its dictations, especially IN crop type selection and land size allotment to each type.

Besides, it has been reported that there are no other NGOs or community organizations helping the irrigators in irrigation production. Neither are there such organizations causing them problems. It is only the woreda agricultural offices and their representatives at the schemes (extension workers) who are working with the users in relation with irrigation.

Respondents said that the extension workers and the woreda agricultural office help them with issues like water usage, sowing technique, tilling practices, timing fertilizer and pesticide usage. Extension workers also supervise maintenance and weeding. The woreda agricultural office provides fertilizer, seed, pesticides, and gives trainings on how to handle irrigation. Users' judgment about the help provided by these institutions is given in the following table.

TABLE 25: user's judgment whether extension workers and woreda agricultural offices help them in irrigation production

Responses	Extension workers		Woreda agricultural office	
	N	%	N	%
Yes	92	92 %	46	46 %
No	4	4 %	44	44 %
Not significantly	2	2 %	7	7 %
Non-response	2	2 %	3	3 %
Total	100	100 %	100	100 %

Source: Household Survey

Irrigators at Mai- Nigus believe that both the extension workers and the woreda agricultural office are causing them problems for they don't allow water for moistening the dry land for ploughing. They bitterly argue that they cannot manage to plough the dry land without giving it some moistening water for it is so hard to break, and not only causes injuries to the shoulders of their oxen but also demands much labour and time to plough.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

This study was conducted with a general purpose of assessing the socio-cultural aspect of irrigation management in Gum-Selasa and Mai-Nigus community based small-scale irrigation schemes in the upper Yekeze basin. In order to achieve this, the investigation focused on the work of getting answers to the following specific questions:

1. What irrigation activities are associated with problems in irrigation management, and how?
2. What are the socio-cultural contexts affecting management of irrigation practices; and how do they affect them?

Secondary data review, key informant interview, focus group discussion and household interview survey were used as methods of data collection. Both qualitative and quantitative research methods were used for the data analysis, and the findings are summarized as follows.

❖ Irrigation activities associated with major problems in managing the socio-cultural issues in the two study schemes are operation, maintenance, water allocation, water distribution,

decision-making and conflict management. Incapable institutional setting of the management body resulted in ineffective operation.

* Perception of scheme ownership, head-end /tail-end position of land, and weak enforcement of collective action rules are affecting irrigators' commitment to structure maintenance. No body has been identified as responsible for desilting the sediment deposit in the reservoir dams, and it is accumulating further.

* Water in the study schemes is not allowed for protective irrigation. It is used only for dry season irrigation. As the meteorological realities in the area usually cause insufficient rainfall during the final months of wet season growth period, it is likely that there would be reduction in yields. However, water allocation in the schemes doesn't take this into consideration.

* There exist attempts of water distribution breaches. These include detaining water at one's Self plot, Abbo-mai's taking away of water from someone's field before the required rate is met, or giving water to some irrigators out of their turns, and irrigators' over-irrigating of fields. That users pay a uniform charge without taking the amount of water into consideration, and the weaknesses in enforcing rules of water distribution breaches are causing lack of incentive for efficient use of water.

* Due to socio-economic and cultural factors, some landholders in the schemes have been rendered non-beneficiaries, or else, partial beneficiaries of irrigation benefit even though the water availability is in a status of enabling them to use. They are forced to decide to lease

out their irrigation plots instead of producing themselves. Their decisions are determined by lower socio-economic condition, shortage of oxen and gender–related shortage of labour. As a result of this, inequality (income disparity) could be getting aggravated between the out-leasers and in-leasers of land. Most of the households leasing out their irrigation lands are female headed.

* Income disparity could also be widening, even worse, between the farmers who have been cut off because of water shortage and their tail-end land positions and the farmers who are continuously using irrigation. Many farmers whose lands have been taken for irrigation and whose cumulative land size has been diminished during redistribution were promised of benefiting from irrigation, as the Co-SAERT experts at the beginning said, " Those who do not get water at present will get water in the future when concrete canals are constructed," (Woldeab, 2003:97). However none of the experts promises has come true so far, and these farmers have staid mere watchers of the benefits being reaped by the continuous beneficiaries. On top this, socio-technical factors are rendering more beneficiaries at the tail-end part non-beneficiaries as water shortage caused by less run off harvest, inappropriate decision on the technical proportion between water and irrigable area, and seepage from the dams create the condition in which the total irrigable land size is usually diminished.

* These differences between beneficiaries and non-beneficiaries are causing adverse **social effects,** in which non-beneficiaries are developing resentment for irrigation as a new technology, negative attitudes towards beneficiaries (especially to those who are from other communities and were given land in the present irrigated area), and are usually in conflict with the government bodies.

* There is a considerable struggle undergoing between household livelihood strategies in the mixed farming system and the government priorities for irrigation production in the schemes. The priorities in the cropping pattern of a substantial number of irrigators radically diverge away from the government priorities. This and other farmers' decisions in relation with their livelihood objectives have dominated over government objectives, a condition which renders the projects to be underperforming seen from the government objectives perspective.

* Several unmanaged conflicts are prevailing in the schemes' performance. Serious conflicts between head-enders and tail-enders over water share, conflicts over the 22-day /year free labour between irrigators and government bodies, conflicts between non-irrigators and irrigators as well as non-irrigators and the government over adverse effects of newly emerged birds and malaria; and conflicts between users and Abbo-mai as well as among the users themselves are major types of adverse **social effects** which always prevail without efficient attempt to manage them.

❖ The socio- cultural contexts affecting management practices are land rights, labour linked with gender and religion, supporting services (credit, savings and education/ training), market and local institutions. Irrespective of the lifelong land use right certificate given to the farmers, some irrigators are still suspicious of its materialization. Due to this feeling, they are not caring for the improvement of the productivity of their lands. A serious problem with land rights exists in Gum-Selasa. Land was taken away from the indigenous people and given to people from other communities. This created a feeling, among the

indigenous people who lost their land, that irrigation has been introduced for the benefit of the urban elite on the expense of the indigenous people.

* Several reasons cause labour shortage in the schemes. Prevalence of malaria makes irrigators fall sick and causes loss of time and labour. Soil and water conservation work takes away 22 day's time every irrigation season, and the Ethiopian Orthodox Christian observances of Saints', Angels' and Martyrs' days render irrigators labourless for 5 – 11 days (Saturdays and Sundays excluded) every month at household level. Female-headed households are, in most cases, without man labour, which culturally covers the essential parts of irrigation labour.

* Shortage in coverage of irrigation training, high prices and inadequate provision of inputs, non-use of credit services, absence of saving habits and lack of storage facility are problems in the performance management of the schemes. Though many irrigators have financial needs for input purchase and labour hiring, they don't use the credit services available at their areas because they feel the interest rate is high; they are unable to secure the collateral; they feel the group loan system is unsuitable; and they fear the risks with repayment.

* Another context entailing problem in the two schemes performance is output market. Unorganized marketing, low price of output and harassment from government tax collectors (in the case of Mai-Nigus) create problems in this issue.

* Actors in irrigation management as local institutions have been found to be water committee (aided and supervised by extension workers, 'tabia' administration and community court),

the Woreda Agricultural Offices and the DA centers (extension workers). Water committee is responsible for matters with water distribution, conflict management and resource mobilization for maintenance. Conflicts beyond the capability of the committee are referred to the community court. But neither of these bodies is with strong performances of enforcing rules and regulations as formulated. The task of water allocation is performed by Woreda Agricultural Offices and extension workers. As observed from documentary evidence and interviews with extension workers, the decision regarding the proportion of water and irrigable area is not based on technical recommendations of experts.

* The extension workers and the Woreda Agricultural Offices help the irrigated system technically, but these institutions are also sources of harassment in irrigation production. They threaten irrigators that they would be confiscated of their lands and denied of water use if they don't obey government-set priorities.

* The water committee is too incapable to manage all issues in the socio-cultural aspect of irrigation management. Essential issues like input and output marketing management, head-end/tail-end conflict minimization works, controls of efficient water use tasks are vacant presently.

7.2. Recommendations

Based on the findings of the study, the following recommendations are given.

1. As the findings show that the **social requirements for use** of irrigation technology in the two schemes are not fulfilled, formal water users' associations, taking the local culture in to account, should be established in order to better manage the issues in irrigation. Such organizations can

a. solve the problems with input and out put marketing management . They can claim legal personality in the name of the users and perform dealings of acquisition of financial resources, and legitimate marketing licenses as producers and users. Even though the bad experiences of cooperative associations during Dergue are threat against farmers' support to such associations, there is also much of opportunity that many are getting aware that organizing in an association will bring them better benefits.
b. be able to establish efficient water utilization. This can be achieved through introduction of a simple water use charge which takes amount of water used as a criterion through community participation in decision, and full enforcement of collective action rules.

The present obedience of the users in contributing up to 45 birr per household at once for maintenance is an indication that there is an opportunity to implement water charging.

c. be able to, at least minimize head-end/tail-end conflicts over water use and structure maintenance . The organizations can have some deposit of money after some time or, with the consent of the communities, can acquire some money through aid or loan for better construction of canals in order to reduce seepage and maximize water users' number. Or with a higher vision, they can deposit money through time from water use charge or acquire from other sources in order to develop the system into drip irrigation, which can enable a larger number of farmers to be beneficiaries.

Regarding maintenance, money from water charge can be used to hire temporary or permanent staff in order to get rid of conflicts among users over participation in maintenance as people with the experience advise. For example, Freeman and Lowdermilk (1991), from their experiences with difficulties of mobilizing labour contributions for maintenance, suggest that it is less disruptive to the farmer organizations to collect revenue in advance of water delivery according to some concept of water share, and hire staff to perform routine maintenance.

d. be able to establish reliable supportive services such as forms of saving, storage facility and consultancy services to the members.

2. There should be a reform in the government priorities of irrigation in the schemes so as to incorporate farmers' livelihood strategies in the crop-livestock mixed farming system. Irrigation objectives should give adequate attention to the farmers' ways of life and their relations to the new technology. Farmers should be given the chance to produce not only cash crops, as their main concern is not only cash income. Their food security and livestock

agendas should not be glossed over, for time and experience aided with training/ education and other supporting services might lead them towards the capitalistic concept of production.

Thus increased plantation of grass types used for animal feed on marginal areas, other forms of animal feed provision and reasonable allocation of land between all objectives regarding cropping pattern is advisable.

3. There has to be a targeted intervention in order to enhance the women's and economically weak farmers' benefits from irrigation. A special program of credit service and awareness raising in how to use credit should be enhanced to this portion of the communities in order to bring them into access to key resources like capital and labour.

Practical evidences indicate encouraging effects of such endeavours. For example, Van Koppen (1998 in Tegegn and Asfaw, 2002) gives an account of such an experience. In Bangladesh, female groups received financial and technical assistance, the support being similar to that given to pure men groups, but more intensive. Here, access to capital and operational loans improved women's bargaining position.

4. The traditional practices like 'wofera' and 'rofedit', in which labour short farmers are helped by the community members should be promoted. Through a planned action, women household heads should be encouraged to utilize the potentials of using these practices, whereas men should be convinced to help women.

5. Endeavours to minimize the negative impacts of religious practices on labour availability should be made. Religious leaders should be approached and made to play important roles in convincing people to further value their concerns to their worldly lives.

6. A proper and immediate measure to overcome the problems caused by newly emerged birds and malaria should be taken.

7. Government bodies should consider the labour demand of irrigation systems during the plan for the 22-day free labour of soil and water conservation work. Attempts should be made in order to free irrigators during times of their high demand of labour for irrigation, and make up their programs independently by planning together with them.

8. Immediate solutions should be thought of and attempts should be made to at least minimize the problems with irrigation benefit-promised but rendered non-beneficiary farmers. Concerned bodies should make endeavours to get concrete canals constructed and the number of beneficiaries increased.

9. Presently, communities should be helped with removing the sediment in the reservoir dams. Machinery aid should be requested by Woreda Agricultural Offices from possible sources, and preventive watershed management activities should be continuously done by the communities.

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Appendix 2

Household Interview Survey Questionnaire

Dear respondent,

This is a household interview survey questionnaire designed to assess the performance of irrigation management in the community-based small-scale irrigation schemes in the upper Tekeze basin. The study focuses on the socio-cultural aspects of irrigation management, and household interview survey with the aim of scrutinizing the organizational human behaviour as well as collective action with particular reference to irrigation production is one of its data gathering methods. The ultimate goal is to propose appropriate management strategies in order to improve the agrarian livelihood and maximize benefit of irrigation from a holistic point of view.

Thus, your genuine response is of paramount importance for the success of the study, and the researcher kindly requests your cooperation in so doing. Please be sure that any information you provide will be kept confidential and be used purely for the purpose of the study.

Thank you!

Part I. General Information

Date _____ Enumerator _____
Name of irrigation scheme _____
Questionnaire code _____
Household head's :
Sex _____ Age _____
Ethnicity _____ Religion _____

Household Family size

Age group	No of HH members
0 – 9 = 0	
10 – 14 = 1	
15 – 64 = 2	
> 65 = 3	
Total = 4	

Part II

A. Operation and Maintenance

1. Is/are there practice in which livestock walk about in the irrigation/irrigated area or the scheme structure? Yes = 1 No = 2
2. If yes, in what cases?

   For drinking water = 1 For grazing during fallow periods = 2

   For feeding on crop residue after harvest = 3

   Uncontrolled livestock feeding on irrigated crops = 4

   Others/specify _____ = 5

   _____ = 6

   _____ = 7

   Any Combination of the above _____

3. If yes to Q. No.1, what damages do they cause in the scheme?

   They eat up the irrigated crops = 1 They damage irrigation canals = 2

   They cause soil compassion = 3

   Others/specify_____ = 4

   _____= 5

   _____= 6

   Any combination of the above _____

4. Have you ever participated in maintenance of the irrigation scheme?

Yes=1 **No=2**

5. If no, why not? _____
6. If yes, how many times in a year do you participate approximately?

   _____

7. If yes to Q4, is it on your own plot or on the whole scheme?

   On my own plot = 1 On the reservoir dam = 2

   On the canals = 3 At any point of damage in the scheme = 4

   Any combination of the above _____

8. How frequently does the structure get damaged?

   About _____ times in a year.

9. What is/are the main cause/s of structure damage in your scheme? List down in order of importance.

1. _____
2. _____
3. _____
4. _____
5. _____

B. Water Allocation and Distribution

1. Do you use water for supplementary irrigation (During the wet season)?

   Yes = 1 No = 2

2. If no, why not? _____

   _____

   _____

3. If yes, is the water availability in the reservoir sufficient for both wet season and dry season irrigation?

   Yes = 1 No = 2

4. Do you feel you share equal water with every user in the scheme?

   Yes=1 No =2

5. If no, what do you think is the reason for the inequality?

   Ethnicity =1 Gender = 2 Political Power =3

   Religion = 4 Crop Type =5

   Others/Specify _____ = 6

   _____ = 7

   _____ =8

   Any Combination Of The Above _____

6. If there is inequality, which groups of people get more?

_____

7. If there is inequality, which groups of people get less?

_____

8. If there is inequality, do you get more or less? More= 1 less =2

9. If you get less, do you believe this is reasonable? Yes = 1 No =2

10. If no, what measures do you take in response?

    Become Reluctant to participate in maintenance =1

Try to over use water in my turn = 2

Conspire with my likes in order to bring about equality =3

Other / specify _____ =4

_____ =5

_____= 6

Any combination of the above _____

11. Do you use crop water requirement rates for watering your fields? Yes = 1 No =2
12. If yes, who gives you the rate? _____
13. If yes to Q 11, do you always stop watering when the rate is met even if the usual time given to watering turn is yet to get? Yes = 1 No = 2
14. If no to Q 13, why don't you stop at the given rate? _____

_____

15. Have there been any defaulters of water distribution in the scheme? Yes = 1 No = 2
16. If yes, what is done in cases of water distribution defaults? _____

_____

17. Does the community have a system of rule for controlling water distribution default?

Yes = 1 No = 2

18. If yes, what does the rule say? _____

_____

19. If yes to Q17, do you believe the rule is enforced in the way formulated?

Yes = 1 No = 2

20. If no, what are the weaknesses? Please, list down in order of importance

1. _____
2. _____
3. _____
4. _____
5. _____

21. Who or what body is responsible for enforcing the rules?

_____

22. Whom, do you think; does the water in the reservoir belong to?

_____

23. Whom, do you think; does water belong to when it is at the gate of your plot just getting to your plot at your watering turn? _____

24. Are there special considerations for crop-type and stage of growth during water allocation?
Yes = 1 No = 2

25. If No, what happens when somebody is convincingly in higher need of water for his/her field?

Can do nothing until his/her term is up = 1

Can contact water controlling body in terms of emergency and get water = 2

Can negotiate with the irrigator of that turn and get water = 3

Other/specify _____= 4

_____= 5

_____= 6

Any combination of the above _____

26. Do you pay any water use fees? Yes =1 No=2

27. If yes, what kind?

Cost recovery fees for structure construction =1 water use charges =2 Both = 3

Other /specify _____

C. Organizational Activities

1. Do you have a storage facility for your irrigation products? Yes = 1 No = 2

2. If yes, whose is it, your own or the community's? _____

3. If it is the community's, how do you use it? _____

_____

4. If it is the community's, do you think you are equally served to anyone in the community?
Yes =1 No = 2

5. If no, who do you think uses it more? Why?

_____

_____

_____

6. If no to Q4, who do you think uses it lesser? Why?

_____

_____

7. Do you feel this way of using it is fair? Yes =1 No =2

8. Did you lose any asset of your own because of irrigation dam construction?

Yes = 1 No = 2

9. If yes what did you lose? Grazing land = 1 Cultivated land = 2

Residential house and place = 3

Others, specify _____ **= 4**

_____ **= 5**

_____ = 6

Any combination of the above _____

10. If yes to Q no. 8, what was your response to your loss? Opposed the construction = 1

I accepted my loss assuming the future benefit = 2

Internally opposed; however I eventually yielded in as I didn't have the power =3

Others, specify _____ **= 4**

_____ **= 5**

_____ **= 6**

11. If you opposed the construction, how was the conflict resolved?

It wasn't resolved as the project designers went on with the process = 1

It was resolved by giving me compensation = 2

I was given compensation which I didn't agree upon; and I was driven out = 3

Others, specify _____ = 4

_____ _____= 5

_____ = 6

12. If you opposed then, has your feeling changed now?

Yes, I am convinced that irrigation has brought me better advantages = 1

No, still I feel insecure = 2 I am now indifferent = 3

13. If you were given compensation, please mention the case.

_____

14. If you still feel insecure, would you like if you could get back your original asset and give up your

irrigation use? Yes = 1 No = 2

15. Have you ever had a conflict related to irrigation production with anybody?

Yes =1 No = 2

16. If yes to Q 15, how many times in an irrigation season would it be approximately?

17. If yes to Q 15, please mention all cases and their causes you remember.

Case	Cause
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

18. What do you think is/are the main cause/s of conflict in your scheme?

Water allocation = 1 Water distribution = 2

Storage sharing = 3 Land redistribution = 4

Others/Specify _____ _____=5

_____= 6

_____=7

Any combination of the above _____

19. Is there a problem of product theft in your scheme? Yes = 1 No = 2

20. If yes, is the stealing from store or field?

_____

21. If yes to Q 19, which groups of people steal do you think (know)?

_____

22. If yes to Q19, at what time does the stealing take place?

At day time = 1 At night time = 2 Any time = 3

23. If yes to Q 19, is the stealing related to conflicts pertaining to irrigation use?

Yes = 1 No = 2

24. What hostile activities are there among the community members resulting from conflict over irrigation production?

1. _____

2. _____

3. _____

4. _____

5. _____

25. Were you happy when you first heard that an irrigation scheme was going to be constructed in your area? Yes = 1 No = 2 Indifferent = 3

26. If yes, why? _____

27. If No to Q 25, why not?

_____

28. Whether yes or no to Q25, has your feeling held true after irrigation implementation?

Yes = 1 No = 2

29. If no, what change is there?

_____

30. Do you practice irrigation all dry seasons as long as water is available?

Yes I do = 1 No I sometimes hire out my plot = 2

No, I sometimes leave my plot for fallowing = 3

No, I sometimes contract out my plot for sharecropping = 4

Any combination of the above (use the codes)

_____

31. If No. 2 or 4 are taken as answers to Q 30, what is your reason?

Shortage of labour = 1 Problem of ox/oxen = 2

Because I am not interested in undertaking the laborious practice of irrigation during the hot weather = 3

Because I can meet my household needs from other means = 4

Others /specify _____= 5

_____ = 6

_____= 7

Any combination of the above (use codes) _____

32. If No. 4 is taken as an answer to Q. 31, what is/are the other means?

Relief assistance = 1 Rain-fed production = 2

Fire wood selling = 3 Wage labour = 4

Other specify _____ = 5

_____ = 6

_____ _____ = 7

Any combination of the above: _____

33. If No. 4 is taken as an answer to Q 32, where do you get the job?

On irrigation fields of my community members = 1

On farm fields of others than my community members = 2

From non-farm activities in my own area = 3

From non-farm activities in others than my area = 4

Any combination of the above = _____

34. If No. 2 or 4 is taken as an answer to Q No.33, do you have to go out of your area for some time and stay there in order to accomplish the work mentioned?

Yes = 1 No = 2

35. If yes, how long do you have to stay there? _____

36. Do you know what crops have been recommended for irrigation production for your scheme by project designers? Yes = 1 No = 2

37 If yes, do you crop your field according to the recommendation for types of crop and area of land? Yes = 1 No = 2

38. Is it on your discretion that you plant the crop types that you grow using irrigation?

Yes = 1 No = 2

39. If yes, list down the rank of crops you produce using irrigation in terms of area of land devoted to each.

Take the crop to which the largest area is devoted as 1st rank.

Roll No	Name of crop	Rank
1		
2		
3		
4		
5		
6		
7		

40. What is/are the reasons for devoting much area of land to your high ranked crops?

Household Consumption = 1 Livestock feed = 2

Cash income source = 3 Being less laborious = 4

Risk sharing with other farmers = 5 Land size = 6

Others, specify _____=7

_____= 8

_____= 9

Any combination of the above _____

41. If no to Q 38, who dictates you? _____

42. If no to Q 38, would you crop other crops than you do now if you were left free for choice?

Yes = 1 No = 2

43. If yes, what crop/s and why?

Crop type	Reason for planting
1. _____	1.
_____	
2. _____	2.
_____	
3. _____	3.
_____	

4. _____ 4. _____

5. _____ 5. _____

Part III

A. The Agrarian Structure

1. Do you care for improving the fertility of your irrigation plot?

   Yes = 1 No = 2 I care, but not significantly = 3

2. If yes, what techniques do you use?

   Fallowing = 1 Crop-rotation = 2 Manure = 3 Compost = 4

   Chemical Fertilizer = 5 Crop-residue = 6

   Others, specify _____= 7

   _____ = 8

   _____= 9

   Any combination of the above = _____

3. If 2 or 3 are taken as answers to Q 1, what is the reason?

   _____

4. What were the criteria for the size of irrigation land allocated to a household during redistribution?

   _____

   _____

   _____

5. What is your general judgement concerning the fairness of the land redistribution?

   _____

   _____

   _____

6. Under whose title is the land you are using for irrigation?

My self = 1 **My spouse = 2**

All the family = 3 My self and my spouse = 4

Others, specify _____ **= 5**

_____ **= 6**

_____ = 7

7. Do you have child/children who is/are at the age of claiming land under their own title? Yes = 1 No = 2

8. If yes, how is/are the child (children) going to get the land?

Through redistribution of the whole irrigation land newly = 1

Through allocation of some marginal land not put under cultivation but potentially irrigable = 2

Through allocation of some marginal land not put under cultivation nor potentially irrigable = 3

Through inheriting land under my title at my will any time = 4

Through inheriting land under my title when I pass away = 5

Others, specify _____ = 6

_____ = 7

_____ = 8

9. Do you think the land you are using will be under your title through out your life?

Yes = 1 No = 2

10. If yes, what relations does this feeling of yours have with improving productivity of your land?

It motivates me to improve the fertility and conserve soil = 1

It assures me of the fact that the land is mine, and I have to take every care of it = 2 Both = 3

Doesn't make any difference = 4

Others, specify _____ **= 5**

_____ **= 6**

_____ **=7**

11. If no to Q 9, what relations does this feeling of yours have with improving productivity of the land?

I am not motivated to improve fertility and soil conservation = 1

I am not sure that it is my land, so I don't bother much about the care for the

land = 2 Both = 3

Others, specify _____= **4**

_____= **5**

_____ =6

12. Did you have any conflict with anyone concerning irrigation land use?

Yes = 1 No = 2

13. If yes, what was the reason? _____

_____

14. If yes to Q 12, which people (what kind of person) was it with? _____

_____

15. If yes to Q 12, how did you resolve the conflict? _____

_____

_____

16. Do you and your family seek modern medication at times of illness or injury?

Yes = 1 No = 2 Sometimes = 3

17. If no, why not? _____

_____

18. How far is the nearest health institution from your residence? _____

19. If 'yes' or 'sometimes' to Q 17, how do you transport ill or injured persons to heath institutions?

_____

20. Can you hire labour at peak periods? Yes = 1 No = 2

21. If no, why not? _____

22. Are there days of the month on which you mustn't engage yourself in part or whole of irrigation work?

Yes = 1 No = 2

23. If yes, please list down the dates.

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

10. _____ 11. _____ 12. _____

13. _____ 14. _____ 15. _____

24. If yes to Q 23, can some of your household members other than yourself engage themselves in irrigation activities on the mentioned days? Yes = 1 No = 2

25. If yes, which of your household members and in what activities?

_____

_____

26. If yes to Q 23, why don't you get engaged on the kinds of work you don't on those days?

Because I am sincere at my religion = 1

Because I want to get rest of laborious irrigation work = 2

I do this following the deeds of my neighbors/colligues = 3

The culture forbids working on those days = 4

Others, specify _____ _____= 5

_____ _____= 6

_____ _____= 7

Any combination of the above _____

27. What would your feeling be if you see some other irrigator working on irrigation field on those days?

_____

28. Do other irrigators following another religion than your own don't either work on those days? No, they don't = 1 Yes, they do = 2

29. Which of the following inputs do you use in irrigation production?

Vegetable seeds = 1 Fruit seedlings = 2

Chemical fertilizer = 3 Pesticides = 4 Herbicides = 5

Any combination of the above _____

30. If you use any of these, where do you get them from?

_____

31. If you use any of them, do you get them easily? Yes = 1 No = 2

32. If no to Q 32, what is the reason?

Reason	For which input?
High price = 1	_____
Unavailability of provision = 2	_____
Problem of getting credit service = 3	_____
Others, specify _____= 4	_____
_____=5	_____
_____ = 6	_____

33. How do you sell your irrigation products?

By taking to markets =1 By selling to agro-processing industry =2

Traders come to my area and buy =3

Others, specify _____=4

_____=5

_____=6

Any combination of the above _____

34. Do you have any problem with output marketing? Yes = 1 No = 2

35. If yes, list down your major problems in order of importance.

1. _____
2. _____
3. _____
4. _____
5. _____

36. Does the community have a cooperative for irrigation promotion?

Yes = 1 No = 2

37. In what form do you market your irrigation products?

As an individual = 1 As a member of informal group = 2

As a member of a cooperative = 3

Others/specify _____

Any combination of the above _____

38. Have you ever taken training/education related to irrigation?

Yes = 1 No = 2

39. If yes, what is it specifically related to?

Irrigation production practices = 1

Irrigation management = 2 Marketing of outputs = 3

Others, specify _____ = 4

_____= 5

Any combination of the above _____

40. If yes to Q 39, who (what organization) gives the training/s? List them down

1. _____ 4. _____

2. _____ 5. _____

3. _____

41. Is/are there credit services in your area? Yes = 1 No = 2

42. If yes, formal or informal? Formal = 1 Informal = 2 Both = 3

43. Have you ever taken credit for irrigation purpose?

Yes = 1 No = 2

44. If no, why not? Because the interest rate is high = 1

Because I couldn't secure the collateral = 2

Because I have got my own sufficient money = 3

Because it isn't easily accessible = 4

Others, specify _____ = 5

_____ = 6

_____ = 7

Any combination of the above _____

45. Do you know anyone/s in the area who has been in problem because of borrowing credit?

Yes = 1 No = 2

46. If yes, please describe the cases you know.

Who & how ? From formal or informal institution ?

1. _____

_____

_____ _____

2. _____

_____

_____ _____

3. _____

_____

_____ _____

4. _____

_____

_____ _____

47. Do you have any form of savings for your irrigation income? Yes = 1 No = 2

48. If yes, in what form is it?

Iqqub = 1 Private deposit in bank = 2 Community savings organization = 3

49. If you have community savings organization, please describe how it works.

_____

_____

_____

50. Is there any change in your livestock holding because of irrigation introduction?

Increased = 1 decreased = 2 No change = 3

51. If increased, what do you think is the root cause?

Increase in animal feed from crop residue = 1

Increase in animal feed from grass types introduced together with irrigation = 2

Increased income from irrigation to buy more livestock = 3

Increased income from irrigation for better veterinary service attainment = 4

Others, specify _____ _____= 5

_____ = 6

_____ = 7

Any combination of the above _____

52. If decreased, what do you think, is the root cause?

Shortage of grazing area = 1 Animal disease emerged after irrigation = 2

Shortage of labour to share between livestock rearing and irrigation practicing = 3

Others, specify _____ = 4

_____ = 5

_____ = 6

Any combination of the above _____

53. Has irrigation introduction caused any change in the way you get water to your livestock?

Yes = 1 No = 2

54 If yes, is it an advantage or a disadvantage? Specify the case _____

_____

_____

55. What is your judgement concerning the impact of irrigation introduction on your livestock holding?

Negatively affected my livestock holding = 1

Positively affected my livestock holding = 2 Has no impact = 3

56. If your answer to Q 56 was "Negatively affected …," what do you feel about the cumulative effect of

irrigation in terms of your family livelihood?

In terms of livelihood, irrigation contributes more than the loss it causes in livestock holding = 1

Loss in livestock holding is maintained, and there is a cumulative loss in livelihood = 2

Even though irrigation contributes more to livelihood, it cannot compensate for the social resource values lost as a result of loss in livestock = 3

I cannot determine the balance = 4

B. Development NGOs and Local Institutions

1. Whose do you think is the irrigation scheme?

The government's = 1 SAERT'S = 2 REST'S = 3

The community's = 4

Other's, specify _____

2. Are the extension workers helping you in irrigation practices?

Yes = 1 No = 2 Not significantly = 3

3. If yes, in what ways are they helping you?

_____

_____

4. Is the woreda Agricultural office helping you in irrigation practices?

Yes = 1 No = 2 Not significantly = 3

5. If yes, in what ways is it helping you? _____

_____

6. Is/are there an NGO/s or community based organization/s helping you in irrigation practices?

Yes = 1 No = 2

7. If yes, what NGO/s or community organization/s is/are helping you?

NGO	***Community organization***
1. _____	**1.** _____
2. _____	**2.** _____
3. _____	**3.** _____
4. _____	**4.** _____
5. _____	**5.** _____

8. How is/are these NGO/s and CBO/s helping you?

_____

_____

_____

9. Is/are there NGO/s or community organization/s causing you problem/s in undertaking irrigation production?

Yes = 1 No =2

10. If yes, what is /are the organization/s?

NGO	Community organization
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	
4._____	
5. _____	5.

_____

11.How is /are the organization/s causing you problem/s?

_____

_____

12. Does the Woreda Agricultural Office or the DA center in your 'Tabia' create you any problem in your irrigation practices? Yes =1 No =2

13. If yes, how do/es it /they create you problem/s?

_____

_____\

14. Do you experience any harassment related to your irrigation production?
Yes = 1 No = 2
15. If yes, please specify the case as to form whom and how it is. _____
_____
_____

Appendix 3
Interview Questions To Irrigation Experts From Woreda Agricultural Office

Date ……...

Name of Irrigation Scheme ……...

Interviewee……Sex……

Responsibility/ Position …… …….....

1. Who initiated the construction of the small-scale irrigation projects in the area?
2. Did the community participate in the construction?
3. Whose are the irrigation structures now?
4. How are the irrigation activates managed?
5. What like is the relation between the Woreda Agriculture Office and the irrigation schemes?
6. Who is responsible for desilting sedimentation in the main reservoir?

Interview Questions to the Development Agents

Date……

Name of DA interviewed ……..

Name of irrigation scheme ……

1. Whom does the irrigation structure belong to?
2. How do you help the irrigation users?
3. Have there been any conflicts pertaining to irrigation in the scheme?
4. Do you make decisions pertaining to irrigation on your discretion or have to wait for guidelines to come down from Woreda Office?
5. Do the Community practice supplementary irrigation?

6. How is sedimentation in the main reservoir managed?

Interview Questions to Irrigation users Originally Affected Because of Structure Construction

Date ……

Name of Irrigation Scheme ……

Interviewee/s…… Sex……

……Sex……

Responsibility/ Position …… ……

1. What did people lose because of irrigation structure construction?
2. What was the response at the time?
3. Was there compensation for the losses?
4. What have people gained because of irrigation introduction?
5. What do people now feel about their losses and gains due to irrigation?

Interview Questions to the Water Committee Heads and Abbo-Mais

Date ……

Name of Irrigation Scheme ……

Interviewees …… Sex……

1. Is there a water users Association for the scheme?
2. How is water allocated and distributed to users?
3. How is maintenance and rehabilitation handled?
4. Do you collect water use fees?
5. How is input and out put marketing managed?

Interview Questions to the PA Chairpersons

Date ……

Name of Irrigation Scheme ……

Interviewee ……..Sex…….

1. Have there been any conflicts pertaining to irrigation in the community?
2. How is land distributed to irrigation users?
3. What like is the input market for irrigation production?
4. Is there any special support to female headed households using irrigation?

Appendix 4

Interview Guide For Focus Group Discussion

Date …….....

Name of Irrigation Scheme …….....

Group Members……Sex ……...

…… Sex …….

……... Sex …….

……Sex ……..

……Sex …….

……Sex …….

1. History of the farming system in relation with irrigation
2. Common resource pool and management
3. Institutions involved in irrigation management
4. Water Users Association, legitimacy and function
5. Water users Association, charter, joint agreements, appeal for reform
6. Conflict resolution, defaulters, enforcement of rules
7. Water Court, water use change, unused water disposal
8. Conflict with downstream water users (non-irrigators)
9. Cooperatives, market
10. Water related health affairs

11. Livestock, their role in social resources, livestock-related irrigation problems and management
12. Ethnic /religious/ gender-related problems
13. Mutual (reciprocal) exchange systems for labour
14. Labour availability, migration
15. Activities competing for labour during peak periods