Dissertation By

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ADDIS ABABA UNIVERSITY

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Institutions, Management Practices and challenges of Small-Scale irrigation Systems in Ethiopia : a case study of two Small-scale Irrigation Systems in Western Oromia, Ethiopia

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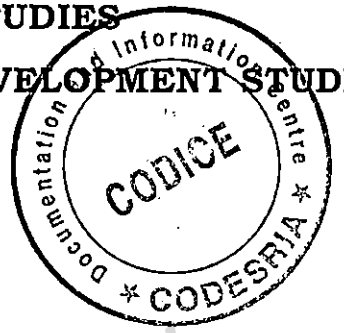

INSTITUTIONS, MANAGEMENT PRACTICES AND CHALLENGES OF SMALL-SCALE IRRIGATION SYSTEMS IN ETHIOPIA: A CASE STUDY OF TWO SMALL-SCALE IRRIGATION SYSTEMS IN WESTERN OROMIA, ETHIOPIA

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE MASTER OF ARTS IN REGIONAL AND LOCAL DEVELOPMENT STUDIES (RLDS)

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

By

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DEDICATION

I dedicate this thesis manuscript to my sisters, Emebet and Zenebework, and my mother, Teniye, for your dedicated partnership in the long course of my education.

And to

The memory of my father, Dejene Oda, who died before enjoying the fruits of the seed he sowed.

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LIST OF ACRONYMS

ADLI	Agricultural Development Led Industrialization
AESE	Agricultural Economics Society of Ethiopia
ARDD	Agriculture and Rural Development Department
DAs	Development Agent(s)
DCs	Development Committee (s)
DID	District Irrigation Desk
EFSS	Ethiopian Food Security Strategy
EPRDF	Ethiopian Peoples Democratic Revolutionary Front
EWZFEDD	East Wellega Zone Finance and Economic Development Department
FAO	Food and Agriculture Organization of the United Nations
FDRE	Federal Democratic Republic of Ethiopia
FHHHs	Female Headed Household (s)
GLSSIS	Gibe Lemu Small Scale Irrigation System
GSDID	Gobu Seyo District Irrigation Desk
GSDARDD	Gobu Seyo District Agriculture and Rural Development Department
GSDRLUANRA	Gobu Seyo District Rural Land Use Administration and Natural Resources Authority
GTSSIS	Gambela Terre Small-Scale Irrigation System
HH(s)	Household(s)
HHH	Household Head
IWMI	International Water Management Institute
JICA	Japan International Cooperation Authority
M and E	Monitoring and Evaluation
MHHHs	Male Headed Household (s)
MNRDEP	Ministry of Natural Resources Development and Environmental Protection
MOA	Ministry of Agriculture
MOFED	Ministry of Finance and Economic Development
MoWR	Ministry of Water Resources

OBPED	Oromia Bureau of Planning and Economic Development
OBWMERD	Oromia Bureau of Water, Mineral and Energy Resources Development
Odi	Overseas Development Institute
OIDA	Oromia Irrigation Development Authority
O and M	Operation and Maintenance
ORLUANRA	Oromia Rural Land Use Administration and Natural Resources Authority
PA(s)	Peasant Association(s)
PRSP	Poverty Reduction Strategy and Programme
SPM	Strategic Planning and Management
SSA	Sub-Sahara Africa
SSI	Small Scale Irrigation
SSIS	Small Scale Irrigation System
TU(s)	Territory Unit(s)
WBO	Western Branch Office
WC	Water Committee
WUAs	Water Users Association (s)
WUTs	Water Users Team (s)

GLOSSARY OF LOCAL TERMS

"Kore Aba Laga": Water Committee

"Gulbetegna": Bully

"Goxi": Team (Water Users" Team)

"Awekhush nakhush": Undermining each other

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ABSTRACT

This paper examines the present state of irrigation management in Gibe Lemu and Gambela-Terre Small-Scale Irrigation Systems. The main focus of the study was to bridge the information gap with special reference to the institutional context, management practices and constraints of the selected irrigation systems. Key informant and expert interview, group discussion, observation and household interview were used to collect data. Findings revealed that the irrigation systems have been poorly managed. There was poor performance in managing water distribution in terms of the three indicators: adequacy, reliability and equity in water distribution. There is widespread water dispute but not settled yet. The Gambela Terre SSIS was poorly maintained and the structures deteriorated. Less than 80 % (in Gibe Lemu) and 40% (in Gambela Terre) of the developed irrigable land was under irrigation. There were institutional, organizational, socioeconomic, socio-cultural and hydraulic (decline in water supply) problems that impeded effective and lasting WUA-committee irrigation management and led to underutilization of the developed resources. Findings of the study also indicated that irrigation had positively impacted diversification and intensification of crop production and household income during the initial years of project implementation and it was significantly different between irrigation systems and among head-end, middle and tail-end farmers within irrigation system. The change to diversified and intensified horticultural production and the income from irrigation could not be sustained and many irrigators either do not regularly cultivate vegetable, suspended the diversified irrigated vegetable production, or shifted to perennial horticultural crops and in Gambela Terre, to the former cereal production (mono-cropping) under rain-fed. The constraints were scarcity and unreliability of water, lack of necessary inputs and institutional, management and socioeconomic problems. Finally, the paper draws a number of conclusions about requirements in the readjustment of the surveyed irrigation systems and in the design of irrigation projects of these types.

CHAPTER ONE: INTRODUCTION

1.1. Background

During the last twenty or more years, millions of Ethiopian households have been suffering from continuing misery, characterized by recurrent droughts that led to shortage of food and severe famine and high levels of malnutrition and food insecurity (AESE 1995; Tassew, et al 2004; Webb, et al 1994 and EFSS, 2002). Furthermore, the country could not meet its large food deficits through relying on rain-fed agricultural production alone.

Adverse climatic change (a series of droughts) combined with rapid population growth, declining land holding size, growing landlessness, environmental degradation, subsistence and rain-fed dependent agricultural production have resulted in a growing problem of drought vulnerability and food insecurity in Ethiopia (Tassew, et al 2004 and AESE, 1995). Continued attempts to expand cropping frontier would entail accelerated deforestation, natural resource degradation; ultimately falling yields (Webb, et al 1994). Therefore, many sources suggest that a strategy to cope with the drought and food insecurity problem in Ethiopia should be based, among others, on agricultural intensification, including expansion of small-scale irrigation (Mulat, 1998; Webb, et al 1994).

The role of irrigation in addressing food insecurity problem and in achieving agricultural growth is well established (Burke, 2002; FAO, 2001 and FAO/World Bank 2001, 1987 C: FAO, 2000 and FAO, 2000: Woldeab, 2003). The central role of irrigated agriculture within the context of recurrent drought and famine is also well understood in Ethiopia. MoWR (2002) argue that, 'if the country is to achieve its goal of food self-sufficiency and food security, the current production shortfall calls for drastic measures in the expansion of irrigation".

The government in power also appears to be committed to the promotion of smallholders' irrigation as a solution to overcome the problems of drought induced famine and food insecurity (AESE, 1995; Webb, et al 1994 and EPDRF (PRSP), 2000). By 1992, a total of 288 modern communal SSI schemes that are capable of irrigating 30,000 ha had been constructed and made available for achieving food security through government intervention (MoWR, 2002; MOFED, 2002: IV).

The regional government of Oromia has also adopted the strategy pursued by the Federal Government (OIDA SPM, 2003). To date, 130 low cost smallholder irrigation schemes with an estimated area of 11819 hectares have been constructed through government intervention as part of the Regional State's drive to achieve food security. In addition, the constructed schemes were handed over to users for self-management (OIDA, 2000).

In spite of the heavy investment made in the expansion of smallholders irrigation in the last ten or more years, the majority of the constructed schemes are not without problems, and mixed results have been reported (OIDA, 2000). Although some schemes have good record of accomplishment, a preliminary study conducted on SSI schemes in Oromia in 2000, including Gibe Lemu and Gambela Terre, showed the majority of the SSI infrastructures have been poorly managed and left unused. In Gibe Lemu and Gambela Terre too, the area developed by irrigation is below expectation and it is less than 78% (Gibe Lemu) and 40% (Gambela Terre) of the potential. However, no attempt was made to conduct scheme specific and detailed study to understand why it is so. This study therefore attempted to examine the reasons for underperformance of the SSI infrastructures through analyzing the grassroots operation of the irrigation systems and what problems have occurred in their institutional context and management.

The study was therefore initiated to address the information gaps stated above

and broaden our understanding with special reference to the institutional context, management practices and challenges of the irrigation systems mentioned above.

1.2. Problem Statement

In Gibe Lemu and Gambela Terre SSIS, the developed irrigable land has not been irrigated as expected. The area that has been put to use accounts less than 80% (Gibe Lemu) and 39% (Gambela Terre) of the total irrigable land. But to have the necessary impact, and to obtain economies of scale, FAO (1986: 20) argue that a substantial area usually needs to be developed and it must be cropped intensively .In addition, the investment in SSI promotion can be justified from the stand point of effective and equitable use of the developed irrigation land and water resources. Why farmers who possess irrigable land failed to use it fully for irrigated agriculture needs examination.

Water disputes are common and widespread phenomenon among irrigators within the irrigation systems and the surrounding traditional irrigators. The questions "What are the reasons for rampant water disputes?" and "What are the constraints WUAs are facing in playing their expected roles and how are they organized to undertake scheme management functions?" have not so far been answered and need to be addressed if we are to improve management of the irrigation systems.

In addition, enabling institutional and organizational condition and good management of irrigation schemes is becoming increasingly recognized, as an essential means to achieve successful irrigated agriculture (Pavlov, 2004). However, past research has highlighted that underperformance and many problems of irrigation systems are based on shortcomings and weaknesses in institutional development and in the management of the schemes (Odi, 1995 and Pavlov, 2004). In spite of the presence of generalized evidence showing poor track record of GIBE LEMU and Gambela Terre SSIS, detailed micro level

(scheme specific) study in order to understand how are the irrigation systems managed and what underlying institutional conditions facilitate irrigation management and identify what problems have occurred in irrigation management has not been conducted.

This study proposes that expansion of modern smallholders' irrigation as one means of achieving food security has uncritically been supported by the government; i.e., there has been no emphasis on and adequate planning and support for institutional development and management of the selected irrigation systems.

The purpose of the study is to clarify the present state of irrigation management in the two SSIS with a focus on institutional contexts, management practices and challenges and establish where problems have occurred and suggest possible policy options and strategies for future improvement of irrigation planning and management, in the study area in particular and the country in general.

1.3. Research objectives

The specific objectives are:

- To analyze the local level institutional arrangements and relationships among stakeholders that affect the 'performance' of the irrigation systems;
- To understand how users are organized for self management of irrigation and analyze the constraints they are facing;
- To assess and clarify governance issues such as formal and informal laws that define access to the developed irrigation land and water resources and governs irrigation management and;
- To understand and document current irrigation management practices in the irrigation systems;

- To identify and document the major challenges of the irrigation systems

1.4. Research Questions

The central research question raised for addressing the objectives of the research is the following.

How are the irrigation systems managed, and what institutional conditions facilitate irrigation management activities in the irrigation systems?

The specific questions are:

- What institutional arrangements and relationships facilitate irrigation management?
- How are water users organized for irrigation management? What are their key irrigation management functions and constraints?
- Is there a legal framework (formal and informal laws) that defines access to the developed land and water resources and governs irrigation management? How was (is) their enforcement?
- Why has the developed irrigable land been underutilized?
- What are the current irrigation management practices going on in the irrigation systems?
- What are the major challenges for management and sustainability of the selected irrigation systems?

1.5. Significance of the Study

The information generated via this study will help in narrowing the information gaps regarding the institutional context, management practices and major problems of smallholders' irrigation development at the grassroots level. It will also shed some light on the wider problems of smallholders' irrigation management and sustainability. Furthermore, it will provide useful feedback for

monitoring and evaluation of the schemes and to improve management of the irrigation systems that were considered by this study. It will help guide future planning and investment in SSI development. It will help improve database of OIDA and other stakeholders and assist in building the capacity of OIDA for future improvement of SSI development policies and strategies.

1.6. Research Methodology

1.6.1. Selection of the Irrigation Systems

In order to address the objectives of the research, two communal small-scale irrigation systems, namely, GIBE LEMU and Gambela Terre were studied. Before selecting the target irrigation systems, Regional, Branch and Wereda Offices of the irrigation agency and five SSI systems in East Wellega zone were visited. Based on the information gathered during the visit, the visited irrigation schemes were classified into two groups based on their performance in terms of utilization of the developed land. Then GIBE LEMU was selected from the three schemes considered to have relatively good track record and Gambela Terre was selected from the poorly performing schemes so as to make comparative assessment between the two irrigation systems.

The reasons for concentrating only on these two irrigation systems were: Firstly, given the time and financial resources available and the objectives of the research, it was not possible to handle more case studies. The other criterion considered for selecting the schemes was accessibility.

1.6.2. Methods of Data Collection

The research work included both a review of the literature on smallholders' irrigation management, institutional issues of SSI management as well as the analysis's of data that were obtained during field research. Both secondary and primary data were collected and used in this study.

1.6.2.1. Secondary Data Collection

The study started with brief review of the regional and national irrigation policies, the policy and legal frameworks regarding irrigation land and water rights. The main sources of secondary data were published and unpublished documents. These included policy statements, proclamations and regulations, project appraisal documents, reports and past case study papers on irrigation.

1.6.2.2. Primary Data Collection

Primary data were collected using various instruments such as key informant interview using semi-structured checklist, group discussion, expert interview, structured questionnaire and observation of events in the irrigation systems.

Key informant interview was conducted to generate general understanding of the irrigation systems, including pre-intervention situations, historical background of the irrigation systems, the major technical, institutional and management problems in the irrigation systems and crops grown before intervention. The information obtained through key informant interview was also used for modifying questionnaire developed for the household interview and to focus the formal survey more on the variables, which are more relevant to the irrigation systems and irrigators. Key informants include elderly and knowledgeable irrigators, WUA committee members, development agents (DAs), Zonal and District Irrigation Desk Officials and professionals.

Interview (semi-structured) was held with WUA committee members to gather data regarding profiles of the WUA board members, basic information of WUAs, management activities of WUA, the support they receive from the Irrigation Authority, problems WUAs are facing in irrigation management, including conflict management. Semi- structured interview was also administered with officials of such institutions as GSDID, Cooperative Promotion Desk (zone and District offices), Rural Land Administration Offices (zone and District) and the

then OIDA-WBO so as to generate data for analyzing the governance structure of the irrigation departments, the operation of the irrigation systems, institutional capacity, service provision issues, stakeholders and inter-institutional linkages.

Group discussion was conducted to generate detailed understanding of the irrigation systems. A total of 60 purposively selected irrigators, being divided into six groups (three in Gibe Lemu and three in Gambela Terre), and each group with 10 members were involved in-group discussion. All socioeconomic groups (rich, poor and medium households and farmers from the head-end to the tail-end areas of the irrigation systems were included in the groups. In addition, questionnaire survey was conducted to collect primary quantitative and qualitative data.

1.6.2.3. Sample Size and Sampling Techniques

A total of 65 sample HHs were selected from 216 households (sampling frame) using the following procedure

a) First, the list of beneficiary households was obtained from the executive committee of WUAs in the respective irrigation systems;
b) Then, the beneficiary households were stratified into head-end, middle and tail end irrigators based on their location in the farm layout of the irrigation systems so that the end results of the study reflect the views and situations of irrigators in the three locations. The households were stratified on the basis of their location with the basic assumption that there could be inequity in the distribution of irrigation water and the benefits derived from irrigation because of weak water control, technical problems and lack of management structures that suit layout of the irrigation infrastructures (see also Vermillion/IIMI, 1997:30-31);
c) Then the farm households at each water level (location) were stratified further in to high income[1], middle income[2] and lower - income[3]

households based on the local wealth indicators; possession of irrigable land and livestock and proportion was assigned to each group for inclusion in the sample for the survey. This was done to make the sample more representative; and

d) For the survey, 30 % (from each scheme) of beneficiary household heads were selected using simple random sampling technique. 25 sample irrigators from a total of 83 households in Gibe Lemu and 40HHHs from 133households (sampling frame) in Gambela Terre were randomly selected and participated as respondents in the household interview.

1.6.3. Data Analysis

Both qualitative assessment and descriptive analysis techniques were used for data analysis. The data generated through household interview was analyzed by employing the computer Software known as statistical package for social science (SPSS). The descriptive statistical methods such as frequency, percentage, mean, and[1] standard deviation, X^2-statistic, T-test and ANOVA/F-test were used for analyzing the data generated through household interview.

1.6.4. Limitations of the Study

The study has the following limitations: firstly, adequate data was not gathered on the nature of inter-institutional linkage at various levels for it was very stressful because of the short time-frame available for the research. The individual government institutions and farmers' organizations identified as key partners were not investigated in detail in terms of their linkage policies and strategies, rules and allocation of resources to work with the irrigation sector and the constraints they are facing in playing their expected roles in irrigation

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According to the local standards:

[1] High income households are households that own more than two-pairs of oxen, greater than four milking cows and three hectare land and one or more donkeys

2. Middle income households are households that possess 1-2 pairs of oxen, 2-4milking cows and 1-3ha land

3. Lower income households are households with one or no ox, less than two milking cows and less than 1ha land

management. Secondly, there was a problem of gaining a well recorded time series data on production, income and sufficiency of own agricultural production to meet household food demand, because of poor data recording and handling by irrigators, WUA committee and the irrigation agency.

1.7. Theoretical Background and Conceptual Framework

1.7.1. Institutions Defined

Institutions are defined as the rule of the game in a society or, are the humanly devised constraints that shape human interaction (North 1990: 3- 4). Institutions include the formal (statute law, economic rules, common law and regulations) and informal rules (conventions, norms of behavior, and self-imposed codes of conduct) and the enforcement characteristics of both. The creation of formal legal system to solve more complex disputes entails formal rules. Formal rules can complement and enhance effectiveness of informal constraints (Millgrom and Weingast, 1990: North, 2000). In this regard, Alula (2001) found, in his study in South Wello, that indigenous institutions and irrigators' internal bylaws (informal rules) play a role in conflict resolution in smallholder irrigation management. To add to this, he proved that, more serious issues were addressed by the formal rules.

Ostrom (1992: 45: Woldeab, 2003: 6) distinguishes the layers of rules that affect irrigation systems. These include operational rules, collective choice rules and constitutional choice rules. Implementing regulations refers to rules that guide day-to-day decision-making in irrigation management; decision concerning when, where and how to withdraw water, monitoring of actions and sanctions assigned to actions. They define appropriate irrigation management practices and have implication for irrigation water management (World Bank 2000). Irrigators, their officials and external authorities use collective choice rules (Ostrom 1992). Constitutional choice -rules are developed by the parliament or by senior public officials and they determine who is eligible and

specify the specific rules that are used to craft collective choice rules (Woldeab 2003 and World Bank 2003).

According to Blank, H. et al (2002), few among the institutional arrangements which facilitate collective action in small-scale irrigation systems, and which were the subjects of this study include the following:

- Land tenure and water rights (formal and informal) in the irrigation systems
- Users organizations and their by laws and enforcement characteristics
- Stakeholders and their Relationships in irrigation management (concerned government agencies, farmers' organizations and users)

1.7.2. The Link between Institutions and Small-Scale Irrigation Systems

Small-scale irrigation projects are basically sustainability projects given the objectives for which they have been promoted, i.e., addressing food insecurity problems. Food security is the major output of small-scale irrigation development promotion (Blank, H. et al 2002; OIDA, 2000 and 2003). The sustainable production of food is the first pillar of food security (Hinchcliffe, F. 1996:14). An important qualification of SSI for food security is therefore its sustainability. In this case, sustainability of the irrigation projects matters, and therefore a need for addressing sustainability constraints. According to Engel (1997) any concept of sustainability must include a systematic notion of human agency, i.e. its role in conceptualizing, achieving, maintaining or eliminating sustainable practices. Sustainability is not just a problem of technology and natural resources; it is a human, or better, a social (institutional and organizational) problem as well; our actions, and type of social organization we achieve to coordinate and manage these resources. Therefore, adequate institutionalization and organizational development is crucial to enhance

management and sustainability of the irrigation systems.

Nonetheless, many African countries facing drought and famine have been considering irrigation as a drought proofing mechanism without paying much attention to sustainability (Woldeab, 2003: 1). Institutional and/or social aspects of irrigation technologies have remained outside the realms of irrigation planning and analysis. As a result, many water and land related problems in smallholder irrigation schemes and poor track record, which may be worst in sub-Saharan African, have been reported (Webb, 1991 and FAO 1986).

1.7.3. Water and Land Rights Institutions and Irrigation Management

Provided that irrigation water is not a private property but common property and no one is held responsible for the mismanagement, established norms, rules and known laws that ensure the interest of all beneficiaries are required ((Blank, H. et al 2002; OIDA 2000). Good governance and legitimacy are of crucial in irrigable land allocation and irrigation water distribution and management (OIDA 2000: 97). This component of irrigation management is ensured through establishing legal framework of known laws. Formal laws which specify appropriate management practices, the rights of WUAs and individual users both in quantitative and qualitative terms, and operational regulations and clearly spelled out sanctions against illegal actions are required (WB, 2000). Lack of these regulations at the revel of associations leads to conflicts and poor water management (WBI 2000: 9).This aspect of irrigation management has also been addressed by this study.

The land tenure system has a profound impact on SSI development and management through its effect on ownership and access to irrigable land and the associated resources such as irrigation water (FAO, Website). When a land tenure system fails to indicate who does what, when, how, and where, ambiguous situations arise, paving the way for conflict in the irrigation systems. Additionally, some tenure systems provide for the transfer of rights to

land from one user to another through conventions such a gift, lease, share-cropping, mortgage, or out right sale (Yeraswork, A., 2000: AEEA and AAU, 2000: 27). However, the various tenure arrangements in the irrigation systems, their limitations and implications on irrigation management have not been studied. Therefore it is crucial to study these institutions if we are to improve performance and management of irrigation

1.7.4. Irrigation Management

Irrigation management activities have both technical and social dimensions (Up Hoff: Mollinga 2003: 21). These include control structure activities (design, construction, operation and maintenance), water use activities (acquisition, allocation, distribution and drainage), and organizational activities (decision making, resource mobilization, communication and conflict management). Further, Hubert (Mollinga 2003: 35) classifies irrigation management functions into four types viz. planning, organizing, leading and controlling. These tasks and activities should be properly coordinated and managed in irrigation systems.

In irrigation management, water control is crucial. It refers to the managerial control of water distribution and organizational processes in the irrigation system (Hunt 1990:144 in Mollinga 203). Irrigation management or water control is thus the regulation and control of human behavior; implying social relation of power and competition (Mollinga 2003)

Effective water control in irrigation management is a function of several factors including physical, technical, socioeconomic, organizational, political, cultural and complex institutional factors (Lawdermilk 1990: Mollinga 2003:35). These components of irrigation systems interact in irrigation management (Mollinga, 2003). Political factors such as the irrigation law and policy can enable or constrain irrigation management. Mollinga (2003: 38) has found that socioeconomic differentiation among farmers impeded the emergence of effective

water users organizations in India and Bangladesh. Inequity among water users makes it difficult to achieve social control. Hydraulic factors such as a decrease in water supply (scarcity) may increase conflict and competition among water users, with implication for social relation of power and management. It is therefore crucial to investigate this component of the irrigation systems for understanding their limitations and strengths and to suggest ways for improvement.

As Stern (in FAO 2000), noted, where issues of organization and management of irrigation are not well considered problems may arise in such areas as:

1 Existence of indefinite regulations or instructions about the share of responsibilities
2 Lack of coordination between different work groups
3 Absence of common meeting point for discussion and setting difference;

1.7.5. Irrigation Systems as Socio-technical Systems

According to this theory, most approaches to irrigation planning and management so far have biased towards engineering and construction and tended to focus on achieving the most technically effective system of water distribution. They have taken less account of the managerial and social factor which will determine whether irrigation leads to efficient agricultural production or not (FAO, 1986:27). They have given, in accordance with Scheer (1996: Mollinga 2003:16), less consideration for social interaction, and notions like interest, conflict and struggle. Mollinga (2003: 15) criticizes past management and economics literature on irrigation and current approaches to irrigation studies for having three conceptual problems: lack of appreciation of the social dimension of technology, simplified concept of the human agency and little interest in social relations of power and the institutional forms through which purposes of irrigation are achieved (ibid: 19). Additionally, Woldeab (2003) has shown, quoting Moris and Thom ((1990:33), the constraints that jeopardize

success of irrigation, among others, include weak economic policies or institutions, lack of institutional capacity to manage or weak management and lack of clearly defined legal framework and faulty conflict resolution.

Mollinga (2003) regards irrigation systems as socio-technical systems; they embrace both technical and social system components. Solon Barraclough (1974: Engel 1997: 18), also argue that technological and social or institutional innovation go hand in hand. Irrigation technologies shape and shaped by social relations (Mollinga, 2003). The social shaping perspective of irritation technologies has three dimensions: social requirement for use, social construction and social effects (ibid: 17).

1.7.5.1. Social Requirement for Use

Irrigation technologies require particular social conditions to work effectively (Mollinga, 2003: 18). In relation to social requirement for use, it is important that there are management structures that suit the different irrigation technologies in use (Horst, 1998:16). The type of canal system in use determines the type of organization needed in an irrigation system (Woldeab 2003).

Gibe Lemu and Gambella Terre SSIS are basically river diversion gravity irrigation systems. Gravity irrigation is carried out using cemented and earth canals. Gravity irrigation canal that run from the upper to lower stream delivers water to irrigators. Water distribution and the type and nature of the physical irrigation infrastructure (technology) impose specific demand on the management structure of the irrigation systems to work effectively. It requires personnel, pre-specified and agreed upon decision rules and organization. Continuous operation and maintenance of the physical irrigation infrastructure and canal maintenance activities also require certain institutional arrangement. Continuity of management activities requires strong and well-established institution. Operation and maintenance activities require certain skills.

Therefore, capacity building activities are crucial so that users undertake operation and maintenance activities themselves.

FAO (1986) and Woldeab (2003) also argue that irrigators will be committed to irrigated agriculture if the financial returns gained from irrigation practice are attractive. Acceptable commitment of irrigators is obtained where good commercial opportunities exist and provide strong incentives and above all, where scheme management has been capable, consistent and firm (FAO 1986: 53).

For irrigation technologies to work effectively there should be compatibility between the traditional agriculture and the requirements of the new and relatively modern irrigation schemes (FAO 1986). According to Horst (1998: 36, Cited in Woldeab 2003), incompatibility between the project cropping pattern and farmers actual cropping pattern in the developed schemes could lead to under utilization of irrigation water. Analyzing how this requirement has been met in Gambela Terre and Gibe Lemu SSIS is of great interest in this study.

1.7.5.2. Social Effects

Irrigation technologies have social effects (Molinga 2003: 19). Irrigation affects people's livelihoods through its effect on crop production. Irrigation allows more diversified and intensive cropping. This leads to higher agricultural production and increased income, which may, in turn, generate economic growth and employment.

There could be conflict between irrigation and other activities in the allocation of family labor. There may be conflict in the choice of crops. An ill-designed canal system limits farmer's access to water (Woldeab, 2003). Scarcity of water breeds conflict due to competition. Un-reliability of water supply discourages and /or imputes farmer's participation (Woldeab 2003: 9). But the social effects of the two irrigation systems have not been studied and documented.

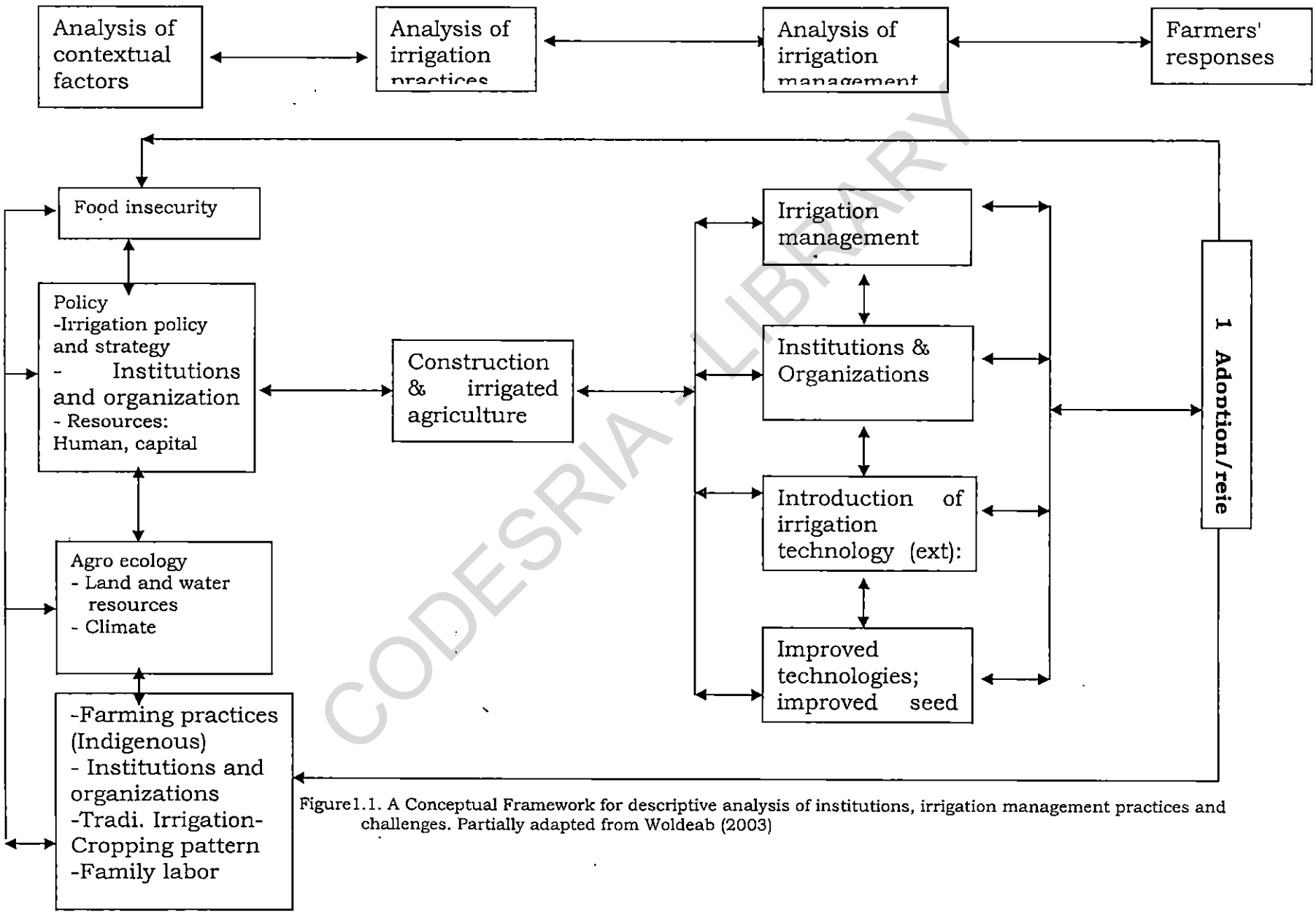


Figure1.1. A Conceptual Framework for descriptive analysis of institutions, irrigation management practices and challenges. Partially adapted from Woldeab (2003)

1.7.5.3. Social construction

Engel (1997): 147) argued that agricultural innovation emerges from interplay among social actors from relevant social practices. Irrigation technologies too, are essential components of agricultural technologies. Irrigation technologies are shaped by social relations, and in Mollinga's words, "Irrigation technologies are socially constructed". Irrigation technologies are developed and designed within particular forms of cooperation and management in mind. Technology development and design invite social process in which different actors/stakeholders communicate, negotiate and take decision (Engel 1997). Furthermore, social actors negotiate and deicide on the choice of technology and water management. Adequate institutional leadership and effective coordination mechanisms (organizational context) contribute to achieving this goal (Engel 1997).

1.7.6. Conceptualizing the Context for Successful Irrigation

Context refers to the socially constructed (social) as well as the natural conditions (material) that reduce the degrees of freedom actors have to create or choose among volitions and propositions (Engel 1997: 147). The concrete elements refer to the agro-ecological system, physical activities and opportunities that are useful for irrigation or technical infrastructure (Mollinga 2003 and Dillon, 1992: FAO, 2003C). Specifically, the concrete elements involve technical resources such as technology, land, credit, labor, inputs, and knowledge of irrigated agriculture activities or the irrigation system.

Social actors also construct social context for joint learning, probing, action and resource pooling in the innovation process (Engel 1997: 148, Actor-oriented Innovation Theory). The abstract social conditions that enable the conduct of irrigation activities include, among others, the legal system of property rights, government policy, social relations (like gender), and institutions (government

agencies, government policy and different forms of farmers organizations).
These abstract elements relate, according to the farm system theory (Dillon 1992 in FAO 2003), to the irrigation system through management activities of developing plans, specifying organizational structure, choosing technology, allocating resources, establishing control processes, and harmonizing relations between sub-systems relevant to the farm. Well-established social and organizational context provides an opportunity to think of coordination of efforts. Therefore, such social contexts should be studied as one of the components of the irrigation systems.

1.8. Structure and Contents of the paper

The paper contains six chapters. The first chapter introduces the subject of the study. The chapter also discusses the research problem, objectives of the study, the research questions, methodology and the theoretical background of the study and conceptual frame. Chapter two is a review of empirical literature. In chapter three, results of the study are discussed. The fourth chapter deals with the local level institutional arrangements for small-scale irrigation development and management. Chapter five presents conclusion and suggested policy options.

CHAPTER TWO: REVIEW OF EMPIRICAL LITERATURE

2.1. Introduction

Irrigation is a very old practice in the world and its history dates back to the early civilization of mankind (Peter, H. Stern, 1979; Woldeab, 2003). Irrigation development historically started, as a response to bad agro-climate in low rainfall areas and seasons (Nigussie, 2002). Woldeab (2003:1) argue, quoting Vincent (1994), that irrigation development has been promoted as a means to bring about socio-economic transformation since the Second World War. Up until the 1950s, the area irrigated globally expanded and reached 94 million hectares. Between 1950s and 1978, irrigated area expanded much more rapidly than population, averaging 2.8 percent per year (Postal, 1993 and MoWR, 1999).

According to Rosegrant, et al, (2002) and FAO (1986:20), there has been significant cutbacks in rain-fed agricultural production due to frequent occurrences of drought and erratic rainfall especially in the Sub-Sahara African countries. In Sub-Sahara Africa 196 million people are undernourished FAO (2002: Woldeab, 2003). Governments of SSA countries have considered irrigation, as an attractive solution for removing the food insecurity problem and ameliorating the impact of droughts (Woldeab, 2003).

Irrigation schemes are classified as small, medium or large-scale depending on the area irrigated, scale of operation and type of control or management. But the criteria used for classification may vary from country to country. For example, in India irrigation scheme of 10000 ha is classified as small while in Ghana the largest scheme is 300 ha (Smith, 1998). FAO (1997) and Peter Stern (1979) strongly argue in favor of the significance of smallholder irrigation for poor countries as a means of ameliorating food deficit, because it is lesser than large scale because of the problem of human management reduced to

manageable scale. To add to this, Raigu and Rukuni (1990: FAO, 2000) and Makombe and Mainzen, D. (1993) argue that the most viable schemes for poor countries, given their poor financial resource, limited government capacity, under developed markets and weak managing institutions, are small scale irrigation systems.

In Ethiopia, Woldeab (2003:38) noted failure and ineffectiveness of large-scale irrigation systems have resulted in the shift of attention to SSIS assuming their cost effectiveness and manageability by local people. However, Dessalegn (1999) has a different view; he writes, "Small-scale irrigation intervention in Ethiopia took place mainly because of the 1984/ 85 catastrophic drought and famine that affected the lives of millions of Ethiopians".

2.2. Management and Performance of SSI: An Overview of Global Experiences

The success of irrigation in Africa has been an issue of debate because of its disappointing performance in many cases (FAO, 1986: Webb, P., 1991 and Woldeab, 2003).

As regards positive impacts of irrigation schemes (SSIS), it is argued that about 75% of all SSA countries irrigation projects achieved or exceeded economic return though they are not operating at full capacity (Shawki and Maigne (1990). FAO (1987: FAO, 2000) pointed out that many SSA countries have realized the critical role of irrigation in food production. Irrigated maize yields three times as much as rain-fed during drought years in Zimbabwe (Meinzen: Webb, P. et al, 1994). India and China, where famine was a threat, have a chivied agricultural growth through investments, among others, on the promotion of SSIS (UNDP, 2000:1).

FAO (2000) found out that irrigation helped to increase agricultural productivity of a given land through increased intensification in Africa such as Zimbabwe.

Findings of FAO (2000) proved that choices of crop types could be facilitated by irrigation and increase food variety and availability. Furthermore, FAO (1997 b: Nigussie, 2002: 22) and Meinzen-Dick et al (1993: Nigussie, 2002: 22) reported that 72% of farmers could secure better food production through the use of irrigated land in Zimbabwe. Moreover, study by Webb (1991) of an irrigation scheme in Gambia showed that irrigation provided the chance for increasing income that was translated into increased expenditure, investment in productive and household assets, saving and trade.

Contrary to the above, there are arguments against the positive impacts of irrigation in Africa. Woldeab (2003) has noted that African countries challenged by drought and famine have been considering irrigation as a drought mitigation strategy; with little attention to sustainability issues though it is one of the qualifications of SSI for achieving the food security goal. Desalegn (1999) examined that many drought prone countries of Africa, whose population cannot be adequately supported by rain-fed agriculture alone, expanded irrigation schemes to promote food security. Nevertheless, many of these water projects were performing poorly and unable to meet their objectives. FAO (2000: Nigussie, 2002: 2) indicated that most new smallholder irrigation schemes in the southern Africa region could not cover the cost of development and they have negligible impact on household food security. Additionally, ODI (1995) reported that irrigation schemes have often under performed in economic terms in spite of its success in supporting the Green Revolution in Asia.

There are a number of constraints that have been responsible for a slow rate of development and underperformance of irrigation. Field research has highlighted substantial shortcomings in management (operation and maintenance), equity, cost recovery and agricultural productivity (Odi, 1995). A review of project experience by FAO (1986) and Woldeab (2003: Shawki and Maigne, 1990)) make clear that institutional, social, policy and economic problems tended to be more common constraints to the exploitation of small-scale irrigation schemes in

Sub-Sahara Africa (SSA). To add to this, Webb, P. (1991) found out that one of the reasons for the failure and unsustainability of small-scale irrigation projects in Gambia has been institutional and management deficiencies. But few of the institutions responsible for irrigation are adequately structured and lack of qualified personnel is another cause of poor management performance irrigation systems in Africa (FAO, 1986: 53).

According to ODI (1995), the factors that account for under performance of irrigation include, among others:

1. Poor system management and service provision, and
2. Poor understanding of farmer priorities or and inadequate markets for produce (ibid);
3. Lack of clear and sustainable water rights accorded to users, at on individual or group level;
4. Lack of clear and recognized responsibilities and authority vested in the managing organizations;
5. Lack of transparent accountability of, and supporting incentives for, the managing entities.

2.3. An Overview of Small holder Irrigation Development in Ethiopia

Traditional irrigation is very old in Ethiopia and has a history of several centuries in some parts of Ethiopia (FAO 1995: 129) and Woldeab 2003: 25). According to FAO (1995: 130), about 359,000 farmers are involved in traditional small-scale irrigation in Ethiopia. In Ethiopia, separate studies have indicated a potential for small-scale irrigation of between 165,000 and 400,000 ha (FAO 1995). Out of this potential, a total of 1309 traditional SSIS, covering an estimated area of 60,000 ha existed in 1992 (MOWR 2002: 46).

Although traditional irrigation was practiced in the highlands for centuries, it was only in the second half of 1950s that modern irrigation technologies were

adopted in large private and government owned schemes, primarily in the Awash River Basin. They were at large scale and state run (Dessalegn, 1999: 5; Wolldeab 2003: 32; FAO, 1995: 129). The interest in smallholder modern communal irrigation development started in the late 1970's in response to increasing food shortage and the catastrophic droughts of 1973 and 1984/85 (FAO, 1994: Ali, 2002: 39; MOWR 2002: 46). In Ethiopia, a total of 288 modern communal SSIS that are capable of irrigating 30,000 ha existed in 1992 (MOWR 2002: 46). MOWR (2002: 6) also reported that the total area under irrigation increased from 176, 105 ha in 1991 to 197, 250 ha in 1998. Most of that increase, a total of about 21,145 ha of modern SSIS stemmed from growth in SSIS in the various regions (Ibid).

As regards Oromia Region, there is 1.7 million hectares of land suitable for surface irrigation in the region (Oromia Economic Study Office, 1999). Out of this potential, only 5.51% or 93,185 ha has so far been developed. Out of the developed area modern communal SSIS constitute 17408 ha (10820 ha by government and 6588 ha by NGO), while the area developed traditionally comprised 48816 ha in 2000 (OIDA 2003: 27). With regard to production, out of 46.5 million of quintals of total crop produced in the region in 2003, 6.01 million quintals (12.9%) were produced using irrigation in Oromia (Lema, 2004).

2.4. Irrigation Management Experiences in Ethiopia

According to recent classification by the MoWR (2002: 46), irrigation schemes in Ethiopia are organized in four different ways on the basis of size and type of control or management.

- Traditional small-scale schemes of up to 100 ha, built and operated by farmers in local communities;
- Modern communal schemes with the discharge that can water up to 200 ha, built by government agencies with farmer participation;
- Modern private schemes of up to 2000 ha; and

- Public schemes of over 3,000 ha, owned and operated by public enterprises such as state farms

Water WUAs committees have long existed to manage traditional SSI schemes of up to 100ha (ibid). They are generally well organized and effectively operated by farmers. The associations handle construction, water allocation, operation and maintenance functions with government technical and material support (MOWR 2002.

However, those smallholder farmers who practiced traditional irrigation were denied proper support from government in order to upgrade irrigation systems (Dessalegn, 1999). The modern irrigation development policies and initiatives during the Imperial regime (second half of the 1950s) and the experience during the military regime (since 1975) were also not in favor of small-scale irrigators (Dessalegn, 1999). Almost all SSIS built after 1975 were made into producers' cooperatives (FAO: 1995: 129). The attempts to SSIS development were also failed because the irrigation systems were denied operational autonomy and guided by undemocratic guidelines (Dessarglegn, 1999: 14 and Woldeab 2003: 39), which were top-down in approach. Under the centralized governmental management, operations and maintenance activities weré also usually inadequately performed (MOWR 2002: 107).

The government in power also appears to be committed to the promotion of irrigation. Government policy in irrigation consists, among others, channeling direct support to farmers since the1991 government reform (FAO 1995: 132). The status of producers' cooperatives has been redefined with a consequence for irrigation management (FAO 1995: 129). The farmers/communities are now forming their own organizational set up (WUAs) for own and autonomous management of irrigation schemes with support from the government and NGOs (FAO 1995; MOWR, 2002). In Oromia Region too, almost all schemes operation is fully left to the water committee.

But still they (SSIS) suffer by multifaceted problems, including management and organizational problems, lack of access to credit and in put and marketing facility (Rahmato, 1999). The schemes were found to be inefficient (economically), technically the structures deteriorated before their service life and some of them left unused (OIDA 2000). In this regard, (Dejene and Yilma, 2001) argue that inefficient and under utilization of available capacity of the schemes in Ethiopia arises from giving more emphasis to technical aspects and less emphasis to the managerial and institutional aspects.

2.5. Institutional and Organizational Overview of SSI in Ethiopia

2.5.1. Existing Government Irrigation Policy

Though Ethiopia has apparently adequate annual rainfall for food crop production and pasture for livestock, its spatial and temporal distribution is too uneven leading to recurrent drought, food shortage and famine (MOWR, 2000j). Sometimes even the western highlands of the country, which enjoy adequate rainfall, suffer from food shortage due to discrepancies in rainfall distribution (ibid).

The National Economic Development Strategy (policy) recognizes and places a heavier emphasis on the agricultural sector to ensure food security at the household level and to achieve ADLI in the long run (MOWR, 2000 Policy document). The strategy further stipulates that this goal can be achieved through the augmentation of agricultural productivity that calls for mitigating water shortage problems as a pre-condition. Hence, in accordance to the policy/strategy, small, medium and large-scale irrigation schemes will have to be developed to, among others, meet food requirements of the rapidly growing population (MOWR, 2000: 25-26).

There is no separate smallholder irrigation policy document in Ethiopia. The basic water policy document in Ethiopia is: Ethiopian water Resources management policy (EWRMP) issued in July 2000 (MOWR 2002: 97). This policy deals both with water resources general and water management policies that relate to irrigation (MoWR, 2002: 97 and MOWR/EWRMP, 2000). Some of the irrigation policies include:

- Promote the development of irrigation on participatory basis for promoting efficiency and sustainability;
- Promote decentralization and user-based management of irrigation system;
- Promote full and meaning full participation of stakeholders: farmers, cooperatives, government agencies at different levels, NGOs, at all phases of studies, implementation, O and M;
- Develop systems for the harmonious co-existence of indigenous peoples and irrigation project;
- Promote credit facilities and bank loans for the development of irrigation schemes;
- Promote the development of appropriate institutional structures for the management of irrigation; and
- Develop capacity in human resources development and new technology

The Regional Government of Oromia also recognizes the role irrigation could possibly play in achieving food security. Hence, it has adopted the irrigation policy and strategies issued by the Federal MOWR in 2000 and 2002 respectively (OIDASPM, 2003). Although the policy framework is there, the lack of organizational and grassroots capacities has significantly affected the implementation of the policies, and overall performance of the smallholder irrigation sector (OIDASPM, 2003: 4). The area developed by irrigation is under expectation. So far the area under irrigation in the region is only 5.5% of the potential (OIDASPM, 2003: 4 and JICA and OIDA, 2003).

2.5.2. Organizational Setup of SSI Management in Ethiopia

Several institutions are involved in the water sector development in Ethiopia. The surface water division of the Soil and Water Conservation Department (SWCD), of the Ministry of Agriculture (MOA) was in charge of formal small-scale irrigation schemes until 1983 (PODA, 2003: 5). The Irrigation Development Department (IDD) was created in the MOA in 1983 (FAO 1995: 131). IDD was formerly responsible for small-scale irrigation development and management. In 1994, the activities of MOA were being decentralized to zonal offices and IDD staff was being transferred zonal offices and IDD was dissolved (FAO 1995 and OIDA 2003).

At national level, responsibility for small-scale irrigation remains in MOA, with the creation of an Irrigation Agronomy Team, under the supervision of the Agricultural Development and Crop Production Department (FAO, 1995: 131 and OIDA, 2003: 5). At regional level, the responsibility for SSIS, including planning, design and construction rested with the Regional Offices of MNRDEP, under its Irrigation Development Study Team (IDST) until 1995 (OIDA, 2003 and FAO, 1995).

In August 1995, MNRDEP was dissolved and its responsibilities were shared between MOA and the MOWR (Ministry of Water Resources). The responsibility for irrigation development belonged to the Bureau of Water, Minerals and Energy Resources Development (BWMERD) while MOWR has an overall policy, planning and regulatory role in respect of water resources development (OIDA, 2003: 26).

BWMERD was restructured in July 1999, and hence Oromia Irrigation Development Authority (OIDA) was established through proclamation, No. 30/1999. Its major responsibilities include planning, designing, coordinating irrigation development in the region and providing extension service and technical assistance to users (JICA and OIDA, 2003: 2).

Structurally, all the activities OIDA were under the control of the head office in Addis Ababa (JICA and OIDA, 2003: 2). The zonal operation is entrusted to four (4) branch offices, namely central (at Adama), Eastern Branch (located at Harare), Western Branch (located at Nekemte), and southern Branch (Located at Bale Robe). Coordinators were assigned at 12 zonal MOA offices and further to 69 selected "Aanaa" offices out of 197 Aannaas in the region.

In addition, community based irrigation management has been emphasized by OIDA (JICA and OIDA, 2003). There has been a shift of policy emphasis towards decentralized/participatory SSI management by the then OIDA. To meet the requirements of decentralization policy, OIDA departments were restructured (JICA and OIDA, 2003). The community participation department at the head office was minimized and its functions transferred to the branch offices. Under branch offices, extension and water management and community mobilization teams were created in 2000 (ibid). Under the branch offices, 69 wereda extension offices were operational in 2000 (ibid).

However, OIDA was dissolved again in 2004 and restructured under Oromia Rural Land Administration and Natural Resources Authority. Wereda Irrigation Desk (offices) was created in Wereda Agriculture and Rural Development Office with no direct reporting relation with the branch offices. There were DAS assigned in each irrigation system until the 2004 restructuring, who were directly accountable to the District Irrigation Office. The DAs become multipurpose and accountable to the wereda Agriculture and Rural Development Office after the 2004 organizational change. This paper also examines the impacts of the frequent restructuring and instability of the irrigation sector institution on local capacity building and management of the selected smallholders' irrigation systems

CHAPTER THREE: RESULT AND DISCUSSION

3.1. Introduction

This chapter is a discussion on results of the study. The second section of the chapter describes the irrigation systems (location and physical setting, socioeconomic profile of the area and characteristics of irrigators, historical development of the irrigation systems, and institutional and organizational conditions of the irrigation systems. The third section examines current irrigation management practices in the irrigation systems, including water acquisition, allocation and distribution, conflict management and system maintenance. The fourth section provides insights about farmers' responses to the intervention, i.e, utilization of the potential irrigable land and crop production and the influence of management and institutional constraints on utilization and sustainability of the irrigation infrastructures.

3.2. The Irrigation Systems

3.2.1. Location and Physical Setting

Gibe Lemu is found in Buli Chala and Sombo Kejjo PAs in Gobu Seyo Wereda, East Wellega Zone of Oromia Region. It is located 80km towards Addis Ababa from Nekemte, capital of East Wellega zone. It is located at 37° 02'E longitude and 9°09' N latitude. Its altitude is in the range of 1556-1680 masl. The average annual rainfall of the area was 1400 mm in 1996 where as the main rainfall season is from June to September and the hottest season is from December to April. The annual mean maximum and minimum temperature is 30°C and 10°C respectively.

Gambela –Terre SSIS is located in Ongobo Dembi and Gambela Terre PAs in Gobu Seyo District, Oromia Region. It is at 12kms from Ano-town, the district capital and 30km from Bako, the biggest town providing access to markets for

farmers. It is located at an altitude of 1550 masl in a high potential crop-livestock zone in the Gobu-Seyo District.

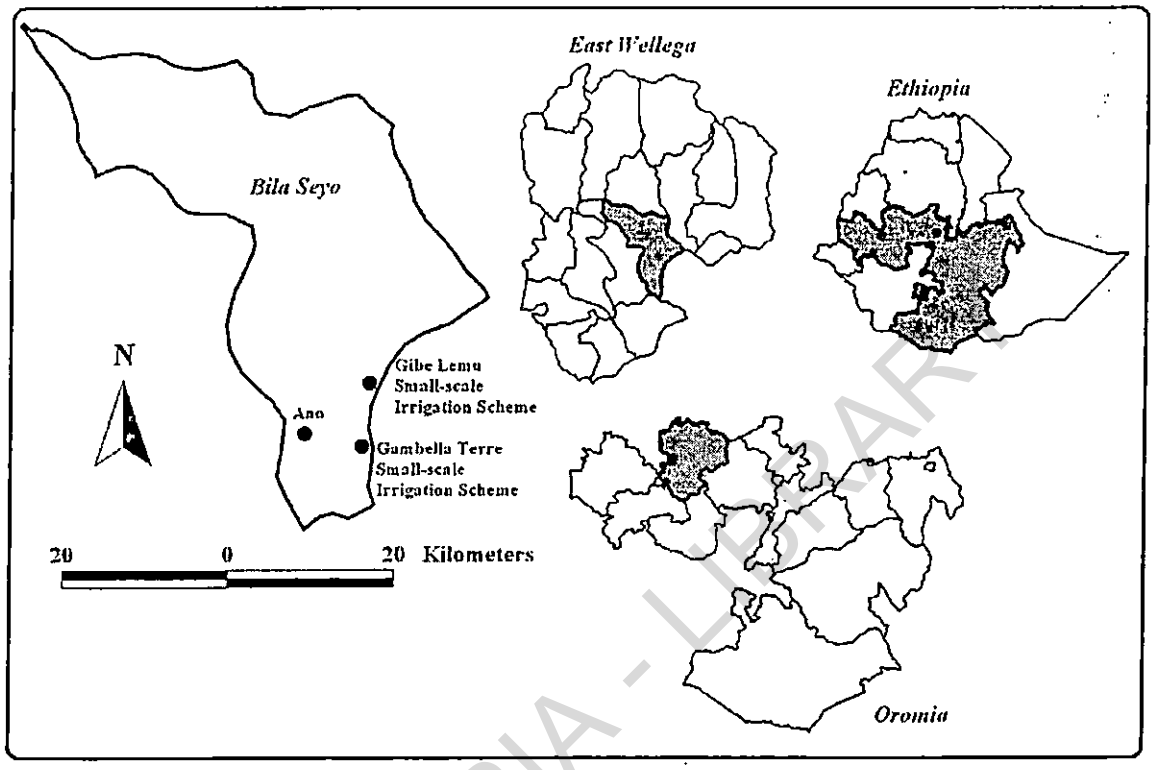


Figure3.1 Location map[2] of GIBE LEMU and Gambela Terre irrigation systems

In Gobu Seyo District, there are a number of perennial rivers that can be used for irrigation. The Gibe, Meki, Dokonu and other small rivers are the potential sources of water for irrigation (EWZFEDD, 2004: 15 and OBPED: 2000:183). In addition, the district has sufficient potential irrigable land (673 ha), of which only 373ha has so far been developed (OBPED, 2000).

The rainfall in both irrigation systems is unimodal. The main season is from early June/end of May to September. The pattern of rainfall (unimodal) dictates the single cropping season, starting in June/May and ending in December.

[2] Bila Seyo District was divided administratively into two districts viz. Gobu Seyo and Bila Seyo. Nevertheless, separate maps were not prepared for each district so far

However, in recent years, the pattern of the rainfall is changing; become uneven and unpredictable with negative implication on food production.

3.2.2. Socioeconomic Profile of the Study Site

Agriculture is the main economic activity that employed the majority of farmers in the study area. Smallholder mixed crop livestock farming is the dominant mode of production in the district. The system is oriented towards providing subsistence requirements for the farm household.

Farmers traditionally practice irrigated agriculture by diverting the available rivers by traditional means, especially in Gibe Lemu. Before construction of the Gibe Lemu Irrigation scheme, farmers in the area used to practice irrigation in their small home garden by diverting Gibe and Lagaya rivers using traditional means (Design Note by Korean Design Team, 1990). These farmers irrigated such crops as maize, sorghum, sugarcane, chat, coffee, hot pepper, tomato, potato and other different vegetables. In spite of farmers' experience and growing interest in irrigation, no significant area, relative to the potential, has been developed using traditional irrigation due to technical difficulties and topography problem to divert the Gibe and Lagaya rivers and lack of financial resources (Gibe Project Design Note, 1996 and EWZFEDD, 2004).

In Gambela Terre area too, farmers produce a mixture of cereals, vegetables, fruits and pulses before arrival of the new irrigation scheme, using rain- fed. Farmers have little or no knowledge and experience in traditional irrigation.

Livestock play a key role in day –to-day life of farmers. Oxen are the main source of draft power for cultivation and farmers with no oxen are considered as poor. It was reported that about 30% of the farmers in the district had no farm oxen (ibid). Family labor is free during the dry season as farmers in the area do not have alternative employment opportunities, other than rain-fed agriculture during the main rainy season.

3.2.3. Development of the Irrigation Systems

3.2.3.1. The Gibe Lemu Small-scale Irrigation System

Informants expressed that irrigation in Gibe Lemu area was initiated during the imperial times by a landlord named Dejazmatch Bizuwork (second half of 1940s –1974). Only the landlord or persons designated by him had control over and /or run the irrigation. He had exclusively occupied the irrigable land. Only the Dejazmach and his families had excusive land and water rights. Inline with this, Alula (2001) has found in his study in South Wello that landlords tended to have first choice (in imperial times) and only once their fields were saturated, would peasants compete over the surplus referred to as **"hyena water".** He grew crops like sugarcane, mango, chat and orange.

With the overthrow of the imperial regime in 1974 and the 1975 land proclamation referred to as "Land for the Tiller", Dajazmach Bizuwerk had evacuated from the area leaving the land because of confiscation by the Derg. The nationalized land was transferred, in 1974, to tenant peasants in the area and migrant settlers from Wello. Some peasant landowners in the imperial times had also retained a larger potentially irrigable land during the post-revolution period.

The Gibe Lemu SSI project was initiated and constructed by the Regional Government of Oromia. Construction of the scheme was completed and it became operational at a full-scale in 1997 (OIDA, unpublished report). The total irrigable command area of the scheme is 113 ha. Part of the developed irrigation land (GIBE LEMU-I; which is covering an irrigable area of 53ha) was distributed to displaced ex-solders, migrants from Wello, landless farmers and existing users. Gibe Leu-II which is covering an irrigable area of 60ha has not been redistributed; It was retained by the former peasant landowners in the

command area of the scheme. The irrigation project was initiated to benefit 370 households.

The Gibe Lemu SSI scheme acquires water from Gibe and Legeya rivers. A main canal having a length of 7kms conveys water into the command area. The method of distribution to the main, secondary canals and TUs is continuous, while it is rotational in the farm units as per the initial design of the project. However, currently, the method of supply to the TUs is rotational due to the decline in the volume of water conveyed into the diversion weir. The method of application to the farm units is rotational, while the method of application of water is furrow. Seven days are one irrigation interval for each farm unit at the time of design (Korea Design Team, 1990). However, there is severe water scarcity in the scheme to day to supply water in accordance with this interval.

3.2.3.2. The Gambela Terre Small-scale Irrigation System

Gambela Terre SSI project was initiated during the Derg Regime (1988) to cultivate 80 ha land using irrigation water. The main objective of the project was to benefit 235 members (households) of producers' cooperative that was established at Gambela Terre PA. The Project activities were interrupted in 1991 due to the political unrest in the area.

The project was re-initiated by the Regional Government of Oromia (RGO) in 1993 and construction of the physical infrastructure completed, on the basis of the previous design, i.e., to develop an irrigable area of 80ha, in 1994. In 1995, 34 turnouts, division box and other structures were constructed along the main conveyance canal to bring additional 70 ha of land under the command area of the scheme so as to benefit up stream farmers whose land holdings fall on the left and right sides of the main conveyance canal (Farmers in Ongobo Dembi PA). This increased the command area from 80ha to 150 ha. The additional 70ha land brought under the command area was not considered in the initial

design of the irrigation system. The infrastructure was developed to benefit 235 households and 1175 family members.

The water source for Gambela Terre is Dokonu River. It was supposed to be perennial with a discharge of 0.25-0.587 m^3 /sec at the time of design and construction (1988). A partially cemented main canal having a length of 7.23km conveys water to the command area of the irrigation scheme. Water supply to the farm units is rotational; while the method of application is furrow. Nevertheless, there is a wide gap between the supply of water to day and during the time the project was designed (1988). A night storage having a capacity of 8400 m^3 was constructed to overcome water shortage through rotational distribution of water in day and night.

Community self-management of communal SSIS is underlying policy principle of OIDA and MoWR in SSIS development (MOWR, 2000 and 2002; OIDASPM, 2003). Hence, management of Gibe Lemu and Gambela Terre small-scale irrigation systems was delegated to water committees established at completion of construction (for participatory management) in 1997 and 1995 respectively.

3.2.4. Socioeconomic Characteristics of Irrigators

Table 3.1 shows a summary of the demographic and other characteristics of households in Gibe Lemu and Gambela Terre SSIS. Of the 65 households interviewed in the two irrigation systems, 86.16% were headed by males and 13.84% were headed by females. Age of the household head, 92% in Gibe Lemu and 95% in Gambela Terre was in the range of 21- 65 years. Regarding level of education, the majority of the interviewed households, 60% in Gibe Lemu and 40% in Gambela Terre, were illiterate.

Occupation of the farmers in the command area of both irrigation systems is based on smallholder mixed crop-livestock farming (Gibe Irrigation Project

Table3.1 Socio-demographic characteristics of the sample households

Characteristics	%age of households			
	Gibe Lemu (N=25)		Gambela Terre (N=40)	
	Count	%	Count	%
Age of head:				
Below 15	-	-	1	2.5
15-20	1	4	-	-
21-65	23	92	38	95
Above65	1	4	1	2
Level of education of the head?				
Illiterate	15	60	16	40
Read and write	6	24	3	7.5
Elementary	3	12	11	27.5
Junior	-	-	9	22.5
Secondary	1	4	1	2.5

Source: - Field survey

Design Document, 1996 and EWZFEDD, 2004). Table 3.2 also shows the occupations from which households derive their means of livelihoods. The majority of the surveyed households have been engaged in three or all of the farming activities described in table 3.2. But very few farmers, 8.3% in Gibe Lemu and 20% in Gambela Terre, were engaged in off-farm activities ((Table3.2)

Table 3.2 Distribution of the sample households by their occupations

Description	%age of farmers giving the response	
	Gibe Lemu (N=25)	Gambela Terre (N=40)
Crop production under rain-fed	92	95.5
Crop production using irrigation	92	87.5
Livestock rearing	92	95
Off-farm activities	8.3	20

Source: Field Survey

In addition to crop production using rain and irrigation, livestock rearing is also an important economic activity in both irrigation systems. They rear cattle, sheep, goat, chicken and equines (table 3.2). The average number of cattle owned by the sample irrigators was higher (8) in Gambela Terre compared to

Gibe Lemu; which was 4.8 cattle per household (table3.3). But the average number of chicken and sheep was relatively larger in Gibe Lemu.

Table3.3 Livestock ownership by type of animals

	Gibe Lemu			Gambela Terre		
Type of livestock	Mean	N	St.Dev.	Mean	N	St.Dev.
Cattle	4.78	23	2.7	8	36	5.5
Sheep	8.5	2	9.2	2.5	8	1.7
Goat	3.67	3	3.8	4.67	3	4.73
Donkey	1.25	4	0.5	1.5	16	0.82
Mule	1	5	0.00	-	-	-
Chicken	12.8	16	23.8	8.90	32	4.93

Source: Field Survey

Oxen are the main sources of draft power for cultivation in both irrigation systems (EWZFEDD, 2004). Table 3.4 shows that there was no farmer with no ox in Gambela Terre. Almost all farmers had at least one ox in Gambela Terre. A farmer who do not own ox is considered poor. Out of the surveyed households, only 28% in Gibe Lemu and 40% in Gambela Terre, had more than a pair of oxen (table3.4).

Table3.4 Oxen ownership

Oxen ownership?	Number and percentage of households			
	Gibe Lemu SSIS (N=25)		Gambela Terre SSIS (N=40)	
	Count	%	Count	%
One ox	7	28	13	32.5
Greater than a pair	7	28	16	40
A pair	10	40	11	27.5
No ox	1	4	-	-

Source: Field Survey

The average round trip distance from the main asphalt road and the market place is different between the two irrigation systems. Irrigators in Gambela Terre have to walk longer hours than Gibe Lemu to access the nearest local market to sale their agricultural produces (Tables 3.5). In addition, there is no

all-weather road connecting the irrigation system to the main asphalt road despite the fact that it is one of the material contexts for successful irrigation (Engel, 1997; Mollinga, 2003; Dillon, 1992: FAO, 2003).

About 64% (Gibe Lemu) and 70% (Gambela Terre) of the interviewed households stated that they have enough labor for irrigation farm operation during the off-season and they did not regard labor as a major constraint. The implication is that labor demands for irrigated agriculture is not in conflict with the busy time of the majority of farmers in the irrigation systems, or rather take advantage of the idle household labor for irrigation. For these households, the irrigation project did not compete with other dry season activities. This is attributed mainly to the farmers traditional working calendar; i; e, alternative employment opportunities, rather than rain-fed agriculture during the wet season, are non-existent during the dry season.

Table3.5 Average distance from the market and average number of household labor

Round trip distance (minute):		Gibe Lemu			Gambela Terre		
		Mean	N	St.De	Mean	N	SD
From the main road:		55.20	25	40.56	116.75	40	64.22
From the market:		93.24	25	51.32	144	40	77.49
Number of active HH* labor?		MHHHs**	FHHHs***	Total	MHHHs	FHHHs	Total
	Mean	3.38	3	2.54	4.38	2.5	4.18
	N	22	3	25	34	6	40
	SD	1.96	2	1.9	2.32	1.92	2.34

Source: - Field survey, *=household, **= Male headed households, ***=Female headed households

The average number of active labor per household was higher in households headed by males in both irrigation systems (Table3.5). The number of rich house holds who expressed the opinion that they are endowed with adequate household labor for irrigated farming was the lowest in both irrigation systems compared with poor and middle income groups despite the fact that they were

managing a larger area of irrigable plots.

3.2.5. Institutional and Organizational Conditions of the Irrigation Systems

3.2.5.1. Land Tenure

3.2.5.1.1. Land Use Category and Average Land holding

The farmland in Gibe Lemu and Gambela Terre SSIS is broadly categorized into rain-fed and irrigable lands. Eighty per cent Gibe Lemu) and all of 100% (Gambela Terre) of the sample households possess their own farmland. Of the sample households, 80% and 97.5% in Gibe Lemu and Gambela Terre possess own irrigable plots respectively. The average total farmland and the average plot area allocated for rain fed agriculture was higher in Gambela Terre compared to Gibe Lemu (table3.6). In Gibe Lemu, the sample households allocated a large part of their farmland for irrigation (an average of 1.08ha) (Table3.6). Men and women have equal access to farmlands.

3.2.5.1.2. Land Distribution and Its Problems

Gibe Lemu and Gambela Terre Small-scale irrigation schemes were constructed to resolve the problem of farmland shortage, increase production and productivity and to improve farmers' livelihoods through effective and equitable use of the developed land and water resources. Many sources indicated that the fair and even distribution of the limited irrigable land is a necessary condition for good management and to meeting the desired objectives of the projects (JICA and OIDA, 2003 and Torori, et al, 1995, 2002). In view of this, the Council of the Regional State of Oromia issued a proclamation that defined irrigation land rights in 2002 (ORLUA Proclamation No. 56/2002). The proclamation states that a maximum of 0.5 ha is retained for each former landholder in the command area and each member is equally allocated 0.25 ha per household, in

Table3.6 Average land holding size by type of use, wealth status and sex

			Statistic			Statistic	
Description	Irrigation system	Wealth status	Mean	N	Sex	Mean	N
Total farm land*	Gibe Lemu	Poor	1.21	5	Male	2.09	17
		Medium	1.77	8	Female	5.08	3
		Rich	6.58	7	Total	2.54	20***
		Total	2.54	20***			
	Gambela Terre	Poor	3.39	13	Male	3.19	34
		Medium	3.14	14	Female	2.95	6
		Rich	2.94	13	Total	3.16	40
		Total	3.1570	40			
Irrigable land	Gibe Lemu	Poor	0.64	9	Male	1.05	22
		Medium	1.67	9	Female	1.25	3
		Rich	3.08	7	Total	1.10	25
		Total	1.10	25			
	Gambela Terre	Poor	0.68	12	Male	0.75	33
		Medium	0.60	14	Female	0.52	6
		Rich	0.89	13	Total	0.72	39**
		Total	0.72	39**			
Area under rain-fed	Gibe Lemu	Poor	0.550	5	Male	1.30	17
		Medium	1.232	8	Female	2.58	3
		Rich	3.25	7	Total	1.60	20***
		Total	1.60	20***			
	Gambela Terre	Poor	2.050	13	Male	2.0450	34
		Medium	2.23	14	Female	2.3	6
		Rich	3.20	13	Total	2.10	40
		Total	2.5	40			

Source: Field Survey, ** =One sample irrigators had no rain-fed land, *** =Five sample water users had no rain-fed land

order to properly use irrigation land, and water resources potentials. Nonetheless, this has not been finished in practice in both irrigation systems in

spite of the proclamation. Fair distribution of irrigation land has not been achieved by the survey date; especially in Gibe Lemu.

Gibe-Lemu and Gambela Terre SSIS were constructed to benefit 370 and 235 households respectively. However, the whole command area in Gibe Lemu and Gambela Terre was owned and managed only by 83 and 133 households respectively. These numbers represent 22.4% (in Gibe Lemu) and 57% (in Gambela Terre) of the intended beneficiary households. Former plot holders continued to control and manage land areas that fall in the range of 0.5ha to 12ha in Gibe Lemu and 2ha to 5ha in Gambela Terre SSIS, while the rest farmers are landless; tenants and/or sharecroppers (specially in Gibe-Lemu SSIS).

The problems of landlessness and unequal distribution of irrigable land was more severe in Gibe Lemu. Out of the irrigators in Gibe Lemu, 2o% did not possess own irrigable plots, while some rich farmers were managing 9-12ha of potentially irrigable land in the command area of the Gibe Lemu SSIS. Regarding Gambela Terre, the majority 39 (97.5%) of the sample households were irrigable plot holders. T-test also showed that there was no significant difference (at the 10% level) among poor, rich and medium, households (in Gambela Terre) in the average total farmland and irrigable plot size of households compared to Gibe Lemu; which is significant at the 5% level (Table3.6).

Fair distribution of the developed prime irrigation land has not been instrumental mainly because of the lack of policy and enabling legal system for a long period. ORLUA Proclamation No.56/2002, which determined irrigation land rights, was issued in 2004 (1994EC); many years after construction of the schemes. Nonetheless, it has not been finished in practice by the survey date due to a time lag between the issuing of the Proclamation and the operational regulation. Implementing guideline was provided by ORLAUANRA in Nov. 2004.

Some tangible steps have been under taken both at Wereda and scheme levels following the issuing of the guidelines by ORLAUANRA in 2004. At the wereda level, a committee composing the GSDID, the District Administration and other concerned government development institutions in the district was formed to deal with land redistribution in both irrigation systems". Sub-committees were also formed at PA and scheme levels to identify the likely effects of the redistribution on loser households and under take the distribution in participatory manner.

3.2.5.1.3. Land Tenure Arrangements in the Irrigation Systems

Irrigators in Gibe Lemu and Gambela Terre access irrigation land mainly through two major land right institutions, namely ownership right and use right. Government distribution (40%), inheritance (32%) and gift (20%) were are the major tenure systems through which the sample plot holders in Gibe Lemu obtained the land they own (Table3.7). As regards Gambela Terre, inheritance (32.5%), gift (25%), government redistribution (20%) and retaining former holding (22.5%) are the most important, in that order, land right institutions through which the sample irrigators obtained their irrigable land (Table3.7). In addition to inheritance, plot holders in both irrigation systems share their land and transfer ownership rights to their young sons (who are going to establish themselves as new households) and landless relatives in the form of gift (see table3.7).

Landless farmers and those who own small plots access irrigation land through sharecropping, labor exchange, exchange of ox for land and gift. Sharecropping (44%) and followed by gift (32%) are the most important tenure arrangements through which non-plot holders and farm families with small plot size gained access to land in Gibe Lemu (Table3.8). Table3.8 also shows that gift is the prime mode of tenure (as reported by 37.5% of the interviewees) which grants use rights for non-plot holders in Gambela Terre. Plot holders transfer use right, free of charge and for an agreed period, to landless friends, relatives and neighbors during the off-

season.

Table3.7 How irrigators obtained land ownership rights

Tenure systems	Gibe Lemu (N=25)			Gambella Terre (N=40)		
	All HHs (%)	Sex (%)		All HHs (%)	Sex (%)	
		Male	Female		Male	Female
Inheritance	32	28	4	32.5	30	2.5
Gift	20	16	4	25	25	-
Distribution by government[1]	40	36	4	20	12.5	7.5
Retained former holding[3]	8	8	-	22.5	17.5	5

Source: Field survey,

Table3.8 Tenure systems through which irrigators obtained land use rights

Tenure systems	%age of respondents			
	Gibe-Lemu (N=25)		Gambela-Terre** (N=40)	
	Count	%	Count	%
Lease/contract	4	16	4	10
Share cropping	11	36	4	10
Purchase	2	8	3	7.5
Gift	8	32	15	37.5

Source: Field survey, **= 25% of the sample irrigators said "do not know" the tenure systems through which irrigators obtained land use rights

Share cropping (leasing-out and leasing in) system is a very common and most important means of gaining access to irrigable land in GIBE LEMU than in Gambela Terre.

Share cropping system is very common and most important in GIBE LEMU than in Gambela Terre. This is true mainly because; firstly, there are households who control a large area (9-12 ha) of irrigable land irrespective of their capacity to develop the whole area. Farmers' ranking of reasons shows lack of capacity

1. Gibe Lemu-I, which is covering an irrigable area of 53ha was distributed at completion of construction to displaced ex-soldiers, migrants from Welo and the nearby residents.
2. Some farmers retained the unoccupied land they claimed many years ago

(shortage of cash, labor, input and oxen) to cultivate irrigable land, forces large plot holders to lease-out for sharecropping (see table 3.9). Similar study by JICA and OIDA (2003: 3-6) on SSIS in East Shoa also documented that sharecropping was one of the common option available to land owners with low resource capacity.

Secondly, there are many landless farmers and farmers with smallholding in the scheme. These groups of irrigators gained access to irrigable plots mainly through sharecropping system (see table3.9). Similar study by Woldeab (2003) in Tigray revealed that sharecropping enables farmers to gain access to land. However, the sharecroppers in Gibe Lemu are categorized under low-income groups based on the local wealth ranking criteria. JICA and OIDA (2003) have also found in their study in East Shoa the income sharecroppers obtained was low for the output is halved with landowner.

With reference to Gambela Terre, few crop-sharing holders (leased-in and leased-out for sharecropping) were observed (Table3.8). This is true because most of them (97.5%) control their own irrigable plots in spite of the variation in the size of plots across households.

Table3.9Farmers' ranking of the reasons for leasing-out/in irrigable land

Reasons for Leasing in:	% of farmers and rank (Gibe Lemu)			% of farmers and rank (Gambela Terre)***		
	N	%	Rank	N	%	Rank
Shortage of land[1]	10	40	1	8	20	1
Irrigation is profitable[2]	9	36	2	5	12.5	2
Own free labor[3]	6	24	3	3	7.5	3
Leasing-out:						
Shortage of oxen	4	16	4	7	17.5	1
Shortage of seed	5	20	3	3	7.5	4
Lack of in put	7	28	1	4	10	3
Shortage of labor	6	24	2	5	12.5	2
Own large plot	3	12	5	1	2.5	5

Source: Field survey, ***= the rest sample water users said "don't know"

3.2.5.1.4. Imp[4]lications of Land Tenure on Irrigation Management

Past research on SSI demonstrated, that lack of clearly defined land right has drastically affected irrigation development and sustainable WUA management of SSI in many areas (Torori, et al, 1995: Blank, et al, 2002; OIDA and JICA, 2003 and Lema, 2004). Lack of clearly defined land right has also created management difficulties in the surveyed irrigation systems. Both 'Kore Aba Lega', DAs and the GSDID do not clearly know the actual size of irrigable plot area managed by individual households in both irrigation systems. Hence, the water committee could not adjust water allocation and resource mobilization to amount of water used and irrigable area controlled by individual households.

Equal contributions are requested from all members who cultivated 0.5ha-12ha of irrigable plots. Those farmers with small irrigable plots are reluctant or tended to resist WUAs committee when tried to mobilize labor for maintenance and other activities. Ali Seid (2002), Lema (2004) and JICA and OIDA (2003) found similar problem in their study on SSIS in North Wello and in East Shoa zone respectively. In addition, some farmers are over supplied with water, while some others obtained water, which is far short to meet their needs as water allocation has been made by guess. Over supply has led to ineffective and misuse in the context of severe water scarcity.

3.2.5.2. Organization of Users for Self-Management of Irrigation

3.2.5.2.1. Organizational Set-up of the WUAs

In accordance with the policy framework for SSI development in Ethiopia, management and operation of SSIS is the joint responsibility of the state

1 Farmers with smallholding gain access to irrigable land through sharecropping system
2 Some farmers lease-in irrigable land because of the good market opportunity for horticultural crops at Bako Town (market stimulus) and attractive market prices of vegetable crops
3 Some others lease-in land because they are endowed with free family labor but are landless and/or possess a small irrigable plot.

irrigation agency, cooperative promotion and input supply desks, district and village level administrative and legal entities and farmers and their organizations. In view of this, therefore, management of Gibe Lemu and Gambella Terre SSIS was delegated to water committees/ 'Kore Abba Laga' formed at completion of construction in 1997 and 1995 respectively. Water committees "Kore Aba Laga" (in each irrigation system) are now in charge of water allocation, distribution, conflict management and maintenance.

The major management tasks of the Water Committee" Kore Abba Laga" include (as stipulated in the O and M manual):

- Allocate water and controls proper distribution of water
- Observe the water rights of members
- Ensure the safety of the schemes through organizing O and M works and mobilizing resources for these works
- Resolve disputes related to land, water and maintenance based on their bylaws.

One of the social requirements for successful irrigation is organization and management structure that suit the irrigation infrastructure (Mollinga, 2003; Woldeab, 2003). The water users in both irrigation systems have also created management structures that suit layout of the irrigation schemes. Executive committees, sub-committees and water user teams were formed at irrigation system and distribution levels for in the hope of better coordination of O and M activities.

An Executive Committee consisting of seven members in each irrigation system is responsible for operation and maintenance (O and M) of the irrigation systems. The general assembly is the highest body, which make the final decisions based on the bylaws. The composition of the WUA committee members has, in both schemes, chairman and vice chairman, a secretary,

treasurer, control and monitoring committee, cashier and two members.

Organizational set up and management functions of the committees are further decentralized depending on layout of the schemes. All water users in the irrigation systems constitute the water users teams (WUTs/'Goxi'). Sub-committees comprising three members are in charge of control of water distribution and coordination of maintenance activities in the respective territory units (TUs). As a rule, they are accountable to the executive committee and expected to report to the board when regulations in the water distribution by-laws are violated. However, they did not effectively discharge this responsibility as stipulated in the O and M manual because of organizational and institutional weaknesses and socioeconomic constraints discussed in the different sections of chapter five.

All water users in Gibe Lemu are organized into 6 WUTs, each group comprising 10-20 members. Irrigators in Gambela Terre are organized into four WUTs/ "goxi" with the number of members per WUT ranging from 17 to 44. However, the number of members of two WUTs in Gambela Terre is above the optimum range (20-30) for good management and performance (See Woulter, 2002: Blank, 2002). In these WUTs it has been observed, because of large group size, that there is a greater socioeconomic differentiation among water users, leading to severe problem of water distribution and conflict over water because of lack of mutual understanding. Similar study in Kenya showed that, the whole schemes or part of it was not operational, in all schemes consisting of groups of over 30 members (Woulter, 2002). With a membership below 30, he observed no water distribution problem in Kenya. However, the situation in Gibe Lemu contradicts with Woulter's findings in Kenya. The number of members of WUTs is 10-20, which is below 30 but still there is water distribution problem and users could not settle water dispute themselves. This shows group size is not the only factor for social cohesion and effective group performance in water distribution.

Effective and sustainable management of SSIS requires well-established rules that ensure the interest of all irrigators. Farmers had also designed their own internal by laws. Nevertheless, these bylaws have a number of deficiencies (for detail, see section 3.2.5.2). The WUA in GIBE LEMU has relatively a better defined by-laws compared to Gambela Terr. It defines that:

- Any individual whether plot holder, sharecropper or a contractor so long as he full fills membership requirements, he/she has the right use irrigation water.
- Both a plot holder, share cropper or contractor; so long as he participate on canal work he will have his water right
- Any user has the right to appeal his/her complaints to the committee and to get resolution
- If any user abuses turn out of his turn he will be fined Br. 20.
- A farmer who is found guilty of breaching canals and diverting water where there are no turnouts will be fined birr 60.
- Any member (user) is obliged to give consent to be governed by WUA committee and to respect the decisions of the WUA committee members at conflict resolution; and if he failed to do so he will be fined Birr 300.

The internal by-laws of the Gambela Terre WUA are vague and less detailed compared with Gibe Lemu. It has been stipulated in the by-laws that:

- A water user who is found guilty of turn abuses for the 1st, 2nd and 3rd time, will be fined Birr 15, 30 and 50 respectively;
- A water user who diverts water by breaking canals where there are no turnouts, will be fined birr 15, 30 and 50 for the 1st, 2nd and 3rd time respectively; and
- Members of the WUA are expected to respect the decisions of the committee and to implement the guidelines provided by DA and WUA

committee. Any member failed to comply with this rule will be fined Birr 50.

3.2.5.2.2. Viability and Constraints of WUAs for Self- Management of Irrigation

The responsibility for running O and M of gibe-Lemu and Gambella Terre SSIS was delegated to "Kore Aba Laga" in the in the hope of enhancing effectiveness, equity and responsiveness in irrigation management and to ensure sustainability. However, they are weak and unable to shoulder the responsibility for running O and M of the irrigation systems as expected because of the following organizational and institutional weaknesses and socioeconomic constraints ((WBO, GSWID and users)).

a). They have not been organized legally and registered. The WUAs committee has no recognized power and legal personality to act on users' behalf. They have not been provided with official stamps. They cannot sue and be sued on behalf of their associations and users. They cannot enforce rules because they do not have recognized legal power.

b). The roles, responsibilities, authorities and accountability of the executive and sub-committee members are not clearly formulated in the bylaws. The members of the committee do not clearly know their power, authority and accountability. The behaviors for which committee members are responsible are totally missing from the by-laws of the WUAs in Gambela Terre; while it has shallowly been defined in Gibe Lemu.

c). In spite of the presence of management structures extending down to TU level, there has been lack clearly defined water rights though it is one of the essential factors for effective irrigation management (ODI, 1995). The WUA committee allocates water by guess because of lack of technical capacity and lack technical support from the Irrigation Desk. Hence, WUA are unable to

undertake effective, reliable, and equitable water distribution.

d). There is lack of transparent accountability of the WUA committee members though it is one of the basic factors for good irrigation governance (Vermillion, 1994: Odi, 1995, No. 5). Some committee members do not observe even the shallowly defined rules in Gibe Lemu. For example, one of the articles in the by-laws stipulates that, "all committee members should meet fortnightly and listen to users complaints and give solutions to the complaints." But informants reported that the committee members do not observe this rule. Nevertheless, they were not held accountable through legal processes.

In addition, the beneficiaries accuse the committee members for power abuse, selfishness and lack of commitment and responsiveness. One informant in Gibe Lemu expressed the problem of lack of accountability and commitment as follows:

> "We have a strong sense of ownership of the scheme. We have taken the responsibility to administer it. We are willing to maintain it, to contribute labor and "every thing". However, we do not have committed coordinators; who mobilize us, who enforce our bylaws and who resolve conflicts. Overall, this proverb, **'yegebere balesiltan yasyilign gebeya new'**, holds true and describes well our committee, meaning, they abuse the power and authority we vested on them and prioritize their interest and irrigation fields in water allocation and distribution" Mohammad Shumiye, GIBE LEMU,2005

e). Lack of adequate external support (in water and conflict management, technical assistance and capacity building) by the local irrigation agency and the other concerned partners despite the regional institutional framework states that the management and operation of irrigation systems is a joint responsibility.

f). Problematic social relation of power among water users; some powerful

groups resist the committee during coordination of O and M activities. This deterred the possibility for proper allocation and distribution of irrigation water and conflict management by the committee in both irrigation systems.

3.3. Irrigation Management Practices within the Irrigation Systems

3.3.1. Water Management

3.3.1.1. Water Allocation

Water committees are in charge of water allocation and coordination of rotational water distribution. In principle (as stipulated in the o and M manual prepared for the schemes), irrigation agronomists and DAs are also supposed to provide technical assistance to water committees in water allocation, in preparing the annual schedule for water distribution and in defining the water rights of members based on study on water requirements of different crops and irrigable plot area and measurement of the yearly water supply. However, both the multipurpose DAs and the Irrigation Desk did not maintain strong link with the water committees and did not provide them with the required technical assistance in undertaking these water management tasks.

The designed irrigation season for the projects is October-March. In early September/*Quagme* Water Committee/'Kore Aba Lagas' call a meeting and coordinate maintenance and canal cleaning activities. They allocate water and prepare rotational schedules (by guess) for each of the TUs every year in September but without adequate study and knowledge on the yearly water supply, the water requirements of the individual irrigators and WUTs because of skill problem. In addition, water users do not, in spite of the law (bylaws), register types of crops they grow (vegetables or perennials) and area of each plot with the WUA-committee for clear definition of water rights of individual farmers and TUs and to adjust the rotational schedule with the yearly water supply. This have had also a deterrent effect on the possibility for proper allocation and scheduling of water distribution by the WUAs-committee.

Water allocation and rotational schedule, which was prepared and being implemented by the water committees has got limitations in terms of both design and implementation. In terms of design, water allocation is made by guess. It does not clearly define the water rights of individual water users and WUTs. Equal water supply period per turn are allocated for all TUs and individual water users. Amount and time of water supply are not defined in accordance with the water requirements of the different crops grown and area of irrigable plots managed by individual irrigators and WUTS. This resulted in a major problem in the implementation of rotational distribution of irrigation water.

Participants of group discussion held in Gibe Lemu explained the limitations of water allocation made by the water committee in the following manner.

> "The committee allocates water by guess. The distribution schedule has many limitations. Equal water delivery period per turn is allocated for all TUs in spite of the variation in water demands indifferent TUs. In addition equal number of irrigation hours is assigned for all irrigators within a TU with different land holding size and different crops grown. Amount and timing of water supply are not specified based on water requirements of the different crops and plot area. This has often led, within a TU and among TUs, to ineffective use (misuse) of water due to over supply or under supply, and in justice in water allocation, scarcity, conflict and crop failure due to unreliability of water".

Another informant in Gibe Lemu expressed the negative effects of the ill-designed rotational schedule and lack of clearly defined of water rights (within the irrigation systems) on management of water distribution within TUs and among TUs as follows:

> "Water is supplied simply for about 24 hrs for each TU per turn. The number of irrigators in one WUT ranges from 10 to 20. Within this timeframe water does not reach to all members of the team. It is diverted to other groups soon after the supply period per turn is over but before all farmers (claimants) in a TU get irrigation water. Even during the second turn, those farmers who did not obtain water during the previous turn may not get priority; while some dominant farmers arbitrarily obtain

water for the second time. "

3.3.1.2. Water Distribution

3.3.1.2.1. Performance of `Kore Aba Laga` in Water Distribution

WUAs-committees consisting of seven members coordinate and controls water distribution in each irrigation system. The most important performance indicators in the distribution of irrigation water include adequacy, timeliness and equity in the supply of water (World Bank, 2000).Table3.10 shows users' evaluation of performance of "Kore Aba Legas" in water distribution. The WUAs in both irrigation systems were found to be in efficient in managing water distribution in terms of the three indicators.

Table3.10.Water users' opinion about water distribution in Gibe Lemu and Gambela Terre irrigation systems

Item	Opinion by irrigation system and location			
	Gibe Lemu (N=25)		Gambela Terre (N=40)	
	Count	%	Count	%
Enough water is not obtained	20	80	36	90
Water is not reliable	19	76	32	80
Water distribution is unfair	21	84	33	82.5

Source: Field Survey

In Gibe Lemu and Gambela Terre, 80% and 90% of the sample households witnessed that they could not obtain the quantity of water that can support irrigation over the plot area they own (Tables3.10). Access to adequate irrigation water has also strong association with location of farmers' fields relative to the headwork and it is highly significant in Gambela Terre (X^2=10.6, X^2-Prob. =0.005). This indicates that there is a greater probability that access to adequate irrigation water is more unlikely if the farmer's irrigable plot is in the tail-end area in Gambela Terre (Table3.11).

Table3.11.Water users' opinion about water distribution by irrigation system and location of farm plots

Item	Response (yes/No)	%age of water users giving the opinion by irrigation system and location							
		Gibe Lemu (N=25)				Gambela Terre (N=40)			
		Head	Middle	Tail	X2-Stati.	Head	Middle	Tail	X2-Stat.
Enough water is obtained	Yes	12	8	-	1.32NS	7.5	2.5	-	10.6**
	No	20	28	32		25	30	35	
Water is received when needed	Yes	16	8	-	4.5NS	15	5	-	9.8**
	No	16	28	32		17.5	27.5	35	
Water distribution is equitable	Yes	16	-	-	5.5*	12.5	5	-	9.6**
	No	16	36	32		20	27.5	35	

Source: Field Survey, NS= Non-significant, *= significant at P<0.1, **=Significant at p<0.005

Table3.12 shows that water scarcity, turn abuses and poor coordination of water distribution by WUAs were the 1st, 2nd and 3rd most important problems that constrained the supply of adequate water in the command area of the projects. Turn abuses, water scarcity and lack of proper control of distribution by WUA were identified by irrigators in Gibe Lemu as the 1st, 2nd and 3rd major constraints respectively, while scarcity followed by turn abuses was the most important problem in Gambela Terre (Table3.12). Some selfish irrigators and powerful socioeconomic groups extracted and obtained more water by abusing turns, with negative consequence on the quantity of water available for the other member users.

Water users also mentioned poor WUA committee water control (management) as the third major constraint (as ranked by 20% of water users in each irrigation system) that deterred the schemes ability to meet water needs over the command area of the irrigation systems (table3.12). Table3.13 presents users' perceptions about the major weaknesses in WUA-committee water management. Of the surveyed households, 84% in Gibe Lemu and 92.5% in Gambela Terre, reported irrigators that extracted and used more water by

abusing turns were not charged. In Gibe Lemu and Gambela Terre, 88% and 85% of the interviewees stated that they did not obtain the quantity of water they needed because, among others, rotations are not strictly implemented (table3.13)

Table3.12 Order of reasons why farmers do not obtain adequate water for irrigation, Gibe-Lemu and Gambela Terre SSIS

Irrigation system	Statistics	Reasons				
		Water scarcity	Seepage loss	Poor water control	Turn abuses	I am tall end irrigator
Gibe Lemu	N	6	3	5	9	2
	% of farmers	24	12	20	36	8
	Rank	2nd	4th	3rd	1st	5th
Gambela Terre	N	20	2	8	9	1
	% of farmers	50	5	20	22.5	2.5
	Rank	1st	4th	3rd	2nd	5th

Source: Field survey

Table3.13Users' opinions about major management problems of water distribution (weaknesses in water control)

Opinion	Percentage of users giving the opinion		
	All HHs (N=65)	Gibe Lemu (N=25)	Gambela Terre (N=40)
Illegal water users not fined	89.32	84	92.5
Rotations do not accomplish equity	89.32	68	77.5
Rotations are not strictly implemented	73.92	88	85

Source: Field survey

In Gibe Lemu SSIS, hydraulic and technical problems (water scarcity and seepage water loss) tended to be the least important factors for not meeting water needs in the command area of the scheme, indicating institutional and management problems are more relevant. Water users in Gibe Lemu believe that the current volume of water flow to the scheme can meet water requirement in the command area with some adjustment and adaptation of

water allocation and distribution to the change in water supply and if there had there been strong system management.

The water committees in both irrigation systems were also found to be inefficient in managing water distribution in terms of timeliness of water supply. Figures in table3.10 revealed that the vast majority, 76% (in Gibe-Lemu) and 80% (in Gambela Terre) of irrigators were not able to obtain water in a reliable manner because of poor water management and scarcity. In addition, the problem of unreliability in water distribution has strong link with location farmers' irrigable plots and it is highly significant in Gambela Terre ($P<0.005$). Water is scarce and the problem of unreliability is more severe in the middle and tail end areas in both irrigation systems (table3.11). Informants expressed that the intensity of the problem of fluctuation in water supply, because of both poor water management and decline in the quantity of water conveyed into the scheme, in the tail end areas of Gambela Terre as follows:

> "In Gambela Terre area a small amount of water is received in September and October. Then the supply declines sharply and totally dries some times in November sometimes in December and/or the maximum in January. It is unpredictable; some times it dries after land preparation and purchase of input before planting. Some times it dries immediately after planting. At the other time, water stops nearly at flowering and before maturity. This has been resulted in crop failure, loss of our resources without return"

Lack of equity in water distribution was the other deficiency of WUA-committee water management in both schemes; as witnessed by 84% (Gibe Lemu) and 82.5% (Gambela Terre) of the sample households (see Table3.10). There has been inequity between locations and among socio-economic groups. Head, middle and tail-end areas do not have equal access to water because of institutional, management and technical problems.

The various groups of informants and interviewed households expressed that powerful households, in their words, *'gulbetegnas'* have had better access to irrigation water and have been benefited more. Table3.14 shows the

socioeconomic groups and locations that obtained more water. Head-end

Table 3.14 Socio-economic groups that get more water in the irrigation systems

Groups	Percentage of farmers giving the response		
	All HHs (N=65)	Gibe Lemu (N=25)	Gambela Terre (N=40)
Farmers with large family size	89.5	60	42.5
Head-end farmers	89.5	76	82.5
Rich farmers who irrigate perennials	39.7	36	35

Source: Field survey

farmers have better access to irrigation water because of their proximity to the headwork and the main canal (location advantage). They release water for the down stream farmers once their fields have been saturated with water. Households with large family size are more powerful (because of size) and often, they exercise power to obtain water by illegal means. They also take advantage of the relatively large family size and/or labor in defending their water rights and in the operation of irrigation farming. Rich farmers in the middle areas, especially in Gambela Terre, irrigate large areas of tree crops which are not in the priority list and do not release water for the tail-end farmers and the less powerful members of the WUTs to which they belong. Nonetheless, the WUA committee could not regulate this distribution inequity in both schemes though it is relatively better in Gibe Lemu.

There were also technical and/or design related problems that impeded efficient water distribution and limited farmers' access to irrigation water in both irrigation systems. Although the intensity and magnitude of the problem was not investigated in detail and not quantified through this study, water users complained that turnouts are not evenly distributed. There are also irrigable plots, which are not leveled. Hence, there are pocket areas (farmers) in the command areas of the schemes, which (who) do not obtain water because of slope and uneven distribution of turnouts.

3.3.1.2.2. Water Scarcity and Coping Measures

3.3.1.2.2.1. Water Scarcity

Survey results revealed that water scarcity was the 1st and 2nd most important reason for not obtaining the needed quantity of water for irrigated agriculture in command areas of Gambela Terre and Gibe-Lemu respectively (table3.12). Participants of the household interview stated that diversion of water by traditional irrigators and flour mill operators in the upstream areas of the source rivers, seepage loss, increasing number of water users in Gibe Lemu, and poor scheduling and inadequate coordination of water distribution were the prime factors for water scarcity (Table3.15).

Table3.15 Perceptions of irrigators about causes of water scarcity, Gibe-Lemu and Gambela Terre SSIS

Causes for water scarcity	% of farmers giving the opinion		
	All HHs (N=65)	Gibe Lemu (N=25)	Gambela Terre (N=40)
Diversion of water by traditional irrigators	89.32	88	97.5
Seepage loss	47.74	52	52.5
Increasing number of users	63.14	80	62.5
Poor scheduling of distribution	64.68	72	70
Inadequate coordination of water distribution	70.84	80	80

Source: Field Survey

A). Water Diversion by traditional irrigators and flour mill operators

Water is scarce in the irrigation systems because, among others, of diversion of water by farmers of traditional irrigation and flourmill operators in upstream areas of the source rivers; as reported by 88% (in Gibe Lemu) and 97.5% (in Gambela Terre) of the interviewees (table3.14). Gibe and Dokonu rivers, which are water sources for Gibe Lemu and Gambela Terre, were diverted at 2 and12 locations respectively. In addition, flourmill operators diverted Gibe River at two

places with negative consequence on the quantity of water conveyed into the Gibe Lemu irrigation scheme.

However, GSDID and WUA committee members reported that no legal action has been taken to resolve the problem because of lack of enabling institutional and organizational conditions to deal with it. That means there is no organizational means and well established legal system that facilitate the shared use of water by the two groups (upstream and downstream users).Firstly, the responsibility for addressing such problem is not clearly defined. The role (who should do what) of the different stakeholders both at District and scheme levels has not been defined. Secondly, there has been no enabling legal system, which clearly defines the water rights of the upstream traditional irrigators and irrigators in the new irrigation projects. According to proclamation No. 197/2000" All water resources and/or water is the common property of all Ethiopians". In spite of this general constitutional rule, there are no formal operational rules and regulations for managing the relation between the upstream and downstream irrigators in sharing the water from the same source (MOWR, 2002 and GSDID, Head).

B) Seepage Water Loss

Informants, 52% in Gibe Lemu and 52.5% in Gambela Terre, expressed that seepage water loss was one, if not the most important, of the factors responsible for water scarcity in downstream areas of the projects (table3.15). Except some part of the main conveyance canal, field and distribution canals are earthen construction; not lined with cement. This resulted in water-logging in some irrigable plots, seepage water loss, and these led to water scarcity in downstream areas.

C). Increasing Number of Water Users (Gibe Lemu)

A key informant, Ato Abetu Abdi, 55, illiterate and with eight family members, expressed that continuous increase in the number of water users, against the

declining quantity of water conveyed into the irrigation scheme, have had contribution for the problem water scarcity. He described his experiences in historical perspective as follows.

> "The number of youngsters who are going to establish themselves as new households has increased over time. In addition, farmers within the irrigation systems and the surrounding residents become well aware of the value of irrigation as some people started to get substantial income from the sale of irrigated horticultural crops and maize in the initial years of project implementation. Hence, claimants of irrigation water (through different tenure arrangements) have increased with increasing pressure on the declining irrigation water. This led to scarcity and intense competition and conflict over water. In addition, management and control of water distribution has become more complex to be handled by the WUA committee ".

Similar studies have also documented that increasing number of users on the limited irrigation water has led to scarcity, competition and conflict, water management become more complex (Alula, 2001 and Freeman and S.Silim, 2002)

D) Inadequate coordination of water distribution

Farmers in the middle areas, especially in Gambela Terre, irrigate large areas of perennial tree crops which are not recommended by the WUA-committees, leading to water scarcity in tail-end areas. Selfish and powerful households obtained more water by illegal means; limiting the other users from access to adequate irrigation water. This was because, among others and as mentioned by 80% of water users in each irrigation system, of lack of proper coordination and strict control of water distribution

E). Incompatibility between the designed irrigation time and farmers' growing season (Gambela Terre)

The designed irrigation season for the scheme (Gambela Terre) was October to March every year. But informants reported that the indigenous growing season

for rain fed agriculture in the area is May to December. Farmers start irrigated agriculture by the end of December. But, by this time, the volume of water flowing to the diversion weir has declined substantially to the extent that it cannot support irrigation over the command area of the scheme or dries totally.

3.3.1.2.2.2. Coping Measures to Overcome Water Scarcity

The following coping measures were taken to overcome water scarcity in the command area of the irrigation systems

- In 2004/05 the executive committee of WUA in Gibe Lemu changed the duration of water delivery for each TU from 48 hours per turn per TU, to 24 hours per turn per TU in January 2005 so as to address the scarcity problem. However, this has not been a success because the newly designed rotational schedule itself has limitation and could not be implemented. They changed the water supply period per TU per turn by guess; not based on measurement of the actual water supply. In addition, the water rights of individual water users are not clearly defined in the newly designed rotational schedule.

- The WUA committee (Gibe Lemu) has made effort to coordinate members to construct" night storage" for rotational distribution day and night. However, members who used to comply with the group by-laws were not cooperative. This is because there are many farmers who use water without involving in or paying for canal maintenance (as argued by water users). There were also farmers who did not obtain water though they observed the bylaws and they had regularly involved or paid for canal maintenance (Gibe Lemu WUA);

- Prioritizing crops to be grown (in both schemes); vegetable crops,, which require frequent watering, were given priority. However, irrigators did not

observe the newly recommended cropping pattern by the Water committee. This was mainly because the rotational schedule has not strictly been implemented to supply water in a reliable and timely fashion to grow vegetables and cereals. Hence, many farmers shifted from vegetables to perennial tree crops as an adaptation to the problem of unreliability of water. This is because these crops do not require frequent watering and little affected by the scarcity and unpredictability of water.

- Night storage was constructed by the Regional Government (in Gambela Terre SSIS) to over come water scarcity through rotational distribution day and night. But most farmers do not water in the night. In addition, the volume of water flow is also far short of water needs in the scheme even through rotational distribution in day and night. The scarcity problem has been further compounded by turn abuses and illegal abstraction of water by farmers in the middle area. Hence night storage itself did not solve the problem of water scarcity.

- Water users in Gambela Terre employed a guard; to control water distribution and to address the coordination problems of WUA committees in implementing rotational schedules. However, the guard could not adequately manage the distribution because of the size of the irrigation system that needs control. There is still water theft and breaching of canals, which is beyond the capacity of one person to control.

Overall, the problem of water scarcity has not been fully addressed by all these means due to defects in the design and implementation of the adaptive measures.

3.3.1.2.3. Enforcement of Water Distribution Rules

The Gibe Lemu WUA has relatively a better defined by-laws crafted and ratified by users themselves being assisted by DAs, compared to the internal by-laws of the Gambela Terre WUA; which is vague and shallow. The bylaws define membership requirements, water rights of plot holders and non-plot holders, abuses and the sanctions that apply against abuses, absenteeism on assigned dates for maintenance work and the penalty it entails and the respect to be given to WUA-committee members.

However, none of the rules except the law on absenteeism on maintenance activities have been put into practice in both irrigation systems. The committee usually fined birr 6 per person per day for absenteeism. Offenders who were found guilty of turn abuses, breaching canals, power abuse to use water out of turn and failure to respect decisions of the WUA-committee members have not been charged. For example, in accordance with the by-laws of the Gibe Lemu WUA, a water user who is found guilty of diverting water where there are no turnouts will be fined birr 300. However, none of them were charged although there were many offenders of this kind. Water theft has been one the most (as ranked by 80% of respondents in Gibe Lemu) serious problem that limitted farmers from access to adequate irrigation water than scarcity (Table3.12). Water theft and/or turn abuse was also a very serious problem in Gambela Terre. Nevertheless, the WUA-committee in both irrigation systems were not able to control these abuses through imposing the sanctions stipulated in the bylaws.

Furthermore, informants stated the following as manifestations of lack of enforcement of the rules for water distribution.

- Frequent breakage of canals where there are no turnouts;

- There were many farmers, who used water without involving in or paying for canal maintenance. There were also farmers who did not obtain water though they had regularly involved or paid for canal maintenance (Gibe Lemu WUA);
- Unequal distribution of water among individual irrigators within TUs, between locations and among socioeconomic groups
- Unreliability and shortage in the supply of irrigation water

The various groups of informants for this study expressed that social relation of power (social inconsistency) among water users was one of the factors responsible for the lack of enforcement of the rules that guide water distribution. Specially, rich and powerful households frequently violated the rule and resisted both the development committees (DCs) in TUs and the executive committees of the WUAs in obtaining irrigation water by illegal means. They do not respect the rules for rotational distribution and do not release water for the less powerful members of the WUT to which they belong and for farmers in the tail end (more serious in Gambela Terre). Nevertheless, they have never been charged through legal process as they resist the committee. This frustrated the water committee members; they become less committed to enforcing rules and to undertake strict control of water distribution. This problem has also been more serious in Gambela Terre.

An informant in Gibe Lemu explained the influence of social relation on `Kore Aba Laga` water control and enforcement of rules as follows:

> "Newariw bemulu Zemed new. Yitewawekal. Yinanakal. Komitewim Yehibiretesebu akal new. "Awekhush nakhush" new. Wusane Ayikeberim. Hig ayikeberim. Geleltegna wegen bimeta ena biwesin teseminet yinorewal. Yihe gin altederegem"

Meaning:

> "All of the residents in the WUTs/ irrigation system are relatives. They know each other. They undermine each other. The committee is also from and part of the community. "Awekhush Nakhush new", meaning, water users undermine the committee members, which are from the community

itself. Hence, members do not respect their decisions. There is no respect for the rule of law. If a neutral person would control water distribution and impose sanctions against those who do not abide by our by-laws, his decisions would have been respected and water discipline in our TU would have been ok".

3.3.2. Conflict and Conflict Management

Water dispute is a common phenomenon in both irrigation systems. Conflicts over irrigation water persistently occur between irrigators within the irrigation systems, between WUAs and traditional irrigators and flour mill operators in the upstream areas of the rivers which are sources of water for the irrigation systems.

3.3.2.1. Conflict between Traditional Irrigators and Irrigators in the Projects

Diversion of the Source Rivers by traditional irrigators has brought about water scarcity in the newly constructed irrigation systems. This gave rise to frequent disputes between the two groups. The responsibility for resolving such disputes is mandated to the District Irrigation Desk (DID) in cooperation with concerned stakeholders. However, WUA committee members in both schemes reported that the dispute has not been settled though it needs external intervention to be addressed. On the other hand, the GSWID mentioned lack of clearly defined water rights of the two groups, lack of rules governing construction of new diversion, lack of clear definition of responsibilities for dealing with the problem and lack formal implementing regulations as the main reasons for the existing problems.

3.3.2.2. Conflict among Irrigators within the Irrigation Systems

Water users, WUA committee members and key informants explained that conflicts arising from water allocation and distribution are rampant among irrigators within WUTS and between WUTS. Results of household interview also that the majority of the sample households, 56% in Gibe Lemu and 57.5% in Gambela Terre, have faced conflicts arising from water allocation at least once

(Table3.16). Water users in the tail-end areas of both irrigation systems constituted the lion's share of irrigators who faced disputes over irrigation water (table3.16). They mentioned water scarcity, increasing number of claimants of irrigation water, illegal abstraction of water and lack of strict enforcement of bylaws as the prominent factors for water conflict.

Increasing number of irrigators in the context of declining volume of water conveyed into Gibe Lemu has led to intense competition and conflict over water. Similar findings are demonstrated in studies conducted by Freeman and S.Silim (2002) and Alula (2001). With increasing number of users, conflicts arising from water allocation became more common; water management became more problematic and the interval between watering of plots increased almost to "breaking point" (Alula, 2001). The problem has further been compounded by lack of institutional adaptation and weak conflict management.

Illegal abstraction has also been among the prime factors for water disputes within groups and between groups. Informants also expressed that lack of enforcement of bylaws for water allocation has also been one of the most important constraints (than scarcity) that led to unnecessary competition and water disputes (in Gibe Lemu). Rich farmers who grow coffee, chat, and sugarcane in the middle area of the irrigation systems extract and capture more water by abusing turns means (more serious problem in Gambela Terre). They do not release water for the tail-end farmers as per the established distribution schedule, leading to tough conflict between the two groups. The conflict has been more serious and not resolved yet. The WUA-committee members expressed that it was beyond their capacity to be settled.

Many members of the respective WUAs had cases of conflicts arising from violation of the group-based rules for water distribution to be settled by the "Kore Aba Lagas". However, the sanctions crafted and rarified by the user community have not been imposed against offenders. Even when the committee

imposes the sanctions members do not respect the decisions of the committee.

Table3.16 Irrigators who faced conflict over irrigation water by schemes

Irrigation system	Have you ever faced water conflict? (Yes/No)	Percentage of farmers giving the response				
		All HHs	Head-end	Middle	Tail-end	X^2-statistic
Gibe Lemu (N=25)	Yes	56	8	20	28	4.3NS
	No	44	24	16	4	
Gambela Terre(N=40)	Yes	57.5	7.5	15	35	5.90 **
	No	42.5	12.5	17.5	-	

Source: Field survey, NS=Non-significant, **=Significant at the 5% level

Table3.17 shows farmers' ranking of the major challenges to conflict and water management. One of them is lack of external support. It was the first and second most important constraint that deterred enforcement of rules and conflict management by the WUA-committees in Gibe Lemu and Gambela Terre respectively (table3.17). The committees transfer cases of irrigators who were found guilty of illegal water abstraction to the PA administrations and the local social court. But these entities do not make timely decisions, suspend the cases even for year or more and/or did not charge them at all. This has further intensified illegal practices to obtain water. In addition, GSDID and DAs do not provide any meaningful and consistent support to WUAs committees in conflict management though the task of water and conflict management systems has become more complex that it cannot be by contained by the WUA committee alone.

Farmers` ranking of reasons also showed that resistance by water users was the second (in Gibe Lemu) and the first (in Gambela Terre) most important impediment to enforcing rules and conflict management by WUA-committees

Key informants and participants of group discussion and household interview

mentioned lack of incentive for committee members, resistance by some water users and lack of external support as the prime reasons for reluctance, and lack of commitment of 'Kore Aba Legas' in water and conflict management. Irrigation management is not their permanent work. Nevertheless, they have not been paid and compensated for the time they spent in irrigation management activities.

Table3.17 Farmers' ranking of causes of weak enforcement of rules and poor conflict management

Reasons	% of farmers and rank					
	Gibe Lemu			Gambela Terre		
	N	%	Rank	N	%	Rank
WUA-committee members are reluctant	7	28	3rd	12	30	3rd
Water users resist the WUA committee	8	32	2nd	15	37.5	1st
Social court & PA administration are not responsive	10	40	1st	13	32.5	2nd

Source: Field survey

In summary, lack of support from the local stakeholders and inefficiency of the WUA committee in enforcing rules and in resolving conflicts created frustration among irrigators. Hence, in recent years, many of them do not appeal cases of abusers either to WUA-committee or to PA and social courts. They have started to exercise their own power as their last option to secure water due to lack of trust on their own organizations and the operation of the legal system. Farmers who used to respect the set of rules for water allocation and distribution and conflict management started to resist the committee members. This is because water users who violet the rule obtained more water or benefited more by illegal means.

One irrigator in the tail-end area of Gambela Terre SSIS explained his deep

resentment as follows:

> *"No one goes to the local legal and administrative units. Why we go? For what? No! No! We tolerate each other; no one goes to the PA or WUA-committee. Just we ignored the case and started using the quantity of water that reaches to us whether adequate or not"*

3.3.3. Maintenance of the Irrigation Systems

Farmers undertake canal cleaning and system maintenance activities twice a year under the leadership and coordination of the water committee formed at the different levels with the assistance of multipurpose village level extension workers. Most of the time members contribute labor for maintenance. In accordance with the bylaws, the first round is under taken in *kuagme* every year. But most of the time they conduct canal-cleaning activities in September, when the rainfall is low. The second round is undertaken between February - March.

The O and M manual prepared for the schemes (by the then OIDA) recommends that canal cleaning and maintenance activities should be undertaken thrice a year. But irrigators did not observe this. Maintenance has been very irregular. Further, the WUAs committee members in both irrigation systems have not been provided with these manuals being interpreted into the local language. The DAs give them only oral advice on maintenance activities.

In Gibe Lemu the majority (56%) of the interviewees stated that maintenance of the structures was very good; 36 percent said it was good and only 4 percent said very poor (table3.14). key informants and participants of group discussion also expressed that canal cleaning and maintenance is not a major problem. It is far better compared to Gambela Terre as maintenance has been carried out more regularly.

The different groups of informants for this study reported that irrigators in Gibe Lemu are more committed, compared with Gambela Terre, to maintain and sustain the water distribution canal networks in spite of the severe coordination problem. Evidences obtained from the DA office and the GSDID showed that more than 75 percent of the water distribution canals were functional by the survey date although there was no clear evidence whether it had been functioning fully or partially. The most important reason they suggested for the relatively better maintenance and farmer commitment was the role of irrigation in the life of farmers in the area, accessibility (location) of the scheme to the good commercial opportunity in Bako Town and the high market prices and value of horticultural crops produced using irrigation. A review of impacts of irrigation management transfer by Vermillion (1997:19) came up with similar results.

Table3.18 Users' opinion about maintenance of the schemes

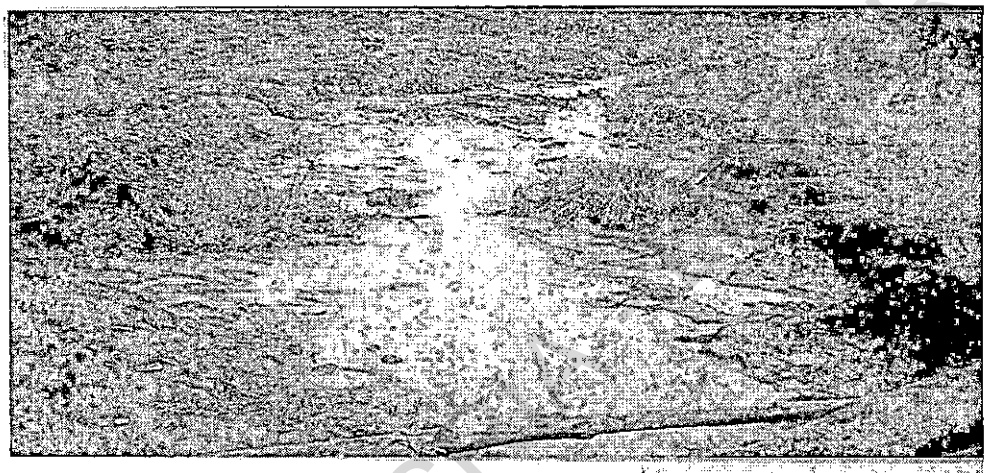
Description	Number and percent of irrigators					
	All HHS		GIBE-LEMU		GAMBELA TERRE	
	Count	%	Count	%	Count	%
Very good	16	24.6	14	56	2	5
Good	22	33.8	9	36	13	32.5
Acceptable	4	6.2	1	4	3	8
Poor	12	18.5	-	-	12	30
Very poor	11	16.9	1	4	10	25
Total	65	100	25	100	40	100

Source: Field Survey

In both irrigation systems, turnouts are far apart and not evenly distributed in some areas. Hence, irrigators break canals and extract water where there is no turnout. These illegal users cause a huge damage on canals and threatened safety and sustainability of distribution and conveyance canals. These offenders have not been held accountable through legal means. These problems remained

unresolved since it has been beyond the capacity of the water committee. The water committee was able to enforce only on those who do not participate in maintenance; fined 6 Birr per person and used it for buying cement for maintenance and minor construction such as construction of bridges where cattle cross canals and fencing of canals and ditches to protect it from damage by livestock.

Photo3.1 Water pond created on the main water conveyance canal due to damage by livestock and lack of maintenance, Gambela Terre SSIS



In Gambela Terre, the scheme structures (conveyance and distribution canal networks) have deteriorated due to a number of reasons. The first reason is poor coordination of by the irrigators' organization of maintenance activities. Canals are not protected against livestock and are frequently damaged; culturally, livestock freely graze over the command area of the scheme for not all farmers cultivate their irrigable plots uniformly. The distribution and conveyance canals became flat in many areas and pockets of water ponds were created at many points along the conveyance and distribution canals hindering water flow to downstream areas. Results of survey on farmers opinions indicated that poor coordination of maintenance (92%), weak enforcement of group-based rules for system maintenance (87.6%), breaching of canals (87.2%) to extract water by illegal means and damage from animals (98.5%) were the

major maintenance problems and threats to the safety and sustainability of the Gambela Terre.

3.4. Irrigation Management and Irrigated Agriculture in the Irrigation Systems

3.4.1. Irrigation Management and Utilization of the Developed Land

The farmland in Gibe Lemu and Gambela Terre irrigation systems is broadly categorized into rain-fed and irrigable land. The average total farmland per household was larger (3.16 ha) in Gambela Terre compared to the per capita plot size in Gibe Lemu (Table3.19). The plot size farmers allocated for irrigation occupies only a small portion of the total average farmland owned by irrigators in Gambela Terre; which is (o.72ha). The average farmland allocated for rain-fed agriculture occupies the lion's share of the farmland managed by individual households. The implication is that farmers in Gambela Terre are committed less to irrigated agriculture and more to the practice of rain –fed agriculture. In addition, the actual irrigated area was small compared to the potential (150ha) and findings of time series analysis indicated that it has continuously been declining during 2001-2004/2005 (see figure3.2/table3.20).

Table3.19 Average land holding by type of use

Type of use	Average plot size per household					
	Gibe Lemu			Gambela Terre		
	Mean	N	SD	Mean	N	SD
Total land size (ha)	2.54	25	3.05	3.16	40	1.77
Irrigable area	1.08	20**	0.72	0.72	39**	0.99
Area under rain-fed	1.57	25	1.73	2.5	40	1.27

Source: Field survey, the sign `**` implies the rest sample irrigators (five in Gibe Lemu and one in Gambela Terre) do not have own irrigable land

As regards Gibe Lemu, the total average farmland was smaller (2.54ha) as compared to Gambela Terre. Farmers assigned a large part of their farmland for

irrigation (1.08ha) (Table3.19). Estimates of the actual irrigated area (in ha) during 2001- 2004 /05 also revealed that the average irrigated land in Gibe Lemu had slightly been increasing during 2001/02-2002/03 and it was almost constant during 2003-2004/05 (Table3.20 and figure3.1).

Table3.20 Estimates of actual irrigated area (ha) and its trend, 2001-2004/05)

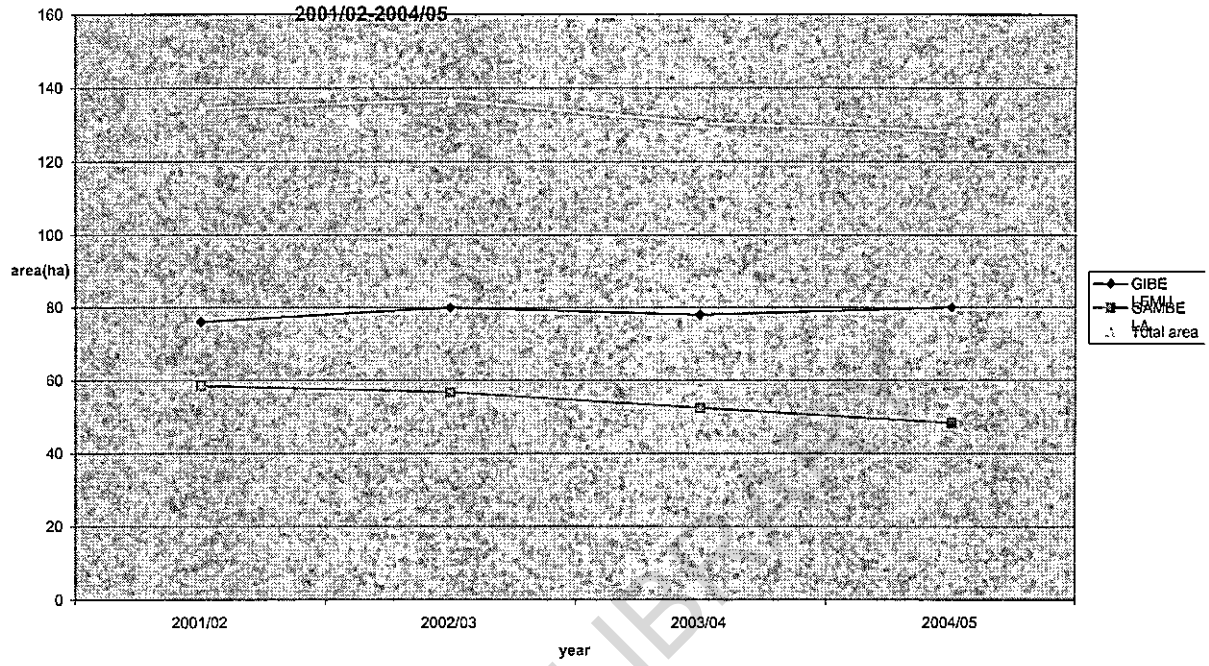
Irrigation system	Irrigable land (ha)	Irrigated area (ha)							
		(1994) 2001/02		(1995) 2002/03		(1996) 2003/04		2004/05	
		Area (ha)	% of total	Irrigated area	% of total	Irrigated area	% of total	Irrigated area	% of total
Gibe Lemu	113	76.05	67.30	80	70.80	78	60.02	80.0	70.80
Gambela Terre	150	58.5	39	56.75	37.83	69.5	52.4	48.27	32.18
Total	263	134.55	51.16	136.75	52	130.4	49.58	1324	48.77

Source: Gobu Seyo District Irrigation Desk (GSDID)

In general, table 3.20 shows that only less than 80% (Gibe Lemu) and 40% (Gambela Terre) of the developed land was irrigated during 2001-2004/005. A substantially large portion of the sample households, 33.5% in Gibe Lemu and 43.6% in Gambela Terre, irrigated only a portion of their irrigable plots in 2004/05. The sample households in Gambela Terre irrigated only an average area of 0.19ha in 2004/05 and this constituted 26.38% of the land allocated for irrigation (0.72ha).

Table3.21 shows farmers ranking of the constraints that discouraged them from participation in irrigated farming and led to underutilization of the developed infrastructures. The surveyed households in Gibe Lemu mentioned unreliability of water due to poor water management, water scarcity and possession of large plot size as the 1st, 2nd and 3rd most important factors responsible for under use of the potential irrigable land respectively. In the case of Gambela Terre, water scarcity, unpredictability of water and shortage of labor were, as ranked by water users, the 1st, 2nd and 3rd most important reasons for not irrigating the entire irrigable plot owned by irrigators (table3.21). Especially, irrigation in the

Figure3.2 Estimates of trends in irrigated area in Gibe Lemu and Gambela Terre, 2001/02-2004/05



tail-end area of Gambela Terre that constitutes the majority of the command area of the scheme (53.33%), has almost collapsed. This was due mainly to scarcity and unreliability of water and poor water management in the irrigation system.

Table3.21 Farmers' ranking of the reasons for under use of their irrigable land

Statistics		Water scarcity	Shortage of oxen	Unreliable access to water	Shortage of labor	Possess large plot
GLSSIS	N	7	2	9	3	4
	% of farmers	28	8	36	12	16
	Rank	2nd	5th	1st	4th	3rd
GTSSIS	N	18	2	12	5	3
	% of farmers	45	5	30	12.5	7.5
	Rank	1st	5th	2nd	3rd	3rd

Source: Field survey

In addition to the institutional and management problems discussed in the different sections of chapter three and four, the various groups of informants (water users, irrigation experts and key informants) expressed that double

cropping has become less feasible and the developed land in Gambela Terre left unused because of a number of socio-cultural impediments in the irrigation system. Firstly, farmers have limited or no experience in irrigation before arrival of the new project. In the second place, there is problem of incompatibility between the project cropping pattern and the indigenous cropping pattern despite the fact that compatibility is one of the social requirements for successful irrigation. Maize planted shortly after harvesting vegetable crops is affected by disease. This is due to the short time frame between harvesting of vegetable crops and planting maize, and lack of cropping sequence studied and specifically recommended for the irrigation system. Horst (1998: Woldeab, 2003) and FAO (1986) also write, 'incompatibility between the project cropping pattern and farmers' cropping pattern could lead to underutilization of irrigation water'. Thirdly, culturally, livestock freely graze in the command area of the scheme during the dry season, leading to crop and canal damage and discouraged farmers participation in irrigated agriculture.

3.4.2. Irrigation Management and Crop Production

Irrigation had contributed towards improvement of irrigators' livelihoods through its effect on crop production. Irrigation brought about change in cropping pattern and increased production and farm income during the initial years of project implementation. Irrigation increased crop diversification and intensification of land use practices such as double cropping (table3.22).

Findings also indicated that the impact of irrigation on diversification, production, income and livestock ownership has association with the location of irrigable plots in the layout of the schemes. In Gibe Lemu, the chi-square analysis indicated that there was no significant difference between locations except the impact on increased livestock ownership; which is significant at $P<0.05$ (table3.22). And of course, the percentage of farmers who could diversify their production and who could increase production, income and livestock

ownership was smaller in the head-end area of Gibe Lemu as compared to the middle and tail-end areas (see table3.22). This is attributed mainly to the

Table3.22 Farmers' opinion about the contribution of SSI by irrigation system and location

Opinion	% of farmers giving the opinion									
	Gibe Lemu					Gambella Terre				
	Total	Head	Middle	Tail	X^2-Statistic	Total	H	M	Tail	X2-stati.
Diversification of crops	96	24	36	36	1.563NS	8o	30.6	33.3	2.5	5.02*
Increased production	88	16	40	32	3.956 NS	80	39	30.6	19	5.45*
Increased income	96	20	40	36	3.299NS	77.5	36	33.3	18	8.2 ***
Ownership of livestock	64	8	36	20	5.662**	32.3	13.9	16.7	5.6	2.13NS

Source: Field Survey, NS=none significant, *= Significant at P<0.1, **= Significant at P<0.05, ***= Significant at 0.01

dominance of rain-fed agriculture in the head-end area. These groups of farmers possess a large area of land (3-12ha) in the command of the scheme (Gibe Lemu_II) and they used it mainly for rain-fed agriculture. On the other hand, water users in the middle and tail-end areas are settlers/migrants from Wollo and ex-soldiers who have no other options such as rain-fed land except irrigation. Hence, they have been more committed and used the land they own fully for irrigated agriculture. Regarding Gambela Terre, there was a significant difference between locations in terms of impacts of the implemented irrigation on diversification of crops (P<0.1), increased crop production (P<0.1) and increased income (P<0.01) and tail-enders were benefited least (see table3.22).

One of the most important social effects of the implemented irrigation projects was increased diversification of production. One method to show the impact of the intervention on diversification is through comparison of types of crops cultivated by farmers before and after irrigation. Findings (table3.23) indicated that the types of crops and the number of farmers who grew a wide range of horticultural crops, including potato, tomato, sugarcane, Chile, avocado, carrot, banana and beetroot has substantially increased after irrigation (see table3.23) The chi-square analysis also revealed that the production of potato (P<0.05),

onion (P<0.05) and tomato (P<0.05) was significantly different before and after the introduction of irrigation in Gambela Terre area (table3.23).

Table3.23 Comparison of agricultural diversification before and after

Crops grown	Gibe Lemu (N=25)				Gambela Terre (N=40)				
	HHs growing the crop				HHs growing the crop				
	Before		After		Before		After		X^2-tatist.
	N	%	N	%	N	%	N	%	
Maize	22	88	23	92%	15	50	23	23.59	0.835NS
Potato	6	12.5	22	875	9	29.0	29	93.5	5.226**
Onion	12	36	16	64	6	19.4	25	80.6	4.476**
Cabbage	1	-	9	37.5	7	23.3	17	56.7	0.709 NS
Pepper	14	58.3	13	54.2	11	36.7	19	63.3	0.660 NS
Carrot	1	4.3	7	30.4	2	6.9	14	48.3	2.005 NS
Chat	6	26.1	7	30.4	1	3.4	14	48.3	.967 NS
Coffee	7	28.0	18	72	5	17.2	23	79.3	1.616 NS
Sugarcane	5	20	20	80	1	3.4	10	34.5	.545 NS
Mango	6	24	17	68	8	26.7	24	80	.384NS
Tomato	3	12	21	84	6	20	21	70	4.802 *

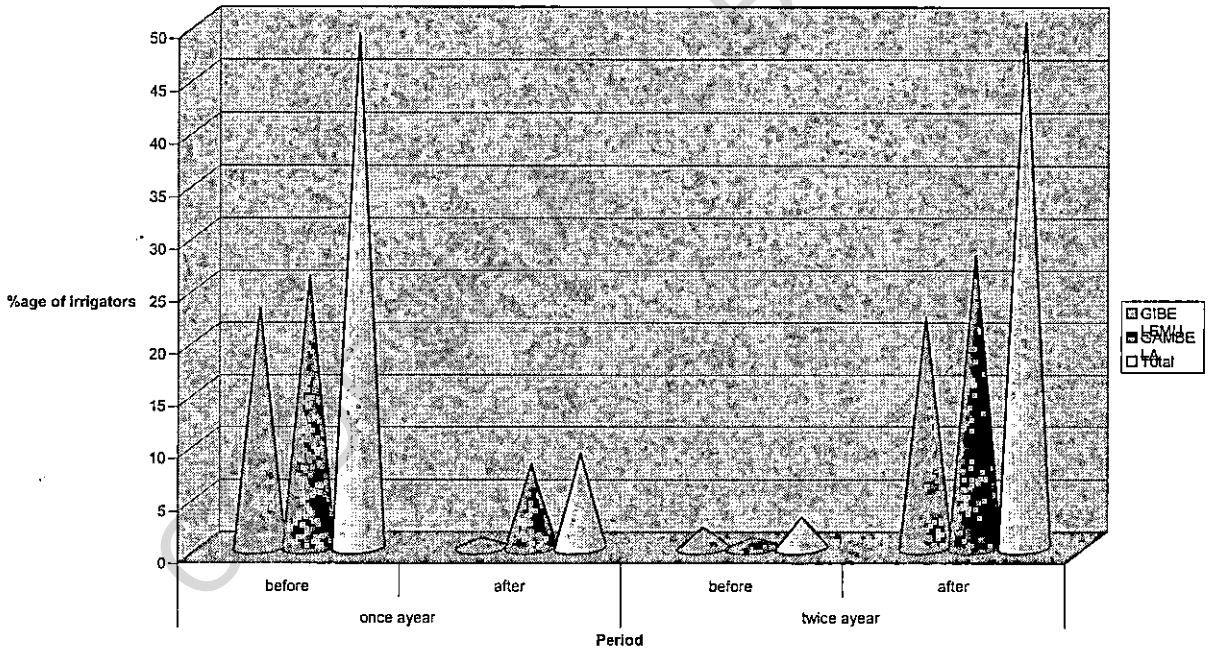
Source: Field survey, NS=Non-significant, **=Significant at P<0.05

The second most visible impact (social effect) of the implemented SSI projects was increased intensification of land use practices (temporal diversification of production) in both irrigation systems. In Gibe Lemu, the number of households who used to grow twice increased from 8% before irrigation to 88% after irrigation. In Gambela Terre, the percentage of farmers increased from 2.5% before to 70% after irrigation (figure3.3).

Results also revealed that the implemented schemes had differential impact on intensification of production between locations plots in Gambela Terre and it is highly significant (X2-Prob. = 0.000) (see appendix table 2). This indicates that the possibility for intensification has link with the location of the farmers'

irrigable plots in the layout of the schemes and farmers in the tail-end area of Gambela Terre were benefited least (see also table3.24). This could be due to poor water management (inequity in the spatial and temporal distribution of irrigation water) and water shortage in the tail-end area. Furthermore, the proportion of irrigators who grow twice a year was higher in Gibe Lemu (88%) compared to Gambela Terre (70%) (table3.22). The difference could possibly be attributed to the more severe problem of water scarcity, lack of proper control of water distribution and farmers biased ness towards rain-fed agriculture in Gambela Terre. This is true because farmers were disappointed by the problems of unreliability and scarcity of irrigation water.

Figure3.3 **Comparison of cropping intensity before and after irrigation**



Alongside diversification and intensification of crop production, SSI had a positive impact on the income of farm households in both irrigation systems in 2004/05. However, ANOVA showed that there was a significant difference ($F=13.47$, $P<0.0001$) in the net income of households between irrigation system, between location of household's irrigation plots and between MHHHs and FHHHs (see appendix table3). The average household net income from all

sources in 2004/05 was relatively higher in Gibe Lemu (see Table3.24). This could possibly be due to the relatively better supply of water, better water management and more commitment of farmers to irrigated agriculture in Gibe Lemu. Within Gibe Lemu, tail-enders obtained the highest income from irrigation in 2004/05(see table3.24). This was mainly because water users in this area planted the whole area of their irrigable plots to perennial tree crops (sugarcane) as an adaptation to the problems of unreliability and scarcity of water in the tail-end and obtained an attractive income from the sale of sugarcane. Farmers in the middle obtained lower income because they planted some part of their irrigable plots to vegetables but faced crop failure due to disease.

Table3.24 Household net income (Birr) from irrigated agriculture in 2004/05 by irrigation system, location and sex

Name of the irrigation system	Statistic	Location of farm plots				Sex of HHH	
		Head-end	Middle	Tail	Total	Male	Female
Gibe Lemu	Mean	946.23	797	1180	949.1	1011	534
	N	8	9	8	25	22	3
	St. Dev.	1145.9	1141	1727	1327	1396	586.02
Gambela Terre	Mean	394.61	624	276	351	372.16	177.5
	N	13	13	14	40	33	6
	St. Dev.	579.3	509.6	370	484.3	504.62	199.2

Source: Field Survey, Gibe Lemu and Gambela Terre, March-April, 2005

The average household net income from irrigation was also different between head-end, middle and tail- end areas of both irrigation systems and it is highly significant ($F= 13.47$, $P<0.0001$) (appendix table3). Farmers in the tail-end area of Gambela Terre obtained the smallest income. The difference in the mean net income of households between locations is attributed mainly to scarcity and unreliability of water (more serious problem in tail-end areas) and poor water management.

3.4.3. Sustainability of the Changes in cropping Pattern and Risks to Feasibility and Sustainability of Irrigated Agricuture

The impact of irrigation projects on diversified and intensive irrigated horticulture and the income from irrigation could not be sustained. Investment in the water intensive horticultural crops has become a risky business in both schemes because of frequent crop failure arising from water shortage and unreliability of water supply. In Gibe Lemu and Gambela Terre, 92% and 84% of the sample households have faced crop failure at least once respectively. Specially, irrigators in the fail- end areas of both irrigation systems constituted the lion's share of these percentages (Table3.25). Hence, the majority of irrigators do not plant their irrigable plots to vegetable crops regularly (table3.25).

Table3.25 Vegetable growers who faced crop failure, by irrigation system and location of plots

Irrigation system	Do you grow vegetables every year using irrigation? (%)	Ever faced problem of crop failure (Yes/No)			
			By location of farm plots (%)		
		All HHs	Head-end	Middle	Tail-end
Gibe Lemu (N=25)	Yes	8	92	24	36	32
	No	92	8	-	4	4
Gambela Terre(N=40)	Yes	77.5	84.2	26.3	26.3	31.6
	No	20	15.6	10.5	5.3	-

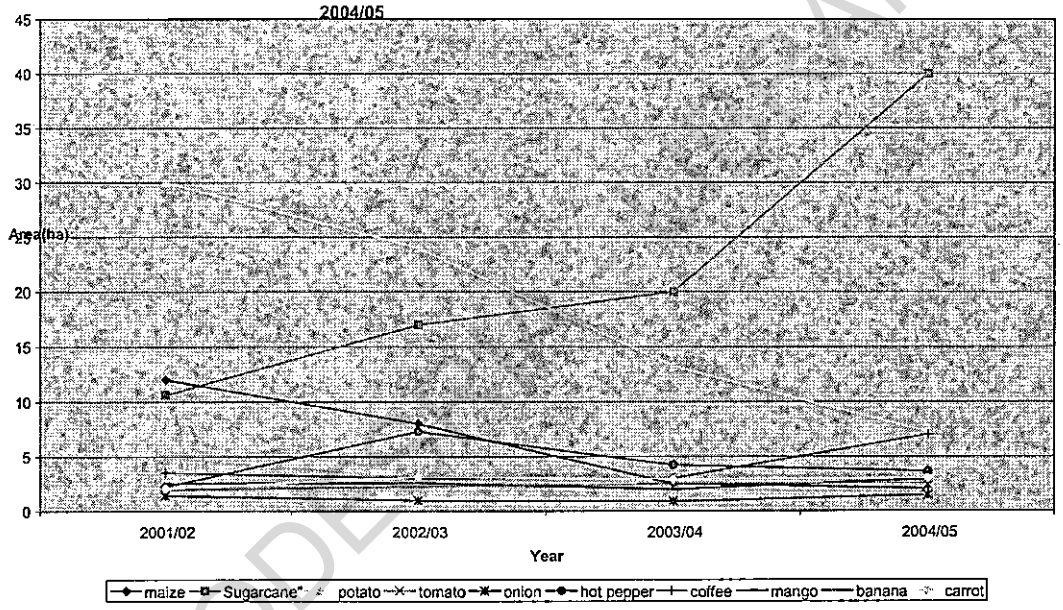
Source: Field survey

Hence, farmers become less interested in and/or shifted from the fast growing vegetable crops to perennial tree crops such as:

- Sugarcane, chat, coffee and banana, in Gibe Lemu
- Coffee, chat, 'Gesho', mango in Gambela Terre

and to cereal production (mono-cropping) under rain-fed. As estimates of trends and areas of major crops cultivated in the irrigation systems shows, the actual irrigated area of vegetable crops (potato, tomato and chile) and maize under irrigation have increasingly become shrunk during 2001/02-2004/05, while the area planted to perennial crops such as sugarcane and coffee had been increasing in Gibe Lemu (Figure3.3). In Gambela Terre, irrigated area of maize and chile had been declining; while irrigated area of sugarcane and coffee was increasing during 2001/02-2004/05 (figure3.4).

Figure3.4 **Estimates of the trend in irrigated area of major crops in GIBE LEMU, 2001/02-2004/05**



The various groups of informants unanimously expressed that water shortage, prevalence of vegetable diseases and unreliable access to water were the most important constraints that dictated and brought about a change in cropping pattern in both irrigation systems (Table3.26). Shortage and unreliability of irrigation water were the major causes of crop failure in the tail-end areas of both irrigation systems, while vegetable disease was the major risk and cause of crop failure in the head and middle areas (see table3.26). Results of similar work by Alula (2001) also showed that unreliability of water supply and increased interval between watering of plots due to scarcity and poor ware

management, affected the type of crop that could be grown, even apparently limiting the practice of vegetable production. An account of the following case from Gibe Lemu illustrates this fact.

Ato Mussa Ayano, 49, illiterate and with 9 family members, explained the benefit he obtained from irrigation and the sustainability problem as follows:

> "Irrigation highly supports our main season (rain-fed) production, both as a supply of food as well as cash. During the initial years of project implementation I successfully irrigated vegetables and obtained 6000-7000Birr from 0.5ha.It assisted us in diversifying our meals. We purchase and consume such food items as sugar, macaroni, pasta ---etc using the income obtained from irrigation. My family has also better access to medication. I could send my children to school. However, the impact has been declining because of vegetable diseases and scarcity and unreliability of water due to increased competition and uncontrolled distribution"

Figure3.5 **Estimates the trend in irrigated area of major crops in GAMBELA TERRE**

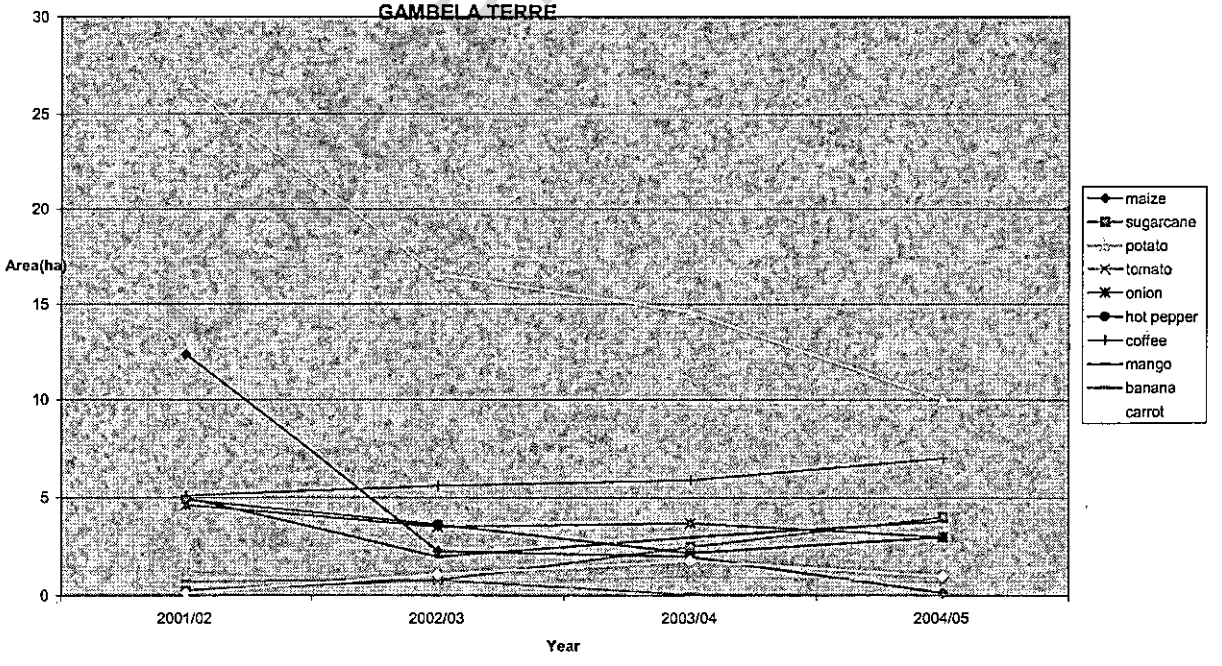


Table 3.26 Farmers' perceptions about major causes of crop failure

Irrigation system	Reasons	All HHs (%)	%age of irrigators mentioning the reason by location			X^2-stati.
			Head	Middle	Tail	
Gibe Lemu (N=25)	Unreliability of water	76	16	28	32	4.46NS
	Water shortage	36	4	12	20	3.65NS
	Diseases	84	32	36	16	1.00NS
Gambela Terre (N=40)	Unreliability of water	80	12.5	32.5	35	7.60*
	Water shortage	55	5	15	35	17.29**
	Disease	70	32.5	32.5	5	21.5 **

Source: Field Survey, NS=Non-significant, *= Significant at the 1% level, **=Highly significant (X2-Prob. =0.000)

CHAPTER FOUR: LOCAL LEVEL INSTITUTONAL ARRANGEMENTS

4.1. Introduction

This chapter deals with the local level organizational and institutional conditions of irrigation management. The first section examines capacity of the District Irrigation Desk to support WUA-committee management of irrigation. The second section focuses on stakeholders and their participation in the administration of the irrigation systems. The last section focuses on land tenure. The section examines the nature of land tenure in the irrigation systems and its influence on irrigation management.

4.2. Institutional Capacity of the Gobu Seyo District Irrigation Desk

The governance structure of the then OIDA, which was restructured under the ORLUANRA in 2003/4, is divided into four levels of accountability; Regional Bureau, four Branch Offices, District Extension Offices and Development Centers with full time extension workers. District Irrigation Extension Offices were created, including GSDID, under the 4branch offices in 2000. Furthermore, there was one full-time extension worker assigned in each irrigation system.

However, the Irrigation Offices both at district and grassroots levels did not continue as independent units of the then OIDA. The district extension offices and development centers were merged with the Agriculture and Rural Development Department following the re-organization of OIDA in Nov.2004. The GSDID has been created as a team in the GSDARDD.

The GSDID and the extension centers are accountable for providing technical assistance to irrigators, supporting the O and M activities of WUA and supervision and coordination of irrigation management activities at district level and with in the irrigation systems. However, it has inadequate capacity to shoulder these responsibilities; manpower, technical units, structure and

logistics. The GSDID has been consisted of only one team leader who is in charge of the Desk. It operates only with 20% of the required technical staff (table4.1). Regarding transportation means, the Desk is equipped with only one motor bicycle, one room (office), one table and one chair which are exclusively used by the Team Leader. In terms of structure, the GSDID lacks organizational unit (development centers and DAs) fully responsible for irrigation at the scheme levels.

Table4.1 Manpower status of GSDID; as of March 2005

Discipline (positions)	Required and Approved	Available	Gap
Team leader	1	1	-
Irrigation Engineer	1	-	1
Irrigation Agronomist	1	-	1
Community participation Expert	1	-	1
Water Harvesting Expert	1	-	1
Total	5	1 (20%)	4 (80%)

The responsible irrigation institution has seen frequent changes in its governance structure. Frequent restructuring and/or institutional instability has adversely affected its existing human resource capacity at both District and scheme levels and the supports to be provided to user-communities. It could not maintain its trained manpower at both levels. The number of trained professionals who were working on irrigation at the District Irrigation Office were reduced following the restructuring of OIDA in 2004. This has weakened irrigation expertise at the District level.

Until the 2004 reorganization, there had been one trained Development Agent (DA) (Diploma graduates, who received in-service training in irrigation) in each irrigation system. These trained DAs were taken to wereda to work in other

offices. However, no full-time and trained DAs have been assigned at both irrigation systems after the restructuring. The newly assigned DAs did not receive any specialized training in irrigation. In addition, they have multiple mandates and are over stretched with many activities. Therefore, they are unable to undertake strict follow up of O and M, conflict management and couldn't deliver adequate extension services to farmers.

In summary, there has been inadequate capacity building and organizational development (at the local level; District and irrigation system) to support WUA-management of irrigation; which has partly been outcome of institutional instability, logistic and financial problems. The GSDID prepares plan for irrigation extension activities every year but none of them have been executed as expected due to capacity problem. However, CTA (1999: 91-92) argue that a necessary condition for more efficient and lasting management of smallholders' irrigation is existence of management capabilities, which are built through organizational and institutional development at various levels; from the apex through the middle level to the grassroots levels.

4.3. Stakeholders and Linkage in Irrigation Management

More efficient and lasting management of smallholders' irrigation involves and calls for the participation of many key players (CTA, 1999; FAO, 1986). In recognition of this, the then OIDA, OIDA/WBO and GSDID identify the following as main stakeholders concerned with the administration of SSI systems in the study area.

- At Wereeda level (Gobu Seyo Wereda): DID, GSDARDD, CPD, RLUA, ISD, Administration, GSWOC
- At scheme level: DAs, WUAs committee, Users, PA administration; Social court, Cooperatives and council of elders.

In addition, in 2004, the regional government merged the DID, CPD, ISD, MOA

and RLUANRA in one institution; ARDD, with the assumption that organizational proximity can provide a fertile ground for linkage, promote a shared goal and facilitate collaboration between the five groups. However, in spite of listing the names of the actors and merging in one organization, there has been no strong involvement and influence of these actors in managing the irrigation systems targeted by this study. Merging has not guaranteed that the five institutions work together in irrigation management; it has required good strong leadership and linkage management. This responsibility fell on GSDID However, the DID did not manage their linkage and promote partnership among them due among others to capacity problem. It has very informal or no linkage with these entities though there has been good opportunity.

The negative impact of lack of participation of the above-mentioned players include:

- Credit, improved seed and extension services could not be availed to farmers regularly;
- Irrigation has no research input; adaptive crop varieties and watering frequency recommended for irrigation are non-existent;
- The district and village level administrative and legal entities do not play any meaningful role in conflict management although conflict resolution has become more complex that it cannot be addressed by WUA committee and the simple informal rules (bylaws); and
- The WUA committees were also found to be weak because of lack of adequate and consistent external support.

4.4. Support Services

Change to sustainable diversified irrigated agriculture and to year –round vegetable production could not be met in the irrigation systems. One of the major challenges has been lack of adequate support system that supplies farmers with the material conditions that enable successful irrigation. These

include, among others, credit, improved seeds that work under irrigation and knowledge of irrigated agriculture (irrigation agronomy) as well as lack of strong extension services (Engel 1997:147, Mollinga 2003: 24 and Dillon, 1992: FAO 2003).

4.4.1. Improved Seed

Only 48% and 35% of the sample households ever used seeds of improved vegetable and cereal crop varieties in Gibe Lemu and Gambela Terre respectively. Out of the sample households, 36% in Gibe Lemu and 27.5% in GTSSIS procured improved seeds of maiże and potato from the extension service. Nonetheless, the maize and potato seeds they obtained from the extension service are not recommended specifically for irrigation (but for rain-fed agriculture). In addition, seeds of carrot, onion, tomato, chile and other vegetable crops that irrigators regarded as *'improved'* seeds have mostly been procured from the market or shops; they are not specifically recommended for production under irrigation. Therefore, they did not suit the irrigation systems, for they are affected by disease (potato, tomato, onion, pepper, cabbage)

4.4.2. Credit

Only 52% and 32.5% of the respondents in GLSSSIS and GAMBELA TERRE respectively used credit for irrigation. Among the farmers, 36% in GIBE LEMU and 37.5% in Gammbela Terre did not use credit because they were not interested respectively; 20.5% of households in GAMBELA TERRE did not use credit because of lack of adequate credit service. The sources for credit were cooperative, microfinance institute and extension program.

Credit was availed through the local government and the Gobu Seyo District Women's Affairs Office (for women irrigators) for the purchase of seeds of vegetable crops (potato, cabbage and onion), fertilizer, and even oxen in 1991/92 and 1992/93 cropping season. But the credit service could not be continued. It was interrupted soon because of repayment failure and failure to

repay on time by some farmers. Hence, there has been no credit service since 1993.

Informants expressed that irrigators have not consistently been supplied with these services mainly because the government policy on agricultural input supply, agricultural research and rural extension services, gives more priority to those farmers registered in package program for rain fed agriculture. It is biased in terms of both supply and timing of supply; it is prepared and supplied for rain fed agriculture during the main rainy season (Irrigators, WBO of the then OIDA and GSDID).

CHAPTER FIVE: SUMMARY, CONCLUSION AND SUGGESTED POLICY OPTIONS

5.1. Summary of Main Findings

Gibe Lemu and Gambela Terre SSIS were constructed to promote household food security through effective and equitable use of the available land and water resources. However, these projects were poorly performing and the area under irrigation is below expectation. The reasons for underutilization of the developed resources have not been studied and not known so far. The purpose of the study is to clarify the present state of irrigation management in the two SSIS with a focus on institutions, management practices and challenges and establish where problems have occurred and suggest possible policy options. The social survey design was used to tackle the research. The major findings of the study are summarized hereafter using the objectives and/or the research questions as guides.

5.1.1. On Current Irrigation Management Practices in the Irrigation Systems

WUA committees are responsible for water allocation and distribution, coordinating maintenance activities and conflict management in both irrigation systems with little support from extension workers. Nonetheless, the WUAs in both irrigation systems were found to be inefficient in managing water distribution in terms of adequacy, timeliness and equity in the supply of water. In Gibe Lemu and Gambela Terre, 80% and 90% of the sample households did not obtain the amount of water they needed respectively. Water users, 70.8% in Gibe-Lemu and 80% inGambela Terre SSIS, witnessed that water supply is unreliable. There is also inequity in water distribution between locations, between socioeconomic groups and between farmers within "Goxi". Survey results indicated that access to adequate irrigation water is more unlikely if the farmer's irrigable plot is in the tail-end area of Gambela Terre because of poor

water management and scarcity.

In Gibe Lemu, institutional and management problems are more relevant than the technical problems and water scarcity for not meeting water requirements of irrigators. In Gambela Terre, water scarcity followed by turn abuses and poor water management was the most important reason for not obtaining the required quantity of water for irrigation over the command area of the project.

There were also technical problems that negatively affected water distribution in both irrigation systems. There are pocket areas in the command area of the schemes that are not reached with water because of slope and uneven distribution of turnouts.

Conflicts over irrigation water persistently occur among irrigators within the irrigation systems and between WUAs and practitioners of traditional irrigation in upstream areas of the source rivers. The interviewed households reported water scarcity due to declining quantity of water from the source and lack of strict water control and enforcement of the bylaws for water distribution as the responsible factors. The problem is found to be very complex and beyond the capacity of WUA committee running management of the irrigation systems.

There has been serious water dispute between upstream traditional irrigators and water users in the two irrigation systems (downstream consumers). Nevertheless, it has not been settled yet. The constraints are 1) there is no enabling legal system (operational regulations) both at District and PA levels which clearly define the water rights of the two groups; and 2) lack of clear definition of responsibilities for dealing with the problem.

Better system maintenance was observed in Gibe Lemu SSIS compared to Gambela Terre. The irrigation infrastructure in Gambela Terre was poorly maintained and it is found to be a major threat to sustainability of the irrigation

system.

5.1.2. On Organizational Setup and Viability of the *'Kore Aba Lagas'* for Self-management of Irrigation

Currently, a Water committee consisting of seven members is responsible for overall coordination of O and M in the respective irrigation systems. A sub-committee consisting of three members is responsible for controlling water distribution and coordinating maintenance at TU level. However, it has been found that the WUAs in both irrigation systems have inadequate institutional, organizational and technical capacity and less viable to run O and M of the irrigation systems in an effective way.

They (WUA-committees) have a number of organizational and institutional deficiencies. The roles, responsibilities, authorities and accountability of the different positions along the management structure of the committee were not defined; and even the committee in Gambela has no well defined by laws. The committee in the respective irrigation system has no legal personality. The committee lacks transparent accountability to users and do not observe the bylaws. There is lack of clearly defined water rights. The WUA committee allocates water by guess because of lack of technical capacity and support from the Irrigation Desk. These resulted in a major problem in the implementation of rotational distribution of water by the committee.

The WUA committees are weak, reluctant and less committed because of lack of incentive structure for committee members, problematic social relation among water users (resistance by some powerful groups), lack of technical capacity and adequate external support in water and conflict management.

5.1.3. On Local Institutional Arrangements and Relationships

Results revealed that GSDID is responsible for the overall coordination of SSI development in the Wereda. The Desk also identifies a number of government agencies at wereda level and 'Kore Aba Laga', the PA administration and social courts at village level as main stakeholders of irrigation management.

It was also found that the Irrigation Desk has inadequate institutional capacity to coordinate the efforts of stakeholders and to provide the needed support to water users in irrigation management. It is inadequately structured and lack of qualified personnel and logistic is a major challenge. It lacks organizational unit and DAs fully responsible for irrigation at scheme level. Therefore, it is unable to undertake strict follow up of O and M of the irrigation systems and couldn't deliver adequate extension services to farmers. In addition, inadequate coordination of efforts and lack of strong involvement and influence of the district and village level stakeholders have been seen in the administration of the irrigation systems. Lack of participation of the players resulted in weak WUA-committee, ineffective use of the developed resources, poor and unsustainable water, and conflict management.

5.1.4. On Land Tenure and Water Rights and their Implications for Irrigation Management

Fair distribution of irrigable land has not been achieved despite the ORLUA Proclamation No.56/22 states that each irrigator shall be equally allocated 0.25ha of irrigable land. The whole command area of the schemes has been owned and managed only by 22.4% and 57% of the intended beneficiary households in Gibe Lemu and Gambela Terre respectively. Landless farmers, farmers with small irrigable plots and young farmers who are going to establish new households access irrigation land and obtain water rights mainly through sharecropping system and gift from relatives. Equal distribution of the

developed prime irrigation land has not been instrumental mainly because of the lack of policy and enabling legal system for a long period and due to a time lag between the issuing of the Oromia RLUA Proclamation NO.56/202 and the operational regulation.

Lack of clearly defined land right within the irrigation systems has drastically affected irrigation management. The local managing entities could not adjust water allocation and resource mobilization to the size of irrigable area controlled by individual households and amount of water used. Informants expressed that over supply and undersupply of water has often led to ineffective and misuse of water because of the guess work in water allocation.

In spite of the general constitutional law, which stipulates that all water resources of Ethiopia are the common property of all Ethiopians, there are no clearly defined and well-enforced formal and informal rules that accord clear and sustainable water right to users at the Wereda and scheme levels. Users have crafted their own bylaws (informal) that define water rights of members. But they lack clarity and poorly enforced. Hence, there is serious problem in controlling water distribution and conflict management because of lack of these legal arrangements.

5.1.5. On the Challenges for Management and Sustainability of Irrigated Agriculture and the Irrigation Systems

Irrigation has been a success in the first few years of the project implementation operational. Irrigation has positively affected farmers' livelihoods through its effect on increased diversification and intensification of production and increased household income. Survey results also revealed that irrigation had differential impact (in terms of the above indicators) between irrigation systems and between locations of irrigation fields within irrigation system. The social effects (impact) of the implemented SSI were higher in Gibe Lemu compared to

Gambela Terre and in head-end and middle areas of Gambela Terre. The difference between irrigation systems is attributed mainly due to the relatively better supply of water, better water management and commitment of farmers to irrigated agriculture in Gibe Lemu because many of them are migrants from Welo and displaced ex-soldiers; they do not have adequate rain-fed land as an option and therefore, they should derive their livelihoods from irrigation. The difference between the tail, middle and head-end areas was attributed to water scarcity and poor water control; the inequity in the spatial and temporal distribution of irrigation water.

However, change to sustainable diversified irrigated agriculture and to double cropping could not be met in Gibe Lemu and Gambela Terre SSIS. Farmers are not able to undertake diversified and intensive agricultural production in a sustainable manner and the income from these high value crops could not be sustained. Many farmers have either suspended (rejected), or do not regularly cultivate vegetable crops and/or shifted their attention to perennial tree crops. A substantially large area of land left unused, the area planted to some perennials has increased, and irrigated area of some vegetable crops has declined.

The challenges and sustainability constraints include:

- Weakness in water management and institutional development (lack of well defined and sustainable water rights and weakness in enforcing rules);
- Prevalence of vegetable diseases because farmers have not regularly been supplied with improved and adaptive seeds of vegetable crops that work under irrigation;
- Lack of regular supply of agricultural inputs, extension services and credit. Extension service and in put supply policy is biased both in terms of supply and timing of supply to rain-fed agriculture. It is not adjusted to

meet the requirements of SSI at the grassroots level

- Expansion of traditional irrigation in the upstream areas of the rivers that are water sources for the schemes. There has been continuous decline in the amount of water conveyed into the schemes. Nevertheless, there has been no organizational and institutional (legal framework) arrangements that facilitate the shared use of water by the two groups (upstream traditional irrigators and irrigators in the new projects/downstream users)
- Lack of clearly defined and sustainable water rights both at District and scheme levels
- Weak institutional capacity of the local state irrigation agency to support decentralized management of SSI
- Weak linkage among stakeholders of SSI management both at the District and scheme levels and lack of organizational and institutional means to coordinate the efforts of stakeholders
- Lack of enforcement of the policies for decentralized management of smallholders irrigation at the grassroots level

Double cropping has become less feasible and unsustainable more in Gambela Terre. Farmers in Gambela Terre are committed less to irrigated agriculture and more to the practice of rain –fed agriculture compared to GIBE LEMU. The major impediments are:

- Farmers' interest and experience in irrigation. Especially in Gambela Terre, irrigation is not a long-standing tradition and farmers were found to be less interested in irrigation compared to Gibe Lemu. Almost all (97.5%) of them own large area of rain-fed land as an option.
- Incompatibility between the new cropping pattern and the indigenous cropping pattern and between the projects growing season and the indigenous growing season for agricultural production under rain-fed has also imputed farmer participation. Cropping pattern and cropping

sequence has not been specifically studied and recommended for the irrigation systems

- A culture of open grazing during the dry season in Gambela Terre. Crop damage from livestock discouraged interested farmers to engage them selves in irrigated farming.
- Poor maintenance of the physical infrastructure is also found to be a major threat to sustainability of the scheme. The conveyance and distribution canal networks have been deteriorated because of poor and irregular system maintenance.

5.2. Conclusion and Suggested Policy Options

The study used the socio-technical approach to irrigation technologies as conceptual frame in examining institutions, management practices and challenges of the irrigation systems. A number of conclusions are drown from findings of the study using the theoretical notions like context, social requirement for use and social effects.

5.2.1. The irrigation systems were poorly managed in terms of water allocation and distribution, conflict management and system maintenance (Gambela Terre). It was mainly because of the lack of the social conditions (well-established organizational, social and institutional conditions) that allow the conduct of successful irrigation. The main irrigation agency has weak capacity to support WUA management of irrigation. The WUA are not well organized and found to be weak to run O and M of the irrigation systems. Users have problematic social relation. Clearly defined and well-enforced land and water rights are non-existent at the operational level. Uneven distribution of irrigable land is a major problem. Therefore, policies for future investment in smallholder irrigation development and for improving management, performance and sustainability of the irrigation systems considered by this study should give due consideration to averting these problems.

5.2.2. Regarding the material context, such technical resources as improved seed (technology) that is adaptive to the situation of irrigation, labor (some households) and knowledge of irrigated agriculture (extension service and capacity building for irrigators) have not been met in the two irrigation systems. This problem has been a major impediment to farmers ' participation in irrigated farming, utilization of the developed resources and sustainable WUA-management of irrigation. Therefore, policies for input supply, technology development and rural extension have to be adjusted to meet these requirements of irrigated agriculture in the irrigation systems.

5.2.3. In spite of the lack of strong system management, water scarcity and unreliability and organizational and institutional problems, acceptable commitment of farmers was observed and the impact of the implemented SSI on farmers' livelihood was also relatively higher in Gibe Lemu. This could be due to market stimulus (access and the good commercial opportunity at Bako Town), shortage of adequate rain-fed land and the problem of landlessness, experience and interest of farmers in irrigation and the role of irrigation in the life of farmers.

This shows that irrigation should find its appropriate socioeconomic and institutional location to work effectively. The policy implication is that:

- Small-scale irrigation should be promoted where it is most demanded; and
- Farmers' priorities and interest, compatibility of irrigation to the socio-cultural environment and farming system of the area and the opportunities for irrigation should be understood before intervention.

5.2.4. Irrigation has been a success in the first few years of project implementation. It has positively contributed towards increased diversification

and intensification of production and increased farm income. Nonetheless, farmers, what Engel (1997) and Mollinga (2003) call `the human agents` did not maintain these practices for long. They, do not practice irrigated vegetable production regularly, discontinued it, shifted to perennial tree crops or returned to the former cereal/mono-crop production under-rain-fed. The constraints that discouraged farmers participation were unreliability and scarcity of water, socioeconomic problems, lack of regular supply of inputs and extension services, poor water management, institutional and organizational weaknesses that led to poor water and conflict management or the lack of what Engel calls `the social organization` to coordinate and manage the irrigation systems. Therefore, adequate institutional and organizational development is crucial to enhance effectiveness, water management and sustainability of the benefits of irrigation and the irrigation systems.

5.2.5. Expansion of traditional irrigation in the upstream areas of the rivers that are water sources for the schemes is a major threat to sustainability of the irrigation systems. There has been continuous decline in the quantity of water conveyed into the schemes. This led to progressive degeneration and collapse of irrigation in the tail-end area of Gambela Terre. Therefore, there is an urgent need for addressing this problem through establishing the necessary legal framework.

5.2.6. One of the major factors for underperformance of the Gambela Terre SSIS is water scarcity. Therefore, future fate (sustainability) of the scheme should be determined through detailed hydrological study on the water source before embarking upon any investment aiming at rehabilitation of the irrigation system.

BIBLIOGRAPHY

Alem, Abraha (1999) Food Security in South Wollo. In: Aspen, Harald and Abdulhamid Bedri Kello. 1999.(eds). Poverty and Resources: Ethiopian Rural Realities. Working Papers on Ethiopian Development No. 13: 1999.

AESE (1995) Food Security, Nutrition and Poverty Alleviation in Ethiopia: Problem and Prospects. Proceeding of the Inaugural and First Annual Conference of the Agricultural Economics Society of Ethiopia, 8-10June 1995, Addis Ababa, Ethiopia.

Alula, Pankhurst (2001) Institutionalization of Irrigation in South Wello. In: Alula, Pankhurst (2001) (Ed.). Institutions for Natural Resource Management: Thematic Briefings, FSS (Ethiopia) and University of Sussex (UK).

Bagadion, Benjamin and Frances F. Korten (2004) Developing Irrigators Organizations: Learning Process Approach.In: World Bank (2004). Putting People First: Sociological Variables in Rural Development

Blank, H.G., Clifford M. Mutero and Hammord Murray – Rust (2002) Eds. The Chaning Face of Irrigation in Kenya: Opportunities for Anticipating Change in Eastern and Southern Africa. Colombo, Sri Manka: International Water Management Institute.

Cernea, M. (2004) (Edit). Putting People First: Sociological Variables in Rural Development. Washington, D.C: The World Bank Group.

CTA(2001) Water Management: Proceedings of a CTA Seminar. Cordoba, Spain, 20-25 September 1999. Aniane, France: Louma Productions.

Debebe, Habtewold (1995) Food Security: A Brief Review of Concepts and Indicators. In: AESEC (1995). Food Security, Nutrition and Poverty Alleviation in Ethiopia: Problem and Prospects. Proceeding of the Inaugural and First Annual Conference of the Agricultural Economics Society of Ethiopia, 8-10June 1995, Addis Ababa, Ethiopia.

Dessalegn, Rahmato (1999) Water Resource Development in Ethiopia: Issues of Sustainability and Participation, FSS Discussion Paper, Addis Ababa Ethiopia.

EEA and AAU (2000) Institutions, Resources and Development in Ethiopia: Proceedings of the Ninth Annual Conference on the Ethiopian Economy. Oct.8-9, 1999, Addis Ababa, Ethiopia

EWZFEDD (2004) Socio-Economic Profile of Gobu Seyo District, Nekemte

East Wellega Zone Water, Mineral and Energy Resources Development Department (1998) Design Report of Gibe Lemu Irrigation Project.

Engel, P.G.H (1997) The Social Organization of Innovation: A focus on Stakeholder Interaction. Amsterdam: Royal Tropical Institute (KIT).

Engel, P.G.H and Monique L. Salomon (1997) Facilitating Innovation for Development: ARAAKS Resource Box. Amsterdam: Royal Tropical Institute(KIT).

Ethiopia, Interim Poverty Reduction Strategy Paper 2000/01 - 2002/03(2000) Addis Ababa, Ethiopia (Reprinted from World Bank Document Report No 21469- ET, January, 30, 2001).

FAO (1995) Irrigation in Africa in Figures. FAO: Rome.

FAO (1986) Irrigation in Africa South of the Sahara. FAO Investment Center Technical Paper No.5, FAO : Rome.

FAO (1997) Farm Management for Asia: A Systems Approach, Department of Agricultural and Resource Economics, University of New England, Australia.

FAO(2000) Socioeconomic Impacts of Smallholders Irrigation Development in Zimbabwe. SAFR, Harare.

FDRE, (1996) Ethiopian Food Security Strategy, Addis Ababa.

FDRE (2002) Food Security Strategy (FSS). Addis Ababa, Ethiopia

Fiona, H., John Thompson and Jules N. Prety (1996) Sustainable Agriculture and Food Security in East and Southern Africa: An Empirical Analysis of Current Initiatives and Review of the Literature. Stockholm: Sweedesh International Development Cooperation Agency (SIDA).

Freeman, D. and M. Lowdermilk. (1991) Middle Level Farmer Organizations as Links between Farms and Central Irrigation Systems. In: Cernea, M. (ed). Putting People First: Sociological Variables in Rural Development, The World Bank.

Freeman, H. and Said S. Silim (2002) Commercialization of Smallholder Irrigation: Economic and Social Implications in Semiarid Areas of Eastern Kenya. In: Blank, H., Clifford M. Mutero, and Hammond Murray Rust, .eds. 2002. The Changing Face of Irrigation in Kenya: Opportunities for Anticipating Change in Eastern and Southern Africa. Colombo, Sri Lanka: International Water Management Institute.

Gibe Irrigation Project Design Note by Korean Design Team (1990)

JICA and OIDA (2003) Study on Capacity Building Programs for Community Based Irrigation Development in Central Oromia Region of Ethiopia. Progress Repot (1), Nippon Koei Co., Ltd.

Katerere, Y. (1999) Watering the Land: Water Availability, Environment and Social Issues. In: CTA (1999). Water Management. Proceedings of a CTA Seminar, Cordoba, Spain, 20025 September 1999 PP 117-137.

Lemma, Dinku (2004) Smallholders Irrigation Practices and Issues of Community Management: The Case of Two Irrigation Systems in Eastern Oromia, Addis Ababa, Ethiopia (MA Thesis)

Mark, W. Rosegrant, Ximing Cai and Sarah A. Cline (2002) World Water and Food to 2025: Dealing With Scarcity, International Food Policy Research Institute, Washington DC.

MoWR (2000) Ethiopian Water Resources Management Policy Document.

MoWR (2002). Ethiopian Water Sector Development Program 2002-2016. Main Report

Ngigi, S. (2002) Review of Irrigation Development in Kenya. In: Blank, H., Clifford M. Mutero, and Hammond Murray Rust, eds. 2002. The Changing Face of Irrigation in Kenya: Opportunities for Anticipating Change in Eastern and Southern Africa. Colombo, Sri Lanka: International Water Management Institute.

Nigussie, Taffesse (2002) The Role of Irrigation Development in Enhancing Household Food Security: A Case Study of Three Small-Scale Irrigation Schemes in Southern Nations, Nationalities and Peoples' Region. MA Thesis, Addis Ababa University.

North, C.D. (1990) Institutions, Institutional Change and Economic Performance. New York

North, C. Duglous (2000) The New Institutional Economies and Third World Development. In Harris, J., Janet Hunter and Coline Lewis (Eds). 2000. The New Institutional Economics. New York : Roteledge.

Oromia Bureau of Planning and Economic Development (2000) Physical and Socio-economic Profiles of 180 Districts of Oromiya Region. Physical Planning Department; Finefinne.

Odi (1995) Recent Trends in Irrigation Management: Changing Directions for the Public Sector, Natural Resource Perspectives; Numbers, London: UK.

Oromia Economic Study Project Office (1999) Agricultural Sector Study, Credit and Fertilizer, Vol. I, Finfinne.

Oromia Economic Study Project Office (1999) Research and Study Report, Vol, II, Finifinne.

OIDA(2000) Smallholders Modern Irrigation Schemes Evaluation Report. Finfinne.

OIDA (2003) Strategic Planning and Management Document (1996-1988) E.C.

OIDA/WBO (2003) Strategic Planning and Management Document (1996-1988 E.c). Nekemte, Oromia Region, Ethiopia

Oromia Rural Land Use and Administration Proclamation Number 56/2002. Finfinne, August 16, 2002.

Pavlov, S. (2004) Institutional Analysis of Irrigation Management in North Crima Canal Irrigation System, Ukraine. MSC Thesis Report, Wageningen University.

Peter, H. Stern (1998) Operations and Maintenance of Small-Scale Irrigation Schemes. UK: International Technology Publications Ltd.

Peter, P. Mollinga (2003) On the Water Front: Water Distribution, Technology and Agriculture Change in a South Indian Canal Irrigation System. Orient Longman Private Limited: New Delhhi.

Seid, Yasin Ali (2002) Small-Scale Irrigation and Husehold Food Security: A Case Study of Three Irrigation Schemes in Gubalafto Woreda of North Wollo Zone, Amhara Region (MA Thesis, Addis Ababa University).

Shawki, B. and Guy Le Moigne (1990) Irrigation in Sub-Saharan Africa: The Development of Public and Private Systems, W.B Technical Paper No. 123, Washington D.C.

Scheltema, W. (2002) Smallholder Management of Irrigation in Kenya. In: Blank, Herbert G., Clifford M. Mutero, and Hammond Murray Rust, eds. 2002. The Changing Face of Irrigation in Kenya: Opportunities for Anticipating Change in Eastern and Southern Africa. Colombo, Sri Lanka: International Water Management Institute.

Sisay, Asefa (1995) Perspectives on Agricultural policy, Rural Poverty, and Food Insecurity in Ethiopian. In: AESEC (1995). Food Security, Nutrition and

Poverty Alleviation in Ethiopia: Problem and Prospects. Proceeding of the Inaugural and First Annual Conference of the Agricultural Economics Society of Ethiopia, 8-10June 1995, Addis Ababa, Ethiopia.

Tassew, Woldehana and Walter Eberlei (2004) (eds). Pro-poor Budgeting and the Role of parliament in the Implementation of PRSP in Ethiopia: GTZ and AAU: Addis Ababa.

Tegene, Gebre Egziabher (2000) Institutions and Local Development in Ethiopia: The Case of East Shoa. In: EEA and AAU (2000). Institutions, Resources and Development in Ethiopia. Proceedings of the Ninth Annual Conference on the Ethiopian Economy. Oct.8-9, 1999, Addis Ababa, Ethiopia

Vermillion, D.L. (1997) Impacts of Irrigation Management Transfer: A Review of the Evidence. Research Report 11. Colombo, Sri Lanka: International Irrigation Management Institute (IIMI).

Walter C., Jr. (2004) Planning Technical and Social Change in Irrigated Areas. In: World Bank Documents and Reports-(2004). Putting People First: Sociological Variables in Rural Development. Washington, D.C.:The World Bank Group, PP.46.

Webb, P. (1991) When Projects Collapse: Irrigation Failure in the Gambia from a Household Perspective in: Journal of International Development Vol.3 No. 4, July 1991.

Webb, P. and Joachim Von-Braun. (1994) Famine and Food Security in Ethiopia: Lessons for Africa. John Wiley and Sons Ltd: England. The International Food Policy Research Institute (IFPRI).

Woldeab, Teshome (2003) Irrigation Practices, State Intervention and Farmers Life-worlds in Drought Prone Tigray, Ethiopia (PhD Dissertation)

World Bank (2000) Case Studies in Participatory Irrigation Management. WBI Learning Resources Series. Washington, D.C: The World Bank.

APPENDIX

Tables

Appendix table1 Major crops cultivated, estimates of irrigated area and trends (2001/02-2004/05), Gibe Lemu and Gambela Terre SSIS

Description of crops grown	Irrigated area in ha (2001/02-2004/05)							
	GLSSIS				GTSSIS			
	2001.02 (1994)	2002/03 (1995)	2003/04 (1990)	2004/05 (1997)	2001/02 (1994)	2002/03 (1995)	2003/04 (1996)	2004/05 (1997)
Maize	12	8	2.5	2.06	12.38	2.28	2	0.125
Sugarc	10.60	17	20	40	0.27	0.8	2.25	4
Potato	30.00	24	13.25	7.24	26.58	16.55	14.60	10
Tomato	4.85	3.5	2	1.76	1.25	0.61	1.00	0.7
Onion	1.44	1	0.90	1.50	4.64	3.51	2.00	3.00
Pepper	2.22	7.3	4.21	2.05	7.33	3.63	4.21	1
Coffee	3.50	3.00	3	7.01	5.11	5.60	5.92	7.00
Pawpa	4.00	-	0.5	0.12	0.08	0.05	0.03	-
Mango	2.52	2.6	2.92	2.92	5.00	2.00	3.3	6.50
Banana	4.00	3.12	2.93	3	0.74	1.8	1.20	1

Source: Gobu Seyo Wereda Irrigation Desk

Appendix table 2 Comparison of cropping intensity before and after irrigation, by irrigation systems and location of irrigation plots

Cropping intensity	Before/after	Gibela Lemu (%)					Gambela Terre (%)				
		All HHs	Head	Middle	Tail	x^2-Statistic	All HHs	Head	Middle	Tail	x^2-Statistic
Once	Before	92	20	36	36	1.45NS	97.5	37	37	22.2	2.96NS
	After	4	4	-	-	-	27.5	5.4	-	16.2	-
Twice	Before	8	4	-	-	-	2.5	2.5	-	-	-
	After	88	20	32	36	6.40NS	70	27.5	30	12.5	16.105**

Source: Field survey, **= Significant at P<0.0001, **NS**= Non-signifcant

Appendix Table3 ANOVA of household net income from irrigation in 204/05

		Sum of squares	df	Mean square	F	Sig.
Amount (Br.)*irrigation sys*location	Between groups (combined)	13570199	1	13570198.64	13.47	0.000
	Within groups	1.51E+08	150	1007749.71		
	Total	1.65E+08	151			
Amount (Br.)*irrigation sys*Sex	Between groups (combined)	13570199	1	13570198.64	13.47	0.000
	Within groups	1.51E+08	150	1007749.71		
	Total	1.65E+08	151			

ANNEX

Annex-I Checklist used for Interview and Group Discussion

ADDIS ABABA UNIVERSITY
RESEARCH AND GRADUATE PROGRAM

DEPARTMENT OF REGIONAL AND LOCAL DEVELOPMENT STUDIES

Institutions, Management Practices and Challenges: The Case of GIBE LEMU and Gambela Terre Small-Scale Irrigation Systems, Western Oromia, Ethiopia

1. Checklist for key Informant Interview

- Major crops grown before and after intervention and using traditional irrigation water before the recent intervention?
- What are indicators for wealth ranking according to the local standards?
- Working days/ calendar of farmers i.e. what they do during different months, during wet and dry seasons
- Compatibility of irrigation with the farming system and socio-economic and socio-cultural environment
- Major institutional and management problems in the irrigation systems
- Formal and informal institutions of land tenure and water rights in the irrigation systems and their problems

2. Checklist for Group Discussion (with irrigators)

- Organization, management performance and weaknesses of WUAs-committee
- Water management in the irrigation systems: Water allocation and distribution
- Major problems in water management or principal areas of users' complaints.
- Bylaws and enforcement characteristics
- Supports given from the local Irrigation Office and local governance
- Conflict and conflict management in the irrigation systems
- Land tenure and water rights in the irrigation systems
- Support services; Credit, input(seed) and extension
- Technical problems of the irrigation schemes
- Socioeconomic viability of the irrigation intervention: Compatibility of irrigation with the farming system/socioeconomic environment (market, family labor allocation and choice of crops, etc.
- Farmers' perception about benefits of irrigation and its sustainability
- The major constraints of irrigation farming the irrigation systems

3. Checklist for Interview to Institutions

- *Physical setting of the Irrigation system.*
- *Socio-economic profile of the area (BOFED)*
- *Irrigation Development and its institutional in the area*
- Background of irrigation development in the area
- *Historical development/ background of Gibe-Lemu and Gambella Terre SSIS*
- *Organization of users for self management: organization, performance and constrains*
- *Land tenure and water rights and their implication on management and utilization of the schemes*
- *Stakeholders, their expected roles, linkage, performance and constraints*
- *Water management in the irrigation systems*
- *Major management and sustainability constraints*
- Institutional capacity the irrigation agency: organization, capacity and effects of institutional instability
- Policies and strategies for SSI development
- Service provision for irrigation: credit, input and extension
- Performance of WUAs in managing conflict
- Supporting activities of the irrigation desk to WUAs in irrigation management
- Major problems in the irrigation systems as they see them
- Available technologies that work under irrigation and On-going research on irrigation?

4. Checklist for Interview to WUA Committee

- Profile, structure/organization, constraints, bylaws and their enforcement

5. Checklist for Group Discussion with Women Farmers

- Participation/membership to WUA, access to irrigation land, water and services

Annex-II Sample Questionnaire Used for Household Interview

Institutions, Management Practices and Challenges: The Case of Gibe–Lemu and Gambela–Terre Small–Scale Irrigation Systems, Western Oromia, Ethiopia
March 2005

Instruction to the Enumerator

Good morning/afternoon/evening. I am.....from Addis Ababa University.

We are conducting a survey to find out what irrigators and other stakeholders think about the institutional setting, management and challenges of Gibe-Lemu and Gambela Terre Small-Scale Irrigation Systems. A representative sample of beneficiary households in the irrigation schemes has been selected for interview in this study. This will give you the opportunity to 'have a say' and your taking part will make a great contribution to the study.

Tell him/her that the interview will take about **an hour and half.** Then ask for and/or weight until agreement is shown from the respondent. This would create friendly environment and makes it more convenient to carryout the interview and fill the questionnaire out smoothly.

Specifically, Dear Enumerator:

1) Make a brief introduction to each farmer before starting any question;
2) Introduce yourself by greeting a farmer in the local way, tell him your name, and make clear the purpose of the questionnaires;
3) Weight until agreement is shown
4) Ask each question clearly and patiently until the farmer understands your point; and
5) Please fill out the questionnnire according to the farmer's reply; don't put your opinion

Thank You! Shimelis Dejene

Institutions, Management Practices and Challenges: The Case of Gibe–Lemu and Gambela–Terre Small–Scale Irrigation Systems, Western Oromia, Ethiopia
March 2005

1. Identification Information

1. Case number.....
2. Name of the irrigation System? 1= Gibe-Lemu 2= Gambela-Terre
3. Peasant Association_____
4. Location of the respondent's irrigation plot? 1=Head-end 2=Middle 3=Tail-end
5. Name of the household head_____
6. Circle respondent's sex: 1= Male 2= Female
7. Wealth status of the respondent: 1=poor 2=medium 3=rich

2. Socio-economic Characteristics of Households

2. a. Socio-Demographic Factors

2.1. Age of the respondent in years: _____
2.2. The household size _____
2.3. Sex composition of the household: 1. Male(s) ____ 2. Female(s)____
2.4. Age composition in the household:
Below 15 years..... 15-20 years.....
21 –65 years..... Above 65 years.....
2.5. Level of education of the household head:
1. Illiterate
2. Read and write
3. Elementary
4. Junior secondary school
5. High school complete

2.6. Are you currently...married, widowed, divorced, separated, or have you ever been married?
Married.....1 Separated.....4
Widowed.....2 Never married.....5
Divorced.....3

2. b. Resource Endowment of the Household (land, labor, livestock, access to market)

2.7. Do you possess your own land?
1. Yes 2. No
IY YES TO THE PREVIOUS QUESTION:
2.8. Its total area in hectare or local unit: _____
IY YES TO QUESTION 2.9:
2.9. The land use pattern:
2.9.1. Area of grazing land _____ (in hectare /local units/
2.9.2. Area of pasture land _____
2.9.3. Area of fallow land _____
2.9.4. Area covered by trees _____

2.9.5. Total area of cropland _____

3.9.5.1. Irrigable area _____

3.9.5.2. Area under rain- fed_____

2.10. The total number of active labor force in the household? _____

2.11. Do you have enough labor for your irrigation farm operation?

1. Yes 2. No

2.12. Do you rear livestock? 1. Yes 2. No

2.13. IF yes to the previous question, what domestic animals do you rear?

Type of animal (tick)	Number
Cattle	
Sheep	
Goat	
Donkey	
Chicken	

2.14. Oxen ownership?

1=One ox only..... 2= More than a pair.....

3=A pair of oxen..... 4= Have no ox at all.....

2.15. Round trip distance from the main asphalt road (minute) _____, from the market place _____

2. c. Occupations of the Household

2.16. Main occupation?

Responses: 1= Yes 2= No

	Occupation	Responses
A	Rain-fed crop production	
B	Crop production using irrigation	
C	Livestock rearing	
D	Off farm activities such as wage labor	
E	Others, specify:---------- ----------	

3. Land Tenure in the Selected Irrigation Systems

3.1. Do you possess your own irrigable plot? 1= Yes 2= No

3.2. If yes to question 3.1, its total area in hectare? _____

3.3. How did you get your irrigation land?

1= Inherited from family 4= Purchase

2= Gift from relatives 5= Distribution by the government

3= It is previous holding 6. Others, specify: _____

3.4. Do you lease-out irrigable land (**for sharecropping**)?

1. Yes 2. No

3.5. If yes to 3.4, area leased out _____ (in local unit)

3.6. If yes to 3.4, rank the reasons from1=most important, to 5= least important

A. Shortage of oxen.....
B. Shortage of improved seeds.....
C. Shortage of money to buy input.....
D. Shortage of money to hire labor.....
E. I have plenty of irrigation land.....

3.7. Do you lease-in irrigation land for sharecropping?

1. Yes 2. No

3.8. If yes to 3.7, area leased-in _____ (in local unit)

3.9. If yes to Q.3.7 again, please rank the following in order of importance to you (from1=most important, to 5= least important)

A. No adequate own irrigable land.....
B. I have adequate labor.....
C. Good market opportunity.....
A. Irrigation is more profitable.....
B. No other occupation during the dry season.....

3.10. If no to question 3.1, do you have the right to use irrigation land?

1. Yes 2. No

3.11. If yes to the previous question, how do you get access to irrigation land?

Responses: 1. Yes 2. No

A. Leasing in (contract).....
B. Sharecropping.....
C. Labor exchange.....
D. Purchase.....
E. Gift.....

3.14. Explain the major problems of land tenure in the irrigation system? (If applicable)

1._____
2. _____

4. Irrigation practices

4.1. When did you start irrigation in the newly rehabilitated scheme (in years)? ___

4.2. Crops cultivated:

Response: 1. Yes 2. No

Crops	Before irrigation (yes-1/no-2)	After irrigation (yes-1/no-2)
Maize		
Potato		
Tomato		
Onion		
Cabbage		
Pepper		
Avocado		
Carrot		
Chat		
Coffee		
Forage crops		
Sugarcane		
Mango		
Pawpaw		

4.3. If the crops you were growing under irrigation are selected by the irrigation office (if applicable), are they suitable to you?

1. Yes 2. No

4.4. If your answer to question #4.3 is no, why it is so?

Responses: 1. Yes 2. No

A. Coincide with other farming activities.....
B. Not adaptable.....
C. Water scarcity (require frequent watering).....
D. Seeds not available.....
E. Disease.....
F. Others, specify:_____

4.5. Types of crops grown, irrigated area and yield obtained in 2004

Crop	Irrigated area and yield	
	Irrigated area (ha)	Yield obtained (Qt)
Cereals		
Vegetables		
Fruits		
Sugarcane		
Coffee		
Chat		

4.6. How many times do you produce in a year by applying irrigation 1= Once 2= Twice 3= Thrice

4.7. Have you ever faced a problem of crop failure when you are using irrigation?

1. Yes 2. No

4.8. If yes to 4.7, indicate the crops failed:_____

4.9. If yes to question 4.7 why? (Circle as many as apply)

Responses: 1. Yes 2. No

A. Water shortage.....
B. Damaged by disease.....
C. Poor adaptation of varieties used.....
D. Poor administration of water distribution.....
E. Others, specify_____

4.10. Do you irrigate all of your irritable land?

1. Yes 2. No

4.11. If no to the previous question, area of the potential irrigable land_____, area of uncultivated land (in 2004) out of the potential:_____

4.12. If no to question 4.10, why? Please rank the following in order of importance to you. Number them from1=most important, to 5= least important

A. Water scarcity.....
B. Shortage of oxen.....
C. Unreliable access to water.....
D. Shortage of labor.....
E. The plot I possess is large.....

5. Irrigation management Practices

5. A. Water Management

5.1. Do you get enough water for irrigation?

1. Yes 2. No

5.2. If no to 5.1, what do you think are the reasons? Please rank the following in order of importance to you (from 1=most important, to 5= least important)

A. Water scarcity.....
B. Seepage loss.....
C. Poor coordination of water distribution.....
D. Water theft.....
E. I am tail-end irrigator, water does not reach.....

5.3. We have heard also that water scarcity is a problem. Which of the following are important causes for you?

Responses: 1. Yes 2. No

A. Water is captured by up steam traditional irrigators.....
B. Seepage loss.....
C. Increasing number of users.....
D. Declining level of water from the source.....
E. Poor scheduling of distribution.....
F. Inadequate coordination of water distribution.....
G. Others, specify_____

5.4. Taken altogether, what do you feel about performance of WUA committees in the management of water distribution in the scheme?

Responses: 1. Yes 2. No

A. Enough water is not received (adequacy).....
B. Water is not received when needed (timeliness).....
C. Water distribution is unfair (equity).....

5.5. If no to question 5.4.C, which socio-economic groups consume more water?

Responses: 1. Yes 2. No

A. Farmers with large family size.....
B. Head-end farmers.....
C. Rich farmers who grow perennials.....
D. Others, specify_____

5.6. What are the major management problems related to water distribution in the irrigation system (if applicable)?

Responses: 1. Yes 2. No

A. Sanctions not imposed against illegal water users.....
B. Rotation does not accomplish equality.....
C. Rotations are not strictly implemented.....
D. Poor coordination of water distribution by WUAs committee.....

5. B. Conflict Management

5.7. Have you ever faced any conflict over irrigation water?

1. Yes 2. No

5.8. If your answer to question 5.7 is yes, what are the causes?

Responses: 1. Yes 2. No

A. Water theft.....
B. Water scarcity .....
C. Competition due to increasing number of water users.....
D. Lack of proper control of water distribution.....
E. Others, specify_____

5.9. In your opinion, have your internal by-laws been enforced (in relation to water allocation/distribution/conflict management? 1. Yes 2.No

5.10. If no to the previous question, what are the major reasons? Please rank the following. Number them from1=most important, to 3= least important

A. WUAs committee members are reluctant.....
B. Users do not respect the decisions of the WUAs committee.....
C. Lack of external support in water and conflict management.....

5.11. If WUAs committee members are reluctant (if yes to 5.10 A), why it is so?
Response: 1.Yes 2.No

A. They have no incentive.....
B. Some members do not respect their decisions (resistance).....
C. Lack of adequate support from local governance and the irrigation agency.....
D. Others, specify_____

5.12. What do you feel about the performance of WUAs committees in resolving conflicts in the irrigation system?

Responses: 1. Yes 2. No

A. They take immediate action on cases .....
B. They suspend cases .....
C. WUAs committee members do not enforce internal bylaws.....
D. Conflict management has been improved.....
E. Don't know.....

5.C. System Maintenance

5.13. Overall, what is maintenance of the scheme look like?
1=Very good 2= Good. 3=Acceptable 4= Poor. 5= Very poor. 8= don't know. 9=NA/NR

5.14. If maintenance is poor, what do you think are the causes?

Responses: 1. Yes 2. No

A. Poor coordination of maintenance activities (by WUAs committee).....
B. Poor imposition of sanction on reluctant users.....
C. Absenteeism of some members on maintenance days.....
D. Reluctance of some members to make labor contributions.....
E. Breaching of canals by illegal water users.....
F. Siltation.....
G. Animals damage.....
H. Others, specify_____

5.15. Frequency of maintenance in a year?
Responses: 1. Yes 2. No
A. Once a year..... B. Twice a year..... C. Thrice a year.....

6. Support services and adoption of irrigation technologies

6.1. Have you ever used improved crop varieties for irrigation?
Responses: 1. Yes 2. No

6.2. If yes to the previous question, which crop variety ever used?
Responses: 1. Yes 2. No
A. Maize.....B. Carrot..... C. Cabbage..... D. Potato.....
E. Pepper..... F. Sugarcane..... G. Tomato.....
G. Mango.....H. thers, specify _____

6.3. If yes to 6.1, from where do you get the seed?
Responses: 1. Yes 2. No
A. Market..... B. Extension..... C. Research Center..... D. Office of

Irrigation..... E. Cooperative..... F. Others, specify_____

6.4. Do you plant vegetables every year on your irrigation field? 1. Yes 2. No

6.5. If no to question 6.4, what are the factors that account for rejection/discontinuation?

Reasons: 1. Yes2. No

A. No adaptable varieties.....
B. Unavailability of seed every year.....
C. Water scarcity (reuire frequent watering).....
D. Unreliable access to water.....
E. Disease.....
F. Others, specify_____

6.6. Have you ever used credit for irrigation farming?

1. Yes 2. No

6.7. If yes to the previous question, what are your sources? Response: 1. Yes 2. No

A. Cooperative.....
B. Local Lenders.....
C. The irrigation office.....
D. Others, specify _____

6.8. If no, why? (if no to 6.9)

Responses: 1. Yes 2. No

A. No collateral.....
B. No need.....
C. No credit supply.....
D. High cost of credit.....
E. others, specify ----------

6.9. Have you ever participated on extension program for irrigation?

1. Yes 2. No

IF YES TO THE PREVIOUS QUESTION:

6.10.If yes to 6.9, what are the extension programs you have participated?

Responses: 1. Yes 2. No

A. Training.....
B. Demonstration.....
C. Field day.....
D. Others specify.....

7. Benefits of Irrigation

7.1. The positive impacts of irrigation that you have seen (If applicable)? Responses: 1. Yes 2. No

A. Diversification of crops grown (production).....
B. Increased agricultural production.....
C. Increased household income.....
D. Increased share of hired labor in the household's total labor.....
E. Change in ownership of livestock.....
F. Increased level of input use.....

7.2. What are the contributions of diversification to your livelihoods? (if applicable)

Responses: 1. Yes 2. No

A. Increased income.....
B. Decreased fluctuation in food production.....

DECLARATIONS

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

Name _____ Signature _____ Data _____

Addis Ababa University

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

_____

Date