ADDIS ABABA UNIVERSITY
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LARGE SCALE IRRIGATION MANAGEMENT AND CRTICAL ENVIRONMENT CONCERN: THE CASE OF FENTALE IRRIGATION PROJECT IN CEMTRAL OROMIA

A Thesis Submitted in Partial Fulfillment of the Requirement for Degree of Master of Art in Environment and Development

By

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Abstract

Fentale Irrigation Based Integrated Development (FIBID) project, designed to irrigate 18,000 ha and currently supplying irrigation water for 4000 ha for areas which phiscal structures are constructed. The project has passed from 2-6 irrigation seasons at different irrigation blocks based on the completion of farm irrigation water supplying structures and land distribution. Even if there are high positive impacts at the early stages challenges on the irrigation management and sustainability are sprouting. In this study, the scheme is assessed against Uphoff three dimensional irrigation concept i/ Physical structure ii/ Water use iii/ Organizational management. In addition critical environmental concern of the project area is identified. Primary & secondary data through questioner from sample respondents, FGD, Key informants, water measurement and GPS were collected. These data were analyzed using SPSS, Irrigation performance indicator, GIS & VSTM. As a result, the research identified and witnessed the request for the project and public consultation conducted at the commencement of project contributed much to the relevancy and the need of the project. The project is transforming the life of some beneficiaries. Contrary to this, in this study, water management limitations in terms of efficiency and effectiveness, weak irrigation institutions at all stages Government, public & IWUC which are working against the positive impact were observed. Inconsistent water distribution, challenges on how to manage and operate the field level plots and structures flaws are becoming the characteristics of the scheme. The water loss in the scheme is leading and enhancing critical environmental concern -water, land and salinity- which can exacerbate the early positive impact of the project. Livestock development in the project, cattle trough and modern forage production were not given due emphasis. The parallel approach, Design and construction, is quoted as one of the reason for limitations on the quality and endanger the environment without giving room for environmental impact assessment. The cost recovery concept which started to play great role in the irrigation management lost its rate of collection due to unconvincing reasons.

(Key words: Irrigation physical system, Parallel approach, water use, organizational management)

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LIST OF ABBREVIATIONS

AAU	Addis Ababa University
BDAO	Boset District Development Agriculture Office
CSA	Central Statistics Agency
CWR	Crop Water Requirement
DA	Development Agent
FAO	Food and Agriculture Organization
FDPDO	Fentale District Pastoralist Development Office
FGD	Focus Group Discussion
FIBID	Fentale Irrigation Based Integrated Development
GTP	Growth and Transformation Plan
ID	Irrigation Development
IFAD	International Fund for Agriculture Development
IWUC	Irrigation Water User Cooperatives
LSI	Large Scale Irrigation
MOA	Ministry of Agriculture
MOWR	Ministry of Water Resource
OADB	Oromia Agriculture Development Bureau
OIDA	Oromia Irrigation Development Authority
OPDC	Oromia Pastoralist Development Commission
OWMEB	Oromia Water Mineral and Energy
OWRB	Oromia Water Resource Bureau
OWWCE	Oromia Water Works Construction Enterprise
OWWDSE	Oromia Water Works Design and Supervision Enterprise
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
SSI	Small Scale Irrigation
SPSS	Statistical program for social science
TA	Training
VSTM	Vulnerability, Stress, Treat and Mitigation
WSDP	Water Sector Development Plan
WUA	Water User Association

ACKNOWLEDGMENT

"I know that you [God] can do all things; no plan of yours [God] can be thwarted. Job 42:

Was this possible without the support and assistance of the following people, I don't think so!

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All of you, who were besides me in each and every corner of my life May my Father God, Savior Jesus Christ and comforter Holy Spirit bless you and your family.

Abstract

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1 INTRODUCTION

1.1 Background

Agricultural growth remains central to poverty reduction, particularly in the poorest countries, where a large share of the population relies on agriculture for their livelihood. Irrigated lands now account for about 20 percent of the world's farmed area and 40 percent of global food production. Increases in irrigated area, cropping intensity, and crop yields have helped to stabilize food production per capita, even though population and per capita food intake have grown significantly (World Bank, 2010).

Agriculture accounts for the lion's share of the Ethiopian economy (almost 50 perecent of GDP), and employs the majority of the population (80 perecent). The economy has shown little sign of transformation over the past two decades: the share of agriculture remains high, with only a slight decline, from 52.9 perecent in the 1980s to 48.2 perecent in the 1990s (WorldBank, 2006).

According to the Ethiopian Water policy, irrigated agriculture is important in stimulating sustainable economic growth and rural employment and is the cornerstone for food security and poverty reduction (MOWR, 2002). Especially this is very applicable in the pastoralist area where Human Development Indicators and poverty among this [Pastoralist] group are uniformly worse than elsewhere in the country, and they have proven difficult to reach with traditional services. Understanding this, special developemnt programs to support the pastoral areas in Afar, Somali, Oromia and SNNP begun (PASDEP, 2005).

Plans during the PASDEP period included, construction of 24 identified projects covering an area of 322,630 ha, the feasibility study and design of 19 projects (229,149 ha) and pre-feasibility of seven others (117,116 ha.) (PASDEP, 2005). This developent is planned at exponenatial rate in the GTP. According to MOWR (2002) 471,862 ha of Irrigation which 225,763 ha small scale and 246,099 ha large scale is planned to develop in short, medium, and long term from 2002 – 2016.

WorldBank report shows, Ethiopia has only about 170,000 ha of irrigated land developed, just 5 to 10 percent of its potential. Less than 5 perecent (about 200,000 hectares) of the estimated potential 3.7 million hectares of irrigable land in Ethiopia is under irrigation. Four types of irrigation are practiced: tradtional (38 perecent), modern communal (20 perecent), modern private (4 perecent), and public(38 perecent) (WorldBank, 2006).

The prominent data source, Data of OESB (1999) shows Oromia region, one of the largest region of Ethiopia, has 1.7 million hectares of land suitable for surface irrigation, 58billion cubic meter of mean annual run off generated in the region and 2.1 billion cubic meter of underground water, out of which 212,796 ha 14% have been developed by the community 143,144 ha, state farms 26,506 ha and the rest by Government, NGO's and private holders (OWRB, 2008). The regional government planned to conduct 440 schemes with 116,734ha 402 Small, 30 medium and 8 large scale (OWMEB, 2002).

When one observes the aggressive development of irrigation in the country compared to the status of the developed one in the past, a question of sustainability, management, and efficiency of the schemes ignites in mind.

Deribe quoting from Gebermedhin and Peden (2002) states, Irrigation development in Ethiopia has been focused on the agronomic, engineering and technical aspects of water projects, with little consideration to issues of management, beneficiary participation and availability of institutional support services. Moreover, in many developing countries the success of irrigation systems is highly affected by policy, institutional and social factors much more than technical issues (DERIBE, 2008).

Fentale Irrigation Based Integrated Development (FIBID) project, which is the result of the plan of the countries Water sector policy, is planned to irrigate 18,000 ha and currently supplying irrigation water for 4000 ha. The project has started to irrigate before four years and it has passed from 2-6 irrigation seasons at different irrigation blocks based on the completion of farm irrigation water supplying structures and land distribution.

The project is delivering water in two different systems, gravity and pump. In Boset district due to the elevation difference between the main canal and the command area which the gravity system fell to deliver water, Pumps are installed to irrigate 930 ha with two storage ponds. The beneficiaries of this irrigation technology harvested for more than four irrigation seasons. On the other hand at downstream of the pump irrigation more than 3000 ha of land categorized in different blocks are benefiting from gravity system irrigation.

The regional government, understanding the complexity of the project gave the governance - the management and administration- of the scheme for Oromia Water Works Construction Enterprise, OWWCE (OWWDSE O. W., 2009). The management of the scheme from the head work up to the tertiary canal to operate, manage, rehabilitate and collect water fee to be carried out by OWWCE, whereas the field level management including some small tertiary canals is given to the beneficiaries.

1.2 Statement of the problem

Even though numbers of modern small scale irrigation schemes were developed in moisture stress districts of Ormia region, the irrigation schemes have not achieved their primary objective successfully. Most irrigation schemes are poorly operated and managed. So one of the most important aspects of irrigation schemes development is not only the construction but also to know how irrigation scheme systems operate and how communities mange and participate in irrigation schemes management.

Field observations and discussions on Fentale irrigation project witness an early economic impact in last three years, such as introduction of cash crop irrigation, new house construction, new village and market establishment, and electrification etc. due to an intervention of the irrigation project.

Even if all these impacts are shining at this early stage of the project, the scheme is under performing. In order to understand the cause for underperforming, examining the physical irrigation system, water use, irrigation institutions and critical environmental concern are predestined. Accordingly, this research is conducted to investigate the design, construction, management and critical environmental concern of the scheme and provide evidence based information to maximize the intended benefit to the community to the region and further to the country.

1.3 Objectives of the Study

Having the above mentioned problems in consideration this study was conducted with the following objectives:

1.3.1 General Objective

The general objective of the study is to understand the feasibility, scheme management and critical environmental concern of dual managed large scale irrigation (Government & Direct beneficiaries) in Ethiopia, by investigating the design, construction and water management approach in Fentale Large scale irrigation in East Shoa Zone Fentale and Boset Woredas of Oromia, Ethiopia.

1.3.2 Specific Objectives of the study:

- To examine the social and environmental sustainability of Fentale Large Scale irrigation scheme.
- To examine the Irrigation physical structure in attaining the project objective
- To understand the Irrigation institutional of the Project
- To understand the water use of Fentale Irrigation project
- To assess the critical environmental concern of the project

1.3.3 Research questions

- Does the project meets demonstrated and high priority needs?
- Does the physical system suit the environment and the beneficiaries?
- What is the institutional set up of the project?
- What is the water use efficiency of the project in terms of irrigation performance indicators?
- What is the critical environmental concern of the project?

1.4 Significance of the research

In general, the proposed study will contribute for better irrigation service to the direct beneficiaries in improving the wellbeing of the project when it reaches at full scale. Second, it will contribute to planning, designing, constructing, managing and operating, large scale irrigation projects of the country aimed at growth and transformation program. Third, it chips in to the sustainability of large scale irrigations developed and planned in the country. The other unique character of the project which is having pastoralist beneficiary gives this research immense significance. Understanding the rationales behind community based large scale irrigation planning and implementation then giving recommendation and a way forward is not something to be left for some time in the future as it has potential to increase Critical Environmental Concerns and challenges throughout the country.

1.5 Scope and limitation of the Study

This study didn't address some important areas of the scheme. It didn't encompass the whole scheme because water supplying structures are not completed for the whole 18,000 ha in the scheme.

In this study the comparison of the efficiency of the pump irrigation and gravity are not done due to lack of water measurement data for each.

The available data, only one irrigation season, production and water measurement data compel this paper to be limited only to two irrigation performance indicators exercise.

1.6 Organizations of the Thesis

The thesis has the following layout: in chapter two reviews of literature and conceptual framework associated with irrigation scheme management and management critical environmental concern. Chapter three and four deal with the research methodologies, result and discussion of the research, respectively. Finally, chapter five summarizes the main findings of the study and draws the policy implications.

2 LITERATURE REVIEW

2.1 Defination & Need For Irrigation

Irrigation is the practice of applying water to the soil to supplement the natural rainfall and provide moisture for plant growth (Uphoff, 1986). Irrigation is the process by which water is diverted from a river or pumped from a well and used for the purpose of agricultural production (FAO, 1997).

Irrigation offers a range of benefits, both direct and indirect. Irrigation plays a key role in addressing national food security concerns. In addition, successful ID projects contribute to improvements in (i) agricultural productivity; (ii) employment opportunities, particularly for marginal and landless workers; (iii) transport systems, through better farm and access roads; (iv) women's participation; and (v) institutional capabilities, specifically for projects with accompanying TAs for institutional strengthening. The analysis of beneficiaries is often limited to those who cultivate the earth. Successful ID projects result in the growth of both on-farm and off-farm activities (Mongcopa, 2008).

Agricultural growth remains central to poverty reduction, particularly in the poorest countries, where a large share of the population relies on agriculture for their livelihood (World Bank, 2010). Irrigated lands now account for about 20 percent of the world's farmed area and 40 percent of global food production. Increases in irrigated area, cropping intensity, and crop yields have helped to stabilize food production per capita, even though population and per capita food intake have grown significantly (Irrigation and Draninage, 2010).

About 250 million hectares are irrigated worldwide today, nearly five times more than at the beginning of the 20^{th} century. Irrigation has helped boost agricultural yields and outputs and stabilize food production and prices. But growth in population and income will only increase the demand for irrigation water to meet food production requirements. Although the achivements of irrigation have been impressive, in many regions poor irrigation manangement has markedly lowered groundwater tables damaged soils, and reduced water quality (Rosegrant, 2002).

In the past 40 years, demand for food in the developing countries has gone up shrply. Production and average yields of irrigated crops in these countries have responded to this demand by increasingly constrained; environmental stresses are growing as many river basins approach the limits of water and land resources (World Bank, 2006).

2.2 Classification of Irrigation and its Pricing

Numerous typologies are used to define irrigation entities. Size, nature of the water source, the governing body and levels of organization are the most common. For constructing irrigation systems, irrigation agencies have found it useful to classify systems in ways that facilitate technical and administrative input. Accordingly user managed irrigation, agency managed, private managed or local government (Hofwegen, 1998).

Another classification is based on size, technology or method of water abstraction and application. Small scale, medium and large scale are the detail classification method of irrigation based on size, Pump or Gravity irrigation systems are the classification based on water abstracting system where as furrow, basin, flooding, drip and sprinkler are the part of classification of irrigation based on method of irrigation application.

Ethiopia classified irrigation as traditional small scale up to 100ha, modern communal schemes up to 200 ha built by government agencies; modern private schemes up to 2000ha owned and operated by private and public schemes of over 3000 ha owned and operated by public enterprises as state farm (MOWR, 2002).

The fundamental role of prices is to help allocate scarce resources among competing uses and users. One way to achieve an efficient allocation of water is to price its consumption correctly. Pricing of water affects allocation considerations by various users. Consequently, a variety of methods for pricing water have arisen, depending on natural and economic conditions. In this section the prevailing pricing methods for irrigation water are described. These include volumetric pricing, non-volumetric pricing methods, and market-based methods. Volumetric pricing mechanisms charge for irrigation water based on consumption of actual quantities of water. Non-volumetric methods charge for irrigation water bases on a per output basis, a per input basis, a per area basis, or based on land values (Johansson, 2001).

Other irrigation pricing is on the investment of the infrastructure which is cost recovery. "Cost recovery" can range from simple day-to-day operational costs to the entire cost of operation, maintenance, future replacement and amortization of past investments (G A Cornish, 2004). In this study cost recovery mainly indicate the past investment made for the construction of the project.

2.3 Irrigation Water Management

Irrigation now claims close to 70 percent of all freshwater appropriated for human use (FAO). This 70% of fresh water to be abstracted and efficiently used appropriate technology is required that is what Coward(1980) says, Irrigation development requires the successful joining of irrigation technology and appropriate institutions and organizations to govern that technology .

Regarding in preserving the natural environment the Engineering design of irrigation plays great role however according to Ayalew et al (2004) in their paper, Design challenges in small Scale, discuss about the limitation of the engineering designs stating Irrigation structures differ from place to place for different reasons like topography, geology, availability of water resources etc. Besides this, each structure has create[d] a challenge for the operation and maintenance. Most irrigation schemes, which professional's design approach starting from the site selection are considerably less demand driven. Schemes site selection and designs are based on location of potential sites from maps and geographic information system rather than explicit demand from the communities.

The design of irrigation systems needs to be appropriate and flexible to reflect local needs and conditions. The project design stage provides the opportunity to identify potential problems and appropriate solutions based on a set of alternatives. The consideration of alternatives was important in the eventual success of projects in Bangladesh, Republic of Korea, and Pakistan. An appropriate design needs to be based on local conditions and previous experience. Flexibility in designing projects to reflect local conditions and avoid negative environmental impacts is also good practice. For instance, the Nepal and Philippine experiences of strengthening water user/farmer institutions can be replicated in areas where small irrigation systems are a priority. In Bangladesh and Pakistan, the incorporation of lessons in the design of projects that have a successful precedent are examples of good practice that contributed to eventual project success (Mongcopa, 2008).

Parallel to the engineering Legesse and Bekele(2006) on their paper: Integrating Agro enterprise Approach to Small Scale Irrigation; Experience of CRS/Ethiopia in Water Development and management points water management as one of the bottlenecks for sustainability of small scale irrigations. This is true also for large scale irrigation.

Other authors also clearly show the importance of integrated approach among the physical, water management and social approach for successful irrigation which consumes 70% of fresh water. Accordingly Vermillion quoting different authors (Carruthers, 1983; Bottrall, 1981; Murray-Rust & Vermillion, 1989; and Rangeley, 1985) on his paper: The Turnover and Self Management of Irrigation Institutions in Developing Countries emphasizes, the importance of irrigation for the world's food supply and the vast resources expended on irrigation development, it is tragic that the actual performance of irrigation systems has been so disappointingly low. This is largely due to faulty design and construction, poorly-managed operations and inadequate maintenance. Frequently the actual area irrigated is a fraction of the design area. Water is wasted in the upper parts of systems and rarely available in lower-end sections. Water deliveries are often untimely and unreliable. Canals and gates, whether built properly or not, are allowed to fall into disrepair. In general, only about 25 to 30 percent of water diverted into large canal systems in developing countries reaches the crops needing (Vermillion, 1991).

Facon(2007) on his paper 'Performance of Irrigation and participatory irrigation Management: Lessons from FAO's Irrigation Modernization Program in Asia' shows that focusing only on irrigation institution and infrastructure did not result the intended result. Recent performance assessments and reviews have revealed that past reforms and investments in the irrigation sector, focusing either on institutions or infrastructure, have largely failed to produce desired results of improved water delivery service to the farmers (Facon, 2007). In this paper Facon argues unless significant results are achieved in improvement of service delivery to farmers and water users associations and reduction of chaos, institutional reform will continue to have disappointing outcomes.

Vella on his paper participatory irrigation management: A socio-Anthropological Perspective forwards a tailor mode approach. Participatory Irrigation Management schemes may superficially appear to be simple administrative measures but can in fact prove to be complex operations with far reaching social sequences. They must therefore be tailor-made for each situation and to ensure success, the social and cultural backgrounds of the population involved have to be considered. All these and other considerations show that the setting up of a participatory irrigation Management Scheme that may appear to an engineer or policy-maker to be a simple administrative and logistic measure can actually be a complex operation with far-reaching social consequences. The type of privatization or participation has to be tailor-made for each situation (VELLA, 2004).

Irrigation Management can be defined as the process of implementation of suitable operation and maintenance in order to meet the objectives of the concerned irrigation system and monitoring of the activities to assure that the objectives are met. It also can be defined as a process of making decisions about using an organization's resources in order to achieve the organization's objectives (Hoque).

Tural quoting from Vermillion(1994) summarized five essential elements underwriting effective irrigation management 1) clear and sustainable water rights are accorded to users, at an individual or group level; 2) the irrigation infrastructure should be compatible with the water rights allocate and with local management capacity 3) clear and recognized responsibilities and authority are vested in the managing organizations; 4) adequate financial and human resources exist to operate and maintain the infrastructure and the managing organizations and 5) there is transparent accountability of, and supporting incentives for, the managing entities (Turral, 1995).

Due consideration is not always given to how an irrigation and drainage (I&D) scheme will be managed. Often significant resources are put in to the technical work required to identify the soils, map the topography, assess the rainfall and water resources, design and build the system, but little thought and few resources are put into how the system will be managed, operated and maintained (IFAD, 2011).

On the other hand there is no agreed consensus on efficient Irrigation management concept and approach due to numerous actors and sectors on irrigation- organizations, groups, individuals and planning, agriculture, irrigation, environment, legal and others sectors. Starting from early days concept of focusing on technology and improving management then to user participation approach, then to irrigation management transfer and currently to service delivery concept when each is not helping in attaining the intended result (Huppert, 2000). We can see from this that irrigation management is not a simple click and get approach.

Villa quotiing from Vermilion and Brewer, 1996, Most of the benefits that come from the involvement of farmers in the planning and running of irrigation schemes depend on whether there exist solid organizations that will represent farmers and coordinate the work needing to be done. Participatory Irrigation management implies the establishment of an organization of water users. There is also the implication that farmers possess sufficient technical knowledge to play a part in such projects. This is not always the case and the first step to obtain farmer participation is to devise institutional means – for example setting up committees – to bring the all stakeholders together to plan jointly (VELLA, 2005)

Irrigation development in Ethiopia has been focused on the agronomic, engineering and technical aspects of water projects, with little consideration to issues of management, beneficiary participation and availability of institutional support services. Moreover, in many developing countries the success of irrigation systems is highly affected by policy, institutional and social factors much more than technical issues (DERIBE, 2008).
Water management is highly related with water delivery for the farmers. For a farmer there are three essential criteria for water delivery: adequecy, reliability and equity (Hofwegen, 1998).

Regrading the service quality of the irrigation organiztions or institution World Bank report states: Performance of irrigated agriculture in publicly managed schemes (which cover about half the irrigated areas in the developing countries) generally falls well below technical and economic potential. The performance of the large-scale irrigation (LSI) schemes has been particularly disappointing. In most of these schemes, farmers often receive poor water service, and reliable and timely irrigation service delivery is the exception rather than the rule (World Bank, Reengaining in Agricultural Water Managemnt Challenges and Options, 2006).

2.4 Critical environmental concern of Irrigation

When we come to the water management as critical environmental concern of irrigation the water management approach and practice are mostly cause for conflict. Rahmato (1999) discuses on water development & conflicts, according to Rahmato modern water development schemes have often become arenas of multiple conflicts, of which the following are worth noting. a) There is conflict among water users over water allocation, land rights, or maintenance issues. b) Conflict may arise between users and the authority responsible for the project over inappropriate design of infrastructure, peasant relocations, water charges, or management issues. c) Conflict between project beneficiaries and non-beneficiaries is often inevitable. The latter often question the justice of being excluded from the benefits of water projects. Indeed, project beneficiaries are frequently considered enjoying special privileges that are denied other households without any justification. d) Finally, there is conflict between donor agencies and the recipient country over design, management, environmental impact, and financial issues.
Large water use and low efficiency, environmental concerns are usually considered the most significant problem of the irrigation sector (Ximing Cai, 2001).

Concerning to the Awash basin Tefera Bezuayehu and Leo Stroosnijder (2007) explains that there is a growing concern about water use in the Awash basin because of conflicts between agriculture and the environment. Balancing two sides of Irrigation Awulachew et.al' (2007) briefly explains Irrigation development having a positive socio-economic and some negative environmental impacts. Lambiso (2007) appreciating the existence of conflict on irrigation he divided conflicts due to water rights are of two types conflict among irrigators and conflict among irrigators and upstream settlers or downstream settlers.

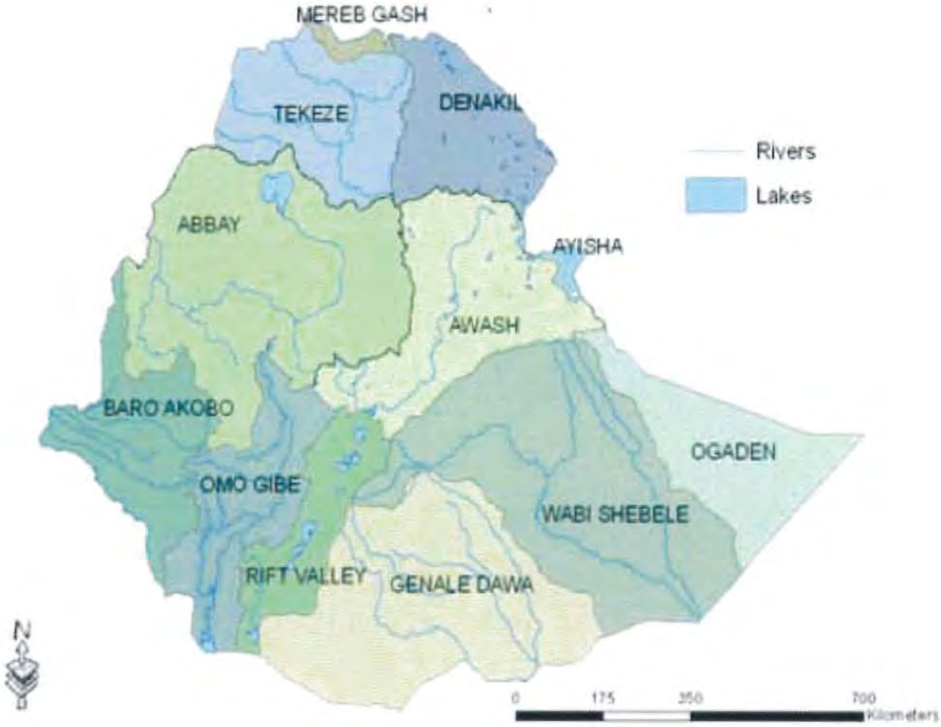
The predictable insufficiency of the flow of information impinges on equitable distribution of water and will cause conflicts between the up and downstream water users. Although these conflicts are temporal in nature, severe damage can occur in no time after conflicts come to scene because of the resident's possession of gun (OWWDSE, 2008).

All irrigation water contains dissolved salts derived as it passed over and through the land, and rain water also contains some salts. These salts are generally in very low concentration in the water itself. However, evaporation of water from the dry surface of the soil leaves the salts behind. Salinization is especially likely to become a problem on poorly drained soils when the groundwater is within 3 m or less of the surface (depending on the soil type). In such cases, water rises to the surface by capillary action, rather than percolating down through the entire soil profile, and then evaporates from the soil surface. Salinity is often linked with the rise of groundwater tables resulting from excess irrigation and poor drainage in large-scale, perennial irrigation systems. The resulting shallow water tables bring salts to the upper layers of the soil profile. That salinity can also be induced by the use of pumped groundwater of marginal or poor quality has been realized only more recently. In these cases, the physical process underlying salinization is the absence of a downward soil water flux of sufficient magnitude to leach the salts from the root zone (Stockle, 2003).

In general literatures encourage seeing FIBIDP in terms of physical and social structure for the project relevance, efficiency, effectiveness and sustainability.

2.5 Status of Irrigation in Ethiopia

The total renewable surface water resources are estimated at 122 billion cubic meters per year from 12 major river basins and 22lakes. Renewable ground water resources are estimated to be about 2.6 billion cubic meters. Althogh less than 2 percent of these resources are diverted for use, the current estimated per capita renewable fresh water resources of 1,900 cubic meters (MOWR, 2002) indicates an abundance of water.



Source: (Awulachew, 2007)

Figure 1 Ethiopian Water Resource Map

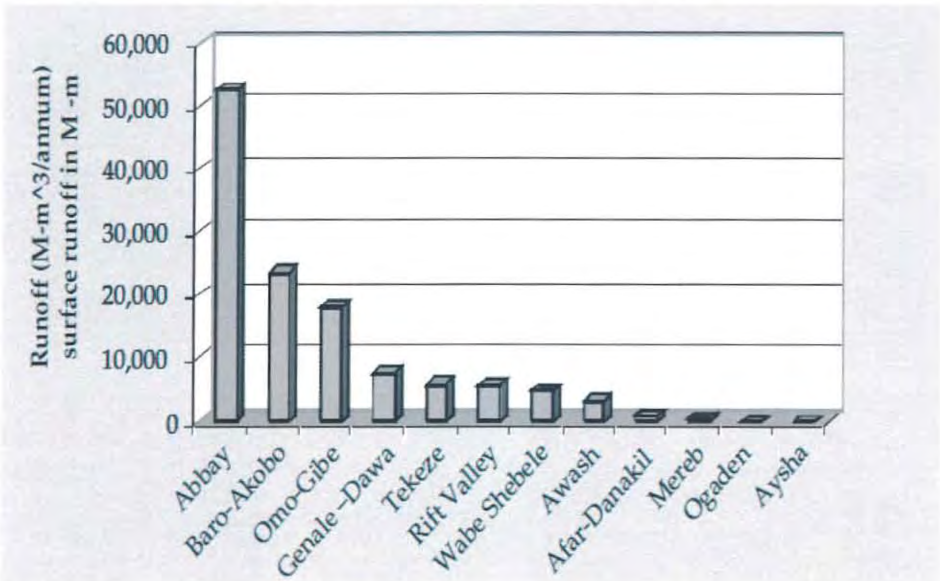


Figure 2: Runoff from the Ethiopia River Basin

Source :(MOWR, 2002)

Irrigated farmlands countrywide in 1991 comprised some 64,000 ha under small-scale schemes and 112,105 ha under medium- and large-scale schemes. MoWR reports 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 small-scale irrigation schemes, stemmed from growth in small-scale irrigation in the various regions. Little or no development ccurred in medium- and large-scale irrigation during that period. Irrigation coverage has not grown significantly since then. On a per capita basis, Ethiopia has developed irrigation over an area of a mere 0.3 ha per 100 people, vis-à-vis its potential of about 4.0 ha per 100 people. Despite this vast potential, irrigation infrastructure has remained underdeveloped while Ethiopia has endured persistent drought and famine (MOWR, 2002).

The abundant water resources in countries such as Ethiopia may trigger more interest in irrigation development—and economic returns may be much higher than thought when all off-site benefits are factored in (World Bank, Reengaining in Agricultural Water Managemnt Challenges and Options, 2006).

2.6 Water Policy

In the coming five years the main objectives of the water sector development plan are to develop and utilize water for different social and economic priorities in a sustainable and equitable way, to increase the water supply coverage, and to develop irrigation schemes so as to ensure food security, to supply raw materials for agro-industries and to increase foreign currency earnings.

In Ethiopia the centrality of water is clear. With little water resources infrastructure, relatively weak management institutions and capacity, extreme hydrological variability and seasonality, and a highly vulnerable economy, Ethiopia faces an enormous challenge in building the minimum platform of water infrastructure and management capacity needed to achieve water security (WorldBank, 2006).

Water has always played a central role in Ethiopian Society. It is an input, to a greater or lesser extent, to almost all production. It is also a force for destruction. In Ethiopia, as in all societies, there has always been a struggle to reduce the destructive impacts of water and increase its productive impacts. This struggle has intensified over the past century as the population has grown dramtically. Today, Ethiopia's development is seriously constrained by a complex water resources legacy and a lack of access to, and management of, these water resources (WorldBank, 2006).

Table 1: Irrigation Development Plan of Ethiopia

		Short-Term (2002-2006)			Medium-Term (2007-2011)			Long-Term (2012-2016)		
No.	Region	Schemes	Area (Ha)	Beneficiaries	Schemes	Area (Ha)	Beneficiaries	Schemes	Area (Ha)	Beneficiaries
1	Tigray	38	3,680	14,720	37	3,600	14,400	42	4,028	16,100
2	Afar	3	500	2,000	3	617	2,468	3	570	2,250
3	Amhara	107	9,711	38,307	104	9,500	38,000	118	11,250	45,000
4	Oromiya	122	9,422	35,900	121	9,400	37,600	133	11,750	47,000
5	Somali	3	500	2,000	4	500	2,000	4	500	2,000
6	SNNPR	172	10,685	42,100	165	10,000	40,000	171	11,383	45,500
7	Benshangul	7	706	2,824	6	600	2,400	6	600	2,400
8	Gambella	5	500	2,000	5	500	2,000	5	500	2,000
9	Harar	2	200	800	2	200	800	2	200	800
10	Dire Dawa	3	300	1,200	6	381	1,524	5	351	1,400
11	Addis Ababa	38	615	2,460	-	-	-	-	-	-
12	All (NGO-Supported)	46	3,500	14,000	58	5,050	20,000	60	5,339	21,350
	Total	546	40,319	158,311	511	40,348	161,192	549	46,471	185,800

Source:(MOWR, 2002)

Ethiopia has a country water policy and water strategy and based on this the country also formulated a water sector Developemnt Program (WSDP). The water policy is formulated in 2001, accordingly it has five objectives and six fundamental princples of water resource management policies (MOWR, Ethiopian Water Sector Policy, 2001).

The objectives are:

1. Development of the water resources of the country for economic and social benefits of the people, on equitable and sustainable basis.

2. Allocation and apportionment of water based on comprehensive and integrated plans and optimum allocation principles that incorporate efficiency of use, equity of access, and sustainability of the resource.

3. Managing and combating drought as well as other associated slow on-set disasters through, **interalia**, efficient allocation, redistribution, transfer, storage and efficient use of water resources.

4. Combating and regulating floods through sustainable mitigation, prevention, rehabilitation and other practical measures.

5. Conserving, protecting and enhancing water resources and the overall aquatic environment on sustainable basis.

Fundamental Principles of water resources management policy:

1. Water is a natural endowment commonly owned by all the peoples of Ethiopia.
2. As far as conditions permit, every Ethiopian citizen shall have access to sufficient water of acceptable quality, to satisfy basic human needs.
3. In order to significantly contribute to development, water shall be recognized both as an economic and a social good.
4. Water resources development shall be underpinned on rural-centered, decentralized management, participatory approach as well as integrated framework.
5. Management of water resources shall ensure social equity economic efficiently, systems reliability and sustainability norms.
6. Promotion of the participation of all stakeholders, user communities; particularly women's participation in the relevant aspects of water resources management.

This Water Sector Development Programme (WSDP) has been prepared in support of the fundamental principles and objec-tives endorsed and issued by the Government of Ethiopia in its Water Resources Management Policy and Water Sector Strategy (MOWR, 2002).

Ingenral theoverall goal of the national water resources management policy is: to enhance and promote all national efforts towards the efficient, equitable, and optimum utilisation of the available water resources of Ethiopia for significant socio-economic development on sustainable basis (MOWR, 2001).

The preceding of IWMI indicates productivity as one important factor parallel to equity and sustainability. Accordingly on the preceding three conditions are stated as must: productivity, equity and sustainability. Low productivity in irrigated agriculture is largely a consequence of inappropriate policies and weak management institutions, which were designed for very different conditions in the past (IWMI, 2001).

2.7 Sustainability of Irrigation

Sustainable development is development that meets the needs of the present without comprising the ability of future generations to meet their own needs (WCED, 1987). As quoted by Loucks (2000) from ASCE, 1998 and UNESCO, 1999: Sustainable water resource systems are those designed and managed to fully contribute to the objectives of society, now and in the future, while maintaining their ecological, environmental, and hydrological integrity (ASCE, 1998; UNESCO, 1999).

Sustainable water resources management is a concept that emphasizes the need to consider the long-term future as well as the present. Water resource systems that are managed to satisfy the changing demands placed on them, now and on into the future, without system degradation, can be called ''sustainable'' (Loucks, 2000).

Sustainable irrigation water management should simultaneously achieve two objectives: sustaining irrigated agriculture for food security and preserving the associated natural environment. A stable relationship should be maintained between these two objectives now and in the future, while potential conflicts between these objectives should be mitigated through appropriate irrigation practices. The purpose of sustainable water resources management is to sustain both the water supply capability and the environment, now and in the future. Water supply capability encompasses both the availability of water and the infrastructure to sustain water supply and use. (Ximing et al', 2001).

When we come to Ethiopia case, the fundamental goal of achieving sustainability irrigation Agricultural system is complex (Tsehayu, 2007). The performances of the existing irrigation schemes are highly variable. Some of the schemes from all typologies in terms of water use efficiency, productivity, sustainability are performing very well, while some are not performing efficiently, interrupted while under construction, abandoned after implementation, or transferred from public to private or community and their performances are not known (Seleshi Awulachew, 2007).

Ruffies and his friends emphasize on another aspect of sustainability stating: Development of large scale irrigation, political decision making and investment strategies are often oriented on short-term profit maximization whereby environmental sustainability is neglected. Due to the fact that environmental sustainability of irrigation projects is rather on the low end of the policy priority list, adverse and irreversible environmental impacts are bound to happen in the contrary nexus of profit maximization, short-term benefits and environmental sustainability (Ruffeis, 2007).

2.8 Conceptual Framework

The conceptual framework of this study consists three types of irrigation activities distinguished as the soul of irrigation: control structure activities (design, construction, operation, maintenance); water use activities (acquisition, allocation, distribution, drainage); and organizational activities (decision-making, resource mobilization, communication, conflict management) (Uphoff, 1986).

Irrigation systems activities matrix adopted from Uphoff et al'.(1985) and quoted by Edward (1987) clearly explains the three variables and dimensions with their components in each activity.

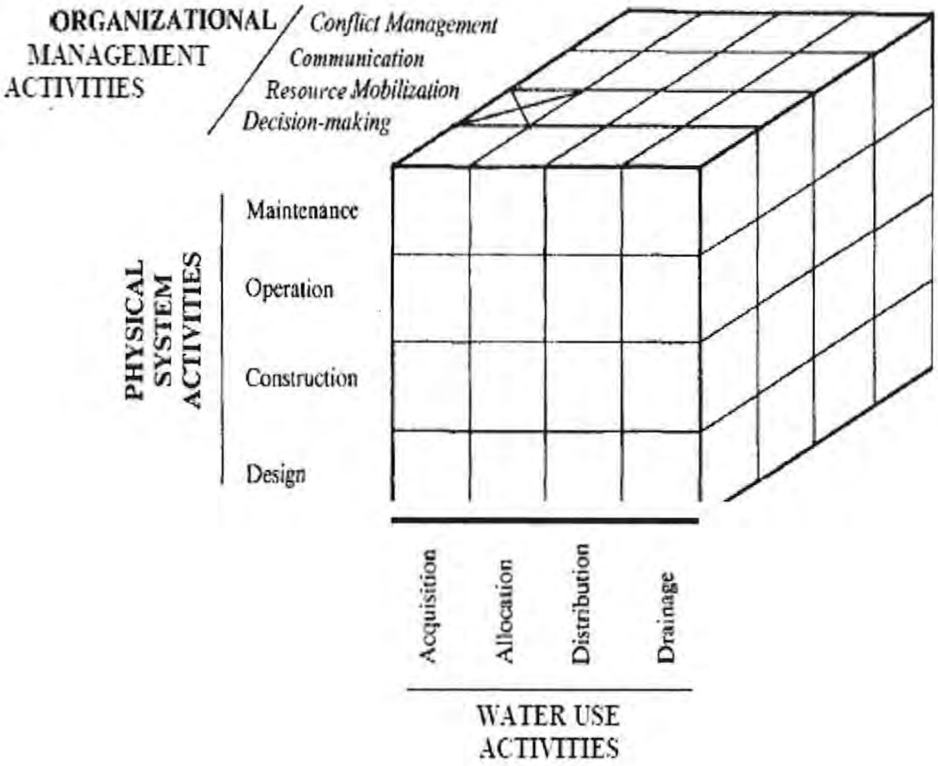


Figure 3: Uphoff Irrigation Matrix (Source: Uphoff (1985))

This concept is also reinforced by the known scholar on irrigation Van Hofwegen (1996) especially on the irrigation management, which he levels it in to three levels as main, Tertiary and Farm system with distinct. The role of the government is to provide the enabling environment for irrigation development and management which allows the irrigation agencies to deliver the irrigation services in a sustainable, efficient and effective manner beneficial to the users in particular and society in general (Hofwegen, 1998). Hence, Fentale Large scale irrigation is tested based on this conceptual frame work.

3 Methodology

3.1 Description of the Study Area

3.1.1 Location

The study zone, East Shoa, is located in the central part of Oromia. It is one of the 17 zones of the Oromia National Regional State with a surface area of about 10,258.57 km^2 and consists of 10 districts. Adama , the capital of the zone, is located 100 km from Addis Ababa. Likewise, Boset and Fentale, the study districts are located at 25 and 100 km from Adama respectively. Welenchity and Methara are district capitals of Boset and Fentale respectively. The total area of Boset is about 1506.37 km^2 where as the total area of Fentale is1197 km^2.

3.1.2 Climate

Ethiopia's rainfall shows high spatial and temporal variability. The highest mean annual rainfall (more than 2,700 mm) occurs in the southwestern highlands, and then it gradually decreases in the north (to less than 200 mm), northeast (to less than 100 mm), and southeast (to less than 200 mm) (WorldBank, 2006).

The climate of Fentale area exhibits typical characteristics of arid and semi-arid environments. The yearly maximum temperature ranges from 32.0 ^oc to 42.0 ^oc while the minimum temperature ranges from 9.6^oc to 22.0 ^0c. The mean annual rainfall is about 553 mm. Rainfall of the area is very erratic and scarce occurring two or three times yearly. The main rainfall season, which accounts for the largest total rainfall of the year occurs from July to September, and this season is locally termed as *Ganna* (which means main rainy season in *Afaan* Oromo). The evapo-transpiration of the area as it is shown in Fig 4, is very high.

Having 1050 m asl at the head work in Boset district the elevation falls down 890 m asl at downstream of the project in Fentale district, that is a fall of 160 m at 42 km distance.

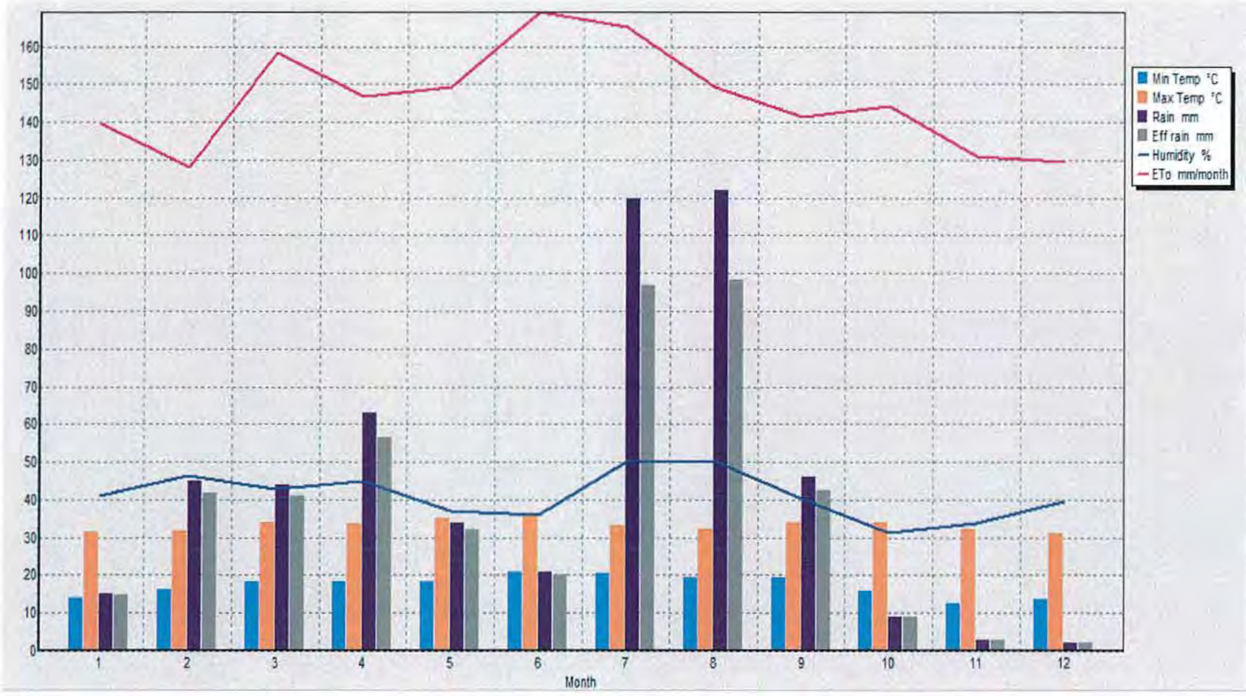


Figure 4: Climate chart of the project area derived from FAO Climwat Methara Station

3.1.3 Demographic Characteristics

According to the data obtained from Fentale district Administration office and the Central Statistics Agency the demography of the project area is 52.9% and 47.1% were male and female respectively, in the district as a whole 25% of the households appeared to be female headed. The CSA census also indicates that the number of female population is smaller than that of male. According to CSA data, out of the total population, about 53% were male while the female constitute about 47% of the population in the district. In the rural areas about 53.6% and 46.4% male and female respectively live in the district. The same source also indicates that about 25% of the people in Fentale district reside in urban areas, while the large majority around 75% dwells in rural part of the district (CSA, 2008).The majority of the rural population are pastoralists and agro-pastoralists.

According to Boset district Agriculture and Rural Development office data (2007) 8214 & 4800 people dwell in Qawamirqisa and Huluqahuruta respectively and this can tell us that 65.5% of the households dwelling in the two kebeles of Boset district are considered to be the beneficiaries of the irrigation scheme.

Table 2: Estimated total rural population to be incorporated into the irrigation development

District	Population size	Households
Fentale	61708	9696
Boset (two kebeles)	8520	1420
Total	70228	11116

Source: CSA &Agriculture and Rural Development office (Boset district)

From this data we can say 75 & 6 % of Fentale and Boset district community benefit from the project respectively. As above table shows the total numbers of the planned beneficiaries in the project are 11,116 households; and hence, the size of land to be developed fully by the irrigation project is 18,000 hectares.

3.1.4 Population of the Specific Study area

The study area as described in the research proposal is selected based on the irrigation season elapsed, hence kebeles which elapsed more than two irrigation seasons in general upstream of the project kebeles were selected and their population is described as below:

Table 3: population on Irrigation Blocks

No	Kebele	District	Total Beneficiary of the specific study area
1	Tuttuti	Fentale	1329
2	Dhebiti	Fentale	394
3	Ilala qarari	Fentale	548
4	Diresaden	Fentale	485
5	Gidara	Fentale	492
6	Tuuro	Fentale	429
7	Qawamirqisa	Boset	1290
8	Huluqohuruta	Boset	130
	Total		5097

Source: **Fentale district administration office**

3.1.5 Agriculture and natural resource features

The two districts economy is dominated by livestock and mixed farming system. Livestock and subsistence crop production is the basic means of life. The most widely cultivated crops in Boset district are maize, Teff, wheat, barley, sorghum, oat and haricot bean and others (BDAO, 2002), where as in Fentale district maize is dominant. Livestock production is another farm component playing a vital role in the rural livelihood of the districts, especially in Fentale. Historical evidence shows that livestock farming was the predominant activity.

Moisture shortage, prevalence of diseases, insect, pests and weeds are among the major crop production constraints in East Soha zone in general Boset and Fentale districts in particular.

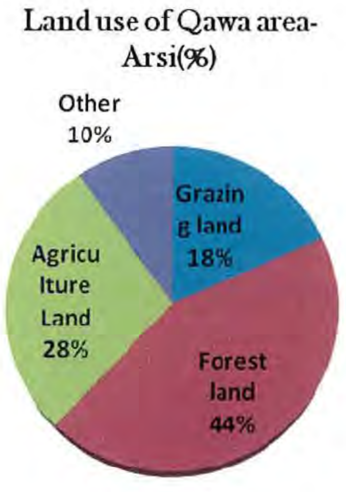
Table 4: Livestock Population in Fentale and Boset Districts year of 2000 Et.c

No	Livestock	Number of livestock	
		Fentale Dist	Qawaa Mirqesa / Boset
1	Cattle	71,478	16,500
2	Camel	97,425	1,123
3	Sheep	69,482	2,950
4	Goat	89,717	10,470
5	Donkey	9,208	2,575
6	Horse	148	0
7	Mule	8	38
	Total	337,466	33,656

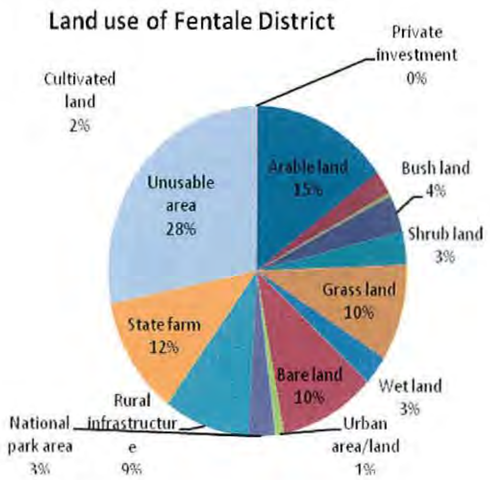
Source: (FDPDO, 2002) & (BDAO, 2002)

The land use of the project area is characterized by forest, rangeland, and agriculture land and infrastructure area.

Graph 1: Qawamirqesa- Boset land use



Graph 2: Fentale District Land Use



3.2 Water resources and irrigation overview of the study area

The main and vital water source of these two districts is Awash River. The river is a source of drinking water, hydropower, irrigation and fishing.

The Awash River has a catchment of 112,696km^2, it originates from central west part of Ethiopia, the highlands around Dandi and Ada'a Barga districts of West Shewa zone of Oromia, flowing 1200km (Awulachew et al, (2007),OWWDSE, 2009) . It is relatively, the most utilized river basin and the only river entirely in the country, Awash covers parts of the Amhara, Oromia, Afar, Somali regional states, and Dire Dawa, and Addis Ababa City administrative states of the country. The river basin has a lowest elevation of 210 m and a highest elevation of 4195 m. The total mean annual flow from the river basins is estimated to be 4.9 BMC (Awulachew et al., 2007)

The other significant water body in the study area is Basaqa Lake, which is situated at the northern side of Metahara Sugar Estate and on the western fringe of Metahara town. The lake is expanding at alarming rate. Its surface area has increased ten times its original size, from 3.5.square kilometer to 35 square kilometer in the last 20 years. It has strong salt content so that it cannot provide any service for both animal and human water needs (OWWDSE, 2009).

According to the FGD conducted with the WUA the other water source which is not accessible for the Kereyu people currently due to conflict with Afar and Argoba neighbors is a river called Bulga, which again has its origin in the highland areas.

There are many traditional and modern irrigation schemes in the district. Large scale irrigation state farms , private irrigation schemes and community modern small scale irrigation dominates the agricultural practice of the districts.

Table 5: Developed Irrigation area

No	Districts	Total Irrigation area (ha)
1	Boset	2124
2	Fentale	710

Source: (FDPDO, 2002) & (BDAO, 2002)

Even though there exists traditional and modern irrigations in the districts, FGD (2008) with district development offices shows the impact on the livelihood of the community is insignificant due to poor irrigation experience and problem of scheme management.

3.2.1 Management system and institutional set up of the schemes

In some schemes fairly rudimentary management procedures can be successful; in others more sophisticated procedures are required. The key variables affecting the management of the scheme are its size, its technical complexity, its age and its history (IFAD, 2011).

Table 6: Irrigation area which elapsed more than two irrigation seasons, in KebeleTable:

No	District	Kebele	Irrigation Area (ha)	Irrigation started year
1	Boset	Qawa	933.69	2001
2		Gidara	588.5	2001
3		Turo	684.5	2001
4		Dire Seden	717	2001
5	Fentale	Tututi	286.5	2002
6		Ilala	534.5	2002
		Total	**3,744.69**	

Source: Fentale and Boset District year of 2003 Et.c (FDPDO, 2002) & (BDAO, 2002)

In this large scale irrigation scheme, the irrigation management consist water management: water abstraction, allocation and distribution, and managing of irrigation facilities mainly focus on diversion weir, pumps and other structures which include operation and maintenance and organizational activities like resource mobilization, conflict resolution and decision making.

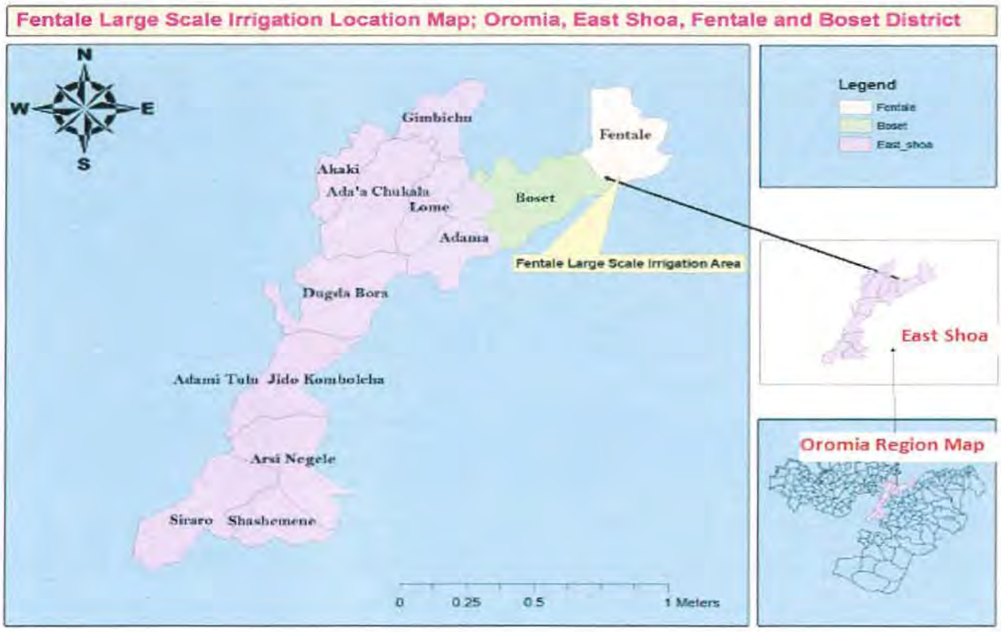
Unlike other irrigation schemes in the region, the irrigation management of Fentale scheme fells in to different organizations; consequently Oromia Water Works Construction (OWWCE) and different water user cooperatives established by the district cooperative office are responsible for water diversion, conveyance and distribution based on their mandate.

According to the FGD conducted in this study with IWUC and district cooperative offices, all the IWUC of the study area are registered and legally recognized. They have by laws and bank accounts. This IWUC manage the distribution of water at tertiary and field level, input supply, market facilitation for the irrigation and conflict management on the scheme. Bylaws of WUCs were initially prepared by cooperative office and endorsed by the general assembly and the Irrigation water use cooperatives elected by and accountable to the general assembly.

The Regional Water Mine and Energy Bureau, which is a client for the project, have a very limited role in respect to the scheme management which is not defined in rules and agreements of the scheme management where as Oromia Agriculture Development Bureau has clear responsibility on the irrigation extension component of the scheme.

The design and construction of this project passed through unique experience: the design, construction and supervision went parallel at same time which is a new experience for the region.

Figure 5: Location of the Study area



3.3 Methods of Data Collection

3.3.1 Sampling Design

The total direct beneficiaries of the project are 57,092 but from the current developed 4087 ha 4009 HH, 3020 male and 989 female are direct beneficiaries. These beneficiaries are heterogeneous in respect to their life style, type of irrigation and clan as pastoralist and semi pastoralist; Gravity & Pump irrigation and Kereyu & Arsi Oromo respectively.

Based on the heterogeneous of the beneficiary and the type of irrigation multistage sampling is done. The first stage in this sampling is done based on the type of irrigation which fortunately coincides with their difference in clan, Arsi and Kereyu, and Boset and Fentale district respectively.

The second stage, stratification is done on the irrigation blocks for the Fentale and on ponds for Qawamirqesa of Boset, then proportional sampling is done based on the irrigation area. At last, after deciding the numbers of samples beneficiaries were selected by simple random sampling.

Table 7: Sample Size from each Irrigation block

No	Kebele	District	Irrigable land in each block(ha)	Number of Samples from each Block
1	Qawa	Boset	933.69	30
2	Gidara	Fentale	588.5	19
3	Turo		684.5	22
4	Dire Seden		717	23
5	Tututi		286.5	9
6	Ilala		534.5	17
	Total		**3,744.69**	**120**

For the external & internal validity of the research the sampling frame was compiled properly and representative sampling drawn.

3.3.2 Data Source and Methods of Data collection

In this study, both primary and secondary data were utilized. Primary data is collected through prepared closed and open-ended questionnaires. These primary data were collected from sample respondents through ten enumerators (for Qawa, D/Seden, Gidara, and Turo two for each and for Iilaala and Tututi one for each) who speak Afan Oromo and can understand the questioner. Before the numerators started data collection training for 1:30 minutes is given to them and made familiar with the questions and methods of data collection and interviewing techniques. In addition pre test is conducted by the numerators and the researcher on 10 households. Incorporating and modifying the questioner final questioner is prepared and beneficiary interview is carried out.

After the numerators finished data collection the researcher checked the collected questioner and coded the response and put them in SPSS 19 version for analysis purpose.

In addition FGD is conducted with WUC of Turo, experienced farmers of each block, Fentale Irrigation Scheme Management (FISM) experts, Fentale Irrigation Extension Technical Team of Agriculture Burea(FIETT), Boset and Fental districts Water Mine and Energy Office, Fentale district Pastoralist Development Office(FPDO), Fentale District Cooperative Office(FDCO), Boset District Agriculture Office(BDAO), and DAs of each irrigation block/ Kebele

Water measurement data is collected from the FISM from 08/09/02 up to 07/04/03[1] for 213 days among which 28 days data is missing (from 02/12/02 -30/12/02)[1]. The water measurement is taken in the form of depth with installed water meter (gauge) at the outlet of the weir every morning and afternoon, twice a day. For verification purpose five days direct observation is done while the recorder is recording the depth of water in the canal. Velocity of the flow in the main canal and the dimension of the main canal is also measured with floating so as it will be possible to change the depth in to flow per unit time. Other Secondary data were obtained from Oromia Water Mine and Energy Bureau (OWME) Oromia water Works Design and Supervision Enterprise (OWWDSE), district offices, FIETT, project design documents, project operation manual.

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[1] The dates are according to Ethiopian calendar

3.4 Methods of Data Analysis

The data analysis is done by qualitative and quantitative analysis method using descriptive statistics and irrigation performance indicators.

Descriptive statistics is used to explain the characteristics of the scheme water management, institution and its environmental impact in general. This is conducted using SPSS 19. These include mean, percentage, standard deviation frequency and Chi-Square test of occurrence different variables tested in the questioner for descriptive analysis.

For better understanding of the water management of the scheme, mapping of the water management and water sensitive areas plotted.

For environmental security factors, Vulnerability, Stress, Threats and Mitigation matrix is adapted.

Only two irrigation performance indicators are exercised, as discussed in the limitation section. The indicators are summarized below.

1. Output per cropped area= Production/ Irrigated cropped area
2. Relative Water supply = Total water supply/Crop demand

These indicators are good to indicate especially the water use efficiency. The researcher adopts these seven indicators only among many. When we consider the project is under construction and partial irrigation. These indicators are not free from limitation,

3.5 The Variables

The adequacy of the water for the project, equitable distribution and efficient use of the water and appropriate institutional setup are the main variables to understand the water management as critical environmental concern of Fentale Large Scale irrigation. The other variables are the amount of diverted water from Awash, the allocation of water for plots or blocks impacts the adequacy of water for the project, methods of water allocation, efficiency of structures in the system and structures suitability for the beneficiary decide the equitable water distribution, strength of WUC, water payments, and conflicts with users indicate the institutional appropriateness. In addition livestock related data with the irrigation shows the critical issues on the beneficiary life style in the future

4 RESULTS AND DISCUSSION

4.1 Demography of the project area

4.1.1 Sampled Household characteristics

The study area beneficiaries consists 24.7% Female irrigation land holders and 75.3% male irrigation holders. Out of the total interviewed Arsi beneficiaries 83.3% were male and 16.7% were female, and for Kereyu beneficiaries 82.2% were male and 17.8% Female were interviewed, as over all view of the project 82.5% male and 17.5% Female were interviewed.

Regarding marital status, of the total sample respondents 93.3% were married and 6.7% single. When we disaggregate this data in to the Arsi (all are pump irrigation users) and Kereyu (all are gravity irrigation users) the collected data shows among the respondent of Arsi 76.7% married, 23.3% single and Kereyu 98.9% married and 1.1% single.

Table 8: Sex Composition of respondents in District

Sex Composition in District						
		Sex		Total	Percentage (%)	
		Male	Female		Male	Female
District	Boset	25	5	30	83.3	16.7
	Fentale	74	16	90	82.2	17.8
Total		99	21	120	82.5	17.5

The housing condition among the respondents was found that 80% of Arsi live in grass roofed houses where as 20% live in corrugated iron roofed house. Regarding the Kereyu respondents 88% live in grass roofed house which is constructed according to the pastoralist house design and 12% live in corrugated iron roofed houses.

Table 9 Distribution of sample households by age

Category of age	Arsi		Kereyu		Total	
	Numbers	%	Numbers	%	Numbers	%
18-32	14	46.7	23	25.6	37.0	30.8
32-60	16	53.3	66	73.3	82.0	68.3
>60	0	0.0	1	1.1	1.0	0.8
Total	**30**	**100.0**	**90**	**100.0**	**120.0**	**100.0**

Age of the sample respondents ranged from 18 to 66 years with mean of 35.96 years and standard deviation of 9.059

When we look at the age characteristics based on the study category 46.7% and 53.35% of Arsi respondents are between 18-32 and 32-60 respectively the respondents of Kereyu can be categorized as 25.6% between 18-32, 73.3% between 32-60 and 1.1% is >60 year age.

The descriptive statistics results also show that 50.83% illiterate according to the modern school 5.8% sample households can read and write, 17.5% are first cycle, 2.5% second cycle and 3.3 are at High school level.

Table 10 Distribution of sample households by educational level

Description		Arsi		Kereyu		Total	
		Number	%	Number	%	Number	%
Education Level	ILLITRATE	7	23	54	60	61	50.83
	READING & WRITTING	8	27	23	26	31	25.83
	FIRST CYCLE	9	30	12	13	21	17.50
	SECOND CYCLE	3	10	0	0	3	2.50
	HIGH SCHOOL	3	10	1	1	4	3.33
	Total	**30**	**100**	**90**	**100**	**120**	**100.00**

4.1.2 Irrigation Land Ownership

The other important variables which contribute for the relevance of the project is the irrigation land ownership or tenure system. In this project land is distributed based on the marital status, for those who are family head 0.75ha and for those who are single but above 18 year old 0.5 ha is distributed. In addition Female households also got 0.75ha and 0.5ha for young females. Among the respondents eight of them are young with 0.5ha land for eah and the rest 112 with 0.75 ha.

4.2 Social and Environmental Sustainability of the Project

Parameters observed and analyzed under the social and environmental sustainability of Fentale large scale irrigation project are discussed below.

4.2.1 The Need for the Project

The need for the project is can be taken as an important parameter for social sustainability. The need for the project can be explained in its relevance. Relevance can be explained in many variables, among the main contribution of the project to agricultural productivity –feeding, irrigation and agricultural land expansion, increased crop yield, welfare improvement, land values and environmental benefits can be seen (ZILBERMAN, 2007).

The effects of the price surge reverberated globally, though the worst hit were low-income, food-deficit countries with meagre stocks. In total, about 100 million poor rural and urban people were pushed into the ranks of the world's hungry (IFAD I. F., 2010). Accordingly, the degree of the need of the project for the beneficiary and the country who are struggling to attain food security is unquestionable.

4.2.1.1 Public Consultation

The project study document and the FGD indicate, the project is incepted based on the request of the community. The previous Oromia Irrigation Development Authority tried to address the community request in two projects, one medium irrigation - Qawa Hara Mirqensa which is medium scale irrigation and Direseden small scale irrigation (OIDA, 2002). This failed due to the capacity & mandate limitation

In case of this large scale irrigation based on the request of the community public consultations at different community level with different level of government officials were conducted and the need for project is witnessed. (OWWDSE, 2009)

4.2.1.2 Policy direction

The GTP encourages irrigation development for three main reasons: to develop irrigation schemes so as to ensure food security, to supply raw materials for agro-industries and to increase foreign currency earnings (GTP, 2010). Based on this fact the regional government implemented this project to attain food security, supply of raw materials and increase of foreign currency. This is explained in the project design document, socioeconomic part, explains the project can bring food security, beneficiaries may obtain nutritious food supply, agricultural productivity and production will increase and their income will be raised, the community can get additional income and improve their living standard, they may be engaged in modern way of livestock production and management and fattening activities. This will induce the overall development of the area, in various economic, social, cultural and infrastructure aspects and the working culture of the people will be changed and improved, lastly the agricultural sector will be developed into agro-processing industries; (OWWDSE, 2009).

4.2.1.3 Evapotranspiration

The metrological data of the area also indicates the area is with very short growing season and high potential evapo-transpiration without enough precipitation.

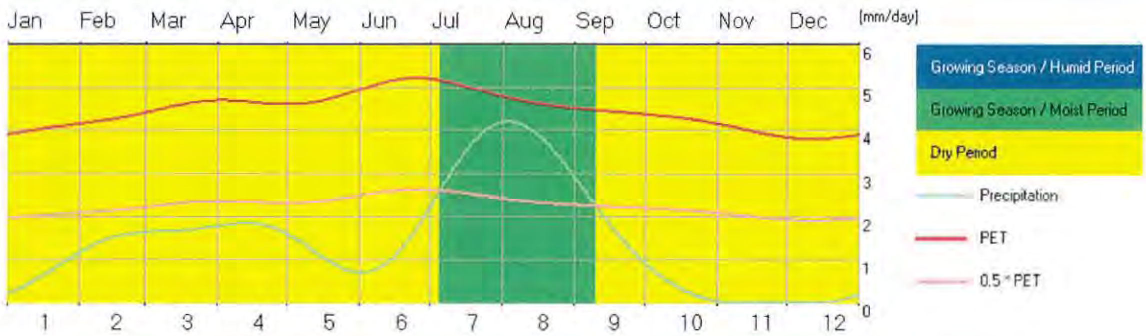


Figure 6: Growing season retrieved from Loclim based on Metahra Metrological station

4.2.1.4 Project acceptance after implementation

In addtion to these , the community attitude after the implemntion was observed through data collected from respondants and its analyises witnesed the need of the project for the community. 120 Respondants from both beneficaries, 30 from Arsi and 90 from Kereyu,were asked about the project importance and relvance and the result is discussed below: out of three possible choice of answers for the importance of the project ; not important, normal and very much important, beneficiaries responded - 94.4% of Kereyu and 73.3% of Arsi responded the project as verymuch important for them and 26.7% of

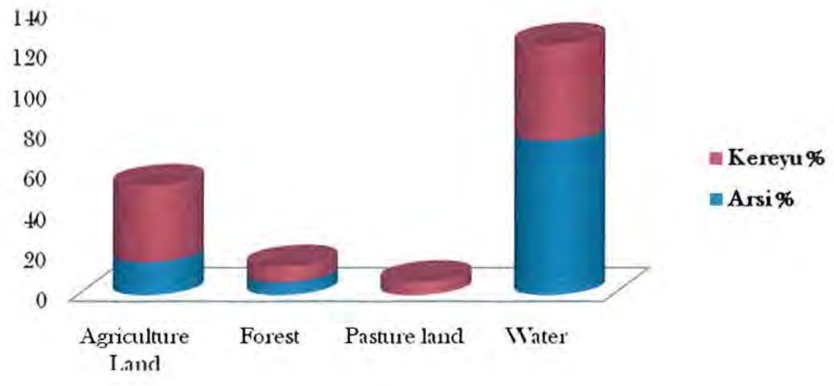
Arsi and 5.6% of Kereyu responded as normal but none of them responded as not important (see graph 3).

Graph 3: Relevance test

The beneficaries priortiztion of the natural resouce also can indicate the need for the project. The FGD on natural resource priority indicates agriculture land and water are getting great priortiztion by the FGD group because of their relation to irrigation. 76.7% & 47.8 % of Arsi and Kereyu respectively priortized water their first priority among the five natural resource listed for them and 16.6% & 37.8% of Arsi and Kereyu respectively prortized Agriculture land as the second, among other forest and pasture land rank third and fourth respectively by the respondants.

Pasture land which was the base for the Kereyu people is in the trend of losing it crticality.

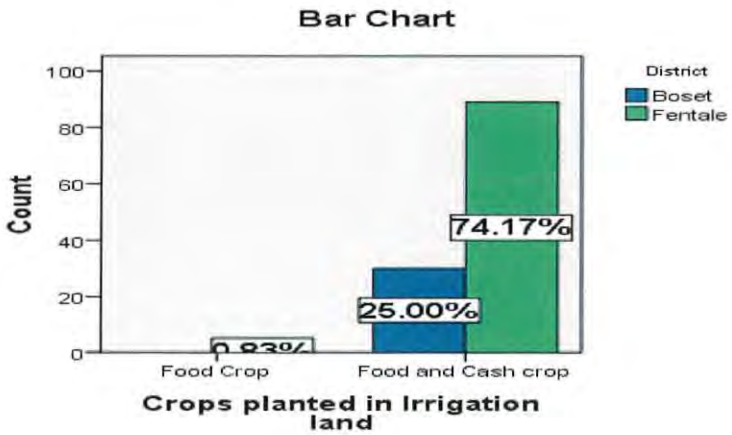
Graph 4: Community prioritization of Natural resource



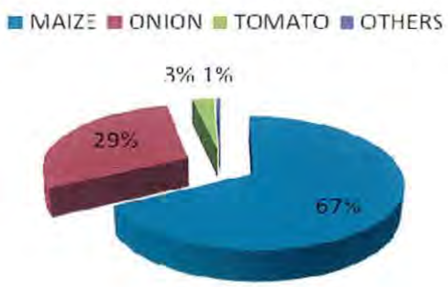
4.2.1.5 Crop Production

The beneficiaries of this irrigation, especially those who are considered in this study attained food self sufficiency and also started to produce using the irrigation crops for both their household consumption and for market (cash crop production); out of the interviewed 120 sample beneficiaries 8% of the respondents produce food crop and the remaining 92.% produce food and cash crop which contribute for food security, the objective of the project which indicates the relevance.

Graph 5: Crops planted



An increase in production and diversification of crops is witnessed by the districts and irrigation extension technical team. In general we can say that the project is on right truck in attaining food self sufficency even if it is early to witness about food security.



Graph 6: Crop coverage of 2002-2003

4.2.1.6 Forage production

As an integrated irrigation project forage production was one of the components planned in the scheme (OWWDSE, 2009). Whereas data collected from the respondents and FGD indicates that most of the planned ranged lands are converted to irrigation land by the beneficiaries and the project. The only encouraging activity is the Adami Tulu Research center trial of range crops on 2.5 ha piece of land.

Table 11: Forage trail

No	Forage Type under trial	Covered area (ha)
1	Elephant grass	1
2	Casa Cajanos	0.1625
3	Cow pea	0.1625
4	Lab Lab	0.1625
5	Rhodes grass	1

Source: Gidara Development Agent (2003)

4.2.1.7 Livestock Vs Irrigation

Both districts of the study area are known for their livestock production; especially the Kereyu people are dependent on livestock as the FGD shows. Accordingly the impact of irrigation on livestock and vice verse was seen in this study. All respondents own livestock at different amount and type.

Table 12: Respondents response for the Negative impact of the project on livestock

Response	Arsi		Kereyu		Total		Chi-Square
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	
Yes	25	80.0	23	24.4	46.0	39.0	
No	5	16.7	67	74.4	72.0	61.0	31.5
Missed	0	3.3	0	1.1	.0	.0	
Total	30	100.0	90	100.0	118.0	100.0	

80% of Arsi and 24% from Kereyu irrigation users believe that the project has negative impact on livestock production where as 16.7% of Arsi and 74.4% Kereyu believe the project has no negative impact on livestock. In general as a whole the 38% of the respondents responded as the project has negative impact on irrigation and the rest 60% percent responded no negative impact on livestock due to the project, the t value at 5% significance level shows that the irrigation has effect on the livestock water supply.

The result obtained through the questioner is triangulated with the FGD conducted with beneficiaries, Fentale and Boset district Pastoralist and Agriculture Development office respectively and other secondary data as shown in the table below:

Table 13: Result of FGD on Impact of Irrigation on Livestock

No	Category	Respondent Response for Irrigation negatively impacts live stock	FGD Main Points
1	Arsi	Yes (80%)	They have much cattle and cannot send them to other area as the pastoralist do, the project decreases the range land area for irrigation, no focus and technical assistance by experts on livestock production, growth of conflict on livestock due to irrigation, very small time to keep the livestock due to irrigation activities.
		NO (16.7%)	They benefited from crop residue,
2	Kereyu	Yes (24 %)	Due to the conflict among the water users due to livestock movement in the irrigation area, due to punishment by WUC for their livestock in irrigation area,
		No (74.4 %)	They own more camel than other livestock and these camels do not stay in irrigation area, they benefited from the residue of the irrigation crops which they were begging from Methara sugar plantation, easy access to water for livestock is given high emphasis

On the other hand the project benefit analysis for livestock four response were presented to respondents, Easy access to water only, crop residue only, both and no benefit. The response collected is tabulated below:

Table 14: Benefit of the Project to livestock

Variables	Response	Arsi (%)	Kereyu (%)	Total (%)	chi-square
The benefit of the project to livestock	Easy access to water only	30	7	12	
	Crop residue for livestock only	22	2	6.8	
	no benefit	0	2	1.7	
	Easy access to water and Crop residue	48	89	79.5	26.239
Total		100	100	100	

The FGD made on this subject justifies the result in the following manner, Arsi beneficiaries are located at the upstream of the project which is very near to Awash River this makes them not to consider the availability of water in canal in their village as big benefit, rather they consider the crop residue as better benefit of the project, where as the Kereyu community who are at downstream of the project and far from the river consider access to water as a big privilege of the project. Both beneficiary's grade access to water and crop residue as the highest, especially the Kereyu beneficiaries before the implementation of the irrigation they were yearly begging sugarcane straw from the Methara sugar factory but now they are relived from this.

The paradox here is easy access to water from the irrigation canal is a challenge for the canal service life and water management which can aggravate the loss of water, critical environmental concern of the area. Unfortunately the project up to now (march 2003 Et.C) didn't provide cattle trough for the livestock drinking water. All respondents (100%) in one voice responded the importance of cattle trough in the project.

4.2.2 Irrigation physical system of the scheme

Alamirew and Checkol(2008) quoting from Ostrom (1992) explains, for irrigation schemes to be sustainable, mutual supportiveness of irrigation hardware (irrigation infrastructure) and software (institutions) are vital. Mutual supportiveness is ensured when the hardware is cost and labor efficient, easy to operate, and yielding predictable results (Alamirew, 2008).

There is a growing recognition that to develop more sustainable systems it is necessary to match both technical and normative designs to users rather than try to match users to designs, fitting and forcing them into an outsider's technological and institutional system (Boelens, 2002). Based on these measures this research examined the physical structure of the scheme.

4.2.2.1 Design and Construction approach

The project design and construction followed new approach that is parallel implementing approach. This parallel implementing approach means to conduct the detail study and construction at the same time had its own benefit & limitations. The FGD discussion made with design departments and construction sections shows the merits and demerits:

Merits

- It is time saving, it save the usually implementation time. In the status quo way the whole study takes 2-5 years and then the construction follows for 2-5 years, but according to the new approach both study and construction go hand in hand.
- The detail design will be real to the actual ground due to direct data collection rather than doing designs from the paper data without actually observing the actual ground condition in detail.
- The variation of volume work will decrease which also can result problem in contract administration.
- Operation test and correction can be conducted immediately

Demerits

- The actual total project cost will not be known and it creates problem in budget allocation.
- Environmental mitigation measures cannot be implemented due to unclear plan
- Clear construction schedule cannot be set

In general it can be said looking the counties condition for the need of rapid growth to wait for long years for development is intolerable but this must not be an excuse for quality which is reflected in Fentale irrigation project.

4.2.2.2 Physical structures of the scheme

The project consists one head work which diverts water from the Awash River, 49.3 km main canal which conveys water for the whole scheme with the capacity $18m^3$/sec discharge.

According to the data collected from the design document, field observation and discussion with the design engineers on site the study area is composed of Diversion weir, pumps, ponds and closed PVC canals for Arsi beneficiaries (Qawa Block) and primary, secondary, tertiary and field canals with different length and capacity (see table 24 & 25), which are provided with different hydraulic structures such as drops, division box and turn outs. Some of the canals are closed PVC pipes, some geo-membrane lined/ covered/ and others masonry or concrete lined based on the geological and slope of the area.

The canals are designed and constructed in to closed PVC and geo membrane to minimize the loss of water through evaporation and percolation which increase the water use efficiency of the project which at the result is environmentally sound in the context of water use in Awash basin.

Table 15 Main Structure of the Project

No	Canal	Unit	Quantity	Remark
1	Head work	No	1	Common for the whole project
2	Pump	No	8	For Arsi beneficiaries
3	Ponds	No	2	For Arsi beneficiaries

Source: OWWDSE (2009)

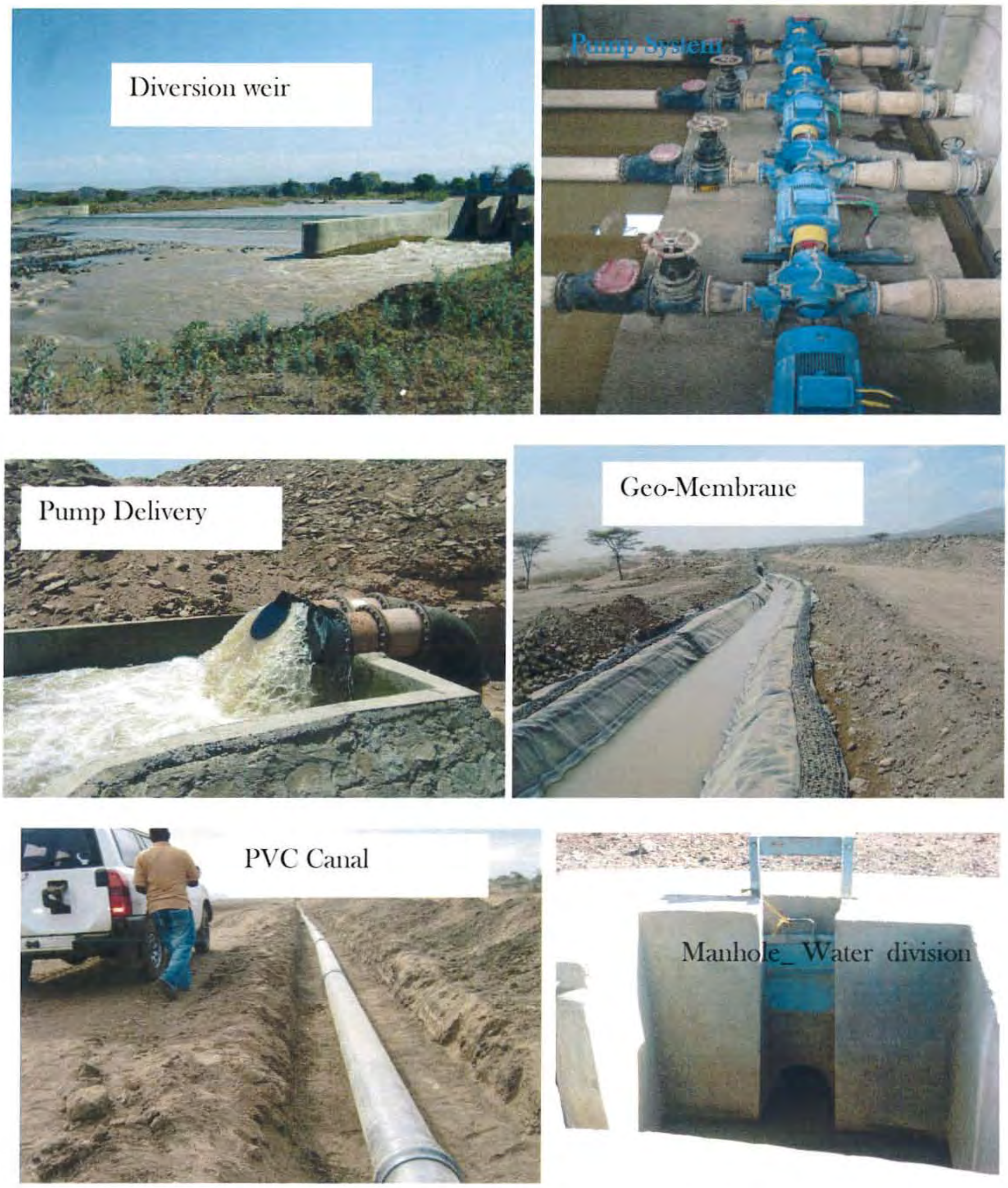


Figure 7: Diversion Headwork and Pump delivery

Table 16: Irrigation Water Distribution System for 4000ha

No	Canal	Quantity	Length (km)	Remark
1	Main Canal	1	49.3	The whole project
2	Primary Canal	2	49.14	Geo-membrane lined
3	Secondary canal	11	109.3	Geo-membrane lined and PVC
4	Tertiary canals	69	58.1	PVC
Total		83	265.84	

Source: OWWDSE (2009)

The irrigation scheme is divided into different blocks based on the topography and water distribution system (see table 27). The smallest block division is the field canal blocks which can be managed by the beneficiaries.

Table 17: Canal Network of Qawa- Arsi Block

No	Canal	Quantity	Length (km)	Type
1	Primary Canal	4	9.26	PVC
2	Secondary canal	11	15.18	PVC
3	Tertiary canals	46	29.7	PVC
Total Canals		61	54.14	

Source: OWWDSE (2009)

The diversion headwork and pumps are fully under the management and operation of the scheme water management sector. Until now no significant problem is observed on the diversion weir, but regarding the pumps the pump operators and the beneficiaries reported a continuous service failure due to the siltation problem in the first pump house suction pool.

Even if the length and number of canals to be provided for an irrigation area is determined by the topography of the area and other factors their adequacy is important for proper delivery of water

Table 18: Irrigation area in Blocks

No	Irrigation Blocks/ Kebele/	District	Irrigable land in each block(ha)
1	Qawa	Boset	933.69
2	Gidara	Fentale	588.5
3	Turo		684.5
4	Dire Seden		717
5	Tututi		286.5
6	Ilala		534.5
	Total		**3,744.69**

Source: OWWDSE (2009)

to all area under irrigation. Accordingly, when we look at the ratio of canal length to the area in the study area excluding the main and field canal Qawa block has 58m canal for one hectare where as the remaining blocks have 77meter/ ha canal coverage.

Table 19: Distribution Canal Length ratio to the command area

No	Category	Ratio of canal length to command area (m/ha)
1	Arsi	58m/ha
2	Kereyu	77 m/ha

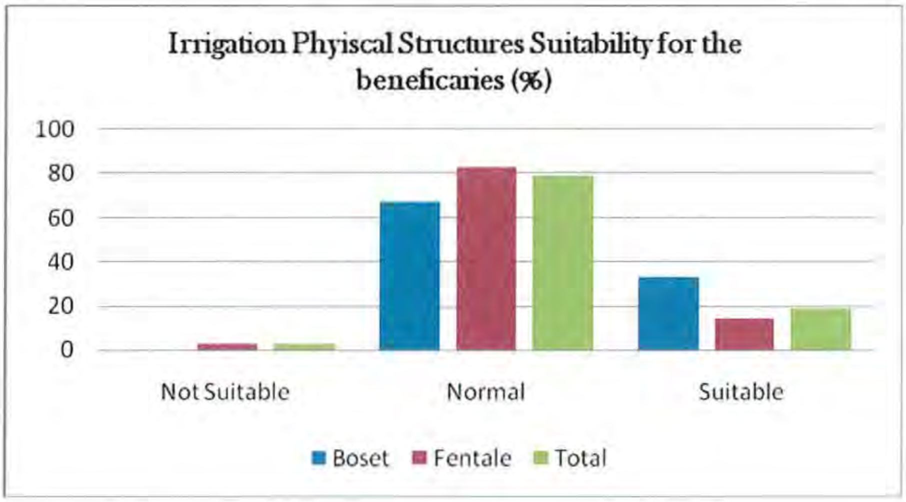
Even if it was not possible to do the cost effectiveness of the project in the new approach and technology two engineers from the OWWDSE and OWWCE explained the technology implemented in this scheme are cheaper than the usually way. This is because of the high cost of construction like cement and steel pipe to use geo-membrane plastic and PVC are much cheaper.

4.2.2.3 Normality - Suitability of structures for beneficiary and environment

The normality and the suitability of the physical structures can be seen from beneficiary direction, bringing the community to adopt, operate or to bring structures common to the community. In other hand, suitability or normality to the environment for this project can be seen in terms of environmental impact especially of water saving which is the center of development in the basin.

Regarding the scheme physical structure suitability for the beneficiaries, 79% of the respondents witnessed that the structure is normal, 19% suitable and the rest 3% responded as not suitable. When we examine categorically both 67% of Arsi and 83% of Kereyu respondents responded as the structure is normal, whereas 33% Arsi and 14% of Kereyu believe the structure as suitable and 0% of Arsi and 3% of Kereyu take the structure as not suitable for them(see graph 7). This data shows that the two groups were found to be statistically significant at 5% probability level. The FGD output also gave the justification for their response that is the scheme except its big size and manholes for field canals most of the structures are not different for the beneficiaries who exercised or observed in the nearby projects. The data analysis and the FGD lead us to conclude the physical structure is one of the contributors to the sustainability.

In addition to the suitability of the structures respondents were asked which canal type they prefer in accordance to endurance and durability from main canal, primary, secondary, tertiary and field canal and the closed PVC system or geo-membrane from their recent and surrounding experience. The response to this question can indicate the system's contribution to sustainability of the physical structure .



Graph 7: Structures Normality -Suitability

The beneficiaries from their short experience prioritized the canals based on their functioning see table below. The respondents response gives less rank for closed PVC canal, especially for the tertiary canal, because of the construction limitation, difficulty for maintenance by the beneficiary themselves frequency of breakage and easy clogging by debris.

The discussion with key informants reflects the beneficiaries are operating and expected to operate the tertiary levels which there are no complicated structure but due to the design and construction limitation some of the division manholes are beyond the capacity of the beneficiaries. The other main structures in the scheme are operated by the scheme management office which is equipped with educated manpower and gatekeepers.

Table 20: Beneficiary response for canal prioritization .

Variables	Category	Unit	Main Canal	Primary canal	Secondary canal	Tertiary canal	Field Canal	Total
Canal Prioritization according to Service	**Arsi**	%	56.7	0	23.3	0	20	100
	Kereyu	%	68.9	11.1	8.9	5.6	5.6	100
	Total	%	65.8	8.3	12.5	4.2	9.2	100
Canal Prioritization according to endurance	**Arsi**	%	85.7	0	14.3	0	0	100
	Kereyu	%	82	7.9	0	2.2	7.9	100
	Total		82.9	6	3.4	1.7	6	100

Statistically significant at 5% probability level

Environmentally, especially for water saving which is crucial issue in Awash basin, the project addressed water saving structures which can minimize evaporation and seepage after water is abstracted, Hence, the main canal more of it is covered by geo- membrane and closed pipe system due to high slope of the route for short length. The primary canals are also geo-membrane covered trapezoidal canal which can minimize the seepage whereas, secondary and tertiary canals are PVC in turn which can mitigate evaporation and seepage. The field canals are currently earthen but planned to be flexi-flume (OWWDSE,2009). The physical structures are by many are considered as sound in the context of environment and can contribute efficient water transportation to the irrigation by minimizing seepage and evaporation whereas few in number consider them as not suitable because of their fear on the durability and their inconvenience for cattle drinking.

4.2.3 Organizational Management

The software [Irrigation software] is characterized by individual/collective interest and management skill embodied in a lean organization of water users besides adequate support services. Lack of appropriate skill and commitments to accomplish mutual responsibilities on the water user's side, and inadequate organizational and management setup of the local irrigation scheme managers is the biggest constraint (Alamirew, 2008).

Irrigation performance has generally remained relatively poor--after widespread and repeated physical improvements, extensive training efforts and attempts to elicit farmer participation. This indicates that something else is more fundamentally constraining effective management. More attention is turning to the nature of the managing organizations themselves (Vermillion, 1991).

Vermillion (1991) also explained one lesson learned is that large government bureaucracies frequently are not very effective at managing irrigation systems without the help of farmers. This is particularly true where irrigation is managed more according to standard administrative procedures than by local, variable management needs. Many large agencies oriented towards construction have little experience in or motivation to achieve management performance standards acceptable to farmers.

The document review and FGD conducted for this project tells different stakeholders OADB, OWMEB, OPDC, and other stake holders were the actors of the project in their respective responsibility. All these stakeholders understanding the relvance are tring to play their own role: OWMEB is the client of the project in irrigation water supply, especially in design construction and supervison of the project by hireing contractor and consultant, OWWCE and OWWDSE respectively.The OADB took the responsibility of irrigation extension part where as OPDC plays on the integration of the livestock and irrigation in the context of pastoralist community social, cultural and econmic context. Other sectors also arranged their institution based on the irrigation project like health center, schools and so on.

Regarding Fentale Large scale irrigation joint approach, Irrigation schemes with mixed control or jointly managed Scheme with state enterprise scheme management and water user cooperative is under exercise (OWWDSE, 2009). Even if it is early to judge the institution on this scheme are effective or not at least the trend can be assessed in terms of water management conflict management and Decision making as explained by Haphoff Irrigation management model to which direction they are inclining.

4.2.3.1 The Organizational setup of OWWCE scheme Management

The scheme management office which is state enterprise is established in 2008 and started to function effectively with the commencing of Qawa block irrigation. The office is under the Oromia Water Works Construction Enterprise (OWWCE) and is given a mandate according to the Regulation No. 58/ 2006, Article 5 Sub Articles 1&2, to ''Build, Own and Operate (BOO)'' and Consequently, the Enterprise (OWWCE) will have direct responsibility for the Management, Operation & Maintenance (MOM) of the Main Canal and Secondary Canal Infrastructures and will have overall supervisory role for Tertiary and Quaternary Canals and infrastructures of Fentale Irrigation Scheme. In general, water management activities, which include operation, maintenance and collection of water charges/fees of Fentale Irrigation scheme, will remain under the responsibility of OWWCE (OWWDSE, 2009). OWWDSE justifies the joint management for the next 15-20 years of this project due to the scale of the irrigation and the experience of the community (OWWDSE, 2009).

The office is planned to be organized according the organizational structure designed by OWWDSE, (see Figure 8) to undertake the above responsibility with established water user cooperatives, joint stakeholder to manage the scheme. Currently, as of march 2003 Eth. C there are 16 water user cooperatives in the study area 5 in Arsi & 11 in Kereyu.

Table 21: Man power of the scheme management office

No	Job Title	Proposed No	Existing
1	General Manager's Office	4	2
2	Administration & Finance Service	14	3
3	Operation Division Head	13	**47
4	Maintenance Division Head	29	
	Total	***60**	

Source: (OWWDSE, 2009)

*Gate keepers and drivers are designed as required based on the gates and vehicles.

** Out of 47 staffs 29 are gate keepers

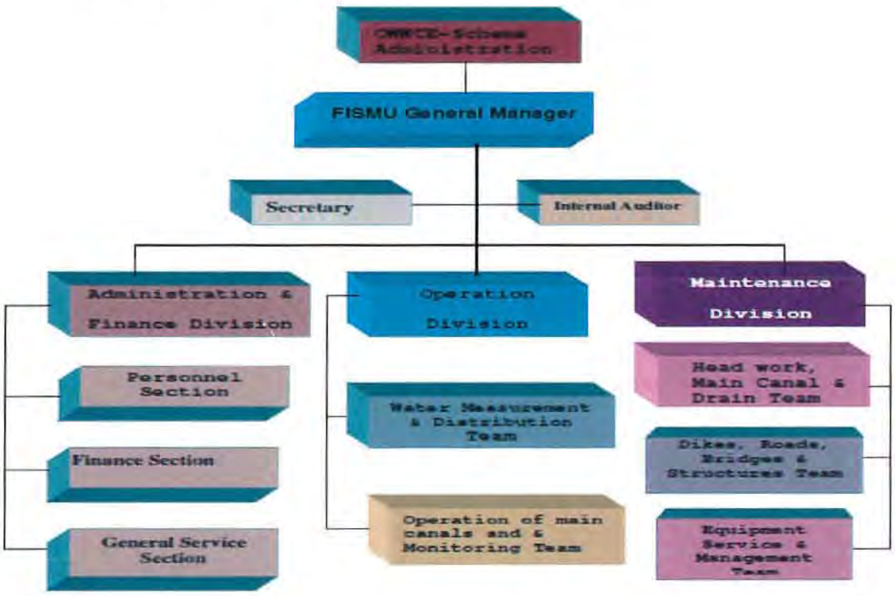


Figure 8: FISMU Organizational Structure

Source: (OWWDSE, 2009)

The existing condition for man power shows the adequacy at least in number for the 4000ha regardless of the quality of the staff.

4.2.3.2 The Organizational Setup of Water Users

Regarding the water user organization the OWWDSE operation and maintenance study report (2009) recommend the water user to be Irrigation Water users Cooperative (IWUC) with its limitations based on Regulation No. 115/2005-Ethiopian Water

Resource Management Regulation and Proclamation No. 147/1998-Cooperative Societies Establishment. In addition the document proposed IWUC to be established the on the base of secondary canals, and accordingly 10 IWUC are recommended, among the ten Qawwa- for Arsi, Birka, Direseden, and S.ilala were proposed for the study area.

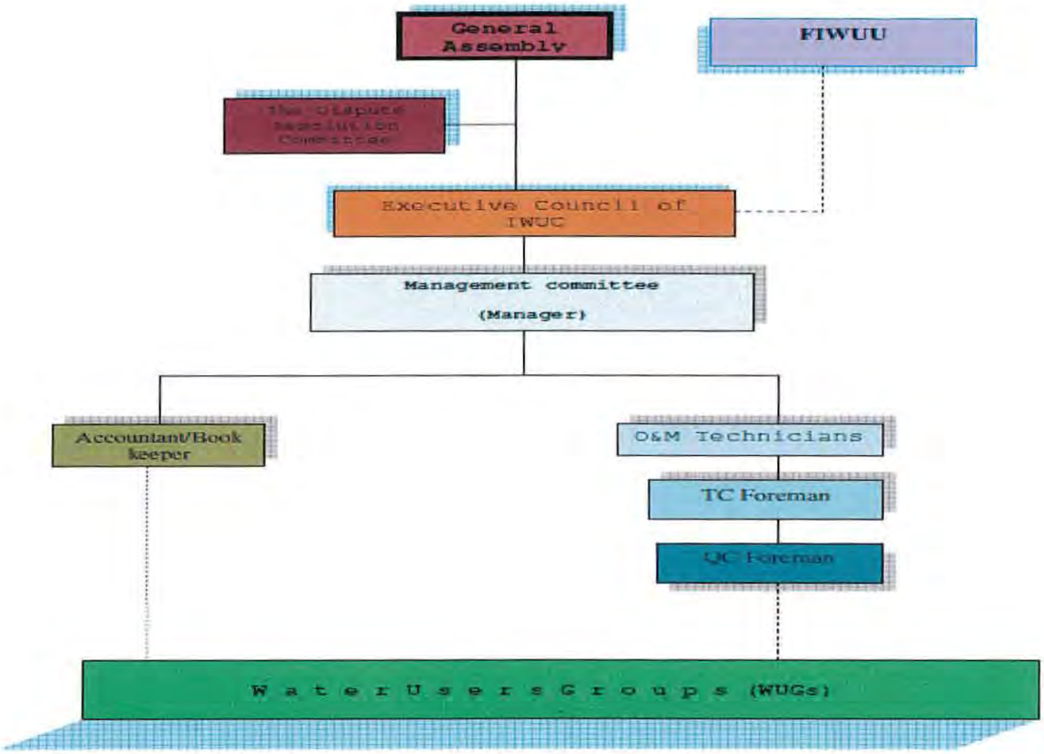


Figure 9:IWUC organizational structure

(OWWDSE O. W., 2009)

The IWUC is designed to be responsible for agricultural input supply, credit facilities, and marketing support, ware house for storage service and machinery and equipment service.

The researcher observation and FGD shows IWUC are not only established based on the secondary canal rather they consider the Kebele administration boundary, even in one kebele there are more than IWUC established based on proximity and secondary canal.

The existing IWUC are greater than the planned by 12 which the designed one made assumption in block. The existing condition shows that the cooperatives are at infant stage to undertake the designed duties and responsibilities but some of the cooperatives are relatively better than other when compared to each other.

4.2.4 Irrigation institutions Activities

4.2.4.1 Cause of Conflict and conflict Management

Almost all the beneficiaries are the members of one IWUC and IWUC have written bylaw, collected membership fee and are legally registered. When these IWUC examined in the context of conflict management, communication and decision we learned that the cooperatives are weak.

The result from the respondents about the cause for conflict, personal conflict experience and measures by the IWUC is tabulated below in tables.

Table 22: Conflict experience

Variable	Response	Arsi %	Kereyu %	Chi-value
Is there Water use conflict	No	23.3	11.4	2.599
	yes	76.7	88.6	
Have you faced conflict on irrigation	Yes	89.3	42.7	18.602
	No	10.7	57.3	
How many times per season you encountered conflict	1	42.3	8.0	
	2-4	34.6	20.5	27
	>5	15.4	15.9	

Livestock movement in the irrigation area, water theft and improper water use are identified as cause for conflict during the FGD, but in this research due to the limitation on the questioner distributed only livestock movements and water theft are addressed. The result shows 61.1 % of Kereyu and 93.3% of Arsi respondents responded the existence of livestock movement in irrigation sometimes and 22.2% of Kereyu and 6.7% of Arsi respondents responded there is livestock movement always in irrigation area. The result shows some difference between the two beneficiaries, especially on those who say always. The FGD clearly justified that this is because the canal system at Arsi is closed PVC where as at Kereyu it is open canal which attract cattle for drink.

When their service level is assessed Arsi beneficiaries witnessed their IWUC as 3% strong, 62% classified them as medium, 19% weak, 5% very weak, and none of them as very strong, whereas Kereyu respondents reflected their IWUC as 10% very strong, 21% strong, 42% as medium, 19% as weak and 8% Very weak .

The respondents categorizing can be seen through small indicators of the activity of the IWUC. One of the duties of the IWUC is the water management starting from the tertiary level that is to arrange water turn, to keep the beneficiary not to steal water, to minimize conflict and related issues.

Table 23: Cause of Conflict & penalty status

Cause of conflict & penalty status	Response	Arsi %	Kereyu %	Chi-Value
Conflict on livestock movement in irrigation area	No	40.0	20.0	
	yes	60.0	80.0	4.8
	yes	76.7	88.6	
Water theft	yes	100.0	94.4	1.682
	No	0.0	5.6	
Is there Penalty for misbehaving on irrigation	yes	16.7	75.0	31.766
	No	83.3	25.0	
Penalty enough	No	66.7	45.6	
	yes	3.3	36.7	17.055
	I don't know	26.7	8.9	

It can be seen from the respondents that there is a significant difference between the Arsi and Kereyu beneficiaries regarding whether the penalty is enough or not. The Kereyu beneficiaries believe the penalty is enough with 36.7% where as the Arsi beneficiaries believe the penalty is not enough at 66.7%. Regarding the Kereyu beneficiaries it is difficult to judge their attitude on penalty, but discussion with key informant shows strong family relationship plays a role against penalty.

The FGD discussion with two categories indicates that there is strong family relation among the Kereyu rather than the Arsi and this cause water theft not to be considered as a series issue and the punishment not to become strong among the Kereyu beneficiaries. On the other hand considering the water shortage they are facing and to minimize the risk of losing their crop the Arsi beneficiaries want strong punishment and strong IWUC. In addition to this their personal experience on conflict shows that the rate and occurrence of conflict is high at Arsi beneficiaries.

Table 24: Beneficiaries ranking of IWUC

Response (%)	Arsi	Kereyu Irrigation block					Total Kereyu
		Gidara	Dire seden	Tututi	Ilaala	Turo	
very Strong	0	11	0	0	0	30	10
Strong	14	0	11	0	27	60	21
medium	62	28	78	0	73	5	42
Very weak	5	28	4	13	0	0	8
weak	19	33	7	88	0	5	19

Statistically significant at 5% probability level

Other stakeholders institutions, such as OWMEB and OPDC , contribution on the water management is insignificant, where as the OADB is giving a technical assistance assigning a team of experts as of 2003.

In general as stated above both, the IWUC and the state owned Scheme management enterprise are at infant stage and even if their contribution for the sustainability of the project at this stage is not high, unless they are strengthen their capacity the institutional condition of the scheme will fail in jeopardy.

4.2.4.2 Cost recovery and O&M Fee

The ownership of an irrigation scheme depends on the budget of the scheme to run (Ankum, 1986). In dual management by two parties government and beneficiaries it requires budget sharing. The main irrigation fee in an irrigation scheme are cost recovery, water fee or service fee, O&M fee. In principle if the community completely pays the cost recovery the project ownership can be transferred to them and they are required only to pay water fee and O&M fee, but in most case this is not true because the communities are not able to pay all the costs and the subsides from the government are un avoidable.

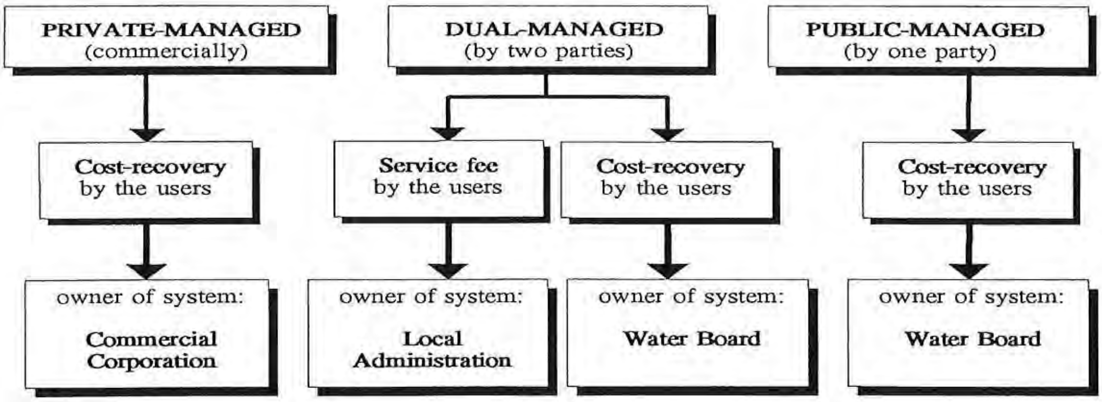


Figure : Irrigation Management (Ankum, 1986)

Irrigation fee in addition to the ownership issue it encourage farmers efficient use of water, better scheme management which contribute to better environmental condition.

In this context, On Fental irrigation project two types of irrigation fee are under collection, Cost recovery by the scheme management and O&M by IWUC. In this study their willingness to pay is asked and the following response obtained.

Table 25: willingness to Pay

Variable	Response	Arsi %	Kereyu %
	yes	100	100
Willingness to pay for cost Recovery	No	0	0
	yes	7	5
Willingness to pay for Operation and Maintenance	No	93	95
	yes	4	3
Willingness to pay for water service	No	96	97

5% statistically significant

The FGD on the willingness to pay indicates that the communities are 100% willing to pay for cost recovery and started to pay where as they are not willing to pay for cost recovery and water service. According to the FGD, this is because they have no trust on their IWUC and they do not have enough awareness on water service payment.

Table 26: Cost recovery in Birr

Duration	Cost Recovery		
	Planned	Collected money	Percentage
First quarter	500,000	98,000.00	19.6
Second Quarter	500,000	30,000.00	6
Third Quarter	500,000		0
Fourth Quarter	500,000		0
Total(Year)	2,000,000		0

The cost recovery was planned to be collected on each harvesting period 20000 Eth. Birr/ha, the HH beneficiaries are expected to pay 15,000 Birr and young irrigation owners are expected to pay 10,000 Birr. The cost recovery collection is not going as planned even if it is started due to different problems such as luck of systematic way of collection and luck of sensitization of the beneficiaries and others.

4.3 Water Use of the project

4.3.1 Water acquisition, allocation and distribution

Water measuring gauge is installed at downstream of the intake gate and water measurement data under collection twice a day by the Scheme management. Accordingly measurement data from 9/03/02 – 4/07/03[2] obtained from the Scheme management and processed in to monthly average. Regarding the quality of the data some data are missed but for the sake of this research it is filled with simple interpolation and checked with the scheme management office. The other issue related with the water measurement is the place of the gauge. The gauge was supposed to be installed where the flow is gentle but now it is placed where there is some hydraulic jump which makes the reading with some error.

To reach to sound result discussion was made with the observer how he made the record, accordingly the following water was abstracted from the river from May 2010 up to November 2010.

[2] Dates are according to Ethiopian Calendar

Figure 10: Water measuring at Head work

Table 27: Water abstracted from the river

No	Month in year 2002-2003	Average water abstracted monthly (m3/sec)
1	May/Ginbot	4.8
2	June/ Sene	5.5
3	July/Hamele	4.6
4	August/ Nehase	4.6
5	September/ Meskerem	6.0
6	October/Tikemet	6.1
7	November/Hidar	4.9
	Average	5.2

Simple arithmetic analysis tells us the gross water diverted from the river per hectare, dividing the diverted water to the area irrigated and this can be compared with designed CWR.

Table 28: Gross diverted water from the river

Month	Water diverted from the river (m3/sec)	Duty or amount of water diverted /ha
May /Ginbot	4.8	1.59
June/ Sene	5.5	1.82
July/Hamele	4.6	1.52
August/ Nehase	4.6	1.53
September/ Meskerem	6.0	2.02
October/ Timiket	6.1	1.61
November/ Hidar	4.9	1.73
December/ Tehases	5.2	2.00

4.3.2 Area covered with crops

Table 29: Irrigation area covered in June 2010-Novemebr 2010

No	Category	Irrigation Block	Potential Irrigable land (ha)	Area covered by crop (ha)	Crops planted			
					Maize	Onion	Tomato	Others
1	Arsi	Qaawwaa	798.5	764.25	434.25	283	47	0
2		Huluqoo	135.19	128.5	100.5	26.5	1.5	0
		Sub Total	**933.69**	**892.75**	**534.8**	**309.5**	**48.5**	**0**
3	Kereyu	Gidara	588.5	557.5	315	234	0	8.5
4		Turoo	684.5	263.5	131	124	0	8.5
5		Diree-Saden	717	609	431	152	26	0
6		Tututii	286.5	120.5	120.5	0	0	0
7		Ilaalaa	534.5	402.5	385	15	2.5	0
8		Debitii	343.25	181.5	181.5	0	0	0
		Sub Total	**3154.25**	**2134.5**	**1564**	**525**	**28.5**	**17**
Total			**4087.94**	**3027.25**	**2099**	**834.5**	**77**	**17**

Source: Fentale Irrigation Project Irrigation Agronomy technical team (2003)

The study area Irrigation is land was covered annual crops such as maize and Onion and Tomato. According to the FGD Maize was the dominant crop in the first two irrigation seasons to meet the immediate requirements of food of the irrigation beneficiaries.

4.3.3 Mode of Water allocation

The other important variable in the water distribution is the mode. The designed mode of distribution for this project at a whole is continuous at main canal, primary canal, secondary canal and tertiary where as rotation is for the field canal.

Rotational water supply system facilitates the means to distribute water to each plot according to the timely moisture requirement of the crop. The rotation completes its cycle within 7 days of the calculated irrigation interval. Maize and Sorghum requires the maximum irrigation interval of 22 days with the application of 133 and 140mm of depth of application of water respectively. Tomato and onion requires 41 and 21 mm of irrigation water respectively with in 7 and 4 irrigation interval days. Fruit is to be irrigated 128 mm of depth of water within 22 days irrigation interval. There for, for practical reasons, the calculated irrigation intervals are adjusted to a maximum of 10 days and minimum of 7 days (OWWDSE O. W., 2009)

The practical observation on the ground shows Main canal, Primary canal, Secondary canals and long tertiary are running continuously, where as short tertiary and field canals are under rotation. To attain the objective of the design it is very difficult at least without similar crop colander and crop pattern in the smallest unit of the irrigation, tertiary. This makes the farmers request for water unorganized.

Table 30: Resemblance of mode of Water Distribution

Mode	Arsi(%)	Kereyu (%)	Total (%)
crop based	10	14.4	13.3
Demand based	0	8.9	6.7
Land size based	6.7	24.4	20
Turn based	80	43.3	52.5
Crop and Turn based	3.3	0	0.8
no method	0	8.9	6.7

Statistically significant at 5% probability level

4.3.4 Water distribution Management

The water distribution management of one irrigation scheme is the deciding variable for the sustainability and efficiency of an irrigation project, especially equitable or proportional sharing, based on adequate water plays great role for sound water distribution management.

Fentale Large Scale Irrigation in respect to the availability of enough water for their plot among total respondents of Arsi 97% , among Kereyu respondents 42% witnessed the existence of water shortage for their plot where as 44% of Kereyu and 3% of Arsi beneficiary responded as there is no shortage of water for their plot.

Table: Water shortage on individual plot

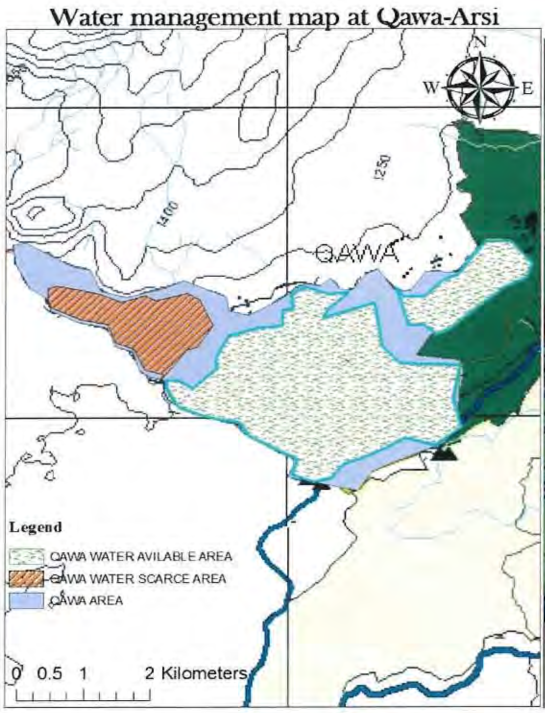
Variable	Response	Arsi	Kereyu	Total	Chi-Value
Is the irrigation water shortage in your plot	No	3	58	44	27.046*
	Yes	97	42	56	

- Statistically significant at 5% percent probability level.

FGD with different stake holders confirms the respondent's response coincides with fact on the ground. For Arsi beneficiary's shortage of water is more related to the pump failure to produce enough water due to silt on the suction pool, which once in every five to seven days silt removal is undertaking currently by manpower and machine. In addition the basic distribution structure, tertiary canal construction problem in delivering water to the plot is also the key factor for their lack of enough water. Whereas for Kereyu beneficiaries, the FGD and field observation shows that the water shortage in their plot is due to the problem of the tertiary canal construction, an elevation difference problem to supply water for the plots through the manhole constructed for delivering water to individual plots, rather than water shortage in the whole system. In addition both beneficiaries complain on the gate keeper's management of the water distribution. Some of the Kereyu farmers believe that the gate keepers are giving water without the planned turn for those who give them small money.

Regarding Water sharing 97% Arsi beneficiaries believe the water distribution is not proportionally within the users and only 4% responded it is proportional. 56% of Kereyu responded water distributed is proportional among users where as 44% do not believe this. The overall project sample shows 57% of the respondents are in favor of "not proportional distribution" where as 43% believe there is proportional distribution.

The water distribution problem is significantly magnified in Arsi users. The FGD & key informant discussion resulted conducted find out that this is because of the water shortage due to pump and this made them sensitive for the water distribution. The main reason for inconsistent/ un proportional distribution counted 24% & 20% due to crop type for Arsi & Kereyu respectively, 17% of Arsi & 26% Kereyu responded management as the case and 10% & 28% said nearness to the canal of Arsi and Kereyu respectively is the reason for un proportional distribution. The FGD also shows relatively remote or outskirts areas of the irrigation are not getting water sustainably.



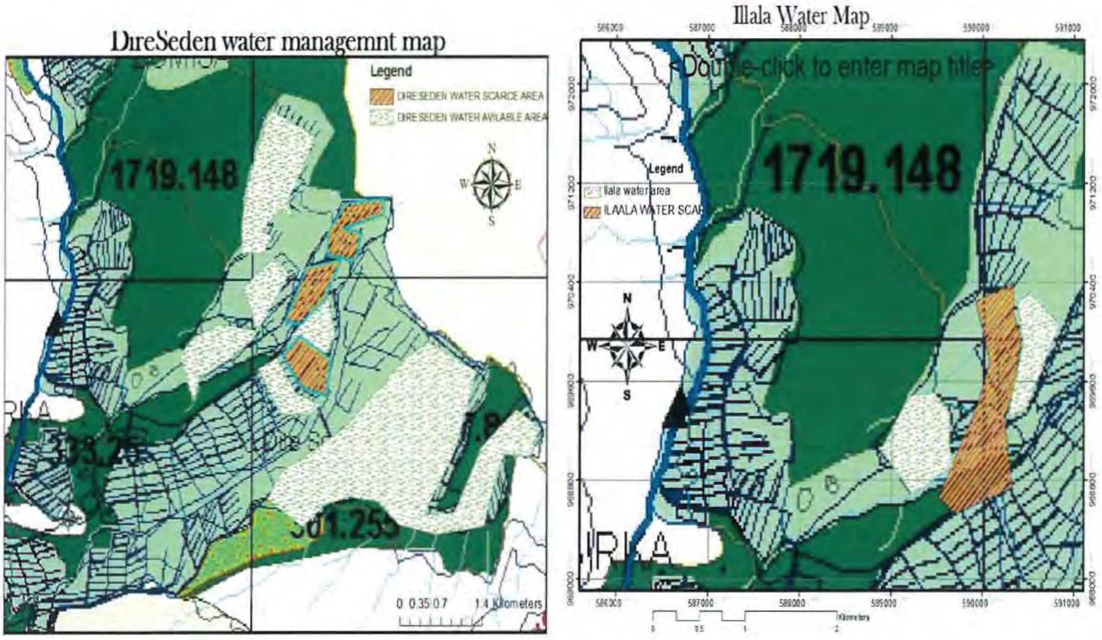


Figure 11: Existing Water distribution maps

4.3.5 Project performance

A major part of irrigation management is deciding when to irrigate and how much water to apply. Many irrigation projects throughout the world never fulfill the expectations envisioned at planning and design stages. The land eventually irrigated is often less than planned, efficiencies are lower, and crop yields are not as high as expected. A major reason is the lack of incentives and a working knowledge about proper water management, including scheduling at the farm level on the part of project planners, designers, system operators, and agricultural personnel, as well as farmers (Hoque)

Large water use and low efficiency, environmental concerns are usually considered the most significant problem of the irrigation sector (Ximing Cai, 2001).

Looking at Fentale Irrigation project performance in respect to water use and its efficiency and unit water productivity can indicate the place of water towards the sustainability of the project and its environmental concern. Accordingly in this research, the researcher collected the amount water abstracted from the river, the land irrigated by this water and the production obtained. In addition it is compared with the designed crop water requirement. The analysis made on the water diverted and designed CWR indicates the existence of water loss. When we see the gross water use efficiency taking 1.14 li/sec/ha for all months as average, it ranges from 33% - 77% and have an average 51.49% loss in the 3027ha.

Table 31: Water diverted Vs designed CWR

	Month	Water diverted (li/sec/ha)	Designed CWR of the project li/sec/ha	Excess li/sec/ha	Excess water in %
1	June/ Sene	1.82	1.14	0.68	59.36
2	July/Hamele	1.52	1.14	0.38	33.53
3	August/ Nehase	1.53	1.14	0.39	34.06
4	September/ Meskerem	2.00	1.14	0.86	75.06
5	October/Tikemet	2.02	1.14	0.88	77.48
	Average	1.73	1.14	0.59	51.49

Taking each month designed CWR and looking in to the water loss, the result is very high. 332% in June is recorded as maximum and 75% minimum water loss.

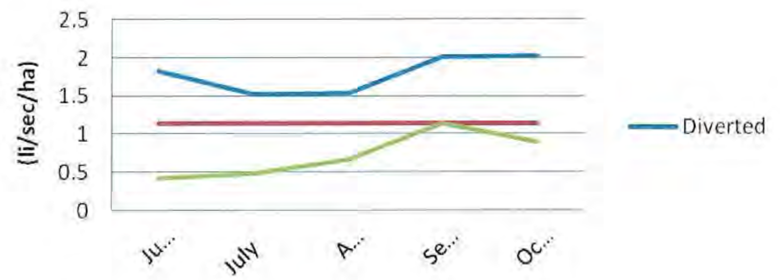
Table 32: Water loss based on monthly CWR

Month (2002-2003)	Diverted water ((li/sec/ha)	Designed CWR (li/sec/ha)	Excess water (li/sec/ha)	Excess water %
June	1.82	0.42	1.40	332.54
July	1.52	0.48	1.04	217.14
August	1.53	0.66	0.87	131.56
September	2.00	1.14	0.86	75.06
October	2.02	0.89	1.13	127.34
Average	1.73	0.36	1.37	379.73

In general the water use efficiency of the project shows the scheme is under low efficiency. Having this efficiency and running the scheme expansion may create water conflict not only in the scheme but also with downstream user of the river. The FGD explains the water loss was because of weak irrigation practice of the beneficiary, constant water release by the scheme management day and night and throughout the irrigation season undefined crop pattern and crop calendar of the community.

Currently the scheme management started to reduce water to be released at night time. Even only with this measure not having planned crop calendar and crop pattern the water loss will not be controlled.

Graph 8: Water diverted Vs Designed CWR (average & Monthly)



4.3.6 Drainage

Drainage or proper excess water removal is another variable of water management in Irrigation. Regarding excess water Arsi and Kereyu respondents responded in majority at 90% and 66.3% as there is no excess water drained from their plot but significant amount of respondents from the Kereyu beneficiaries, 33.7% and 10% from Arsi responded the existence of drained water from their plots.

This study witnessed drainage from irrigation canals and inundating roads and running to downstream to Lake Baseka. Though it was not possible to indicate the amount of excess water which is draining to Lake Beseka in measurements but the existence of the drainage is confirmed with Key informant, from Awash basin Authority experts, community and GOs including the researcher eye observation.

4.4 Critical Environmental Concern

Modern water development schemes have often become arenas of multiple conflicts, of which the following are worth noting. a) There is conflict among water users over water allocation, land rights, or maintenance issues. b) Conflict may arise between users and the authority responsible for the project over inappropriate design of infrastructure, peasant relocations, water charges, or management issues. c) Conflict between project beneficiaries and non-beneficiaries is often inevitable. The latter often question the justice of being excluded from the benefits of water projects. Indeed, project beneficiaries are frequently considered enjoying special privileges that are denied other households without any justification. d) Finally, there is conflict between donor agencies and the recipient country over design, management, environmental impact, and financial issues (Rahmato, 1999). The three mentioned variables for conflict in irrigation as mentioned above are crucial, but in this paper the researcher tries to address first, respondents are asked to prioritize based cruciality, scarcity of the environmental component. The respondents responded water, agricultural and pasture land are identified in their prioritization and in addition salinity is discussed as it is the normal problem of irrigation. After all these identified factors for critical environmental concerns are discussed in the VSTM matrix is discussed (See Appendix).

Graph 9: Natural Resource according to the respondent's prioritization

Table 33: Critical Natural Resource based on respondents

(1% statically significance and chi-square value 12.697)

Natural Resources	Arsi %	Kereyu %	Total %
Agriculture Land	13.3	37.8	31.7
Forest	6.7	7.8	7.5
Livestock	3.3	0.0	0.8
Pasture land	0.0	6.7	5.0
Water	76.7	47.8	55.0

Even if the respondents response for the critical environmental concern gave less attention for pasture land the researcher incorporated the pasture land because of the social, cultural, and economical impact on the of Arsi and Kereyu explained in FGD.

Table 34: Natural Resource based on scarcity according to the respondents

Natural resource	Arsi %	kereyu %	Total %	Chi value
Agricultural land	6.7	12.2	10.8	
Forest	13.3	43.3	35.8	
Pasture land	33.3	38.9	37.5	33.8
Water	43.3	4.4	14.2	
ALL	3.3	0.0	0.8	
Other	0.0	1.1	0.8	

5 % statistical significance

In addition salinity is also discussed as critical environmental concern due to its normality in all irrigation and the location of the project in rift valley. After the critical environmental concerns are identified based on the questioner applied for this research as stated below in the table, factors for critical environmental concern were identified based on FGD and the questionnaire distributed to respondents. The result shows Irrigation expansion and population increase are responded as the major factor by 52.5% and 27.5% respectively. Hence these factors are discussed in the VSTM matrix.

Table 35: Factors for critical environmental concern according to respondants

Cause	Arsi %	Kereyu %	Total %	Chi value
population increase	36.7	24.4	27.5	
Irrigation expansion	30.0	60.0	52.5	
grazing land expansion	3.3	0.0	0.8	10.8
Fuel consumption	20.0	8.9	11.7	
Poor utilization natural Resource	10.0	6.7	7.5	

5% statistically significant

The discussion and the findings are summarized in VSTM matrix below:

In general water, irrigation land, scarcity of pasture land and salinity are identified a critical concern considering expansion of irrigation as a common contribution factor (see details of the VSTM matrix in appendix).

5 Conclusion and Recommendation

5.1 Conculsion

The research conducted on Fentale large Scale irrigation project shows that the project is relevant not to the direct beneficiaries only but also for the country food security program in terms of food production, job opportunity and improving the life standard of the beneficiaries. The request from the community for the project, the public consultation conducted, allignment with the country polciy PASDEP & GTP can contrbuite for the sustainability of the project. The collected data from the community confirm this, communites of kereyu and Arsi at 94.4% and 73.3% respectively strongly confirm the need and relvance of the project.

Irrigation landownership which came from land distrbution which incorporates the young – male & Female, HHs including female headed played great role again for the sustainability.

Parallel Design and construction approach, which is exercised in the region on this project resulted an immediate economic impact and it can be said environmentally sound. The geo-membrane and PVC canals are water saving but the design approach is not without limitations on design construction quality and environmental impact mitigation. These quality problems and negative environmental impact were observed on some of the structures which were not constructed in accordance of the elevation difference that resulted water scarcity in some plots and in the division manholes which are not working well.

The water use analyses indicates scarcity of water at some plots, excess water abstraction, undefined mode of water distribution and other problems which are against the sustainability and good water management. No water planning in participatory approach, at least some mode water distribution in tertiary block. This resulted again undefined water abstraction. Even if the data is not enough to assess the water productivity current observation shows beneficiaries are not aware of the opportunity cost of the water.

The attention given for livestock in the project is not satisfactory which is crucial for the community pastoralist life. Insignificant forage production activities only on 2.5ha and cattle trough are the evidence. 60% & 80% of Arsi & Kereyu respondents confirmed the conflict due to livestock.

The project performance against one irrigation performance indicator shows the existence of 51.5% water loss considering the average CWR and more compared to monthly CWR. The water distribution analyses showed the existence of significant area that are not getting water sufficiently with 97% of Arsi and 42% Kereyu.

The institutions of irrigation schemes which are very crucial for sustainability and the environmental security are at infant stage. This study shows both the public agency and the IWUC are weak in capacity to manage the scheme as intended in the planning.

Lastly, the critical concern analysis resulted water, irrigation land, pasture land and salinity as critical concern taking all the irrigation expansion as factor.

5.2 Recommendation and Policy Implication

For the sustainability and maximizing the project limitations addressed in this paper requires proper response. Based on the findings explained in this document the researcher recommendation stated below:

Regarding the parallel approach room has to be given for proper environmental impact assessment in order to address the negative impacts. The physical structures problem has to be solved or improved for efficient, effective and equitable water use. In addition measures such as check, approval and verification of the design on the ground before construction are advised to avoid the problem of design and construction before implementation and this gives room at least for environmental impact mitigation.

Proper cropping calendar and cropping pattern with defined mode of water distribution at least at tertiary block have to be practiced so as to minimize the water loss which is certified in this paper. Moreover for proper operation and evaluation of the scheme water measuring structures or tools are inevitable. Unless this is done it will be difficult to know the project is whether effective and efficient or not.

The determinant variable in this project that needs attention is modern livestock production with modern forage productions, which are not benefiting from the project and observed as a weakness. These have to be addressed by providing enough cattle trough at proper place and expand the started trial forage production in large scale with the community consultation. These contribute for the proper water management by decreasing the point of conflict in the project management.

Capacity building of the irrigation institutions, scheme management and IWUC, in respect to operation, maintenance, irrigation fee collections and mitigation of negative environmental measures are crucial. Hence, maintaining the non functional structure, silt removal from the suction pool, controlling excess flow water, cost recovery collection and formulating one or more mode of water distribution require urgent measure. Capacity building in manpower, machinery, and vehicle and irrigation water management knowledge is required for the agency where as restructuring the IWUC according to the designed document, in secondary level rather than kebele administration may bring change. This has to be supported with educated manpower. In addition the beneficiaries have to be trained in operating and maintenance at least for some part of the physical structure. Capacity building and encouraging the beneficiaries to pay the Cost recovery makes the project more sustainable and environmentally sound. This can develop the confidence of the community on their Water user organization and empower the IWUC for effective and efficient water use.

To minimize the impact of the critical environmental concern proper irrigation management such as water saving irrigation, proper land use incorporating forage production and understanding the opportunity cost of water inevitable. Strengthening the IWUC and Scheme management office is must for environmental and social sustainability of the project. The management can be proper if only and only all stakeholders in irrigation play their role from their bottom of heart.

Lastly, policy gap in different irrigation fee decision especially how to decide & how to collect, ownership of large scale irrigations especially after cost recovery is paid, role of the regional water, agriculture, pastoralist development bureaus are observed. Looking at the experience of other regions in the country and other countries these gap has to be filled.

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7 LIST OF APPENDICES

7.1 Appendix VSTM matrix

Water

Water as critical environmental concern with contributing factors

CONTRIBUTING FACTOR: 1.Irrigation Expansion						
VSTM	ECONOMY	THECHNOLOGY	GOVERNACE	NATURAL	SOICAL	OTHER
Vulnerabilities (Inherent/existing)	Become source of income	Irrigation Expansion	Weak water Management		Irrigation water use for livestock from the canal	Irrigation water drainage to Beseka Lake
Stressors (existing)	Irrigation interest increased	Climate change	Water theft		No cattle trough	
Threats (potential)			Conflict within irrigators, IWUC & Scheme Management		Conflict with irrigators	Conflict with Awash basin administration
Mitigations (existi. and potential)	Training on proper irrigation	Exercise Water saving Irrigation	Strengthening IWUC and scheme Management		Construction of cattle trough	Exercise Water saving Irrigation

Irrigation land

Irrigation Land as critical environmental concern with contributing factors

CONTRIBUTING FACTOR: Irrigation expansion						
VSTM	ECONOMY	THECHNOLOGY	GOVERNACE	NATURAL	SOICAL	OTHER
Vulnerabilitie s (Inherent/exis	Share irrigation workers	Irrigation expansion	Land distribution		Population pressure	Land was considered as common good for pasture
Stressors (existing)	Land value increased	Irrigation facility constructed but capacity on management is weak	0.5 ha/ young & 0.75ha/ HH is distributed but still there are communities who didn't get land		No enough irrigation land in one kebele to be distributed to all HH & youngsters	Pasture land is distributed for irrigation and livestock area decreased
Threats (potential)	Conflict b/n share holders	Conflict with the scheme management	Conflict with district administration		Conflict with district administration	Conflict with irrigation users
Mitigations (existing and potential)	Capacity building of land owners to do it by themselves	Strong IWUC	Land allocation in another block or Kebele		Land allocation in another block or Kebele	Modern forage production system and implementing the designed land use plan

7.1.1 Scarcity of Pasture land

Pasture land as critical environmental concern with Irrigation expansion contributing factors

VSTM	ECONOMY	THECHNOLOGY	GOVERNACE	NATURAL	SOICAL
Vulnerabilities (Inherent/existing)		Lack of modern forage production	Administrative boundary	Non irrigation area are not suitable for grazing	Youngsters started to do their own irrigation rather than herding
Stressors (existing)		Forage land is possessed by irrigation	Pastoralist movement	Camels require tree, shrubs etc	Nomadic culture
Threats (potential)			Conflicts with other coomunities		Conflict among family
Mitigations (existing and potential)		Modern forage production system and implementing the designed land use plan	Reducing number of camels & Cattles	Planting trees in forage and mountain areas	Reducing number of camels & Cattles

7.1.2 Salinity

Salinity as critical environmental concern with contributing factors

VSTM	ECONOMY	THECHNOLOGY	GOVERNACE	NATURAL	SOICAL
Vulnerabilities (Inherent/existing)		Irrigation water application problem	Equal and continuous water release		
Stressors (existing)			No mode of water distribution		
Threats (potential)		Soil bareness	Salinity & level increase in Beseka lake		
Mitigations (existing and potential)		Proper water application	Controlled water allocation		

7.2 Appendix: Sample respondant survey questionnaire

Addis Ababa University

School of Graduate Studies

College of Development Studies

Department of Environment, water and Development

A questioner designed for sampled farmers

Dear respondents,

The principal objectives of this questionnaire is to understand critical environmental concerns of Fentale Irrigation Project, such studies on the first community based large scale irrigation are useful to the planers and decision makers to draw the most appropriate irrigation development plans, which are based on food security, farmers needs and priorities. You are kindly requested to give an answer freely and openly .any information you give is to be kept confidential. Thus, your cooperation is very necessary to achieve the desired goal of the study.

Thank you for your cooperation in advance

SECTION I

Questioner for Individual Beneficiary

1. General

1.1. Research Site: Region.................. Zone .... Districts.......................................

PA.............................Village........................Irrigation Block....................

Interviewer full name: ....Date of Interview.....................

Time of Interview...

1.2. Respondent identification number ....

1.3. Household Head:

a) Full name ....

b) Sex: 1) male 2) female

c) Age:............(years)

d) Marital Status: 1) married 2) single 3) divorced 4) Widowed

1.4. Clan background

1) Kereyu 2) Arsi 3)Other, Specify -------------

1.5. Educational status

1 . Reading and writing 2. First cycle 3. Second cycle 3.high school 4. Other, specify ....

1.6. Family Characteristics: How many family members do you have... .....

1.7. Structure of the family:

Age category	sex		Level of education see above
	male	female	
≤ 14			
From 15 to 32			
From 33 to 65			
➢ 65			

1.8. What is the type of house you own and live in?

1) Pastoralist traditional house 2) Corrugated iron roofed

1.9. What type of irrigation system you have?

1 . Gravity 2. Pump 3. Both

2. Land resources and utilization

2.1. Do you have land for production and other activities?

1) Yes 2) No

2.2. If yes, provide the following information about your all land holdings for 2003 E.C year

No	Type of Land use	Owned/ non-owned		Area (amount) in	
		Owned	Non-owned	Local (tinde)	Ha
	1	2	3	4	5
1	Homestead				
2	Cultivable				
2.1	Irrigation land				
2.2	Rain fed				
2.3	Fallow				
5	Private Pasture				
6	Common grazing				
7	Other/specify				

2.3.How do you get the irrigation land?

1. Succession
3. Land distribution
4. If any system, specify it_______

2.4. For what purpose have you used your irrigation land?

1. Seasonal crop
2. Food crops
3. Grazing land
4. Cash crop
5. Any other specify_______

2.5. What is the fertility of land on which you are irrigating ?

1. Very good
2. Good
3. Bad
4. Very bad

2.6. What kind of labor you do you use for irrigation activities?

1. Only manpower
2. Oxen
3. Tractor
4. other, specify ____________

3. Relevance of the project

3.1. What do you think is the benefit of Fentale irrigation project?
   3.1.1. For human
   3.1.2. Gender wise
   3.1.3. For livestock
   3.1.4. For other
3.2. What do you think is the limitation of the project?
   3.2.1. For human
   3.2.2. Gender wise
   3.2.3. For livestock
   3.2.4. On other

3.3. Is this irrigation project important to you?
   1 . Very much   2. Normal   3. Not that much   4. Completely not

3.4. Is this irrigation project benefiting your livestock (Cattle, camel, goats, etc)?
   1 . Very much   2 . Much   3. Note that much   4. Completely not

3.5. Is your life changed after you start to use irrigation?
   1 . Yes   2 . No

3.6. If yes what is/ are the indicators?
   1 . Construction of new house   2. Sending children to school   3. Food variety   4. Income increase   5. Other please specify ______________

3.7. Are you willing to pay for the following?

1 . Project cost recovery	1. Yes	2. No
2. Operation & maintenances fee	1. Yes	2. No
3 . water service fee	1. Yes	2. No

4. Effectiveness of the project
4.1. Is your over all annual crop production increased?
   1 . Yes   2. No

4.2. Do you follow the proposed crops from the project?
   1 . Yes2. No   3. Sometimes

4.3. If you answer for question 3.2 is no, why ?

1 . I don't know the proposed crop

2 . I don't have the experience

3 . I don't have the capacity

4 . I do have my own choice

5 . Other, specify________________________________

4.4. If Yes for Question 2.1 which crops production are increased? (Only main crops)

No	Type of Crop	Agricultural land	Previous Production/ ha	New Production/ ha
1				
2				
3				
4				
5				

4.5. Are your livestock benefiting from the irrigation project directly ?
1 . Yes2 . No

4.6. If your answer for question 3.5 is yes how ?
1 . By forage production in the project 2. By residue 3. By direct access to water through cattle trough Other, specify________

4.7. If your answer for question 3.5 is no, why ?

1 . There is no forage production in the irrigation project currently

2 . There is no direct access for livestock water/ cattle trough project currently

3 . The project is not favorable for livestock

4 . other, specify

5. Efficiency of the project

5.1. Do you think the Irrigation is enough for the project?

1 . Yes 2. No

5.2. Is there water shortage for your plot?

1 . Yes 2. No

5.3. If your answer for the above question is yes why you do think is the reason?

1 . There is shortage of water in the river 2. There is shortage of water in the pond 3. The pump capacity is small 4. Water distribution management is poor 5. Water conveyance system is not functioning well (specify) which canal (branch, Main, secondary, tertiary)

What is the mode of water distribution?

1. Crop type 2. Land size 3. Type of irrigation (gravity/ pump)

4. Other, specify -----

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

1 .Yes 2. No

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

1 . Ethnicity 2 . Gender 3. Political Power 4. Religion 5 . Crop Type 6. Management problem 7. Nearness to the main water canal

7 .Others/Specify ____

5.6. Are you able to get the amount of product you planned to get?

1 . Yes 2. No

5.7. If Yes for the above question do you think it is related with water?

1 . Yes 2. No

5.8. How? (for the above question)

1. There was excess water 3. There was enough water

4. Other specify

5.9. Which of the canal system is working well in this project?

1. Primary 2. Main 3. Secondary 4. Tertiary 5. Field canal

5.10. Why do you think this canal is working well?

1. Because it is under the management of OWWCE
2. Because it is under the management of the community
3. Because it is constructed properly
4. Other, specify

Critical environmental concern

5.11. Which environmental component is very crucial for your life? Put in order

1. Land 2. Water 3. Forest 4. Minerals

5. If any specify________

5.12. Which resource you think is short in your area?
1 . Water 2. Agriculture land 3. Pastor land 4. Forest
5. Other specify ____________

5.13. Why you think it is scarce/short
1 . Population increase 2. Irrigation expansion 3. Infrastructure expansion
4. Other specify

5.14. From where are you getting water for your consumption? (Multiple answers are possible)

1. Rain fall 2. From Hawas River 3. Ground water from your locality

4. The project 5. Any another, specify_____

5.15. If you give multiple answer for Q. 3.1 prioritize them

1.______________ 2.________________ 3.______________

5.16. What are the primary uses of water?

1. Agriculture, 2. Domestic, 3. Industrial, 4. Other, specify

5.17. Is there water shortage for human drinking?
1.Yes 2. No

5.18. If your answer is yes for Q.3.4 give reason

____

____

______

5.19. Is there water shortage for livestock?
1.Yes 2. No

5.20. If yes what do you think the cause for shortage of water ?

1. Scarcity 2. Management 3. Accessibility 4. Other, specify---

5.21. Is the shortage seasonal or all the time

1 . Seasonal 2. Always 3. I don't know

5.22. Is there the practice in which livestock walk about in the irrigation/irrigated area or the scheme structure?

1 . Always 2. Sometimes 3. Never

5.23. If there is why do you think is the reason?

1.to drinking water from canal 2. To grazing during fallow periods 3. To eat on crop residue after harvest 4. To pass to the river

5.Intentionally left by the livestock owners 6. Others/specify ___

5.24. If yes to Q. No.7.12, what damages do they cause in the scheme?

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

3 .They cause soil compaction 4.Others/specify____________

5.25. Did you came across when people conflict on such practice (Q. 7.12)

1. Yes 2. No

5.26. Do you think the climate change has an effect on the water availability?

1 . Yes 2. No 4. I don't know

5.27. Do you think the irrigation project can impact the livestock in negative way?

1 . Yes 2. No

5.28. If your answer is yes how
____

5.29. Do you think the irrigation water use can create conflict?

5.30. 1 . Yes 2.No

5.31. If your answer for Q. 3.14 is yes with whom do you think the conflict will be?

1 . Among the beneficiaries 2. With D/s users

3. With U/S users 4. With 1 & 2

5. With 1& 3 6. With 1, 2 & 3

5.32. Why do you think is the water for is the cause for conflict? Because of

1 . Scarcity of water 2. Water Management 3. Water theft

4 . other, specify

5.33. Do you think that soil erosion is an environmental problem in the project area?

1 . Yes 2. No

5.34. If your answer for question 6.18 is yes, why ? because
1 . Irrigation water management problem 2. Irrigation system (furrow or flooding) 3. Structure problem

5.35. Whom, do you think; does the water in the river belong to?
1 . To you 2. To Upstream people 3. To downstream people
4 . To all of the above 5. Other, specify ____________________

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

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

1. Yes 2. No

5.38. If yes to Q 7.27 how many times in an irrigation season would it be approximately? ____

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

Case Cause

1. ________________ 1. ________________________________
2. ________________ 2. ________________________________
3. ________________ 3. ________________________________
4. ________________ 4. ________________________________
5. ________________ 5. ________________________________

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

Water allocation = 1 Water distribution = 2

Storage sharing = 3 Land redistribution = 4

Others/Specify ______ ______________________________=5

5.41. What is the main source of livelihood for your household?
1.On farm 2.off farm

5.42. what is the main source of grazing land?
1. own land 2. Government land 3. Relatives 4. Communal land 1 5. Rented land

6. any other specify_______

5.43. Do you fill that your farm lands are sufficient to satisfy your family basic needs?

1. Yes 2. No

5.44. If your answer for the above question is no, where did you get other sources of income to fill this gap?

1. selling of fuel wood (charcoal) 2. Labor work at plantation 3. weaving

4. Carpentering 5. trading 6. swing clothes

7. other daily work, specify

5.45. How much birr do you get in your household average annually? _____

5.46. Do you think that currently the productivity of your irrigation land has decreased?

1. Yes 2. No

5.47. If you say yes the above equations what is/are the main reasons?

A .ageing of land B. loss of nutrients C. little or no use of following

D other specify

5.48. Is there water logging in your irrigation command?

1 . Yes 2 . No

5.49. Was there signs of salinity in your irrigation before the project ?

1 . Yes 2. No

5.50. Is there signs of salinity in your irrigation after the project?

1 . Yes 2. No

6. Institutional

6.1. Is there any water organization in your irrigation area?

1 . Yes 2. No

6.2. If yes, what it is?

1 . WUA 2. WUC 3. WUG 4. Other, specify ___

6.3. Do your water organization has bylaw

1. Yes 2. No

6.4. Are you a member of water user association

1 . Yes 2. No

6.5. Have you paid membership payment for your water organization?

1 . Yes 2. No

6.6. Have you started to pay project cost recovery?

1 . Yes 2. No

6.7. Do You pay operation and maintenance fee (such as for fuel e,t.c)?

1 .Yes 2. No

6.8. If you pay water fee, how do you pay? Based on ______

1 . The land size 2. Crop type 3. Water amount 4 . Quta 5. Other, specify_

6.9. How do you get irrigation water?

1 . Gravity 2. From the first pump /Pond

3. From second pump /pond

6.10. Is there water theft (using without turn)?

1 .Yes 2. No

6.11. If your answer is yes for the above question? Is there punishment by the water organization?

1 . Scarcity 2, Management 3, other, specify

6.12. Do you think the punishment is enough?

1 . Yes 2. No

6.13. How do you see your water organization?

1 . Very Strong 2. strong 3. Medium 4. Very weak 5. Weak

6.14. The water user organization can manage the project starting from

1 . Headwork 2. Branch canal 3. Main canal 4. Secondary canal 5 . Tertiary canal 6. Field canal

6.15. Do you think the following irrigation facility is manageable in your level?

6.15.1. Head work	1. Yes	2. No	3. I don't know
6.15.2. Branch Canal	1. Yes	2. No	3. I don't know
6.15.3. Main Canal	1. Yes	2. No	3. I don't know
6.15.4. Secondary Canal	1. Yes	2. No	3. I don't know
6.15.5. Tertiary Canal	1. Yes	2. No	3. I don't know

6.16. Are you able to operate the following gates?

6.16.1. Head work intake gate	1. Yes	2. No
6.16.2. Branch canal gate	1. Yes	2. No
6.16.3. Main Canal gate	1. Yes	2. No
6.16.4. Secondary canal gate	1. Yes	2. No
6.16.5. Tertiary canal gate	1. Yes	2. No
6.16.6. Field canal gate	1. Yes	2. No

6.17. Which of the following canals can you or your WUA can maintain or rehabilitate

1 . Branch canal 2. Main Canal 3. Secondary Canal

4 . Tertiary canal 5. Field canal

6.18. Is your water user organization committees report to the members about their activities and plans?

1 . Yes 2. No

6.19. If Yes, when or the frequency of the time?

1 . Once a year 2. Once a month 3. Once in three month

4. Other specify______

6.20. If no why they didn't call meeting?

____

Declaration

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

Declared by:

Yohannes Geleta

Candidate

Confirmed by

Advisor