INDIRA GANDHI NATIONAL OPEN UNIVERSITY, MASTER'S PROGRAMME IN RURAL DEVELOPMENT, NEW DELHI

ASSESSMENT ON THE IMPACT OF IRRIGATION-BASED AGRICULTURE ON FOOD SECURITY IN SEMI-ARID AREAS: With particular Reference to Tibila Irrigation-Based Integrated Development in Oromia Regional State, Ethiopia

A Thesis Submitted to Indira Gandhi National Open University, New Delhi, in partial fulfillment of the requirement for the Degree of Master's of Arts in Rural Development

By: Megerssa Fida Gemeda
Enrollment Number: 109100694
Telephone: +251-911- 48- 77- 97(Addis Ababa)

May,2013
Addis Ababa, Ethiopia

This is for the partial fulfillment of the Master's of Arts (M.A) in Rural Development to Indira Gandhi National Open University (IGNOU), New Delhi by Megerssa Fida on the ASSESSMENT of THE IMPACT OF IRRIGATION-BASED Integrated Development on Food Security in Semi-Arid and Arid Areas: With particular Reference to Tibia Irrigation-Based Integrated Development in Oromia Regional State, Ethiopia.

DECLARATION

I hereby declare that the Dissertation titled **ASSESSMENT ON THE MPACT OF IRRIGATION BASED AGRICUTURE ON FOOD SECURITY IN SEMI-ARID AREAS: With Particular Reference to Tibila Irrigation-Based Integrated Development project** is submitted by**MEGERSSA FIDA**for the partial fulfillment of the Master's Arts (M.A) in Rural Development to Indira Gandhi National Open University (IGNOU), New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by others or by myself.

Place: **Addis Ababa**

Date: May, 2013

Name: Megerssa Fida Gemeda

Enrolment No. 109100694

Signature: _____

Address:**Addis Ababa, Ethiopia**

CERTIFICATE

This is to certify that Mr. Megerssa Fida, the student of M.A. (RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for his Project Work for the Course MRDP-001. His Project Work titled **THE ASSESSMENT ON THE MPACT OF IRRIGATION BASED AGRICUTURE ON FOOD SECURITY IN SEMI-ARID AREAS: With Particular Reference to Tibila Irrigation-Based Integrated Development project,** which he submitted in partial fulfillment for the requirement of Master's of Arts in Rural Development is his genuine and original work.

Name of Supervisor: _____

Signature _____

Place: **Addis Ababa**

Address: **Addis Ababa, Ethiopia**

Date: _____

ACKNOWLEDGEMENTS

I extend my sincere thanks to my wife Ribka Desta for her patience, understanding and encouragements during the time of my study. Even when she was over-burdened with the household responsibilities and care for the children, she has supported and encouraged me to complete this study. I am grateful to her for the unreserved attention. I am also indebted to our children Urjii and Lattu Megerssa for their patience, understanding and continuous moral supports.

I express my special gratitude to my advisor Dr. Mengistu Huluka for his guidance and insightful comments from which I benefited much. I appreciate very much his timely feedback and comments, his critical appraisal of my work. He made very valuable contributions towards the improvement and refinement of this study. Without his professional assistance, the task would have been much difficult.

The documentation of this study reflects the experiences and insight of the farmers that have participated in the project and in this assessment. The farmers are making strong efforts to improve their lots through the irrigation based agriculture. They resolutely struggle with very harsh environmental elements to mitigate and remove the clutch of poverty. Therefore, these farmers who took part in this assessment and opened their doors and hearts to my extensive questionsdeserve my appreciation and gratitude.

I extend my heartfelt thanks to the Oromia Water Works Design and Supervision Enterprise for the assistances rendered me during my fieldwork through provision of data and information required to realize this thesis. I also benefited from the logistics and facilities of the enterprise during my extensive field study.

Last but not the least, I would like to acknowledge and thank all the staffs of the Tibila Irrigation Project. In particular,I thank so much Korcho Mojjo for his support and coordination of the quantitative and qualitative data collection processes. I thank the three professionals including Hailu Bekele, Essey Getaneh and Shimelis Girma for administering the quantitative data collection. I am also much indebted to the extension professionals and other staff members who served in this assessment as focus group discussants and key informants. They have unreservedly shared with me their insights and experiences to make the study successful.

Contents

List of Tables

List of Figures **Pages**

Glossary of Local Terms:

Abba Genda: is a leader or head of a village.

Debo: The reciprocal mobilization of labour force from relatives and neigbhours during the peak agricultural activities such as sowing, harvesting and threshing. Farmers work on each others' field turn by turn and the owner of the pilot is expected to provide food and other necessities on the day of his turn.

Derge: A junta leadership reigned in Ethiopia from 1974 to 1990. The Derge was led by Colonel Mengistu Haile Mariam and his government was quite known for its dictatorship rule.

Genda: is an Oromo term stands for the term village.

Iddir: Is a community-based organization common and viable in rural and urban areas of Ethiopia for the last many hundred years and its original purpose was for funeral services. The membership is voluntary and the leadership is elected democratically. Both members and leaders are expected to provide social, financial and funeral supports to the bereaved. Nowadays, Iddirs are inclined more and more to community development initiatives besides funeral services.

Kalo: Is enclosure or protected area for safeguarding a pasture field from free grazing so that the pasture is kept for the critical time when the pasture in shortage. Kalo can be kept in communal or individual plots.

Mekenajo: is a system or tradition of two neighbours pair the single ox that each person has to plough their field turn by turn.

Teff: is a native plant to Ethiopia which is a grass- like with very tiny seeds. The tiny seeds are used for "Injera" making. "Injera" is a local flat, thin and wide type of bread used as staple food in Ethiopian households.

Waqefata: is Oromo traditional belief which is based on the philosophy of visualizing the creator as single and only one supernatural force who created everything under the sky and His spirit can be anywhere at any time.

Woreda: is equivalent to district administration in Ethiopia administrative structure. A woreda is constituted by a number of PAs (peasant Associations) in rural areas ***and Kebeles*** in urban centers.

List of Acronyms

BCE:	Before Common Era
CE:	Common Era
CIS:	Corrugated iron Sheet
CO-SAER:	Regional Commission for Sustainable Agriculture and Environmental Rehabilitation
CSA:	Central Statistical Agency
EIA:	Environmental Impact Assessment
EIP:	Ethiopian Irrigation Policy
EWRMP:	Ethiopian Water Resources Management Policy
EWSDP:	Ethiopian Water Sector Development Program
EWSS:	Ethiopian Water Sector Strategy
FDRE:	Federal Democratic Republic of Ethiopia
FGD:	Focus Group Discussion
FMIS:	Farmer-Managed Irrigation System
FYP:	Fiscal Year Plan
GDP:	Gross Domestic Product
GIZ:	Geselleschaft Fur Internationale Zursammarbeit
Ha:	Hectare
HTTP:	Harmful Traditional Practices
HYV:	High Yielding Varieties
IDD:	Irrigation Development Department
IFAD:	International Fund For Agricultural Development
IGNOU:	Indira Gandhi National Open University
IWMI:	International Water Management Institute
IWUAs:	Irrigation Water Users' Associations
IWUC:	Irrigation Water Users' Cooperative
MA(RD):	Master's of Arts in Rural Development
MA:	Master's of Arts

MOA:	Ministry of Agriculture
MOFED:	Ministry of Finance and Economic development
MOM:	Management, Operation and Maintenance
MOWR:	Ministry of Water Resources
NGOs:	Non-Governmental Organizations
OWWCE:	Oromia Water Works Construction Enterprises
OWWSE:	Oromia Water Works Design and Supervision Enterprises
PAs:	Peasant Associations
PIM:	Participatory Irrigation Management
QC:	Quaternary Canal
SC:	Secondary Canal
SC:	Service Cooperatives
SPSS:	Statistical Package for Social Sciences
SSI	Small Scale Irrigation
TB:	Tuberculosis
TC:	Tertiary Canal
TIBIDP:	Tibila Irrigation Based Integrated Development
TISMU:	Tibila irrigation Scheme management Unit
UNDP:	United Nations development Program
UNESCO:	United Nations Education, Science and Culture Organization
UNFAO:	United Nations Food and Agricultural Development
USA:	United States of America
USD:	United States Dollar
USSR:	Union Soviet Socialist Republic
WCD:	World Commission for Dams
WRDA:	Water Resources Development Authority
WUAs:	Water Users' Associations
WUGS:	Water Users' Groups

ABSTRACT:

The study on impacts of irrigation-based agriculture on food security in semi-arid areas has been conducted as a case study on the Tibla Irrigation-based Integrated Development Project, which is located in the three adjacent districts of Jeju, Sire and Merti, all of which are administratively found in Arsi Zone of Oromia Regional State in Ethiopia. The main objective of this irrigation-based development project is to tackle the problem of food insecurity and thereby enhance further development endeavours in the project area and its surroundings. The project envisages that through the implementation of the project the food security, the general livelihood and living standards of the people in the project area and its environs will change and improve. It is further anticipated that the realization of this development project will induce and enhance all round development in the agro-practice, in the socio-economic and cultural aspects of the project participant communities.

The Tibla Irrigation-based Development Project is located at about 150 km away from the country's capital, Addis Ababa to the east direction and 95 km away from Asela Town (Arsi Zone capital). Arsi is the zonal administrative division in which the three project districts are located. The project area entirely falls in the lowland areas of the three districts. The project area is situated in the upper Valley of the Awash River. Awash River is the largest water body in this arid and semi-arid area and the river is well known for its irrigation potential and this specific project is situated along the river. The project area is part of the Great East African Rift Valley with the physical feature of extensive plain land.

The main objective of the studywas to assess the impacts of the irrigation development project on the living conditions of the project population. It assessed the impacts of the project on the food security situation of the targeted community and the role of water users' associations on the management of the project.

The specific objectives were to investigate the impact of the irrigation project on household food securityand overall livelihood situation, assess the extent of community-based administrative and management structures and systems, identify strengths including successes and promising practices and limitations that have impending factors, assess market situations for agricultural production in the irrigation project and identify constraints therein, draw constructive lessons and document new knowledge and feasible working systems and strategies and furnish specific, actionable, and practical recommendations for further improvement of the project and realization of optimal benefits.

The main tool of data collection was an interview schedule using close-ended questions in most cases and open-ended question style in some cases. Focus group data collection method and tool was also used with the extension workers and Water Users Associations' (WUA) leaders and ordinary members. Groups of WUA leaders and members and extension workers in an appropriate number or size participated in each focus group discussion to collect information on appropriate issues. Guiding question checklists were employed in the focus group discussions. In-depth interview data collection method was followed while discussing with government officials, professionals and the like key informants. Secondary data collection method was employed to collect relevant data from literature review, from the Districts Agricultural and Rural Development Office, local administrations and other offices.

The findings of this study had revealed that farmers were able to produce more agricultural crops from small plot of land for household consumption and some surplus for marketing. They have ensured household food-security and become self-sufficient after the irrigation scheme began. The project participants were able to generate significant income from the cash crops they produce and thereby highly enhanced household income in a sustainable manner. The irrigators were able to construct corrugated roof houses, build houses at urban centers, and purchase different household furniture. Farming households have been able to access improved health services and send their children to schools. Farmers had started saving in nearby

banks. Other social services like hotel, grinding mill, and shops has been opened in the area. There was high improvement in livestock feed coming from natural grass, forage development, crop residues and adequate and reliable source of water for livestock in the area have become a reality.This study had further revealed that the project has created job opportunity for large number of landless youths and women residing around the project area and for those job seekers coming from different places.

There were some negative impacts because of the project. Chemical sprays used by farmers as insecticides were polluting the water used for domestic purposes. People had expressed concern in that the water will have long-term effect on their health. As the people and livestock livetogether within the irrigation command area, there were high incidents of damage to the main canals. Even though the sending of children and youths to schools, including the opportunity for higher education for youths have increased with the introduction of the project, some youths tend to drop-out of school with the opportunities created for easier cash earning. Increases in social malpractices such as high crime rate due to diverse people migrating to the project area were visible. The other negative aspect of the project was the decline in the livestock population. It was due to scarcity of labour to share between livestock rearing and practicing irrigated agriculture, and shortage of grazing land in the vicinity. Farmers and extension workers were focusing more and more on the production of cash crops at the expense of livestock rearing. Therefore, the livestock holding in the irrigation command area has shown a declining trend, thereby limiting the opportunity of diversifying household nutrition and income.

1. INTRODUCTION:

1.1 BACKGROUND:

Agricultural development and food security have drawn much attention from development academicians, practitioners and policy makers and the world communities in general for the last many decades. The concepts of agricultural development, rural development, food security, livelihood security, intensive agriculture, high yielding varieties (HYV), rain-fed agriculture, irrigation-based agriculture, etc., have been circulating much within the local and international development arenas in recent decades. All the concerned bodies have been dealing with these and other similar issues for the purposes of finding ways and means of realizing agriculture led rural development and attaining food-centered household livelihood security for the multitude of the people in rural areas of the third world.

However, with the intention of realizing immediate impacts on agricultural development, alleviating the situation of rural people through rural development, most of the agricultural and rural development concerns have been emphasizing high priority on sedentary agriculture practiced in productive highlands and mid-highlands. The major part of the other rural population residing in arid and semi-arid areas practicing pastoralist and agro-pastoralist economic bases have been neglected in most cases. As a result, the major segment of the pastoralists and agro-pastoralists living in almost all the countries of the third world were forced to occupy the peripheral and remote social, economic and political status.

In the recent decades, however, in the process of speeding up agricultural development, mitigating the socio-economic problems and bringing about equitable development in rural areas, development strategies have started rendering due attention to situations of the populace in the arid and semi-arid areas. Development planners, policy makers, researchers and rural development practitioners have realized that rural development efforts cannot be effective, impactful and complete

without the development of the erstwhile by-passed pastoralist and semi-pastoralist communities of the world. One of the major challenges for the development of these communities is lack of water resources for agricultural development and large livestock population. To overcome this challenge, many developing countries such as India, Ethiopia and some others have been undertaking irrigation-based agricultural development for the communities in these areas.

The importance of irrigation project has been increasingly recognized as one of the strategies to enhance food-self-sufficiency and ensuring livelihood security at the household and community levels. “Irrigation improves agricultural production and productivity by solving the problem of water shortage caused due to the unpredictable rainfall in dry regions. Developing the available water resources for irrigation is necessary to bring large areas under agricultural development to achieve the goal of food security. Irrigation is also a means of increasing income generation, creating job opportunity, ensuring occupational shift for pastoralists and semi-pastoralists to settled agriculture, guaranteeing livelihood security for many households and generally promoting economic dynamism (Ethiopian Water Resources Management Policy, 1991). Lowland areas are frequently affected by drought and irregular rainfall. The implementation of irrigation schemes become crucial to maintain agricultural production in these areas in order to ensure increased crop yields and enhanced livestock production.

The Federal Democratic Republic of Ethiopia is making concerted efforts to expand irrigation of all categories, including rainwater harvesting, with the prime purpose of alleviating food insecurity, extreme rural poverty, and contributing to the national economic and social development of the country. The government has approved the Water Resources Management Policy in 1999 and Water Sector Strategy in 2001. The overall goal of the policy is “to enhance and promote all national efforts towards the efficient, equitable, and optimum utilization of the available Water Resources of Ethiopia for significant socio-economic development on sustainable basis.

As part of the development strategies, a number of small, medium and large scale irrigation projects have been launched in different parts of the country. At least, the country has come to realize the importance of decreasing the dependence on rain-fed agriculture and supplementing this with irrigation-based agriculture. To such ends, more and more efforts are underway by the federal and regional governments. The Tibila Irrigation-Based Integrated Development Project is one of such projects implemented in Oromia Regional State, in the districts of Jeju, Merit and Sire to improve the food security situations, household income and the overall livelihood conditions of the target population.

This study is termed as, "The Impact of Irrigation on Food Security in Semi-Arid Areas with particular reference to Tibila Irrigation-based Integrated Development Project." This project has been planned and implemented by the regional government of Oromia. The establishment of the project began in 2008 and most of the construction works was completed in 2011. Currently, the project is fully functional and operational in full momentum in the two districts of Jeju and Sire. However, the construction of the irrigation infrastructure for the command area in the Merti district is yet to begin. Therefore, there are no irrigation benefits for the potential participants in this district. This assessment entirely focuses on the command areas in the two districts of Jeju and Sire.

The project is situated at a distance of 150 kms from the country's capital Addis Ababa and about 95 kms away from the zonal capital called Assela. The project is about 50 kms away from the main asphalt road that traverses between Addis Ababaand Assela Cities. The gross command area of the irrigation project is about 7,000 hectares and the net irrigable area is 6,000 hectares including 10 farm blocks. Currently, about 2,500 hectares of land have been irrigated engaging total beneficiaries of over 5,000 and with a total of 17,351 household members. However, since 0.75 hectare is allotted for household heads and 0.50 hectare for individuals and 0.25 hectare for youths above 18 years, the holding capacity of the irrigation project is more than 8,000

households and more than 40,000 household members (TIBIDP, Socio-Economic Study Final Report, 2009).

1.2 STATEMENT OF THE PROBLEM:

Ethiopia is one of the countries depending heavily on rain-fed agriculture. The country's agriculture is remotely linked to modern farming system such as improved inputs, irrigation technology and improved farm practices. However, productivity of rain-fed crop farming has dropped, and the agricultural sector is now unable to provide the basic requirement of food to the citizens. Traditional farming practices, environmental degradation, cost of external agro-inputs, recurrent drought, and high population pressure has aggravated the present food problem in the country. This implies that the need for launching irrigation development projects to achieve the objectives of increasing yield of crops, livestock production, and protecting the environment. Over the past few decades, irrigated agriculture has become more important. Presently, implementation of many irrigation projects is under way, the majority of which being in the Awash Valley where the proposed study area is located.

Many agricultural development policy makers, academicians and development practitioners have the view that the country can reverse the current low agricultural productivity, recurrent drought and consequent water shortage for agriculture and human consumption and eliminate the ever looming food insecurity through irrigation-based agricultural development. The recurrent food crisis has prompted the country to seek different agricultural methods and technologies that increase productivity and agricultural production. One of the alternative methods is irrigation development in dry seasons of the year in highlands and semi-highlands and at all times in semi-arid regions of the country. The government of Ethiopia has accorded due emphasis to irrigation development in recent years and many big, medium and small scale irrigation projects and schemes have been started. The projects are benefiting many thousand households and millions of their members in the different parts of the country.

According to the studies conducted by researchers, Ethiopia has a huge potential for irrigation-based agriculture, but the country, so far is able to utilize its potential in a minor scale. For example, according to the study by Yalew Belete, the country has an annual surface runoff of close to 122 billion m^3 and ground water resources of about 2.6 billion m^3. The estimated irrigation potential of the country is about 4.3 million hectares but so far, only 6% of which has been developed. It can be generalized that even though the country has a huge potential for irrigation agriculture, in terms of both available land and water resource, the bulk of this potential is still untapped (Yalew Belete, 2006).

Currently, the Government of Ethiopia has emphasized the development of the irrigation subsector to fully tap its potentials by assisting and supporting farmers to improve irrigation management practices and the promotion of modern irrigation systems. The sector could be used to reduce household risks associated with crop failures resulting from droughts. To develop and properly use the available water recourses for agriculture and other uses, the government has enacted Water Resources Management Policy and Water Sector Strategy in 1999 and 2001 respectively.

The erstwhile only rain-fed agriculture of the country has gradually started mixing and integrating irrigation supported agricultural production on step-by-step basis. One of the extensively irrigation-fed agriculture is practiced is the Awash Valley by utilizing the Awash River. This valley and the river have been the typical example and starting point of the country's efforts in the development of the irrigation technology. This has been going on for the last many decades. The other parts of the country are taking lessons and precedence from the irrigation development of this famous river and its irrigated valley.

The implication is therefore, such that Ethiopia's development and progress in irrigation-based agriculture is yet at infancy level. The country is so far highly dependent on rain-fed agriculture and such strong dependence on nature is

considered to be one of the critical reasons for the ever-threatening food crisis. However, the irrigation-based agricultural development and all its accompanying technologies and its technical knowledge are gathering momentum in the country. The policy makers, planners and rural development and agricultural development practitioners all have recognized that in order to make the country self-sufficient in food production, one of the viable measures is to tap the water resources of the country. Utilization of the various rivers and other surface water such as lakes, ponds, streams, capturing precipitation of the huge run-off, development and utilization of the abundant underground water, etc., are some of the major outlets for food self-sufficiency.

The study area, the Tibila Irrigation Based Integrated Development Project is one of the government projects planned and implemented to alleviate the problem of food insecurity of the community in this semi-arid locality. The area had been drought-affected for a long time and the people residing in the area were leading their livelihood under pastoralist and agro-pastoralist conditions. The implementation of this project was crucial to improve and ensure food security at household level. It is important, therefore, to study the changes brought about in the area due to the implementation of this project. The finding of this study will also help different organizations to apply the strengths of the project in the implementation of other similar projects and learn more from its limitations.

During the socio-economic study of the Tibila Irrigation-Based Project (Tibila Irrigation Based Integrated Development Project, Socio-economic study final report, 2009) which was conducted prior to the actual start of the project, the study identified different development constraints such as:

- Recurrent drought due to erratic and inadequate rainfall,
- Problem of food insecurity which affected the livelihood and welfare of the people in the irrigation catchment areas,
- Prevalence of pests, and lack of adequate pesticides to prevent and control pests,

- High prevalence of livestock diseases and shortage of drugs for livestock treatment,
- Severe shortage of livestock feeds mainly due to recurrent drought, inadequate and erratic rainfall,
- Lack of organized and well developed market in the area,
- Low capacity and lack of knowledge and favourable attitude of the local population to undertake irrigation schemes,
- Shortage of adequate road network and low market access
- Low access and control of the women in the area over resources,
- Lack of awareness regarding family planning,
- Prevalence of harmful traditional practices (HPT).

Therefore, the current study will make detail assessment on the changes and improvement on the above and other aspects of the irrigation area population in the course of the project implementation. Apart from the food security situation and overall livelihood of the project population, the study will assess and determine the extent of change and development registered among the study population in the above constraints.

1.3. OBJECTIVE OF THE PRESENT STUDY:

The main objective of this study is to contribute to the socio-economic development of the Tibila Irrigation-Based Integrated Development Project among target communities and the population in the surrounding environs through the knowledge, informative lessons and experiences and feasible recommendations to be generated by the study.

The specific objectives of the study are:

- To investigate the impact of the Irrigation Project on household food security and the overall livelihood situation of the target communities and the population in the surrounding environs.

- To assess the extent of community-based administrative and management structures and systems, identify strengths including successes and promising practices and limitations that have impending factors.

- To assess market situations for agricultural production in the irrigation project and identify constraints.

- To draw constructive lessons and document new knowledge and feasible working systems and strategies and furnish specific, actionable, and practical recommendations for further improvement of the project and realization of optimal benefits to the target population.

1.4. HYPOTHESIS:

The hypotheses framed for this study are as follows:

- The irrigation-based integrated development has contributed significantly to the improvement of household food security and livelihood situation.

- Community-based administrative and management structure and approach for irrigation project has proven to have direct correlation with community participation and ownership.

- Inequitable share of water resources has been a challenge and may have been source of conflict among community members.

- Poor market access and linkage may have been benefiting intermediaries at expense of primary producers and has been hindering production in the long run.

1.5. SIGNIFICANCE OF THE STUDY:

The principal objective of the irrigation development strategy is to exploit the agricultural production potential of the country to achieve food self-sufficiency at the household and national levels. Specific objective is to expand irrigated agriculture, improve irrigation water-use efficiency and agricultural production efficiency, and develop irrigation systems that are technically and financially sustainable (Ethiopian Water Sector Strategy, 2001).

Irrigation-fed agriculture for subsistence farmers and/or agro-pastoralist communities residing in semi-arid areas of countries such as Ethiopia for ensuring household food security and improving the living conditions of the population is new and yet to take

root in the country. The introduction of this form of agriculture is at very infant stage and the study on the impact of the technology on the household food security among drought prone communities has huge potential for showing the significance of the practice, learning from the lessons, pinpointing the shortcomings and limitations of such projects. Therefore, this study will strive to contribute to the pool of knowledge, information and lessons to be drawn from the medium and large scale irrigation systems designed and implemented for poor farmers in arid and semi-arid areas in the country.

1.6. REARCH METHODOLOGY:

1.6.1. Study Coverage:

The study was conducted among the target communities of Tibila Irrigation-Based Development Project. The target communities are from the two adjacent districts of Jeju and Sire. However, the Merti District which is the third irrigation district is excluded from this study as the construction of the irrigation facilities were yet to be completed and it would be a bit earlier for coverage in this study. The three districts are administratively found in Arsi Zone of Oromia Region. Arsi Zone is one of the 19 administrative zones of Oromia Regional State. This zone is located at central part of the region. Four Peasant Associations (PAs) and about 67.6% of the project beneficiaries are from Jeju district, while about 17.6% and 15% are from the Sire and Merti districts, respectively. Peasant Associations (PAs) are the lowest administrative units in rural Ethiopia. All the households and household members who are the direct beneficiaries of this irrigation project are the coverage or the universe of this study.

1.6.2. Sampling:

In the first instance, a non-probability purposive sampling method was used and out of the three districts two of them including Jeju and Sire districts were covered automatically by the study. The inclusion of the two districts was therefore, on purpose

and no sampling technique was employed to select the two irrigation districts. The third irrigation district called Merti district was left out of the study on purpose because the construction of the irrigation facilities is yet to be completed. Three irrigation blocks (Blocks VIII, Ix and X) are located in the Merti District and as stated above these blocks were excluded from this study on purpose.

On the other hand, multi-level random sampling method was found to be suitable to select from the irrigation project blocks and households to achieve the objectives of this study and the following multi-level random sampling methods and techniques were employed to select the exact study blocks and households:

- A probability simple draw sampling was used to select the two PAs from the four PAs of Jeju district, while an automatic inclusion of the irrigation PA of Sire district was made on purposeful basis because only this one PA is part of the project from the specific district.
- From the total seven irrigation blocks located in the two districts, four irrigation blocks located in the selected PAs were covered by the study. Such purposive inclusion was to widen the scope and coverage of the study at block level. This way the study did cover the four blocks out of the seven blocks located in the five PAs covered by the project from the two districts.
- Based on the number project participants in each of the blocks a proportionate number of sample households were selected in simple random sampling technique. Accordingly 18 respondents were selected from Block one, 17 respondents from Block two, 30 respondents from Block five and 11 respondents were selected from Block six. Overall, seventy six respondents were chosen on random basis. A systematic random sampling method was used to single out the exact study households and individual respondents. Every household head in the sample household was considered automatically as respondent of the study. However, where the household head was not around and most likely to be absent during the study period the spouse of the household head or where such person is not found, any eligible member of the household above 18 years of age was considered for interview.

- Representative selection from water user association leaders, extension workers and key informants from relevant line departments and government officials weremade and covered by this study.

Table 1: Study sampling design

S/No	Peasant Association (PA)	Farming sites/ Blocks	No. of respondents				
			Beneficiary households	Members of WUAs	E Ws and other project staff	Professionals and other key informants	Total
I	II	III	IV	V	VI	VII	VIII
1	Kollobo Hawas	Block I	18	12	7	4	**41**
		Block II	17	8	6	-	**31**
2	Hurutadore	Block V	30	10	6	4	**50**
		Block VI	11	9	6	-	**26**
	Total		**76**	**39**	**25**	**8**	**148**

As we can see from the above table, 148respondents including 76project beneficiaries, 39 water users' association leaders and members, 25 extension workers and other project staff; 8 professionals from the relevant line departments participated in this study. It is believed that the data obtained from the different group of respondents through appropriate data collection methods have the scope and potential of providing an overall situation of the project.

1.6.3. Data Collection Tools:

In this study, any single data collection tool is believed to have only limited relevance and adequacy in meeting the overall and specific objectives of the study. Hence, different tools were used to collect the data so as to have better and accurate understanding of the research topic and its essence. The following data collection methods were employed:

- One of the main methods of the study is the quantitative study to be employed with the beneficiaries of the project for administering the quantitative survey. For this aspect of the study the main tool of data collection was an interview schedule using questionnaire. The study used close-ended questions in most cases and some open-ended questions in a few aspects. The interview schedules were pre-tested, standardized and finalized prior to actual administration of them with the study respondents.

- A focus group data collection method and tool was used with the extension workers and Water Users Associations' (WUA) leaders and members for the qualitative data collection. Groups of WUA leaders and members and extension workers in an appropriate number participated in each focus group discussion to collect information on appropriate issues. Guiding question checklist was employed in the focus group discussions.

- In-depth interview data collection method was followed while discussing with government officials, professional and the like key informants. A list of questions were prepared for discussion with the key informants in an open-ended style and served as a guiding checklist. The questions focused on technical issues in most cases.

- Secondary data collection method was employed to collect relevant data from the Districts Agricultural and Rural Development, local administrations and other offices.

- A non-participant observation method was employed for issues on which the data is difficult to be collected reliably by way of interview.

1.6.4. Data Analysis:

As one of the important stage in social research, very critical emphasis was accorded to data processing and analysis in this study. Particularly, all the relevant data processing operations such as editing, coding, computing of the scores, and preparation of master charts and the likes had utmost consideration and application. For coding, three master-code sheets were prepared, one sheet for the beneficiaries, another sheet for the members of WUA and the third sheet for project staffs, professionals, officials and other relevant key informants.

Once the data coding, computing of scores, editing, cleaning, etc., were completed the data analysis was done using Statistical Package for Social Science (SPSS). As a preliminary data analysis, the use of frequency tables, percentages and cross tabulation relevant to nominal as well as ordinal type of measurements were employed. Interval or ratio types of measurements were analyzed using several descriptive statistics such as means, standard deviation, minimum, maximum, range, etc. Every precaution and efforts were made to establish relationships and comparisons between the pre and post project situation and scenarios in the process of data management and analysis.

1.6.5 Limitations of the Study:

The study has the following limitations.

- Due to time and financial constraints, this research was conducted in the specified period and the researcher was obliged to limit the sample population to only 148 respondents for the quantitative and qualitative methods. Even though the qualitative data collection is supposed to bridge some of the gaps in the data collection, given the overall sample size, the representativeness has some limitation.

- There were no well-recorded data regarding agricultural productions, household income, and market prices of various irrigated crops in each year because of poor data recording and handling system by EWs, WUAs committee, the irrigation agency, and the district offices.

- The study did not cover the nature of inter-institutional linkages of the concerned district offices with each other and with project institutions at various levels for the management of the scheme. Especially, the provision of agricultural services possibly with research support, commercial services (input supplies, credit, and marketing), and basic infrastructure and social services (housing, roads, schools, health services, etc.)., are facing constraints in playing the expected roles in the irrigation management tomake the project sustainable. Therefore, it is believed that other researchers can close these limitations in other studies.

2. CONCEPTUAL FRAMEWORK OF THE STUDY:

There are some key terms used in this study which need definition and explanation. In the context of this study the key terms and concepts are defined as follows:

2.1 IRRIGATION: THE CONCEPT:

According to Irrigation Wikipedia, the Free Encyclopedia, irrigation can be defined as the science of artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of livestock and landscapes and re-vegetation of disturbed and degraded soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growing in grain fields and helping in preventing soil consolidation. Irrigation systems are also used for dust suppression, disposal of sewage, and in mining. Irrigation is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area (Irrigation Wikipedia, the Free Encyclopedia, 2009).

The Encarta Encyclopedia further explains that irrigation is one of the most intensive types of farming, and it developed in desert, semi-desert, and arid zones and in regions that have inadequate moisture at certain times of the growing season. Very high guaranteed yields of agricultural crops are obtained by irrigation farming. It is three to five times higher than in dry farming. Repeated sowing and inter-planting (such as fodders with crops) are used extensively, making possible the most productive use of land and provision of livestock with fodder. In the world as a whole, irrigation farming occupies about 16% of the area under cultivation, but it produces as much as the un-irrigated area. Irrigation is practiced in all parts of the world where rainfall does not provide enough ground moisture. In areas of irregular rainfall, irrigation is used during dry times to ensure harvests and to increase crop yields. The sources of irrigation water are surface flow such as river, stream, run off and snow melt, and ground water or water wells which are excavated for bringing ground water to the surface for irrigation (Encarta Encyclopedia, 2006).

The term irrigation, in this study, refers to the irrigation development project that has been implemented by diverting the Awash River to improve the food security situation of the targeted people in the three districts of Jeju, Sire and Merti of Oromia Regional State.

2.2 DEVELOPMENT:

Development is a complex issue, with many different and sometimes contentious definitions. A basic perspective equates development with economic growth. The United Nations Development Programme uses a more detailed definition. According to the UN; development is to lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community (hppt:/www.volunteering options). Achieving human development is linked to a third perspective of development which views it as freeing people from obstacles that affect their ability to develop their own lives and communities. Development, therefore, is empowerment. It is about local people taking control of their own lives, expressing their own demands and finding their own solutions to their problems (Encyclopaedia. Free dictionary.com).

The United Nations Development Program proposed the concept of sustainable human development as an alternative development paradigm. The approach regards people's well-being as the goal of development. Unlike previous development approaches, it sees economic growth not as an end in itself but as one of the means to improve human conditions. Human development is the widening of people's choices in life. It means having the privilege to choose one's life direction over another because of preference rather than lack of opportunity. Knowledge, health and longevity, livelihood and political freedom provide its bearers with greater chances for a better life. People who are poor, unhealthy and illiterate simply have fewer choices in life. Sustainable human development is concerned with widening choices of people not only of the present generation, but future generations as well. As such, it aims for the regeneration of the environment and natural resources (hppt:/www.middletown…).

Therefore, development has many meanings depending on the context it is being talked about. In this study, it is the positive change and transformation of the communities targeted by the “Tibila Irrigation-Based Integrated Development” in their income, food security, in their ways of living, attitudes and behaviours as a result of their access to the irrigation facility, extension services, improved agricultural inputs, agricultural skills, adequate and timely information services. Development in this context means the transition of the targeted community in the irrigation area from pastoralist and agro-pastoralist way of life to irrigated agriculture in a settled manner leading to the quantitative and qualitative improvement in the income and household food security and the general living standard of the targeted project community.

2.3 INTEGRATED DEVELOPMENT:

We all know that life in any given community is the interplay among and interdependence, interrelationships and integration of different social, economic, cultural and political aspects. These factors contribute and shape the development and prosperity or underdevelopment and poverty situation of the community in any given locality. Therefore, community development can only be meaningful, impacting, beneficial and sustainable, only when the planning and implementation follow an integrated development approach.

Rural poverty is caused primarily by a limited access to resources in one context. This limitation may result from an imbalance between population and available resources. Besides the problem caused by population growth, access to resources is quite often limited for the rural poor because of the existing socio-political situation. Here, the limited access to resources is deliberate, and the result is that the available resources are underutilized because of obstacles of a socio-cultural and political nature. For example, landless people cannot obtain land for cultivation. Subsistence farmers have difficulties in obtaining credit. Such scarce means of production hinder the production process for the subsistence, poor and marginalized farmers in a great deal.

Therefore, it becomes clear that integrated development is more than economic growth. The necessary political decisions will not come from change in production methods and economic situation alone. They also require a change in the social and political infrastructure and change in the power structure. Integrated development is a goal and a methodological approach at the same time. The goal is to include the neglected masses of rural poor in the process of increasing the well-being of mankind. The approach for reaching this goal is the application of a package of well-balanced strategy of economic and socio-cultural and political nature.

An Integrated Development Plan is a super plan for an area that gives an overall framework for development. It aims to co-ordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area. It should take into account the existing conditions and problems and resources available for development. The plan should look at economic and social development for the area as a whole. It must set a framework for how land should be used, what infrastructure and services are needed and how the environment should be protected (hppt:/www.etu.org.za.).

In this study, integrated development denotes the transformation of the targeted communities from the previous pastoralist and agro-pastoralist way of life into modern crops and livestock farmers with the application of improved irrigated agriculture system. The integrated development in this context signifies the change and transformation in the various aspects of the target population. The change and transformation of household economic bases to crop production in an integrated manner with livestock production, improvement in household income and food security, improvement in community organization, social position and decision-making and empowerment. The integrated development also signifies that there is the linkage of the target community with the different urban centers through production marketing and infrastructure development.

2.4 FOOD SECURITY:

The United Nations defines food security as all people at all times having both physical and economic access to the basic food they need (hppt:/www.globaleducation.edn.au, 2011). The World Food Summit of 1996 defined food security as existing, when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (hppt:/www.who.int/trade).Commonly, the concept of food security is defined, as including both physical and economic access to food that meets people's dietary needs as well as their food preferences (Wikipedia: the Free Encyclopedia.en.).

In this study food security is defined as: (1) Availability of food in sufficient quantities on a consistent basis for the project targeted households. (2) Accessibility of the same households to food with the capacity of having sufficient resources to obtain appropriate and adequate foods for a nutritious diet. (3) The development of capability to utilize the available and accessible food based on knowledge of basic nutrition with adequate water and sanitation. The food security status of the project targeted households is therefore measured in terms of the availability, accessibility and utilization of food by all family members in consistent and sustainable manners.

2.5 ARID AND SEMI-ARID AREAS:

Arid and semi-arid areas are defined as “areas falling within the rainfall zones 0-300 mm and 300-600 mm, respectively. Because of the short growing period (1-74 days for the arid areas and 75-119 growing days for the semi-arid areas), these areas are not suitable for cultivation. Rainfall patterns are unpredictable and are subjected to great fluctuations. Drought occurrence is more frequent in arid areas than in semi-arid arid areas. For example, according to Elis (1992), drought occurs every five years in Turkana District of Kenya (200-500 mm annual rain), whereas it occurs every 8-12 years in the Massai Region (300-700 mm annual rainfall) (UNFAO, FAO, 1987).

The Tibila Irrigation Project Area is categorized as semi-arid area with annual rainfall is about 670 mm. The monthly rainfall varies from 6-129 mm and characterized by erratic

and uneven distribution. The climate of the area is hot with erratic, variable rainfall and unreliable for agricultural activities. Monthly minimum and maximum temperature of the area ranges from 9^0c to 25^0c. Monthly minimum and maximum temperature of the area ranges from 9^0c to 25^0c (OWWDSE, TIBIDP:Agronomy Study, 2009). Economic activities of the area are mostly livestock production but people in the area are generally practice mixed agriculture consisting of livestock and crop production. In recent years people in the area tend to intensify crop production due to population pressure and shortage of pasture land which has aggravated land resources degradation and enhanced aridity.

2.6 EVALUATION:

Evaluation is a step-by-step process of collecting, recording and organizing information about project results, including short-term outputs or immediate results of activities and project deliverables and immediate and longer-term project outcomes or changes in behavior, practice or policy resulting from the project. It is a systematic method for collecting, analyzing, and using information to answer questions about projects, policies and programs, particularly about their effectiveness and efficiency (en.Wikipedia.org/…). In both the public and private sectors, stakeholders will want to know if the programs they are funding or implementing are actually having the intended effect, efficiency and impact.

Evaluation is considered to be an essential tool of development administration. It is a performance or achievement audit that assesses systematically the impact of the project both in quantitative and qualitative in relation to the stated objectives, targets and course of action, assesses the efficiency of the project, identification of factors, and provides feedback to decision makers (IGNOU, MRD 103).

Common rationales for conducting an evaluation are for response to demands for accountability, demonstration of effective, efficient and equitable use of financial and other resources. It is also the recognition and measurement of actual changes and progress made and the identification of success factors and gaps that need improvement.

The major challenges in evaluation are getting the commitment to do it, establishing base lines at the beginning of the project, identifying realistic quantitative and qualitative indicators, finding the time to do it, getting feedback from stakeholders and reporting back to them.

In this study, the evaluation will examine critical issues like impact of the project on the way of life, food security and living conditions of the targeted community, the attitude of the people towards the project, the role of the Water Users' Association and Extension Workers on the management of the project. The evaluation will be based on the socio-economic study conducted prior to the project implementation, and will be measured against the stated project objectives and expected impact of the project on the targeted community.

2.7 PROJECT:

A project, by definition, is a temporary activity with a starting date, specific goals and conditions, defined responsibilities, a budget, a planning, a fixed end date and multiple parties involved."[17] A project in business and science is typically defined as "a collaborative enterprise, frequently involving research or design and careful planning in order to achieve a particular aim ((Wikipedia, the Free Encyclopedia). Projects can be further defined as "temporary rather than permanent social systems that are constituted by teams within or across organizations to accomplish particular tasks under time constraints. Project objectives define target status at the end of the project, reaching of which is considered necessary for the achievement of planned benefits. They can be formulated as SMART criteria (Specific, Measurable, Achievable, Realistic and Time bounded) (hppt:/www.comp.soln.com).

The Tibila Irrigation-based Integrated Development Project is one of the irrigation schemes launched in Oromia Regional State at the present. The main objective of the Tibila Irrigation Development Project is to tackle the problem of food security and thereby enhance further development endeavors in the project area and its surroundings. It has been envisaged that through the implementation of the irrigation project the general livelihood and the living standard of the people in the project area

and its environs will improve. The realization of this development project will induce and enhance the all-round development in the socio-economic, agro-economic and social and cultural conditions of the target population and the surrounding areas.

3. LITERATURE REVIEW:

3.1 BRIEF HISTORY OF IRRIGATION AGRICULTURE:

According to Encyclopedia of Water Science, in the prehistoric times mankind's food came from hunting, fishing, and gathering of wild fruits and berries. Cultivation of seeds was discovered about 5000 B.C.E. but there was no way to plow the land since the Iron Age (600 B.C.E.) had not yet arrived. The ancients then discovered that wooden plows could be used in soft soils in deltasof large rivers like the Tigris and Euphrates in Mesopotamia, the Nile in Egypt, the Indus in the Indian subcontinent, and the Yellow in China. As these areas are arid, water was diverted from the rivers by dams and canals and then raised by human or animal-driven devices that are still in use today. The dams and canals, although crude by modern standards, were beyond the capacity of individual farmers and were built by state-run organizations. Other large-scale works included dyke systems to minimize damages from floods. Various types of water-moving devices have been used since ancient times (Taylor and Francis, 2011).

We find different archaeological investigationsshowing evidence of irrigation in Mesopotamia and Egypt as far back as the 6th millennium B.C.E, where barley was grown in areas where the natural rainfall was insufficient to support such a crop (Kang, 1972). In the 'Zana' Valley of the Andes Mountains in Peru, archaeologists found remains of three irrigation canals radiocarbon dated from the 4th millennium B.C.E, the 3rd millennium BCE and the 9th century C.E. These canals are the earliest record of irrigation in the New World (*Dillehay TD, Eling HH Jr, Rossen J, 2005).*The Indus Valley Civilization in Pakistan and North India (from 2600 B.C.E.) also had an early canal irrigation system (*Ancient India Indus Valley Civilization, Minnesota State University e-museum).*Large scale agriculture was practiced and an extensive network of canals was used for the purpose of irrigation and sophisticated irrigation and storage systems were developed, including the reservoirs built at Girnar in 3000 B.C.E. (*Rodda, J. C. and Ubertini, Lucio, 2004).* There is evidence of the ancient Egyptian pharaoh Amenemhet - III in the twelfth dynasty (about 1800 B.C.E.) using the

natural lake of the Fayûm as a reservoir to store surpluses of water for use during the dry seasons, as the lake swelled annually caused by the annual flooding of the Nile (*Amenemhet III, Britannica Concise).*

Ministry of Water Resources of Government of India, on its web site briefly explains the history of irrigation development in India which can be traced back to prehistoric times. Vedas, Ancient Indian writers and scriptures have made references to wells, canals, tanks and dams. These irrigation technologies were in the form of small and minor works, which could be operated by small households to irrigate small patches of land. In the south, perennial irrigation may have begun with construction of the Grand Anicut by the Cholas as early as second century to provide irrigation from the Cauvery River. The entire landscape in the central and southern India is studded with numerous irrigation tanks which have been traced back to many centuries before the beginning of the Christian era. In northern India also there are a number of small canals in the upper valleys of rivers which are very old.

Furthermore, many documents on the ancient irrigation revealed that the Qanats, developed in ancient Persia in about 800 B.C.E, are among the oldest known irrigation methods that are still in use today. They are now found in Asia, the Middle East and North Africa. The system comprises a network of vertical wells and gently sloping tunnels driven into the sides of cliffs and steep hills to tap groundwater *(UN Food and Agriculture Organization, Rome, 1985).*The irrigation works of ancient Sri Lanka, the earliest dating from about 300 B.C.E, in the reign of King Pandukabhaya and under continuous development for the next thousand years, were some of the most complex irrigation systems of the ancient world. In addition to underground canals, the Sinhalese were the first to build completely artificial reservoirs to store water. The system was extensively restored and further extended during the reign of King Parakrama Bahu (1153 – 1186 C.E)*(De Silva, Sena, 1998).*

The Great Soviet Encyclopedia also states that irrigation farming has been known since the Neolithic period. In hot, dry regions (for example, Mesopotamia) and the states of Middle Asia and Egypt, the first centers of farming culture emerged on lands

that were inundated annually by spring flooding of rivers. Seeds were sown in the deposited silt after the waters receded, and this made possible the growing of plants without tilling the soil. Hoe farming, the first form of irrigation farming, took shape in this way. The natural flow of the rivers either failed to provide annual flooding of the same sectors or kept them under water too long. Therefore, the ancient farmers built ridges to protect their fields or supplied water to them by canals (primitive systems of flooding irrigation). Large irrigation systems were built in slaveowning societies. In Mexico another method of irrigation was used; the land was brought to the water by raising plants on rafts (*chinampas*) onto which soil was sprinkled. On the territory of the USSR, the first centers of irrigation farming were in Middle Asia, Transcaucasia, and Southern Siberia (the Minusinsk and Tuva basins).

3.2 IRRIGATION IN GLOBAL CONTEXT:

Bruinsma (20030 in congruent with FAO (2002a) have the opinion that irrigation is a vital component of agricultural production in many developed and developing countries. In 1997-99, irrigated land provided two-fifths of crop production in developing countries, and accounted for about one-fifth of the cultivated area. The divergence in these statistics reflects the high crop yields and multiple cropping that are achieved through irrigation. Developing countries are particularly dependent on irrigation. For example, in 1997-99, 59 percent of cereal production in developing countries was irrigated. Food production in developing countries is increasing in response to the demands of an expanding population and rising prosperity. Some of this demand will be met by increased productivity of rain-fed agriculture, some by increased imports, but irrigated agriculture will be a major contributor(FAO, 2002a and Bruinsma, 2003).

Furthermore, many different writers indicated that by the early 19th century the world area of irrigated land was 8 million hectares, and by the turn of the 20th century it was 48 million hectares (irrigation construction in India, Egypt, the USA, and Italy). In Russia irrigation work was financed mainly by private capital; by 1913 the irrigated area was not more than 4 million hectares. In 1972 this figure increased to about 12

million hectares in the USSR. In the 20th century, irrigation is developing in many countries, particularly China, India, Pakistan, Iran, Japan, Egypt (the entire sown area is irrigated), the USA, Mexico, Italy, Bulgaria, and France. In the 1950's, irrigated land occupied 121 million hectares and in 1972, more than 225 million hectares.During the 1971–75periods there was a significant increase in irrigated lands (in Middle Asia, the Volga Region, the Northern Caucasus, and the southern Ukraine).At the global scale 278.8 million hectares (689 million acres) of agricultural land was equipped with irrigation infrastructure around the year 2000. About 68 % of the area equipped for irrigation is located in Asia, 17 % in America, 9 % in Europe, 5 % in Africa and 1 % in Oceania (Siebert, S. J. Hoogeveen, P. Döll, J-m.Faurès, S.Feick, and K. Frenken, 2006-11-10).

According to A. Kandiah, the importance of irrigation for increased food production and food security at global level needs no emphasis. 30-40% of the world's food comes from the irrigated 16% (about 250 million hectares) of the total cultivated land. There are wide regional variations in the proportion of irrigated agricultural land: 38% in Asia, 15% in Latin America; and 4% in sub-Saharan Africa. Total irrigated land on the African continent is estimated to be about 12.2 million hectares and six countries (Egypt, Madagascar, Morocco, Nigeria, South Africa and Sudan) account for nearly 75% of the total irrigated land in Africa. In sub-Saharan Africa, water control has, in the past, played a relatively minor part in agricultural development. However, this is now changing. Many sub-Saharan countries have realized the critical role of irrigation in food production. In these countries it is believed that a major part of new irrigation developments should be "small-scale", if they are to meet the household, local and national food security objectives, ensure equity and usher sustainable rural development (A. Kandiah, Senior Officer, Water resource, FAO, Rome).

Therefore, one of the critical factors for today's food crisis is the underdevelopment of irrigation agriculture, particularly in most of the developing countries such as the sub-Saharan Africa. This is compounded by a rapidly growing world population, the conversion of food producing lands to bio-fuel production, diminishing available freshwater supplies, and competition for water by other sectors, climate change

impacts, and the reduction in arable lands due to urbanization. It is critical that investments focus on increasing agricultural production through improved management of land and water resources, and the involvement of all stakeholders.

As different sources indicate, starting with very rudimentary methods and growing very slowly in scope and technologies, irrigation in the developing countries has reached the current status where the area under irrigation in these countrieshas reached about 200 million hectares (494 million acres). There is little potential for increasing this area with the possible exception of parts of Sub-Saharan Africa and Latin America (especially Brazil). Because climates in the developing countries are arid,semi-arid, or monsoon-like (rainy for a few months but dry the rest of the year), the only way for these countries to avoid food shortages is to increase the output of lands already irrigated. In all of these countries, the prevalence of small land holdings which is often 2 hectares (about 5 acres) or less is a serious obstacle. Poverty, illiteracy, and the low status of women comprise further obstacles. In some quarters there is optimism that scientists, through biochemical research, will develop new plant varieties through selective plant breeding as part of a new "Green Revolution." However, this idea leads to a complacent attitude that glosses over the reality that the quantity of available water in many regions is reaching a limit.

However, the environmental and socio-economic rationale for the agriculture sector capturing the world’s exploitable water resources is now being questioned by some thinkers. There are different views that are different to the proponents of irrigation and the diverging views set out to bring together economic and ecological evidence and argumentation in support of the need to challenge and change the fundamentals of the prevailing techno-centric view of water resources exploitation. They argue that there should be a need for a new and more suitable approach to water resources allocation if the world’s population is to be adequately fed, without further degradation and destruction of the planet’s critical ecosystem services. Water productivity needs to be enhanced considerably, and economic cost-benefit analysis and pricing regimes can play a significant role in such a process. They further indicate that these economic measures will not be sufficient on their own. They will need to be reinforced by

technological innovation and institutional changes in order to encourage a more equitable distribution of resources and to mitigate potential international conflicts across 'shared' water basins.

As results of the negative views arising against irrigation in the developed countries and lack of the necessary capacity and resources in most of the developing world, the desired level of development in irrigation agriculture was slow in some cases and scenarios. Such tardiness hascontributed tothe decrease in global food production and as a consequence the global food self-sufficiency has shown diminishing trends over the years. For example, in 2008 the world witnessed a global food crisis which caused social unrest in many countries and drove 75 million more people into poverty. The crisis resulted from sharply higher oil prices, increased bio-fuel production, dwindling grain stocks, market speculation, changing food consumption patterns in emerging economies, and changes in world trade agreements, among other factors. Although the rise in food prices was sudden, the fragility of global food security had been developing for years. During the 1960s and 1970s food production kept pace with demand as more cropland was irrigated and yields of irrigated crops increased dramatically. Irrigation played a critical role in combating hunger, poverty and death due to malnutrition in those days.

3.3. IRRIGATION PROFILE IN ETHIOPIA:

Ethiopia has a total area of about 1.13 million km^2, with estimated arable land resources potential of 55 million hectares, or approximately 50% of its land mass (UNDP-FAO, 1984).Despite the huge arable land resources potential, only 14% of the country's total land mass is being utilized for crop cultivation. Based upon the various river basin master plans and land and water resources surveys, the aggregate irrigation potentials of Ethiopia have been estimated to be 2.523 million hectares net land area. The gross irrigation potential would be about 3.7 million hectares. The total area irrigated till 1991 was 176,015 hectares, this figure had increased to 197,250 hectares in 1998 (Seleshi Bekele, Aster Demekew, Makonen Loulseged, Willibald Loiskandi, 2007). According to data recently compiled by

Federal Ministry of Water Resources, from different master plan studies and regions, the area under irrigation in the country has increased to about 250,613 hectares. This is due to rapid increment of the area under traditional irrigation (MOWR, 2004/5).

Irrespective of Ethiopia's endowment with potentially huge irrigable land, the area of land under irrigation so far is only about 3% showing that water resources have made little contribution towards the development of irrigated agricultural sector up to now.It can easily be realized, however, in addition to the underdeveloped irrigation, the accelerated population growth and the disparity of rainfall distribution make production of sufficient food and food security almost impossible. On the contrary, a number of studies made in the field confirm that if the country's water resources are developed to cater for irrigation, it would be possible to attain agricultural surplus enough both for domestic consumption as well as for external markets (Ethiopia Water Policy, 2001).

While talking about the irrigation profile in Ethiopia, modern irrigation has got its start in the country in the 1950s and 60s as a result of private investment, some of which was funded by foreign investors, particularly in the middle Awash Valley. Prior to 1974, private investment in agriculture had increased particularly during the Third Fiscal Year Program (FYP, 1968 -73) due to the government's policy of encouraging the development of commercial farming in sparsely populated lowland areas of the country. Irrigated commercial farms made a start in the Awash Valley through either, land acquisition, agreement made with the local leaders, or government concessionaire arrangements. Concessionaire farms included the MAESCO of Melka Sadi banana farms, Mitchell Cotts of the lower Awash and Wonji, and Shoa Sugar Estates. Farms established through negotiation with local chiefs included Algetta, and Sublele farms of the Middle Awash Valley. The Awash Valley Authority had made a start in receiving applications for concession farms and water rights during those days (Fekadu, 2000).

However, the irrigation initiative short-lived as a result of the nationalization of all large-scale irrigation in 1975 by the Derge Government which handed them over to the Ministry of State Farms. Small-scale irrigation suffered a similar fate and most

landlord-based small scale irrigations were converted into Producer Cooperatives and new schemes also built, albeit with very mixed results because of resistance to collective farming. During the Derge era, all private farms were nationalized, thereby ending the highly motivated but embryonic private sector. The government pursued the development of medium and large-scale irrigation schemes as State Farms, initiating a number of schemes dispersed in many parts of the country that ranged from Amibara Irrigation Project in the Middle Awash to Alwero Irrigation Project in Gambella and Gode-West Irrigation near Gode town.

Further on, following the downfall of the Derge, the current government until recently withdrew from expanding State Farms and further construction of medium and large-scale irrigation.Also, when the current government'sinitiatives and efforts towards irrigation development assessed, there has been a renewed interest in promoting farmer and community-oriented small-scale irrigation, by providing assistance and support to local communities for rehabilitating and/or upgrading traditional schemes starting from the early 1980s (Habtamu Gessese, 1990). After the major famines of that period, which evidenced the importance of building additional crop productivity capabilities at the local level, the government began to focus on the potential of small-scale irrigation as a food security option.

Regarding the structural and administrative arrangements of the irrigation systems of the country, a distinction in responsibilities for large and medium versus small-scale irrigation has been in place for the last many years.The Water Resources Development authority (WRDA) of the Ministry of Water Resources continues to this day to take the lead in large and medium-scale irrigation development. In recent years the country's irrigation development efforts and organizational setup are progressing and evolving steadily. Beginning in 1985, the Irrigation Development Department (IDD) of the Ministry of Agriculture (MOA) wascharged with the development of Small scale Irrigation (SSI) activities and providing assistance to farmers and communities. Their efforts were eventually decentralized to the zonal level where Irrigation and Rural Water Supply Teams were established to foster and facilitate the expansion of SSI at

the local level. It is noteworthy that SSI development was traditionally seen as “infrastructure” development, and grouped with rural roads and similar construction teams and largely staffed with “engineering” oriented personnel. Fully 75 percent of the staffs of the IDD, as described by Habtamu in 1990, were of the engineering cadre. Under the IDD, the typical Irrigation and Rural Water Supply Team was comprised of three brigades: earthen dam construction, diversion weir construction and land development. The department struggled over the years with less than optimal, centralized funding and staffing limitations to meet the challenges and opportunities of SSI development across the immense territory of the Ethiopian highlands (et.al, 1990).

Furthermore, in 1994, with the recognition of the increasing need for greater regional autonomy and realistic decentralization, the IDD was dissolved. Government policy support for small-scale irrigation, however, remains high; the importance of SSI to the government was perhaps best manifested in the creation of the Regional Commission for Sustainable Agriculture and Environmental Rehabilitation (CO-SAERs) now being promoted under the new federalist structure in a number of regions. These new organizations have embraced the promotion of SSI as their primary mandate and they are channeling millions of Ethiopian Birr each year into such development and construction activities. The focus within these organizations and the overall approach remains rather engineering-oriented; a feature that permeates the approach to SSI even within the activities of the cooperating sponsors (et.al, 1990).

Nowadays, the politicians and development planners and practitioners have high recognition of the importance of irrigation in the development efforts of the country. In line with such recognition various policy document, strategies and guidelines are developed and put into practices. The need of developing irrigation for crop production is acquiring more and more attention in response to the growing demand for agricultural produce. Apparently, Ethiopia receives an annual rainfall adequate for food crop and pasture production. However, the distribution of rain varies from region to region. Much of the eastern part of the country receives very little rain while the western areas receive adequate rainfall. Production of sustainable and reliable food

supply is almost impossible due to the temporal and spatial imbalance in the distribution of rainfall and the consequential non-availability of water at the required period. Sometimes, even the western highlands of the country suffer from food shortage owing to the discrepancies in the rainfall distribution (MoWR, 2001). Attempts have been made by the government to address the food security problems through preparation of relevant agricultural development policies and programs. However, low level of water use efficiencies are among the major constraints for development as well as operation of all water sectors including irrigation (MoWR, 2002).

For instance, one of the policy documents, namely; the Ethiopian Ministry of Water Resources (MoWR, 2001), Water policy entails to contribute to the national economy through the development of the country's water resources and expanding farmers' irrigation schemes in order to boost up agricultural production and productivity. The policy emphasizes on tackling recurrentdrought and unreliable rainfall through the development of farmers small scale irrigation under the use of different alternatives of water abstraction technologies. Ethiopian irrigation development has been considered as a means to back up economic growth, to ensure rural development, bring livelihood development and poverty reduction.

3.4. ETHIOPIAN ENVIRONMENTAL POLICY DOCUMENTS IN RELATION TO IRRIGATION:

Environmental sustainability is recognized in the constitution and in the nationaleconomic policy and strategy as a key prerequisite for lasting success. The constitution explicitly states that the government shall endeavour to ensure that all Ethiopians live in a clean and healthy environment, the design and implementation of programs and projects of development shall not damage or destroy the environment, people have the right to full consultation and to the expression of views in the planning and implementation ofenvironmental policies and projects that affect them directly, and government and citizens shall have the duty to protect the environment(FDRE, Constitution, 1995). In view ofthat, the government has formulated different sector-based environmental policy for each of the development sectors of the country. As

Water is one of the natural resources, which is the foundationof the economy, the government has also formulated policy for Water Resources development of the country.

The national government developed a comprehensive environmental policy on natural resources and the environment in 1997. This is the first comprehensive statement of environmental policy for the Federal Democratic Republic of Ethiopia and it was approved by the Council of Ministers in April 1997(EPA, 1997). It was based on the policy and strategy findings and recommendations contained in Volume II of the Conservation Strategy for Ethiopia. Like the Water Resource Policy, the environment policy is predicated on a growing concern for the degradation of the natural resources base and how that base affects and is affected by the overall productivity of the agriculture sector in the country. The “overall policy goal is to improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (Environmental Policy and EIA, 1997).

As part of the sectoral environmental policy elements, irrigation in particular and the water resource of the country in general have gained very significant emphasis in the National Environmental policy. The policy document states that the water resources utilization and management of the country’s irrigation schemes (including small, medium, or large) aim at ensuring the control of environmental health hazards, recognizing the natural ecosystems, particularly wetlands and upstream forests, ensuring that any proposed introduction of exotic species into water ecosystem is subjected to detailed ecological study, promoting the protection of the interface between water bodies and land, the opportunity costs of irrigating important dry season grazing areas of the pastoralists for crop production by undertaking cost benefit analysis of such irrigation projects, involving water resource users, particularly women and animal herders in the planning, design, implementation and follow up on

their localities of water policies, programs and projects, subjecting all major water conservation, development and management projects to the environmental impact assessment process and calculate the costs and benefits of protecting watershed forests and wetlands, promoting effective water management techniques at the farm level for improved performance of medium to large-scale irrigation schemes, encouraging viable measures to artificially recharge ground and surface water resources (FDRE Environmental Policy, 1997).

The country's environmental policy guideline was developed subsequent to the policy document in order to guide and direct the policy itself. The policy guideline urges that:

- The country incorporates the full economic, social and environmental costs and benefits of natural resources development in the national development efforts;
- Appropriate and affordable technologies, which use renewable resources efficiently shall be adopted or adapted, developed and disseminated;
- When a compromise between short-term economic growth and long-term environmental protection is necessary, then development activities shall minimize degrading and polluting impacts on ecological and life support systems;
- Regular and accurate assessment and monitoring of environmental conditions shall be undertaken;
- To base, where possible, increased agricultural production on sustainably improving and intensifying existing farming systems by developing and disseminating technologies which are biologically stable, appropriate under prevailing environmental and socio-economic conditions for farmers, economically viable and environmentally beneficial;
- To ensure that planning for agricultural development incorporates in its economic cost benefit analysis, the potential costs of soil degradation through erosion and salinity;
- To promote in drought-prone and low rainfall areas, water conservation; and

- To ensure that agricultural research and extension have a stronger focus on farming and land-use systems and support an immediate strengthening of effective traditional land management (EIA-Sectoral Guideline, 1997).

In addition to the environmental policy and guideline, the country formulated the water sector strategy in order to reduce the negative environmental impacts associated with irrigationdevelopment. The strategy (2001) mentioned the followingaspects of environment to be assessed during planning and implementation of development projects: (1) conduct appropriate Environmental Impact Assessment (EIA) Studies forthe irrigation schemes, including the implementation of remedialmeasures, based on the National Conservation Strategy andEnvironmental Guidelines; (2) establish guidelines for maintaining irrigation water quality;(3) establish drainage parameters/requirements, and integrate appropriatedrainage facilities in all irrigated agricultural development schemes; (4) consider technical and technological options, which avoid the prevalenceof breeding ground for vectors; minimize loss of forests; reduce seepage;and prevent erosion, siltation, salinity, and pollution.

3.5. THE NATIONAL IRRIGATION POLICY AND RELATED STRATEGIES:

The geographical location of Ethiopia and its endowment with favorable climate provides a relatively higher amount of rainfall in the region. Much of the water, however, flows across the borders being carried away by the Trans-boundary Rivers to the neighboring countries. Although we cannot be definite due to lack of researched data as yet, preliminary studies and professional estimates indicate that the country has an annual surface runoff of close to 122 billion cubic meters of water excluding ground water (Ethiopia Water Sector Policy, 2001).

In congruent to the above view, a document titled, “Ethiopian Water Sector Development Program” argues that the country is endowed with abundant water resources. A large number of rivers flowing on either side of the rift valley form a

drainage network that covers most of the country. Most of the rivers that carry the water resources, however, end up in neighboring countries hence making them international or Trans-boundary Rivers. The total surface water resources of Ethiopia, coming from the country's twelve river basins, are estimated to be in the order of 122 billion cubic meters per year. With regard to ground water resources, the true potential of the Country is not yet known, however it is widely reported that Ethiopia possesses a ground water potential of approximately 2.61 billion cubic meters. Around 60% of the water resources flow into the Nile River system. However, the amount may be decreasing gradually because Ethiopia, in common with neighboring countries, has experienced apparent long-term changes in climate with an overall decrease in annual rainfall and a higher frequency of droughts since 1970, accelerating a longer-term downward trend in average rainfall by 5% since 1912 (Ethiopia Water Sector Program).

However, the Ethiopian Water Sector policy recognizes that the big and main water resources problem in Ethiopia is the uneven spatial and temporal occurrence and distribution of the resources across the country. Between 80-90% of Ethiopia's water resources is found in the four river basins namely, Abay (Blue Nile), Tekeze in the north, Baro-Akobo, and Omo-Gibe in the west and south-western part of the country where the population is no more than 30 to 40 per cent. On the other hand, the water resources available in the east and central river basins are only 10 to 20 per cent whereas the population in these basins is over 60 per cent (Ethiopian Water Sector Policy, 2001).

This policy document further states that in order to alleviate the problems on agricultural outputs and other water users, sustainable and reliable development and proper use of the water resources of the country becomeimperative. Obviously, this calls for a priority setting and judicious water resources management policy and associated finance. Development activities carried out so far in the water sector in totality or individually reveal a very low level of performance. The cause for this poor achievement and the dilemma for the failure of the country's water resources lies mainly on the absence of a well-defined coherent policy and lack of the necessary investment (et.al, 2001).

Therefore, based on the above facts and the overall dependence of the country on agriculture as well as the unreliability of the rainfall pattern in the region, the country needs to rely more and more on irrigation based agriculture development. For the irrigation sector to be efficient, effective, impactful and sustainable,one of the crucial factors is a proper policy direction. The country formulated irrigation policy and put into practice the policy direction at national level. The National Irrigation Policy indicates that irrigation is one of the sub-sectors included inthe Ethiopian Water Resources ManagementPolicy (EWRMP). The overall objective of theirrigation policy is to develop the huge irrigation potential for the production of food crops andraw materials needed for agro-industries onefficient and sustainable basis and withoutdegrading the fertility of the production fieldsand water resources base. The specific objectives set by the policy are to: (1) develop and enhance small scaleirrigated agriculture and grazing lands forfood self-sufficiency at household level, (2) develop and enhance small,medium and large-scale irrigated agriculturefor food security and self-sufficiency atnational level including export earnings andto satisfy local agro-industrial demand,(3) promote irrigation study, planning andimplementation on economically viable,socially equitable, technically efficient,environmentally sounds bases as well asdevelopment of sustainable, productive andaffordable irrigation farms, (4) promote water use efficiency, controlwastage, protection of irrigation structuresand appropriate drainage systems, and (5) ensure that small-scale, medium-scale andlarge-scale irrigation potential projects arestudied and designed to stage ready forimmediate implementation by private and/orthe government at any time (EIP, 1997).

To translate the national water management policy into action, the Ministry of Water Resources has issued Ethiopian Water Sector Strategy (EWSS) in 2001. The strategy sets the road map as how to make meaningful contribution towards improving the living standard and general socio-economic wellbeing of the Ethiopian people through: (1) realizing food self -sufficiency and food security in the country; (2) extending water supply and sanitationcoverage to large segment of the society, thus achieving improved environmental health conditions; (3) generating additional hydropower (4)

enhancing the contribution of water resources in attaining national developmentpriorities; and (5) promoting the principles of integrated water resources management(EWRMP).

As a subsequent working document and guideline towards the implementation of the irrigation policy and the related water sector strategy, the government developed specific irrigation development strategy and constituted it as one of the sub-sectors in the water sector strategy of the country. In line with these documents, the principal objectives of the irrigation development strategy is to exploit the agricultural production potential of the country to achieve food self-sufficiency at the national level, including export earnings, and to satisfy the raw material demand of local industries, butwithout degrading the fertility and productivity of country's land and water resources base. More specific objectives of the strategy are to: (1) expand irrigated agriculture, (2) improve irrigation water-use efficiency andthus the agricultural production efficiency (3) develop irrigation systems that aretechnically and financially sustainable, and (4) to address water logging problems in irrigation. This strategy document has very detailed environmental, social, technical and engineering, financial and economic, institutionalandcapacity building aspects. The aspects are described in detail in the policy document and each of the aspect is explained in terms of what they comprise and stand for (et.al).

3.6. CURRENT IRRIGATION DEVELOPMENT EFFORTS IN ETHIOPIA:

According to the Ethiopian Water Sector Development Program document, the agriculture sector in the country is the dominant sector of the economy and its performance is the major determinant of overall GDP growth rate. The document states that on the average, the sector contributed about 48% of Ethiopia's GDP between 1995 and 1999. It equally accounted for 90% of export earnings, which consists mainly of coffee, hides and skins, pulses and oilseeds and 70% of raw material inflow into agro-based industries during the period. The agricultural sector is

also the major employer, accounting for 85% of total employment. The crop sub-sector accounts for 60% of the sector outputs, livestock and forestry constitutes 30% & 10% respectively. Peasant farms at household level are the backbone of the sector, cultivating about 96% of the cropped area and producing 90% to 94% of all cereals, pulses and oilseeds. Rain fed agriculture provides the largest proportion of the total production. However, over the past few decades, irrigated agriculture has become more important. At present some 197,000 hectares of land is under irrigation, the majority being in the Awash Valley. Around 68,800 hectares were established, initially by private entrepreneurs and then by the government as State farms, principally growing cotton, citrus fruits and vegetables (EWSDP, 2001).

However, unreliable rainfall, recurrent drought and limited use of the available water resources, coupled with heavy reliance on rain-fed subsistence agriculture, have contributed adversely to the economy of Ethiopia. In fact, the World Bank (2006) estimates that unmitigated hydrological variability currently costs the economy over one-third of its growth potential and leads to 25 percent increase in poverty rates. Hence, enhancing public and private investment in irrigation development has been identified as one of the core strategies aimed to de-link economic performance from rainfall and to enable sustainable growth and development (World Bank 2006; MoWRa, 2002; MoWR, 2002b; MOFED, 2006). In the government policy documents, irrigation development is identified as an important tool to stimulate sustainable economic growth and rural development and is considered as a corner stone of food security and poverty reduction (MoWRa, 2002; MoWR, 2002b; MOFED, 2006).

Irrigated agriculture is a priority of the agricultural transformation and food security strategy of the Ethiopian Government. Increased availability of irrigation and less dependency on rain-fed agriculture is taken as ameans to increase food production and food self-sufficiency of the rapidly increasing population of the country. In line with the development policy, the federal government, regional states and NGOs are promoting irrigation development so as to increase and stabilize food production in the country.

Under the current agriculture led economic development plan of the country,focus is being made on irrigation development by harnessing the naturalresources. The potential irrigable area of Ethiopia is estimated to be about 3.73million hectares (WAPCOS, 1990) out of which to date only 197,250 hectares (1998)have been developed for irrigation, including the areas under small scaleirrigation. According to the estimates made in the year 1991, the areas undersmall scale irrigation comprised of 6,400 hectares while the areas under medium and large scalewere 112,105 hectares. These areas account only for 3.4% of the total food cropproduction of the country. If the country is to curtail the recurrent food deficitcaused by draught and persisting population pressure, relevant measures have tobe taken to improve the productivity of rain-fed as well as irrigated agriculture(MoWR, 2002). The current development has been focusing on the developmentof small scale irrigation.

To address the problem of food security, and to meet the demands of food andfiber requirement, the country has prepared a fifteen year plan to developadditional 273,829 hectares of land, which is an increase of 135 percent of the currentlyirrigated land. A country wide total area of 1,057 small scale schemes having acombined area of 80,667 hectares have been planned for development by variousstakeholders during the short and medium planning horizons (et.al, 2002).

The Federal Democratic Republic of Ethiopia (FDRE) is making concerted efforts to expand irrigation of all categories to achieve the goal of food security by increasing agricultural production and productivity in the country. Despitethat the government has given due attention for the development of variousirrigation development projects in different parts of the country, yet food security has not been achieved.Irrigation is one means by which agricultural production can be increased to meet the growing food demands. Increasing demand can be met in three ways: increasing agricultural yield, increasing the area of arable land, and increasing cropping intensity (number of crops per year (Seleshi B. Awulachew, 2006:5).

In recent times, the government is undertaking a number of irrigation projects in different regions of the country, as part of the development strategies. According to Solomon C. (2006:8), they constitute approximately a total area of 510,603hectares. Most of these projects are envisaged to be completed and ready for production before the end of the irrigation program-planning period in 2016. This is about twofold the area planned to be developed in the irrigation development program.

3.7. POSITIVE IMPACTS OF IRRIGATION:

3.7.1. Improvement in Crop Production and Food Security:

Historically, irrigation originated as a method for improving natural production by increasing the productivity of available land and thereby expanding total agricultural production-especially in the arid and semi-arid regions of the world. Availability and access to irrigation was considered essential for crop production, asset creation and expansion of development frontiers. Rapid expansion of irrigated areas in the recent past, coupled with availability and access to new technology such as high yielding varieties (HYV), fertilizers and tube-well and water extraction mechanisms in the late 1960s and 1970s were major underlying factors for the success of the green revolution in Asia. Better access to irrigation infrastructure facilitated intensification ofcropping practices and inputs used, thus paving the way for the “modernization” of the agricultural sector (WCD, 2000).

Irrigated agriculture is one of the critical components of world food production, which has contributed significantly to maintaining world food security and to the reduction of rural poverty. About 17 percent of global agricultural land is irrigated and contributes about 40 percent of the global production of cereal crops (WCD, 2000). The total irrigated area in the world was 266 million hectares in 1997, which is 250 percent more than it was in 1950 (FAO 1998). The per capita per year cereal production in developing countries has increased from 200 kg during the early sixties (1961-65) to more than 260 kg in 1997. This is despite the fact that world population has increased

from 3 billion to 6 billion during the same period close to 5 billion in the developing world alone (FAO 2000).

Various studies reveal that irrigation enables greater agricultural production than is achieved with rain-fed agriculture. The additional food production obtained with irrigation is essential for food security on a global level, and on a national level for some countries. National food security is attained either through the pursuit of self-sufficiency in food (i.e. meeting demand through domestic production) or through a combination of domestic production and imports. Food self-sufficiency was once a widespread objective and some nations still aspire to it. It creates savings in foreign exchange, protects domestic producers and consumers from the fluctuations of world markets, ensures rural food supplies and contributes to a political sense of national security.

For instance, some of the Asian economies have succeeded in increasing agricultural production significantly over a short span of time by accelerated provision of irrigation facilities. Irrigation infrastructure is one of the critical factors for improving agricultural production, farm incomes and rural wealth (capital) accumulation. The massive investments in irrigation infrastructure in India, China and Pakistan in the 1960s and the 1970s and their success in achieving food self-sufficiency were also driven by the same underlying philosophy. These countries have succeeded in reducing the scale of poverty to a large extent. The uplifting of mass populations above the poverty line (in absolute numbers of people as well as in relative terms) in some of these Asian countries, with the overall success of poverty reduction due to irrigated agriculture, is considered one of the significant achievements of the 20th century unprecedented in the past.There are no authentic statistics available on the net contribution of irrigated agriculture worldwide, which are acceptable to all. Despite some controversies, the WCD statistics, however, can be considered as the lower margin of benefits of irrigation while the upper margin could be much larger than reported here. According to this report, roughly 60% of the rice production and 40% of the wheat production in developing countries comes from irrigated land; thus the success of irrigated

agriculture and better irrigation access has large implications for poverty reduction and maintenance of food security in a nation ” (WCD, 2000).

3.7.2 Improved Employment and Livelihoods:

In addition to increasing crop production and farm and family incomes, improved irrigation access significantly contributes to rural poverty reduction through improved employment and livelihoods within a region (Chambers 1988; Barker, 2000). Indirect benefits, such as more stable rural employment as well as higher rural wage rates, help landless farm laborers obtain a significant share of the improved agricultural production. In addition to yield improvement and intensive production practices, better irrigation infrastructure and reliable water supply also enhance uses of other inputs like fertilizers and High Yield Varieties (HYV). This intensification of agricultural practices generates additional employment opportunities in the rural sector. The irrigation induced benefits are not limited to farming households but also affect broader sectors of the economy by providing increased opportunities to growing rural service sectors and other off-farm employment activities (Mellor 1966). Examples of such opportunities are additional employment creation for landless laborers in agro-industries, rural marketing and other off-farm activities like house construction and basic infrastructural building. In turn, this feedback process increases the demand for employment many folds and generates additional wealth creation and/or capital accumulation in the rural sector. All of these benefit processes create transformation within rural and urban sectors, and their feedback mechanism in an economy has significant importance in designing location-specific poverty reduction strategies.

The full benefits of irrigation are not only captured by farmers, but are also spread to wider sections of society also called positive externality effects of irrigation access to society. These externality effects are the unintended income (also employment) equivalent of welfare changes brought about by the irrigation project. The extent of such irrigation induced positive externalities, or spillover impacts of irrigation benefits, is much wider in scope in large-scale irrigation projects-contributing significantly to the regional and national development pace of a country. The farming sector alone cannot

capture all the benefits of external effects of reduced friction and transaction costs in the rural economy, as they are economy wide impacts. In addition, these reduced transaction costs have other feedback chain effects on the development of new institutions and the emergence of new socio-political orders in the rural economy.

3.7.3 Poverty Alleviation

In an appropriate environment and with suitable planning (e.g. provision of training and credit), investment in irrigation schemes can alleviate poverty both directly and indirectly through stimulation of the rural economy. Indeed, the purpose of many large scale schemes associated with the Green Revolution in Asia was more to do with addressing food security and poverty targets rather than direct commercial returns (Plusquellec, 2002). The IFAD "Report on Rural Poverty 2001" is clear in stating that irrigation schemes have direct benefits for poor people, given the required policy and institutional environment (IFAD, 2001). Even if irrigation is not specifically targeted at poor beneficiaries, irrigation stimulates the agriculture sector of the rural economy indirectly through increased demand for agricultural inputs (including agricultural labour, services of local artisans who manufacture tools and equipment, seed and fertilizer) and the marketing of additional produce. Increased incomes in farming communities can create demand for non-agricultural goods and services (e.g. meat, processed foods, clothes, and repair of bicycles), many of which are marketed only locally and can be supplied by resource-poor individuals. The resultant stimulation of non-farm incomes can help to reduce absolute poverty in rural areas in the long term (Bruinsma, 2003), and it can reduce relative poverty as long as the prevailing asset distribution is not too skewed.

3.7.4 Impact on Infrastructure Development:

Improved rural infrastructure needs to coincide always with irrigation facilities. This greatly reduces transaction costs and rural marketing costs and other frictions associated with the farming sector. The benefits generated by these activities are also called indirect benefits of irrigation investments. These indirect irrigation benefits,

usually intangible, are not fully captured by farming communities alone; rather, they are shared by larger sections of society. For example, lower food grain prices benefit poor urban and rural landless communities more by enabling them to purchase required food items at affordable prices. Keeping food prices at relatively low levels also greatly assists the industrial sector to avoid the pressure of increasing the real wage rate. In this process, improved agriculture indirectly subsidizes the industrial sector of the economy as well.

3.7.5 Irrigation'sMultiplier Effects:

Understanding the secondary impacts of irrigation and the economic multiplier and output as well as employment multipliers, are more meaningful in resolving some of the puzzles on the nature of the relationship between access to irrigation and poverty situation in a region. Irrigation is linked mostly with the alleviation of rural poverty, which is the most predominant form of poverty in developing countries. However, irrigation also indirectly affects urban poor by providing food commodities at affordably low prices. By and large, rural sector off-farm activities (like village crafts, and agro-services) are not internationally tradable but these activities produce domestically consumed goods and services, except plantation agriculture practices like, tea, coffee, rubber, etc (Mellor 2001).

Therefore, these off-farm activities are very labor-intensive in nature and are therefore effective in spreading farm sector benefits to the landless rural poor. To further enhance the effective domestic demand for these sorts of off-farm goods and services, the overall economy has to generate increased absorption capacity, which the increased farm income will create because of its scale and nature of spread within the economy (Mellor 2001). Considering the scale of farming activities in developing countries, increased farm products and farm income due to improved access to irrigation will help create mass scale expansion of the effective demand for these non-tradable goods and services. The feedback mechanisms and linkage effects associated with expanded domestic demand from mass scale increased farm income

and rural employment will help alleviate poverty at a much faster pace (Mellor 2001, 1999).

3.7.6 Improvement in Nutritional Status and Health:

Increased food production from irrigated agriculture can confer nutritional benefits for farmers, their family members and the local population (through increased food supplies). Irrigation can enable multiple cropping, which can smooth seasonal shortfalls in food supply and encourage the production of crops that contribute towards a more varied and nutritious diet. Improved nutrition can enhance quality of life, reduce illness, increase labour productivity, and improve the performance of children at school (FAO, 2003c). Irrigated agriculture can also benefit the urban poor by keeping food prices low despite growing demand from increasing populations (IWMI, 2000). Indeed, continuation of the current decline in irrigation investment could eventually cause an increase in world cereal food prices, which would affect the poor in particular as a large proportion of their income goes to food leading to decreased food consumptions in terms of quantity and quality and then to the resultant malnutrition consequences.

3.8. NEGATIVE IMACTS OF IRRIGATION:

3.8.1 Change in Land Use Pattern

Changing land-use patterns are a common irrigation caused problems. Small plots, communal land-use rights, and conflicting traditional and legal land rights all create difficulties when land is converted to irrigation agriculture. Land tenure and ownership patterns are almost certain to be disrupted by major rehabilitation work as well as a new irrigation project. Access improvements and changes to the infrastructure are likely to require some field layout changes and a loss of some cultivated/cultivable land. The 'losers' will need tailored compensation best designed with local participation. Similar problems arise as a result of changes to rights to water. However, users participation at the planning and design stages of both new schemes and the rehabilitation of existing schemes, as well as the provision of extension, marketing and credit services, can minimize negative impacts and maximize positive ones (FAO).

3.8.2 Inequity and Inequality:

The question of whether, in the past, the benefits of irrigation have accrued to wider sections of society has not yet been answered adequately. The existing literature on this topic is either ambiguous or unconvincing (Chambers 1986; Chambers 1988; Chitale 1994; Sampath 1990). Irrigation induced inequality depends on several locally specific factors like the structure of irrigation, whether it is surface systems (canal or tank), or groundwater systems (deep tube-well, or micro pump sets). Several studies have reported that surface flow irrigation has produced higher inequality in the distribution of benefits across farms than lift irrigation (Sampath 1990). The effect of unequal distribution of irrigation benefits becomes severe when it is coupled with skewed landholding. Due to highly skewed land distribution, large farms can obtain disproportionately large shares of incremental benefits from irrigation development, both in relative as well as in absolute terms. For example, small farms in India constitute about 46% of the total rural households, but they only get access to 15% of the total irrigable land and 14% of the total canal-irrigated area. However, larger farms (more than 4 ha), representing the top 12.5%of the households, get about 40% of the total canal-irrigated area and 38% of the total irrigated land (Sampath 1990).

The discussion on the poverty dimensions of irrigation projects is closely related to the unequal distribution of water resources across systems and across reaches of canals. Inequitable water distribution in a surface irrigation system (large scale canal system) is one of the major factors contributing to income inequality in irrigated agriculture. This is, however, still one of the unresolved issues in water distribution policies in irrigation commands. The problem is particularly severe in large-scale irrigation commands in developing countries with large numbers of smallholding farmers. Several studies on water allocation between head and tail reaches have reported that farmers at the tail end of the canal receive a disproportionately small amount of irrigation water and at times no water at all. The head-end farmers, however, receive an unduly large share of canal water (Chambers 1988; Shah 1998).

3.8.3 Human Migration and Resettlement:

Irrigation projects tend to encourage population densities to increase either because they are part of a resettlement project or because the increased prosperity of the area attracts incomers. Human migration (outside of the nomadic way of life) and displacement are commensurate with a breakdown in community infrastructure which results in a degree of social unrest and may contribute to malnutrition and an increased incidence of disease. Large, new irrigation schemes attract temporary populations both during construction and during peak periods of agricultural labour demands and provision for their accommodation needs to be anticipated. Often the most significant social issue arising from irrigation development is resettlement of people displaced by the flooding of land and homes or the construction of canals or other works. This can be particularly disruptive to communities and, in the past, insensitive project development has caused unnecessary problems by a lack of consultation at the planning stage and inadequate compensation of the affected population. Technical ministries should seek expert assistance at an early stage. Community re-establishment often includes, for example, pilot farms, extension services and credit schemes (FAO, 2001).

3.8.4 Women and Minority Issues:

Changing land patterns and workloads resulting from the introduction or formalizing of irrigation are likely to affect men and women, ethnic groups and social classes unequally. Groups that use "common" land to make their living or fulfill their household duties such as charcoal making, hunting, grazing, collecting fuel wood, growing vegetables etc. may be disadvantaged if that same land is taken over for irrigated agriculture or for building irrigation infrastructure. Historically, it has been men from the more settled and powerful groups that have had greatest access to the benefits and increased income from irrigated agriculture. Women, migrant groups and poorer social classes have often lost access to resources and gained increased workloads. They are often disadvantaged by irrigation development as they are excluded from the scheme because of uncertain land rights and may be pastoralists rather than farmers. An EIA should consider the impacts on minority groups and, after consultation,

appropriate rehabilitation or compensation measures should be allowed for in the project design (et.al, 2001).

3.8.5 Erosion Effects:

The method of irrigation profoundly affects the vulnerability of the land to erosion. Because irrigated land is wetter, it is less able to absorb rainfall and runoff will therefore be higher. Field size, stream size (drop size), slope and field layout are all difficult to change and all significantly affect erosion rates. Archaic in-field water management practices involving poor cut and fill operations through watercourse embankments can result in serious local erosion at the head end of the irrigated field and in sedimentation at the mid or tail-end locations of the field. The micro-topography of a field will thus be disturbed. Unavoidably, this effect creates disproportionate water distribution over the irrigated field. In addition it might create disputes between water users. Improved water management practices related to surface irrigation methods (for example by using gates, siphons, checks) can reduce such hazards (et.al, 2001).

3.8.6 Ecological Imbalances:

Without appropriate management measures, irrigated agriculture has the potential to create serious ecological imbalances both at the project site and in adjacent areas. Excessive clearance of natural vegetation cover in the command area, for example, can affect the microclimate and expose the soil to erosion, leading to a loss of top soil and nutrient leaching. The removal of roots and vegetation disrupts the water cycle, increasing the rate at which water enters rivers and streams, thereby changing flow regimes and increasing siltation in the downstream zone. This is often to the detriment of fisheries and aquaculture activities. The destruction of natural habitats in this manner and the creation of agricultural monocultures also impacts on the local flora and fauna reducing biodiversity. The introduction of exotic species of plant or animal may oust indigenous species or introduce disease agents that may affect plants, animals and/or man. Fertilizers and pesticides are widely applied to correct imbalances. These can percolate through the soil and/or be carried away in the drainage water polluting both ground and surface waters especially in the downstream

zone. The nutrients in fertilizers may give rise to eutrophication of surface water bodies and promote the growth of aquatic weeds. Pesticide residues are hazardous to the health of both man and animals (et.al, 2001).

3.8.7 Soil Salinity

There are four main reasons for an increase in soil salinity on an irrigation scheme: (1) Salts carried in the irrigation water are liable to build up in the soil profile, as water is removed by plants and the atmosphere at a much faster rate than salts. The salt concentration of incoming flows may increase in time with development activities upstream and if rising demand leads to drain water reuse, (2) Solutes applied to the soil in the form of artificial and natural fertilizers as well as some pesticides will not all be utilized by the crop, (3) Salts which occur naturally in soil may move into solution or may already be in solution in the form of saline groundwater. This problem is often severe in deserts or arid areas where natural flushing of salts (leaching) does not occur. Where the groundwater level is both high and saline, water will rise by capillary action and then evaporate, leaving salts on the surface and in the upper layers of the soil; and (4) The transfer from rain-fed to irrigation of a single crop, or the transfer from single to double irrigation may create a "humidity/salinity bridge" in the soil, between a deep saline groundwater and the (so far) salt-free surface layers of the soil. The accumulation of salts in soils can lead to irreversible damage to soil structure essential for irrigation and crop production. Effects are most extreme in clay soils where the presence of sodium can bring about soil structural collapse. This makes growing conditions very poor, makes soils very difficult to work and prevents reclamation by leaching using standard techniques.

3.9 PARTICIPATORY IRRIGATION MANAGEMENT:

One of the world’s great challenges is to increase food production in a sustainable manner so that a rapidly growing global population can be fed. The world’s growing population and production, combined with unsustainable consumption patterns, is putting increasing stress on land, water and other essential resources. Efficient use of

limited land and water resources can only be achieved by development, monitoring and evaluation of those resources. Irrigated agriculture is playing a major role in reaching the broader development objectives of achieving food security, and improvements in the quality of life in developing world. However, despite large financial resources are being directed to irrigation development, the overall performance of many irrigation projects is much less than expected even in the long-term. The situation also contributes to serious environmental, social and health problems. Main reason for poor performance of irrigation projects is lack of efficient irrigation management rather than technical deficiencies in project planning, design and construction. Therefore, irrigation experts, project managers, national planners, and decision makers are discussing on whether establishment of new irrigation projects or rehabilitation of existing ones with efficient irrigation management (Bhattarai, Sakthivadivel and Hussain, 2002).

After the large-scale expansion of the global irrigated area in the 1960s and the 1970s, the central policy focus in the irrigation sector has now shifted to issues like irrigation water management, environment management for system sustainability and more equitable distribution of benefits across irrigation systems and across agro-environments. Often, irrigation systems have not performed as envisaged at the project appraisal phase. Underperformance of systems, in relative terms, has affected the poor and marginal farmers of canal commands more adversely than relatively prosperous farmers. The relatively prosperous farmers, in any case, would obtain the necessary canal water by exercising their legal rights, or even illegally exerting their social influence to agency staff. Numerous case studies on canal irrigation systems in India and Pakistan have highlighted these issues of poor governance in large-scale irrigation systems (Shah 1998; Chambers 1988). The high level of *governmental failure* is one of the root causes for the underperformance and the chaotic situation in water allocation procedures in irrigation commands, particularly where water scarcity is also increasing. The underperformance of the canal system has, therefore, further aggravated the income gap and the relative poverty level in irrigation commands (et.al, 2002).

Therefore, Chambers and Shah further argue that the focus of policy-makers in the irrigation sector has now shifted to issues like irrigation water management, participatory decision-making and institutional reform in the irrigation sector, environment management for system sustainability and more equitable distribution of benefits across irrigation systems and across agro-environments. All these changes are visible in efforts at reducing the level of *governmental failures* and *market failures* associated with managing irrigation commands. The underperformance of canal systems has further aggravated the income gap and the relative poverty level within irrigation systems, leading to an unequal distribution of irrigation benefits across sub-systems. In reality, the wealth creation and trickle- down effect aimed at alleviating poverty in irrigated areas is not happening in the originally envisaged manner. Therefore, additional direct public policy interventions and more pro-poor institutional and policy reformsare required. This will help minimize the differential distribution of benefits across sub-systems and farmers, and increase the social benefits and well-being provided by the provision of irrigation infrastructure. Ultimately, irrigation is a typical public good, either directly provided or largely subsidized by governments for overall social well-being. (Shah 1998; Chambers 1988).

The 1986 Katimandu Workshop on public Intervention in Farmer-Managed Irrigation Systems (FMIS) is one of the breakthroughsin understanding and recognizing the importance ofFMIS to irrigation management. Most FMIS research projects have demonstrated the importance of *farmers'*participation in all steps of irrigation management, from design to implementation to system turnover. Indeed, participation has been identified as one of the "key features" to better managing a dwindling resource. In the same manner, the creation and use of "Social Organizers" have shown to be an effective tool in facilitating the formation and development of farmer groups. Social organizers are especially effective in developing the farmer groups' internal organizational structure. Social organizers also serve as intermediaries between farmers and the various government agencies concerned with any particular

irrigation system, improving the relationships and communications between the two entities in the process.

The workshop recognized that the use of social organizers in FMIS assistance programs has shown great promise in the Philippines where it has been documented in the Communal Irrigation Project and partially on the basis of this experience, social organizers have been incorporated into the development strategies in several South and South-east *Asian* countries but most of these innovations remain in the formative stages. Social 0rganizers are not uniformly effective in every country; some may lack proper qualifications, or their training may not have equipped them to deal with the often complex situations they encounter (Manor; Patamatamkul and Manuel; 1989, 1990***).***

The workshop defined farmers' participationas a transferring of decision-making powers in irrigation systemdevelopment and management to farmers. This participation consists of authority to take decisions and resource mobilization (e.g., ideas, money, manpower, and materials). The type of farmers' participation varies according to the type of irrigation-system management. There are three types of system management: agency-managed, farmer-managed, and jointly managed. The objective of farmers' participation is to develop cooperation between the government and the farmers which will bring fruitful results for farmer-managed irrigation systems. Negative experience in the past with inappropriate participation shows that there is a need to review the approaches being taken to involve farmers in irrigation development. Research has shown evidence of a remarkably high-management potential in indigenous farmer-managed irrigation systems. Evidence from past experiences in many areas indicates increasing farmer involvement and participation, in terms of achieving increased self-reliance and a sense of ownership (et.al, 1989, 1990).

3.10 IRRIGATION WATER USERS ASSOCIATIONS (WUAs):

3.10.1 WUAs: The Concept:

As defined by International Management Institute (IWMI), Water Users Association (WUA) is a non-profit organization that is initiated, and managed by the group of water users along one or more hydrological sub-systems regardless of the type of farms involved. By water users we mean the ordinary cultivators of land, individual members of lease-holding farms and shirkats, owners of private and dehkan farms, owners of home garden plots, etc. These are the potential members of the WUA, who pool financial, material, technical and human resources for the operation and maintenance of the irrigation and drainage system within their jurisdiction for the benefit of all the members. The membership in the WUA is based on contracts and/or agreements between the members and the WUA. Likewise, the supply of water and payment of fees to the water service provider is also based on contracts and/or agreements between the WUA and the irrigation service provider, where rights and obligations of both parties to the contract, time of delivery and agreed-on volumes are specified (IWMI, 2003).

By joint definition from the FAO, GIZW and IWMI, water User Associations (WUAs) are self-governed organizations of farmers who pool their financial, technical and human resources for the use and maintenance of a defined watershed, including irrigation agriculture, livestock production and fisheries. WUA members can range from small-scale or peasant farmers, e.g. in India, to large commercial farmers, e.g. in California. For policy-makers, planners and technical experts, WUA forms a conceptual and institutional tool to transfer water management from a higher political level to the actual users of water resources for agricultural production. This bottom-up organizational form of water governance aims to lead to “effective, comprehensive, integrated and sustainable” reform in water management in order to enhance perceived gaps in irrigation performance (FAO, GIZW, IWMI, 1999).

3.10.2 WUAs: Historical Background:

In order to adequately assess the current Irrigation WUAs in an adequate manner, it would be useful to have a brief views on the earlier and ancient origins of such community structures and systems. According to one of the papers presented on a Workshop on Irrigation Management, in Canterbury, England, it was stated that associations of irrigation water users are among the oldest institutions established by man and still continue to be a useful means of developing and managing irrigation schemes. It is remarkable that some of the concepts developed by these ancient institutions remained in use for centuries and some of them are still valid (FAO, 1976).

As reflected by authors like Driver and Miles, ruins throughout the world bear testimony to the efforts made by man to use water collectively. However, little written evidence has come down to us describing the organizational arrangements under which these works were constructed or used. As stated by these writers, the Hamnurabi Code (2300 BC) is one of the few documents from those early times that cast some light on the arrangements for the operation of the irrigation systems. Several texts describe the punishments applied to transgressors of the established rules governing the operation and maintenance of the irrigation canals. Thus, for example, article 55 states that "he who opens his canal to take water without care and damages his neighbour's field shall provide grain from his own harvest equal to his neighbor’s loss. Other references from the same epoch can be found in the "Code of Manu" referring to the organizational structure which developed in the Indus Valley. Here also severe punishments were established to ensure proper utilization of water and its control was entrusted to a high official vested with full and undisputed powers (Driver and Miles 1952).

The establishment of WUAs marks “a transfer of responsibilities and authority from the political level (government agencies) to non-governmental organizations. WUAs manage water at the lowest level in a participatory and democratic manner, where the users of water, namely farmers, can elect leaders, collect water fees, implement maintenance and resolve potential conflicts over water use internally. It marks an

alternative management to other organizational forms governed by either the public or private sectors (FAO, GISW, IWMI, 1999).

The organizational concept was first introduced by Elinor Ostrom in the “Rules, Games, and Common-Pool Resources” (1994) proposes how to govern scarce resources at the lowest level of decision making and use. In the development sector, the WUA concept has found widespread acceptance amongst many leading organizations involved in water governance strategies, such as GIZ, FAO, IWMI, and the World Bank, in order to effectively govern water resources pressurized by climate change and overallocation. Results from the field have shown that if water users themselves directly decide on the use of water, the performance of irrigation schemes increases, thus providing social and economic incentives to farmers to manage water more effectively (Ostrom, Gardner and Walker, 1994).

WUAs have been implemented in various countries across the world. Each country’s needs and prerequisites must be thoroughly assessed even before the first phase of establishment. The establishment of WUA needs to take into consideration the social fabric of each country with great care. For example, the establishment processes in African countries around small dams such as Burkina Faso were specifically designed to promote a pro-gender approach (Ministry of agriculture of Burkina Faso, 2003). In addition, environmental analyses of water availability, the application of agronomic tools such as crop water requirements, and analyses of soil structures must play a pivotal role in the advisory services provided to the executing authorities that establish WUAs (Guideline on Irrigation Agronomy, 2011, Ethiopia).

3.10.3 WUAs and Recent Trends:

Disappointing performances of government owned and operated irrigation systems have compelled a number of countries to transfer rights and responsibilities for management of irrigation systems from government agencies to private or local persons or organizations. The Philippines, Indonesia (Soenarno 1995), China and Sri Lanka in Asia, Mexico and Colombia (in Latin America, and others such as New Zealand and Turkey have made major efforts in this direction. Transferring

responsibilities has come to be seen as a way to reduce pressures on thinly stretched government finances while at the same time improving irrigated agricultural production and ensuring the long term sustainability of irrigation systems. The intention is to encourage efforts by individuals to take responsibility for the management of resources in the belief that individuals have greater stake and better information for making efficient resource allocations.

During the 1980s and early 1990s, governments started to realize the significance of farmers' participation in management of irrigation systems in view of sharing the costs and contributing towards maintenance (Tanaka and Sattto, 2005; Yercan, 2003; Sato, 2007; Wegerich, 2001). This kind of concept was adopted by many countries such as Iran as Participatory Irrigation Management (PIM). Traditionally, the provision of water has been the responsibility of the Iranian government. In recent years, there has been a large increase in private sector financing of water projects, especially irrigation networks. The construction of about 300,000 hectares surface irrigation networks has been financed by government and the operation of these networks has been transferred to the WUAs. In addition, the operations of some parts of the old irrigation networks have also been transferred to the WUAs. Another role of the WUAs in Iran is to decrease the number of water delivery points and it is also their responsibility to further distribute the irrigation water and collect the fees. All in all, WUAs are to maintain what is left from government-based irrigation projects.

UNESCO states that the centralist's concept led by such authors as Steward (1949) and Wittfogel (1957) have insisted that large scale irrigation required centralized coordination and efforts. Such arguments in turn have led to greater political and management integration of the large and medium irrigation systems and such integration in turn have been observed resulting in the following problems: (1) water supply to farmers become increasingly unreliable and inequitable; (2) small farmers are at a disadvantage vis-a-vis large farmers; (3) tail end deprivation is almost universal; (4) anarchy syndrome is prevalent in irrigation sector; (5) deferred maintenance is resulting in poor performance in irrigation sector; (6) degradation of

land is taking place due to excessive irrigation by some farmers; (7) farmers are not given any relevant information by irrigation agency staff; (8) the cropping pattern is not decided on the basis of total water available; (9) water rates are low and recovery is very poor, and (10) the cognitive distance between the farmers and the irrigation agency staff is very big.

The need to improve the performance of irrigation and the adoption of the participatory or farmers-managed irrigation management approach are widely recognized in the literature more than ever in recent years. Initiated in the 1980s, the Participatory Irrigation Management (PIM) approach aims to improve irrigation management to ensure the timely and equitable supply of water to farmers (Marothia, 2001; 2002). This is achieved through the establishment of WUAs that manage irrigation schemes (World Bank, 1993; Marothia, 2002). A fundamental assumption behind this approach is that local farmers are capable of managing small-scale irrigation because they have local knowledge (though not necessarily have understanding on the technical aspects) of irrigation in their district (Brown and Nooter, 1992, Lam, 1996). As such changing irrigation management from government-managed to farmers-managed system should help improve performance while at the same time reducing the costs incurred by governments (Meinzen-Dick, 1997). According to literature the success of WUAs is influenced by several factors that can be classified as internal and external factors (Meinzen-Dick et al., 1997). The internal factors are those that are under the control of WUAs while external factors are those factors that are outside the control of WUAs.

In traditional irrigation schemes, farmers would get together to build a diversion weir across a river or dig an access canal, because these were things they could not accomplish on their own. Without a capacity for organization and decision-making among the users, it was simply not possible to complete a scheme. This capacity helped users to develop an organization capable of operating and maintaining the scheme. However, in a modern scheme where most of the preparation and construction is done by a government agency, the water users have much less experience in organizing themselves. Yet the fact that in such schemes the water is usually delivered to a group of farmers requires a WUA that is capable of assuming

responsibility for water distribution among farmers. In many cases, the WUAs are also responsible for maintenance and for collecting irrigation fees from its users. WUAs could also play an important role in negotiating with the scheme operators in the service agreement. Based on the experience of WUAs and the subsequent participatory water management accomplishments, in recent years there is strong understanding and appreciation of participatory irrigation management. It is understood that developing, operating and maintaining an irrigation scheme almost always require joint action by the water users.

In India, for example, increasing user participation in the management of irrigation systems is being tried as a means to reduce pressures on government finances, improve performance of irrigated agriculture, and ensure sustainability of irrigation systems. Permitting farmers to play a greater role in India represents a major shift away from the idea that the government is responsible for taking care of farmers. This change is consistent with other changes being carried out in management of natural resources such as the proposed changes in forest policy to enable joint management of forests. The Government of India has supported since the mid-1980's the various moves toward irrigation management transfer in the states through programs and policies such as the Command Area Development, National Water Policy (MOWR 1987), andthe Participatory Irrigation Management Program. However, because irrigation is a state subject, the states have no obligation to heed these policies.

Very preliminary results indicate that, in the proper situations, participatory management leads to significant increases in the efficiency of water use and the value of irrigated agricultural production. The significant outcomes observed at different are increased availability of water, improved reliability of supply and flexibility in cropping pattern which have enabled them to make shifts in cropping pattern towards high value crops. Farmers have reported some improvement in yields for the crops that were cultivated earlier also. Another significant benefit to farmers is the considerable saving in time to obtain water and reduction in hassles to pay for water. There has also been a more equitable water distribution and therefore a reduction in conflicts. This in turn has lead to more understanding and goodwill in the farming community. Farmers are

spending more on repair and maintenance and the physical structures are in good condition. Willful damage to the structure has reduced considerably. WUAs have devised and adopted water distribution rules most suitable to the local conditions. These rules are pragmatic and ensure equity.

However, from other perspectives, the performances of water users associations fall under scrutiny and there are some opinions that question the success if not the relevance of such participatory irrigation management system. For example, FAO in its recent series of large and medium-scale irrigation system in Asia made with Rapid Appraisal Procedures suggest that participatory irrigation management has largely failed to deliver on all major objectives. Water users associations created are weak and have little influence on major management decisions and water deliveries while the difference between the actual and stated management and operations-is not reduced. On-going efforts in a number of countries are essentially based on the same models and are likely to produce the same outcomes. These disappointing results have led reform promoters to advocate deeper reformon the ground that these disappointing results were due to incomplete reform. FAO further argue that unless significant results are achieved in improvement of service delivery to farmers and water users associations and reduction of chaos, institutional reforms will continue to have disappointing outcomes. This will require addressing not only deficiencies of the participatory irrigation management models presently adopted, but also addressing other factors of performance related system operation, management and design, etc., (Facon, T., FAO).

3.10.4 WUAs Establishment and Strengthening:

Some experiences across different parts of the world indicate that there are series of practical steps to be followed in establishing WUAs. For example as illustrated by the International Water Management Institute (IWMI), there are 10 practical steps in the establishment and strengthening of WUAs. For example, FAO, GIZ and IWMI jointly recommend the following four sequential phases ((FAO, GTZ and IWMI 1999):

- **Phase 1** begins with an analysis of the existing performance gaps in an irrigation scheme, followed by a sensitive solicitation of government support for a transfer of responsibilities from a government institution to a non-governmental WUA. This phase is also called “confidence building among all stakeholders”, which can range from members of government to farmers.
- **Phase 2** is the establishment of the institutional settings. Commissions, representational of all stakeholders, are advised on how the strategic reform can be coordinated. As in Phase 1, there is a need for the technical advisors to apply constant consensus building methods throughout the establishment of WUAs. During this process stakeholders meet and discuss on the required changes in workshops, seminars and other meetings. Stakeholders also meet and discuss with political decision makers, as well as convey their local knowledge to the involved external technical advisors.
- **Phase 3** addresses crucial policy and legal issues for a successful implementation of WUAs. First, government subsidies must be gradually reduced until they are eliminated. The goal is for water users to pay for their own water usage without costly government subsidies distorting the actual price of water. Secondly, legal changes are mandatory as WUAs face severe challenges when confronting strong government bureaucracies and powerful local governments if they have no formal water rights. Implementations of necessary legal amendments are a pre-requisite for the successful establishment of WUAs. Finally, the organizational form of the new WUA is addressed to guarantee the accountability of service provision. From the earliest stages of a WUA, all stakeholders are included in each step to foster trust and transparency.
- Finally, in **Phase 4** a plan is drawn up for implementation of the WUA such as capacity building; assistance with hydrological data; legal advice; and planning, design, construction and financing of technological improvement projects, such as better irrigation technology.

In a separate document, the IWMIdescribes the following detail steps of establishing and strengthening WUAs: (1) Build friendly relationships, and create awareness about

WUA, its benefits, structure of WUA, its role, functions and how it is organized, (2) identify essential components of irrigation and drainage service plan,(3) consult the water users on appropriate organizational design, characteristics of the elected representatives, and the way they would like to choose their representatives along each watercourse for forming the representative assembly, (4) representative election meetings for watercourses level water users groups (WUGs) and for the representative / General Assembly, (5) introductory meetings of the representative assembly, selection of WUA Council, chairperson of WUA, and dispute and Resolution committee members, (6) preparing the founding documents, adopting the normative charter, by-laws, and other documents for registration and applying for registration, (7) capacity building and training for management, and system management transfer to WUA (IWMI, 2003).

The International water Management Institute, the Southeast Asia Office proposed the following key, but simple and applicable principles for functional and sustainable participatory irrigation management that(1) the roles of WUA and governance are clear and adequate; (2) through participation in WUA, farmers are guaranteed their demand for water is supplied in timely manner; (3) farmers receive financial benefits through the use of water which allows them to cover the costs of water and associated services; (4) all members are treated equally with respect to water allocation, cost sharing and decision-making; and (5) information on the financial status and transactions are disclosed to members in a transparent manner.

3.11 CHALLENGES OF WUAs:

The challenging factors for WUAs were labeled as (1) dissatisfaction of member farmers towards PIM (2) network ineffectiveness (3) inequitable distribution of water (4) lack of trust towards managers (5) lack ofgovernment support and (6) lack of in group coherence. And the following measures were believed to reduce problems and enhance their successrates: (1) If farmer members are to feelbelonged by their association management,they should have a voice in decision-makingand those

managers should "hand over thestick". This in turn increases the level ofsatisfaction among WUA members. (2)Mutual trust between the government andfarmer members is possible through moreinteractive approaches when working withmembers. This interactive approach helpsmanagers to plan their irrigation schemes byputting farmers first. (3) The government isadvised to transfer irrigation network toWUAs, when all the facilities are intact. (4)Training farmer members on the basics ofParticipatory Irrigation Management wouldenhance their understanding and support forfarmer-based irrigation management. Thegovernment should also take intoconsideration that Irrigation ManagementTransfer (IMT) is a gradual process and thatthey need to take a monitoring role untilfarmers are efficacious in taking full controlover irrigation networks.

4 PROFILE OF THE PROJECT AREA:

4.1 GENERAL CHARACTERISTICS OF THE AREA:

4.1.1 Location:

The Tibila Irrigation Based Integrated Development Project (TIBIDP) is located in the three adjacent districts of Jeju, Sire and Merit. These three districts are administratively found in the Arsi Zone of Oromia Regional State, Ethiopia. The project area is commonly known as **Tibila,** a name associated with the state farm found in the area. As per the final report of the socio-economic study conducted by the Oromia Water Works Design and Supervision Enterprise, the local people or the project beneficiaries do not like the name **Tibila** to be associated with the Irrigation project (TIBIDP Socio-Economic Study Final Report, 2009).

In terms of coordinate system, the project area is located at $8^0$89293'N, 039^0 03129'E at an altitude of 1303m above sea level. The project area is situated about 150 kilometers away to the east from the country's capital city, Addis Ababa and 95 kilometers away from Asella Town, the Arsi Zone capital. It is about 33 kilometers from Awash Melkasa Research Center, to the southeast of the main asphalt road from Addis Ababa to Asella.The asphalt road passes through the Adama Town, the capital of the Oromia National Regional State. The irrigation project is 50 kilometers awayfrom this main asphalt road, on the left bank of the Awash River. The area is accessible throughout the year and has electric power and telephone facility. Hence, it is understood that the project has great opportunity of using such road facilities and the urban centers for transporting and marketing the agricultural products (Ibid, 2009).

The project area is situated in the Upper Awash Valley. The Awash Valley is part of the Great East African Rift Valley. The Awash River has about 1200 km length and it is one of the largest rivers inthe country. It is the main and the largest water body in this arid and semiarid area. The river is the highly exploited river in the country for irrigation

potentials. The physical feature of the areais mainly extensive plain land situated all along the Awash River.

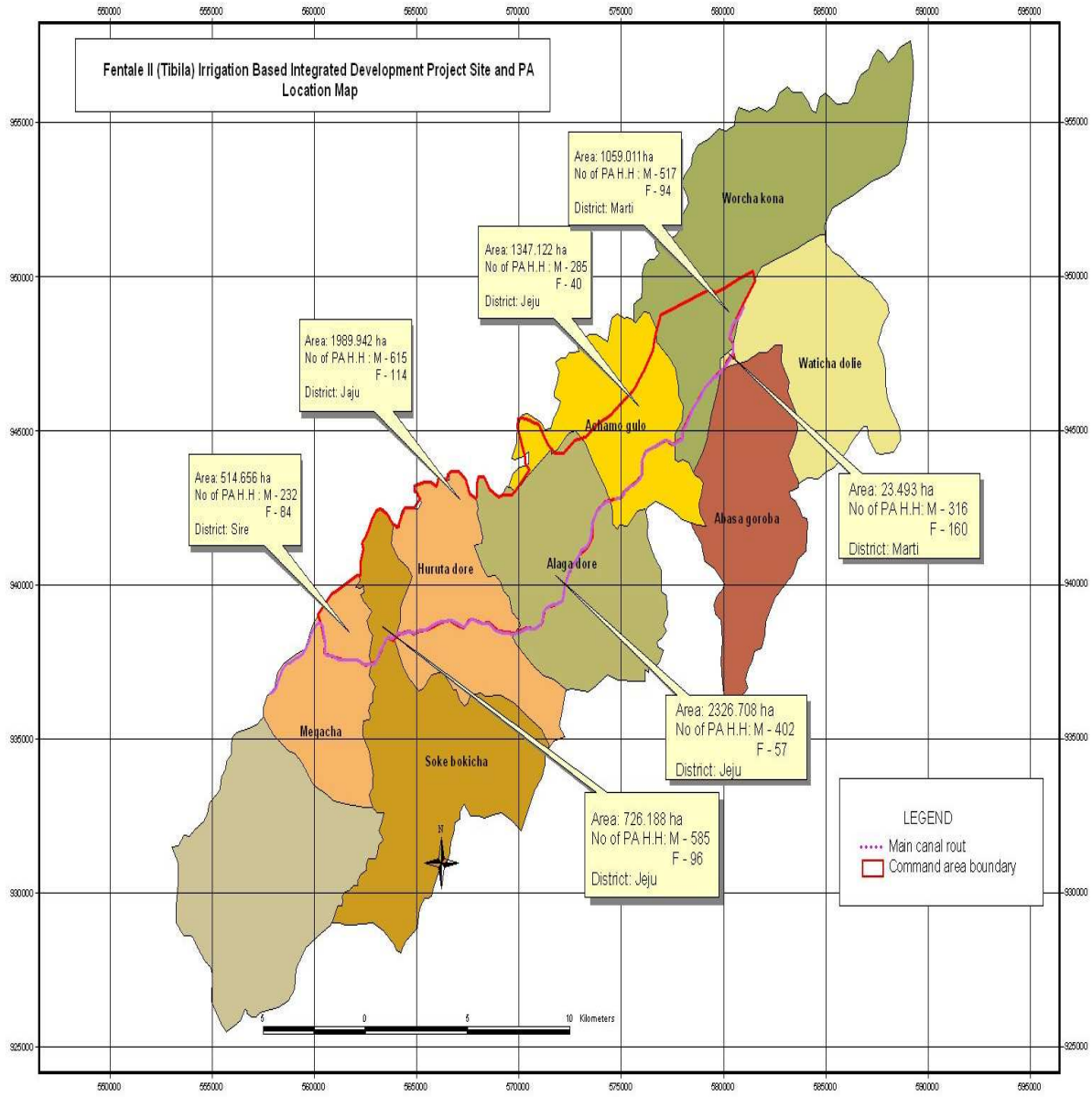

Figure 1: Location map of the Tibila Irrigation Project

Source: OWWDSE, Tibila Irrigation-Based Integrated Development Project Organization and Management, December 2009.

4.1.2 Climate:

The project area is found at the elevationaround 1220 to1250 meters above sea level. According to the meteorological data obtained from the nearestAwash Melkasa meteorological station, which is about 33 kilometers far from the study area, the annual mean rainfall distribution in the area ranges between 500mm to 900mm. The rainfall is mostly characterized by erratic and uneven distribution. The area has a bimodal rainfall pattern, with the small rains occurring from February to April and the main rainfall season, which accounts for the largest total rainfall of the year occurs from July to September. In good years, the area also experiences some amount of rainfall in the month of December and this one month rain is very important for the pastoralists in particular, because it comes at the point when herds and humans are exhausted by the long dry season. The Mean monthly relative humidity varies from 32% to 49%. Thepotential evapo-transpiration is 1650mm per annum and the monthly mean temperature ranges from17 degree centigrade to 23 degree centigrade (OWWDSE, 2007).

4.1.3 Topography:

The topography of the project area is dominated by alluvial plain and the land unit isclassified as flat to rolling of which some parts of the flat land is exposed to flood as theAwash River overtops its bank especially in the month of August The soils arefine-textured dominated by sandy loam content that has good drainage capacity and very prone to irrigation. There are also medium-textured soil and gravel in some places. Regarding vegetation situation, the area is covered with scattered trees and bushes (CARE, 1991).

4.1.4 Water Source:

The Awash River is the only source of water for human population, for agriculturedevelopment including irrigation systems and for the livestock production in the area. It is one of the main rivers in the country suitable for large, medium and

small-scale irrigation. The irrigation potential of the river is 185,000 hectare (Dessalegn, 1999). It is a perennial river having reliable water discharge throughout the year, and as a result there is no water constraint from the source.

4.1.5 Vegetations:

Currently, there are widely open trees and shrubs dominated by poorly scattered ruminants ofAcacia species in the irrigation area. Rural families in the area cut trees, reducing forestcover, and sell fuel wood and charcoal to generate income. In addition, lack of or insufficientenvironmental awareness and motivation to plant trees among local people is other importantfactor that contributes to the degradation of the natural conditions (Oromia Regional State, 2002).

4.2 SOCIO-ECONOMI CHARACTERISTICS OF THE STUDY AREA

4.2.1 Demographic Characteristics:

The Tibila irrigation based development project is targeting 6 peasant associations (PAs). According to the 2007 population and housing census data, the total population dwelling in the six peasant association (PAs) of the Tibila irrigation project is 17,351 people incorporated into 3,258 households. Hence, an average of 5 persons is assumed to be living in each of the household. The males and female disaggregation of the project population is in the rage of 53% males and 47% females. Of the total 3,258 households, 86% of them are headed by men while the remaining 14% are women headed. Taking into account the above total rural and urban population, the population and housing census indicated that about 20% of the people in the districts reside in urban areas, while the large majority of 80% live in rural parts of the three districts. There is no significant difference between three districts regarding the proportion of people living in rural and urban areas (CSA, 2007).

4.2.2 Socio-Cultural Situations:

The socio-cultural situation of the population is mainly concerned with the ethnic composition, religion and marital status and situation of the population and households in the project districts and project PAs. According to the information gathered from local sources such as the offices of the district administrations, agriculture offices and other concerned local offices and sources, the ethnic composition of the population in the three districts is predominantly occupied by the Oromo population with the average of 93.5% of the population constituted by this ethnic group, followed by the Amahara which is about 6.5% of the total population. Most of the population from the Oromo ethnic group is indigenous to the area, while the Amahara have migrated to the area from other areas.The predominant religion is Muslim in the three districts with majority 72% of the population adhering to it and the remaining 23% of the population follow the Orthodox Christian religion while the minority religions practiced are Protestant Christian and ***Waqefata,*** whereabout 4% and 1% of the population are believed to be the followers of these religions, respectively (District Agriculture and Rural Development Offices, 2013).

With regard to marriage status, according to the information obtained from the socio-economic study final report of the irrigation project, over 97% of the study respondents reported that they were married, while about 1.8% and 1.2% reported that they were single and divorced respectively. Also, the FGD respondents reported that divorce is not common among the project population. The same study indicated that the majority, about 78% of the respondents indicated that they were in monogamous marriage arrangement, while 22% reported that they were polygamous with regard to marriage. The discussion with FGD discussants indicated that polygamy is considered as one way of acquiring additional labour force for the households and hence the practice tend to be frequent among the local population.

4.2.3 Settlement Pattern:

The settlement pattern of the population in the project area is both scattered and clustered. In most cases the people live in a cluster and this clustering is called Genda (village) which is based on kin relationship and cattle herding system. A village constitutes a group of households who have common kinshipof people herdinglivestock together. A village was a territorial based herding group headed by the *Abba Genda* (head of the village). It is a social organization for mutual security and protection of the people from any danger. Nowadays, the mode of settlement has consolidated more and more into cluster formation with people changing their mode of life from pastoralists into agro-pastoralists and pure agricultural way of life. The pastoral way of life is no more practiced in the area and sedimentary pattern of settlement has been the mode of life for the population since long. And with the permanent way of settlement and establishment of PA administration system the kinship and clan ties are getting more and more relaxed and the power of the village leaders have been declining steadily since recent years.Regarding housing, the majority of the people live in thatched dwellings. According to the socio-economic study report of the project area, about 80% of the households live in thatched roof houses while the remaining 18% have corrugated Iron Sheet (CIS) roofing (Tibila Socio-economic study final report, 2009).

4.2.4 Land Tenure System:

The land tenure is derived from the Latin word ***Tenere*** which means “to hold”. Tenure defines the social relations between people in respect of the object of tenure, in this case land. Tenure also defines the methods by which individuals or groups acquire, hold, transfer, and transmit property rights in land (Waiganjo and Paul, 2001).

Two types of land tenure system prevail in the project area and these are private land holding with usufruct right and communal land. The former is mainly for crop cultivation while the latter is forgrazing purpose. The dominant form of land holding system in the project area has proved to be private land holding for cultivation. This is one of the

characteristics of mixed farming system, which is becoming less and less way of life for the population in the project area. Nowadays, the predominant form of farming practice is commonly changing to crop production for the population in the project area. The population way of life is shifting more and more to the production of cash crops and animal rearing is getting less attention due to lack of sufficient open space and grazing land. Therefore, there is very few holding of communal land for the grazing by the population in the specific project PAs. These situations are not the cases for the other population of the three districts. As moves far away from the project PAs, the agro-pastoralist way of life take predominance and the chance of finding much open space and grazing land become common place (District Agriculture and Rural Development Offices, 2013).

4.2.5 Land Use Pattern:

The land resource in the project area has been categorized into various types including the cultivated land and arable land. For example, according to the socio-economic study conducted in the project area, 43% of the land resource in the Jeju district is arable land and about 39% is cultivated land. This shows that there is significant potential of land resources for cultivation in the area. On the other hand, about 10% and 4% of land use or potential in the district are woodland and forest land respectively. It is estimated that about 3% of the land area of the said district is waste land and the remaining 1% is pasture land. Taking into account the categorization of the land area in the district, over 82% is agricultural land and very insignificant portion of the land area which is about 1% can be categorized as pasture land. These data show that the district is more suitable for farming than livestock production. On the other hand, the land use category in the Megacha PA of the Sire district shows that the lion share of the land use pattern, which is about 58% of the area is arable land and the next larger land size of 31% is forest land. The pasture land of the project PA is about 10% which is relatively significant.The pasture land use pattern is more dominant in the Watichadole PA of the Merti district, while forest land is the second largest in the peasant association. About 46% of the land in the area is categorized as pasture land and about 36% of land area is considered as forest land. Arable land is

only about 3% and the remaining 14% of the land size in the PA has not been categorized as such (Table 2).

Table 2: Land use pattern in the project Peasant Associations (PAs):

Type of Land use	**Land area for PAs in Jeju district in hectare**	**%**	**Land area For PA in Sire district in hectare**	**%**	**Land area For PA in Merti district in hectare**	**%**	**Total**	**%**
Arable land	11,900	43	-	-	507	3	12,407	27.81
Cultivated/irrigated land	10,421	39	1063	58	200	1	11,684	26.19
Forest land	1019	4	-	-	5700	36	6,719	15.06
Pasture land	225	1	179	10	7173	46	7,577	17.00
Wood land	2654	10	556	31	-	-	3,210	7.20
Waste land	700	3	5	0.3	-	-	705	1.58
Unused land	54	0.2	-	-	-	-	54	0.12
Built up area	-	-	18	1	-	-	18	0.04
Urban area	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	2232	14	2232	5.00
Total	**26,973**	**100**	**1821**	**100**	**15,812**	**100**	**44,606**	**100**

Source: Computed from the Agriculture and Rural Development Offices of the three Districts, 2013.

The agriculture and rural development offices of the three districts indicated that the total size of land in the irrigation PAs accounts for about total of 44,606 hectares, out of which 54% is arable land. The pasture land and forest land area account for 17% and 15% respectively. The total land area of 44,606 is the gross of all the land

resource of the six project PAs. This does not mean that all land resource in the area is currently used for irrigation development. The current irrigation land area is about 2500 hectares, while the planned land area to be under irrigation with the completion of the irrigation infrastructure is calculated at 6000 hectares. However, the project estimates that the potential land area that can be irrigated can extend over 7000 hectares. The proportion of pasture land and forest land is obviously less significant in the area. This shows that the issue of pasture land use and management and forest land conservation should be given due attention parallel to the implementation of the irrigation development project (District Agriculture and Rural Development Offices, 2013).

4.2.6 Grazing Land Holding System:

Due to the scarcity of grazing land, owing to various factors, the pastoralists and agro-pastoralists in the project districts have developed a coping mechanism to mitigate the problem of animal feed shortage. The irrigation participant farmers primarily use crop residues. They also cope with the scarcity of forage by production of improved forage and by using natural grass. On the other hand, the farmers outside the irrigation project use traditional forage reserving mechanism or fodder bank creation called ***kalo*** (enclosure) development. In this regard two types of forage banking systems have been developed in the area, namely, ***kalo*** (enclosure) and forage (hay) producing associations. ***Kalo (***enclosure) is divided into two; namely communal and private enclosures. Private enclosure should be given the first priority to be developed in the area. Onthe other hand, communal ***kalo*** can be given the second priority for grazing landmanagement in the districts. As lack of adequate open space or common land for grazing is obvious problem in the project area, there is a need to consider ways of developing fodder management system so as to enable the people adequately supplement crop production with livestock development (FGD with WUAs, February 2013).

4.3. BASIC SOCIAL SERVICES IN THE PROJECT AREA:

Social services are important components of social assets, the situation of theseservices directly or indirectly affect the labor supply and productivity of a givenpopulation both in quantitative and qualitative aspects. In this regard, different social services can be considered in relation to the irrigation development project being launched in the three districts. These social services include education, health, water and sanitation services, rural infrastructure, telecommunication and household energy sources. The access to these social services in one way or the other influence the health, wellbeing and development of the people and greatly contribute in enhancing or retarding development activities in an area. The situations of these major social services in the project PAs is as discussed hereunder:

4.3.1 Education:

Education has paramount importance in facilitating development interventions and promoting development activities in an area. Education has a great role to play in the enhancement and development of human capital of a given community and a country. Education is also fundamental for the enhancement of the quality of human life and ensuring social and economic progress. Furthermore, education facilitates information dissemination regarding modern agriculture technology, input utilization, and technical know-how, and environmental preservation, upkeep of personal and environmental sanitation and promotion of sustainable development in a community. According to the data collected from the education offices of the three project districts the education facilities in the areas are as follows: There is on average one primary school (grade 1-4) in each of the PAs found in the three districts. For example, there is one primary school in Megacha PA of Sire District, one similar primary school in Watichadole PA of Merti and the Jeju district education office reported the existence of 8 primary schools in the four irrigation projects that district. Out of the eight schools found in the four PAs of Jeju district, four of them were reported to be from grade 1-4 while the other four were from 5-8 grades.The numbers of school aged children going to the above schools were about 4570 in 2012 with the 2,975 (65%) were boys while the remaining

1,595 (35%) were reported to be girls. As the table below shows, there are no high schools that the school boys and girls in six adjacent PAs can attend in their immediate locality after completing their lower and medium level education (Table 3).

Table 3: Number of schools and students in the six irrigation PAs

Districts	**PAs**	**Grade and # of schools**					**Number of students**		
		1-4	**5-8**	**9-10**	**11-12**	**Total**	**Male**	**Female**	**Total**
Jeju	Achamogulo	1	1	-	-	2	368	344	712
	Alagadore	1	-	-	-	1	638	230	868
	Hurutadore	1	2	-	-	3	1022	509	1531
	Sokieboqicha	1	1	-	-	2	601	301	902
Sire	Megacha	1	-	-	-	1	250	102	352
Merti	Watichadole	1	-	-	-	1	96	109	205
	Total	**6**	**4**	**-**	**-**	**10**	**2975**	**1,595**	**4,570**

Source: The Education Offices of the respective districts of Jeju, Sire and Merti, February 2013.

According to the discussion with community members indicate the social and economic problems like the overall poverty situations, long distance to schools, the general understanding and attitude that the people have on sending children to school and above all lack of adequate school facilities such as school premises, shortage of class rooms and teachers are reported to be the major causes for the low school attendance and performance of children in the project areas. Especially, for the non-project project participant household and community members, drought and transhumance are believed to greatly affect school attendance and performance because of the movement of community members and the youngsters with livestock in search of pasture and water during acute dry months. Also, community members reported that the demand for child labour so as to support the labour requirement of families, children restrained from going to school and/or are forced to quit their schooling. In the similar manner, the education offices of the three districts indicated that drought, long distance, early marriage of girls and child labour were the major problems hindering effective educational activities in the area. The problem of food

insecurity is also mentioned by community members and the three districts for the low school attendance and performance.

4.3.2 Health Services:

Both education and health are the fundamental factors for the development of human capital in any given community. As education, health is considered as one of the major prerequisites for the increase in the wellbeing and productivity. Access to adequate and quality health care is one of the major determining factors for the ability of individuals and communities to achieve sustainable livelihood security.According to the information obtained from district health offices, in 2012 there were 1 health center in one of the project PAs, 2 clinics (one government and one private clinic), 2 health posts for the total estimated population of 20,474 believed to be living the six project PAs. The distribution of these health facilities in the respective project PAs is as indicated in the following table.

Table 4: Distribution of health facilities in the project PAs

S/ No	**Distr ict**	**Project PAs**	**Total population**	**Health facilities**			
				Health center	**Clinics**	**Health post**	Total
1	Jeju	Achamogulo	2,386	-	1	-	1
		Alaagadore	2,491	-	1	-	1
		Hurutadore	3,993	1	-	-	1
		Sokieboqicha	4,942	-	-	1	1
2	Sire	Megacha	3,607	-	-	1	1
3	Merti	Watichadore	3,055	-	-	-	-
	Total		**20,474**	**1**	**2**	**2**	**5**

Source: District health offices, 2012

The total number of health professionals in the irrigation project PAs is 14 (including 9 males and 5 females). Regarding the qualification of the health professionals the data

obtained from the district health offices does not indicate the existence of trained midwives, but shows the existence 4 nurses, 1 sanitarian, 1 pharmacist, 2 laboratory technicians, 3 health assistants, 2 health extension workers and 1 unidentified health personnel. As per the information from the said offices the health facilities do not have health officers, doctors and other high qualification health professionals.

The health service sector in the area is restrained by lack of adequate and qualified health personnel, lack of sufficient and quality health facilities and insufficient budget allocation. Therefore, the service is much limited in terms of access, adequacy and quality. These limitations are relegating the health services provision to a sub-standard as compared to the national and regional standards.

According to the information obtained from the respective health offices of the three districts, the major diseases reported and considered to be responsible for population morbidity and mortality in the districts in general and among the project population in particular include malaria, diarrhea, intestinal parasites, acute respiratory infection diseases, TB, rheumatism and kidney infections among the others. The same offices reported that shortage of water supply, lack of personal and environmental hygiene and shortage of qualified manpower and lack of adequate budget were some of the major factors that hindered the adequate and quality provision of health services in the districts and project area (District Health Offices, 2013).

4.3.3 Water Supply and Sanitation:

One of the major problems in the districts in general and the project PAs in particular was the scarcity of water supply. Water resources in its wider sense and potable water availability in particular are very poor and access to water is the main concern for the community. Though intensive and utmost efforts were made at different times to supply potable water for the community, it was in vain, and hence, the people in the area are still suffering from high scarcity of water both for themselves and their livestock. According to the data obtained from the respective district water resource offices, a source of water supply in the area is the unprotected and unclean water from

Awash River. The majority of the household in the project area use the irrigation water coming from the same river by directly fetching from the main and sub-canals. Also, the livestock use the same water source in the same manner as humans.

As per the data obtained from the socio-economic study conducted in 2008 for the irrigation project, the major source of water both for human and livestock of the study area is the Awash River flowing through the area. Accordingly, about 86% of the households reported that they obtained water from the river, while about 6.5% and 5.9% obtained water from hand dug well and piped water supply respectively. About 1.2% of the respondents indicated that their water source is from traditional ponds. This information clearly indicates the serious shortage of potable water supply in the project area. In the same manner the severity of water shortage is very high for the population outside the command area of the project. When the accessibility of people is limited to the main river in the area due to distance and other factors their chance of getting water for survival is much constrained to a life threatening point.The water shortage is aggravated due to the high prevalence of fluorine content of the underground water in the project area. The high presence of this substance in the underground water has hampered the option of using underground water even if there is a chance of getting funding and technical opportunities to avail water to the population from such sources (TIBIDP, Socio-Economic Study Final Report, 2008).

4.3.4 Infrastructure:

Infrastructure is one of the critical conducive factors for the socio-economic development of any given community. The scarcity of such developmental life line in rural communities is a common place. Lack of road networks, telecommunication, electricity, market shortage is always serious obstacles to the development of rural population in the country.The situations of the road network, electricity, market and telecommunication facilities in the project districts in general and project PAs in particular have the following status:

4.3.4.1Road network:

According to the data of the socio-economic study of the irrigation project, about 96% of the sample households reported that they have no access to road, while only 4% of the respondents indicated that they have such access. There is only one all weather road in the area that passes through the project area. Therefore, the 4% of the respondents who reported having access to road network is related to their relative physical proximity to this all-weather road. The project area has critical desire for the enhancement and development of road network in a strategic and planned manners in order to boost up the irrigation based development in the short and long term bases because the easy access of the population to such facility for getting agricultural inputs and the convenient transportation of agricultural products to markets would facilitate growth in productivity in the short term and community development in the long run. There are access roads within the irrigation command area along the main canals, but due the human and livestock interference these access roads get damaged. The plan was to create access to each and every plot in the command area, but none of such roads have been paved (Ibid, 2008).

Figure 2: Photo of the main road passing through the project area, February 2013.

4.3.4.2 Market Facilities:

One of the important services for the rural community is availability of markets in easily accessible distance. This boosts agricultural production and facilitates the marketing of the produces and thereby highly contributes to the improvement in the living conditions of the community and development of the same in the long run. On the other hand, in rural community where the market network is not available or not easily accessible, the improvement in agricultural production becomes meaningless as long as the community members are constrained by lack of market and demand for their agricultural products. Such constraint becomes strong bottleneck to the productivity and the strategy of boosting agricultural production becomes self defeating in any case.

Unfortunately, according to the socio-economic study report of the Tibila irrigation based development project, 96.4% of the study sample households reported that market service is not available in the area and indicated that they have very poor access to the facility and face serious obstacles in marketing their agricultural products. The few market opportunities for the people in and around the irrigation project areas are far away from the project areas and are not easily accessible to the people. The distance and the expensive transportation costs for human and goods are other constraints to the population for accessing these markets.The irrigation based development project seems to be situated at strategically disadvantage location in term of market and much hampered by lack of appropriate market accessibility and thereby low demand for the irrigation products. The market constraint calls for systematic, strategic and concerted efforts of all concerned to think in terms of creating market linkagesfor the project area population (Ibid, 2008).

4.3.4.3 Telecommunication:

All respondents reported that as having cell phone of their own. Also, they indicated that their spouse and older children have their own mobile. Farmers use the cell phone for market assessment for their crops and other business connections and for social

contacts with relatives and friends residing in the nearby and distant places. The respondents indicated that there is poor network connection in their area and there are frequent interruptions. Respondents also indicated that there are many days and months when the network totally stops functioning altogether. They further noted that having personal telephone facilitates and supports the respondents to have timely access to information regarding market situations and stay connected to relatives and friends anywhere. Respondents indicated the existence of fixed telephone line in the nearby Doni Town. They said that the facility is for the town and there is no any connection or extension of the line to the rural area where they live.

4.3.4.4 Household Energy Sources:

It is unthinkable to imagine electricity at household setting in rural areas of Ethiopia at this particular period in the country'ssocio-economic context. However, the rural communities in the irrigation area are exceptional in this regard. Therefore, some of the respondents reported having electricity in their household setting. The project communities have the opportunity of using this source for household light and/or for energy purpose with the collective fund contribution they have made. On the other hand, there are many villages and households in the irrigation command areas that still use very traditional and natural energy sources such as fuel-woods, crop residues, cow dung, tree branches and leaves. On the other hand, some community members such as those who do not participate in the irrigation project, the unemployed youths, low income and destitute groups burn charcoal for sell by seriously aggravating environmental degradation.

4.4 SOCIAL ORGANIZATIONS IN THE AREA:

Immediately after the downfall of the Emperor Haileselassie in 1974, the then newgovernment created what are known as Peasant Associations (PAs). These associations still exist and function in rural areas of the country and are the legal and administrative institutions formed as the lowest administrative units in all rural settings.

These areresponsible to handle arbitration among fellow members, collection of taxes and creditrepayments and perform many other administrative and political functions.

Service Cooperatives (SC) established some years later by the Ministry ofAgriculture (MoA), are also responsible for linking the farmers and industries and vice versa.The service cooperative avail fertilizer, improved seeds and hand tools and other consumables to members, whilethey facilitate the marketing of agricultural products for farmers in some cases. They are also established to stabilizemarket and reduce exploitation of the farmers by greedy traders.These modernorganizations in rural Ethiopia including thePAs, Service co-operatives and thenew association called farmers' union, which is a coalition of many service co-operatives at awereda level, are institutions linking the government with the rural population.

In addition, to these modern institutions, it is very common to find many traditionalsocial organizations like *idir, ikub, debo, sembete, Mekenejo (where two individuals pair the single ox they have for plough)*, oxenowners' *idir* and many others, in the study area. Oxen owners' *idir* is meant to help shareexpenses when a draught ox dies, because of draught or animal diseases. Oxen are one of the major assets of therural population in all rural areas of Ethiopia in pure agriculturalist or in agro-pastoralist areas.Equally important also is ***debo***system prevalent among rural communities.***Debo*** is applied during crop production, house construction,when a major labor force is required which a single household alone cannot accomplish(FGD, February 2013).

4.5 MAJOR ECONOMIC ACTIVITIES:

Two types of main source of livelihood systems prevail in the three districts in general and the irrigation area in particular. The population practice mixed farming with the significant proportion of the population depending on agro-pastoralist way of life. The population in the area undertake bothcrop and livestockproduction with significant proportion of the population focusing on crop production by engaging considerable

portion of their agricultural activities in this farm system. This means the majority of the community members produce crop using rain-fed agriculture for the population in the three districts as a whole, and irrigation-based agriculture for the project population and supplement this by livestock production. The livestock production is on large scale for the population outside of the irrigation command areas and it is very moderate or small scale for the irrigation participant households (District Agriculture and Rural Development Offices, 2013).

4.5.1 Crop Production:

According to the information obtained from the Agricultural and Rural Development Offices of the three districts of Jeju, Sire and Merti, crops grown in each of the districts in general and project PAs in particular include various types of cereals, pulses and horticulture among others. Hence, the population produces maize, ***teff***, wheat, barley, oats, onion, potato, etc. Despite the various constraints that hindered agricultural production, the rural people in the area are mainly engaged in crops cultivation to sustain their livelihood. Therefore, crop production is the main stay and source of livelihood in the project area. However, the population supplemented their crop cultivation based livelihood system with livestock production. For example, according to the socio-economic study report only 4.7% of the sample respondents practice only crop production and none of them are engaged in only livestock production. The vast majority of 95.3% of the respondents said that they undertake both crop and livestock production in a mixed farming system. Therefore, the main source of livelihood in the area appears to be both crop and livestock production with the significant proportion of the population engaging themselves in production of crops as main livelihood and supplementing this with livestock rearing as secondary way of life (Ibid, 2013).

The crop production in the area has been constrained by a number of problems, which include recurrent drought, mainly due to in adequate and erratic rainfall, low agricultural extension services resulting in shortage of agricultural inputs and scarcity of information and technology, prevalence of crop pests and diseases, scarcity of farm land, shortage of farm animals among others.The area experiences high evapo-

transpiration due to its arid and semi-arid nature and becomes less suitable for crop production for the majority of the population in the three districts. However, even though water constraint for crop production is solved for the population in the irrigation command areas, the participants report that unfavorable market which renders the producers prey to brokers and similar unnecessary intermediaries constrain the crop production system. The irrigation participants produce cash crops such as onion, tomato, potato and others, therefore, the unfavourable market situations created by brokers and other intermediaries in an organized and systematic ways one of the serious problems facing the population (Ibid, 2013).

In addition, the Agricultural and Rural Development Offices of the three districts report that the major constraint of agricultural production are insufficient agricultural production resulting from moisture stress, degradation of soil fertility as a result of weak or no fallow period and soil erosion, crop disease, meager or no application of modern farm inputs such as chemical fertilizers and improved seeds, inadequate and/or inappropriate provision of extension service, poor linkage among agricultural research, extension and farmers, and low prices for agricultural produce were the major crop production constraints (Ibid, 2013).

4.5.2 Livestock Production:

In addition to crop production the people in the area are engaged in livestock rearing. The types of livestock or animals kept in the districts include cattle, goats, sheep, camel, equines and poultry. Regarding the current livestock holding, the populations living outside the irrigation command areas are believed to have large number of livestock, while the participants of the irrigation have small livestock holding capacity due to lack of adequate open space and grazing areas. Even before the irrigation project, the majority of these households were located nearby to the rural town called Doni and the land size they had was relatively small and they had less number of livestock population. On the other hand, the majority of the populations living in distance villages and settlements have typical agro-pastoralist way of life and they still

have large land and livestock sizes. It is reported that there are many individual households rearing hundreds of herds of cattle, sheep and goats.

Table5: Livestock population in the irrigation project PAs

Project PAs	Type and number of livestock								
	Cattle	**Goat**	**Sheep**	**Donkey**	**Horse**	**Mule**	**Camel**	**Poultry**	**Total**
Achamogulo	1223	813	204	343	0	5	45	901	3534
Alagadore	3425	1572	825	743	0	5	257	1441	8268
Hurutadore	5250	2000	1200	1300	5	10	200	5095	15,060
Sokieboqicha	3325	1913	897	702	7	13	62	1781	8700
Magacha	1345	1552	240	275	4	3	22	435	3876
Watichadole	1287	2234	353	287	0	12	21	524	4718
Total	**15855**	**10084**	**3719**	**3650**	**16**	**48**	**607**	**10177**	**44156**

Sources: Agriculture and Rural Development Offices, 2012

Usage of rangeland may indicate whether there is available grazing land in addition to its indication of type of farming system in the area. In this regard the dominant form of grazing for the population of the three districts as a whole is a free grazing, which sometimes shows the presence of agro-pastoral way of life. However, the project area population are getting accustomed to zero grazing mode of livestock rearing and taking the small number of livestock they have to the specific plots where they work to feed the animals crop residues, natural grass in and around their plots and sometimes they grow improved forages in an agro forestry manner.

According the socio-economic household survey conducted in 2008 for the start of the irrigation project, about 63.3% of the sample respondents explained that they exercise free grazing to feed their livestock, while 12.4% feed their livestock through zero grazing. Zero grazing is one of the indicators of animal feed shortage, due to agricultural expansion in particular. About 24.3% of the sample households explained that they feed their livestock both through zero and free grazing. The study recommended that due attention should be given to livestock rearing and rangeland management in the process of implementing the irrigation development and allocating land for irrigation in the area. They study indicated the consideration for allocating

considerable portion of land in the areafor forage production and use (TIBIDP, Socio-Economic Final Report, 2008).

4.5.3 Livestock Production Constraints:

The socio-economy study conducted in the irrigation project area indicated that despite its importance in quantitative terms the livestock production did not help much to improve the livelihood situation of the population owing to various constraints. From among the different constraints, shortage of livestock feed, scarcity of water supply, prevalence of livestock diseases, shortage of veterinary services, and lack of improved breed are some of the factors that have hindered the effective production of livestock in the irrigation project area. The major livestock diseases reported in the project area include blackleg, pasturelosis, anthrax, sheep and goat pox, bacterial infection, and internal and external parasites. Also, the Agriculture and Rural Development Offices of the three districts reported that the major constraints regarding livestock production are recurrent drought; shortage of water supply for the livestock and feed shortage (Ibid, 2008).

4.5.4. Off-farm Activities:

According the information gathered through focus group discussion, the populations in the area are taking up petty trading. Many of those engaged in such off-farm activity are women. Their merchandises in most cases aretobacco and coffee. The women use the profits to augment their householdconsumption. The women who undertake the small business activities are those whose husbands do not havereliable income source.In recently years, many people have engaged in burning and selling ofcharcoal, particularly community members that are outside the irrigation command area. Previously, charcoal selling was the mostcontemptuous activity and hatedby every people and hence the business of charcoal burning and selling have not been common in the area until the recent times.It was later introduced to the area by people coming from other places.Nowadays, people produce charcoal and sell it on the roadside or take to the nearby towns. Trees are being cut down for charcoalburning,

building houses, firewood, etc. and the land in the area is progressivelygetting bare (FGD, February 2013).

5. THE RESEARCH FINDINGS AND DISCUSSION:

5.1 SOCIAL AND ECONOMIC PROFILE OF SAMPLE RESPONDENTS:

5.1.1 Gender, Marital Status andFamily Size of Respondents:

The information in this study was based on the views of 76 respondents in the four study blocks. The gender composition of the respondentswas 93%male and only 7% female.Regarding marital status, 92% of them were married while 8%were not married. None of the respondents were divorced or widowed.The total number of individuals in all the families of the respondent households was 382 altogether, 51% male and 49% female. The average family size in each of the study household is 5 (Table 6).

Table 6: Family profile of respondents

Study Blocks	**No. of respondents**	**Sex of respondents**		**Marital status of respondents**				**Total family size**	
		M	**F**	**Married**	**Not married**	**Divorced**	**Widowed**	**M**	**F**
Block II	18	18	0	17	1	0	0	41	45
Block III	17	15	2	17	0	0	0	47	38
Block V	30	27	3	27	3	0	0	73	69
Block VI	11	11	0	9	2	0	0	32	37
Total	**76**	**71 (93%)**	**5 (7%)**	**70 (92%)**	**6 (8%)**	**0**	**0**	**193 (51%)**	**189 (49%)**
								382	

Source:Survey findings, February 2013

Males are the dominant household heads in the study area as it is the case in the pastoralists and semi-pastoralist population.There was no single incident of divorce and the existence of widowed woman. According to the respondents, divorce may not be common among the study population but the existence of widowed woman or man may not be avoidable. However, one can deduce that the marriage of widowed woman to the immediate relatives of the deceasedhusband and the widowed man marrying the immediate relative of the deceased woman or remarrying another wife from elsewhere as soon as possible are common practices among the study population and such practices could be the major reasons for lack of single household heads.

5.1.2 Age Distributionof Sample Respondents:

Of the total 76 respondents21% were in age group of 18-28,31% were in age group 29-39, 30% were inthe age range from 40-50, 18% were 51-60 years old (table 7). However, none of the respondents had reported their ageto be above 61 years old. The overwhelming majorities of the household heads were in the category of economically active age range and can be considered as most desirable age group for projects like irrigation development.

Table 7: Age Group of Respondents

Project Blocks	**No. of respondents**	**Age Group**				
		18-28	**29-39**	**40-50**	**50-60**	**60+**
Block II	18	2	6	6	4	-
Block III	17	1	6	7	3	-
Block V	30	8	12	5	5	-
Block VI	11	3	2	4	2	-
Total	**76 (100%)**	**16 (21%)**	**24 (31%)**	**22 (30%)**	**14 (18%)**	**- (0%)**

Source: field survey result, February 2013

On the other hand, none of the respondents were over 61 years of age. Therefore, old age and retirement may not have be the significant influence on the efforts of the family heads towards working on the irrigation farms and managing the household irrigation plots with the other family members.

5.1.3 Education Level of Respondents:

Almost half of the respondents or 47% were either illiterate or only can read and write.None of them had attained even primary level education and most likely cannot do simple arithmetic. On the other hand, it is quite encouraging to observe that more than half of them had attained primary level education and beyond. Of these, 25% of the respondents had reported that their level of education was at primary level while the 17% and 10% had reported their education status to be at junior and secondary level, respectively (Table 8).

Table 8: Education level of sample respondents

Project Blocks	**No. of resp.**	**Level of Education**									
		Illiterate	**%**	**Read & write**	**%**	**Primary**	**%**	**Junior secondary**	**%**	**Secondary level**	**%**
Block II	18	7	9	4	5	6	8	1	1	-	-
Block III	17	4	5	8	11	3	4	1	1	1	1
Block V	30	4	5	6	8	7	9	6	8	7	9
Block VI	11	-	-	3	4	3	4	5	7	-	-
Total	**76**	**15**	**19**	**21**	**28**	**19**	**25**	**13**	**17**	**8**	**10**

Source: Survey findings, February 2013

5.1.4 Respondent's identity in the Household:

The overwhelming majority 91% of respondents were actual household heads.8% were housewives and 1 person was ordinary household member. Both the housewives and the household members acted as respondents as the household head were not present during the interview. In the absence of the household head or the housewife it was decided to use the eldest household member or any adult member in the household.

5.2 BENEFICIARIES LIVELIHOOD CONDITION IN PRE AND POST PROJECT IMPLEMENTATION:

5.2.1 Household Main Occupation and Source of Livelihood:

Prior to launching the irrigation project, the great majority 99% had reported that they were engaged in mixed farming of both crop production and livestock husbandry. Only 1 person was involved in sole crop production. The least practiced ways of life were livestock production and off-farm activities,as these were not reported by any to be the sole occupation.Off-farm activities were not reported by any of the respondents because such activities were mostly practiced by women whose husbands had been generating low income from crop and livestock production. There was no any significant change in the way of life of the respondents after the start of the irrigation project. Out of the total 76 respondents, the vast majority 99% had reported that their livelihood still depended on both crop production and livestock husbandry. However, the types of crops produced andthe water sources that the respondents were using for crop and livestock production during the pre and post projectsomewhat differ (Table 9).

Table9: Occupation of respondents

S/N	Household occupation	Number of respondents			
		pre project	%	Post Project	%
	Crop cultivation only	1	1	1	1
	Livestock production only	-	-	-	-
	Both crop and livestock production	75	99	75	99
	Off-farm activities only	-	-	-	-
	Had no occupation at all	-	-	-	-
	Total	**76**	**100**	**76**	**100**

Source: Survey findings, February 2013

5.2.2 Household Farm and Other Resources:

According to FAO (1997), farm resources generally fall into two broad categories. The firstcategory is fixed resources that provide services over a number of years or at least over aperiod longer than the production cycle of short-term (seasonal, annual) crop or livestockenterprises. Common examples of these are land, machinery, and an irrigation system.In this category, land is typically the most important resource that will usually provide its serviceindefinitely. As it is generally observed, arable land is neither abundant norscarcein the study area. There were uneven or skewed land holdings among the farming community, especially before the start of the irrigation project. This was due to the fact that land was redistributed only in 1975 following the overthrow of theimperial government. Before the start of the irrigation project the household plot size varies from 0.44 to 3.06 hectares in the project area.

After the project was implemented, allcultivated land of the project area has been redistributed to the beneficiaries based on the regional government criteria.According

to these criteria, 0.75ha of land had been given to those who were married and have families, 0.5 ha of land had been given to those who were unmarried or single and live on their own and 0.25 hectare plot was provided to any individual who is above 18 years of age, but live within the family of origin (District Agriculture and rural Development Offices).

Therefore, the respondents land ownership before and after the start of the irrigation project had shown a significant difference. For the question whether or not the respondents were having their own land, the great majority 95% of respondents responded yes, while the remaining 5% responded that they did not have their own plot before the start of the irrigation project. Regarding land size, 20%had owned less than 0.5 hectare of land, 24% had owned 0.5 to 1 hectare, the other 20% had possessed 1-2 hectares of land, and another 33% owned 3-4 hectares and 5% had reported their land size was over 4 hectares prior to the irrigation project.With the start of the irrigation project the land ownership size has completely shifted, in that, the great majority 83% of the respondents had reported that the land size they hold currently is about 0.75 hectares, while the remaining 17% said that their land size is 0.5 hectare. There was no 0.25 hectare plot holding as a response, because the survey was focused on only household heads with 0.75 and 0.5 hectares land by excluding the children 18 and above years of age having such plot sizes. The farmers had almost proportionate land size as a result of land redistribution made with the start of the irrigation project. Those0.5 hectare land owners are unmarried youths without family and children (Table 10).

Table 10: Land holding size of respondents

Project Blocks	**No. Of respondents**	**Size of Landholding in Hectare**						
		Before the project					**After project**	
		<0.5	**0.5-1.0**	**1.0-2.0**	**3.0-4.0**	**>4.0**	**0.50**	**0.75**
Block II	18	4	5	3	3	3	5	13
Block III	17	3	1	6	6	1	1	16
Block V	30	7	10	4	9	0	4	26
Block VI	11	1	2	2	6	0	3	8

Total	**76**	**15 (20%)**	**18 (24%)**	**15 (20%)**	**25 (33%)**	**4 (5%)**	**13 (17%)**	**63 (83%)**

Source: A field survey result, February 2013

5.2.3 Crop production:

The study participants had indicated that before the start of the irrigation project the major source of household consumption and income in the project area was both livestock and crop production. The production of food grain cropsincluded maize, *teff*, haricot beans and horse beans using rain as source of water. The sizes of farmland cultivated under rain-fed for the production of grain food crops was larger than that cultivated by applying irrigation water. According to information fromextension workers, in 2012, the total land cultivated was around 2500 hectaresand this was sufficient to ensure food security and to have surplus products for marketing for a total of 6000 households and their 30,000 or more household members (FGD with extension workers).

In good rainy season, farmers were able to produce an average of 22 quintals of maize, 13 quintals of ***Teff***and 33 quintals of sorghum per hectareunder rainfall condition. However, these yields were notconsistent every year due to recurrent drought. The communities of the project districts were vulnerable to drought due to repeated climate change. All respondents had indicated that they did not produce enough food grains under rain-fedcondition even for yearly family consumption. Moreover, they werelosing most of their livestock due to drought. As a result, people had been aiddependent from government and donor agencies (Table 11).

With the initiation of the irrigation project, however, the major irrigation crops had grown in the project area in descending order were onion,maize, tomatoes, ***teff***and sorghum. According to respondents, presently they grow mainly two types of crops, namely,onion and maize. They also produce small scale of tomatoes and potatoes. Onion and tomatoes are cash crops produced mainly for marketing purposes.Cash crops refer to vegetable crops produced through irrigation for marketing toincrease

household income. Therefore, farmers under irrigation systemsproduce high value horticultural crops, such as onion and tomato.Moreover, they grow maize for both marketing and household consumption.Production of onion takes the lion's share in the irrigation system and each farmercould produce on average 86 quintals of onion annually.This is because onion is less perishable, easy to harvest and transport ascompared to tomato. The selling price of onion was also better than tomato and that was whyfarmers prefer to grow onion (FGD).

Therefore, onion and maize crops can be considered as the strategic crops for future development of the irrigation systems. Maize is a major source of staple food and at the same time it is the most important source of animal feed than any other crops. It is also easy to apply irrigation water to maize than other crop types. Onion is the single major cash crop very suitable for marketing and generation of income among the project community (Table 12).

Other reasons for production of onion were easy irrigationwater application, field management of the crop was suitable and itwithstands diseases as compared to tomato. The negative aspects of such highdegree of production concentration on one crop (onion) creates competition amongproducers for market, which in most cases results in price decline due to excess production (FGD).

Table 11: Areas of land cultivate by rain-fed agriculture and irrigation system

S/N	**Project Blocks**	**No of respondents**	**Agriculture type and area in hectare**			
			Rain water	**pond**	**Small scale irrigation**	**Total**
1	Block II	18	18	0	0	18
2	Block III	17	17	0	0	17
3	Block V	30	30	0	0	30
4	Block VI	11	10	0	1	11
	Total	**76**	**75**	**0**	**1**	**76**

Field survey result, February 2013

The second largest production in the study area was maize. Each household in the project area was able to produce on average 53 quintals of maize per year. The farmers produce maize mostly for household consumption throughout the year and they also sell part of it to cover cash needs. The third crop grown in the area was tomato, which was the least preferred crop by farmers. Out of the total crops grown by the sample households, only around 300 quintals of tomato was produced by few farmers, and hence, the average production of tomato per household was 4 quintals. According to farmers, tomato is easily perishable and most of the time the price was very low; as such, they did not prefer to grow it. On the other hand, farmers had stated that they do not grow perennial horticultural crops because such plants require long time to mature, which is not tolerable by subsistence farmers whose livelihood is highly dependent on fast growing seasonal crops. Only very few farmers produce papaya and banana to a lesser extent around the backyard and sparsely on the borders of their plots. The volume of production was also very low and was mostly used for household consumption (Table 12).

Table 12: Annualcumulative production of major crops andaverage selling prices in USD, before and after the project.

Types of crops	**Annual Average production in Quintal per hectare**		**Average selling price in USD/Qt**		**Total sell in USD per hectare**	
	Before project	**After project**	**Before project**	**After project**	**Before project**	**After project**
Teff	13	15	36.00	67.00	480.00	1050.00
Maize	22	56	19.00	30.00	418.00	1,680.00
Sorghum	29	33	18.00	36.00	522.00	1,188.00
Haricot beans	-	-	-	-	-	-
Onion	-	246	-	22.00	-	5,412.00
Garlic	-	-	-	-	-	-
Tomato	-	229	-	20.00	-	4,580.00
Papaya	-	-	-	-	-	-

Potato	-	-	-	-	-	-
Other	-	-	-	-	-	-

Source: Field survey results, February 2013

Please, note that the above yieldin the above table does not represent the yield of the total beneficiaries ofthe project. It was collected only from sample respondents cultivating on 53.75 hectares of land using irrigation water. Inaddition, the yield of rain-fed crops indicated in table 12 represents the yieldunder good rainfall condition.

As the focus group discussion with WUAs and extension workers had revealed, onions and tomatoes were sold at farm level. Farmers do not take these crops to markets and they did not have opportunity to negotiate and/or fixprices. It is usually the buyers or brokers who fix the selling price (FGD). According to focus group discussants, even though onion has very good price as compared to tomato, last year (2011), the price of onion was low and most of the farmers were unhappy. The selling price of tomato was also very low during the same year (FGD).

The crops indicated in the above table can be categorized as food crops and cash crops. As far as the populations in the study area were concerned, crops such as *teff,* maize, sorghum, and Haricot beans were categorized as food crops while the vegetables like onion, tomato, garlic and potato and fruits such as papaya were considered as cash crops by the locals and were produced for generating household income. According to the survey, most farmers did not apply irrigation water to all plots. The major reason for less intensification and slow frequency was related to lack of appropriate market for the cash crops. Even though it was reported that most farmers produce three times per year, the kind of market facilities and the return they get from the investment were consideredto be obstacles to more investment and production. There were cases where and when farmers feed the crops, such as onions to their livestock due to lack of market and low price (FGD with WUAs).

Figure 3: Photos of sample horticulture crop plots in the irrigation area, February 2013

Sources: pictures taken during Field study, February 2013

Figure 4: Photos of sample onion seeds and crop farm plots

Sources: pictures taken during Field study, February 2013

Figure 5: Maize and tomato intercropping plot

Source: Pictures taken during field work, February 2013

5.2.4 Source of Water for Crop Production:

Table 13: Water sources for crop production of respondent households

S/N	Water source	Number of respondents			
		Before project	%	After project	%
1	Rain water	76	100	-	-
2	Ponds	-	-	-	-
3	Traditional irrigation	-	-	-	-
	Improved irrigation	-	-	76	100
	Other sources	-	-	-	-
	Total	**76**	**100**	**76**	**100**

Source: Filed survey result, February 2013

Before the initiation of the irrigation based agricultural development, all respondents were depending on rain-fed agriculture and all of them had reported that they were using rainwater for crop production. None of the respondents had reported that they were using traditional irrigation, pond or any other type of water source for crop

production in the pre-irrigation period. However, with the start of the improved irrigation system in the study area, all respondents had reported that they were using water from the improved irrigation system for crop production. Of these irrigation water users, none of them had reported that they still use rainwater for crops even to supplement the irrigation-based agriculture. After the start of the irrigation project, there were no respondent who abandoned the irrigation system to depend on rainwater or other water sources for crop production (Table 13).

5.2.5 Household Income Situation:

The respondents had indicated the average income they were able to generate from the sale of the cash crops such as onion, tomato and maize in any given year. Almost two thirds of the respondents (61.84%) had reported that the average annual income they had earned was ETB 10,000.00 and above (USD 557.00 and above), 18.42%had earned in the range of ETB 4001-6000 (USD 221.00-333.00) and 17.10% earned average annual income between ETB 6001-10,000 (USD 334.00-556.00). One respondent had earned in the rage of ETB 1001-2000 (between USD 56.00-110.00) and another had reported an average annual income of ETB 2001-4000 (USD 111.00-220.00) (Table 14).

Table 14: Average income generated from irrigated crops

S/No	Average annual income in ETB	Average annual income In USD	Number respondents	Percentage
1	500.00-1000.00	27.00-55.00	-	-
2	100.00-2000.00	56.00-110.00	1	1.32
3	2001.00-4000.00	111.00-220.00	1	1.32
4	4001.00-6000.00	221.00-333.00	14	18.42
5	6001.00-10000.00	334.00-556.00	13	17.10
6	Over 10,001.00	Over 557.00	47	61.84
	Total		**76**	**100**

Source: Field survey result, February 2013

5.2.6 Household Food Self-sufficiency:

The study has tried to see the household food self sufficiency situation in the project area before and after the start of the irrigation project. Of the total 76 respondents, only 10.52% had reported that they were food self-sufficient throughout the year before the start of the project, while the great majorities 89.48% were not food self-sufficient during that period. On the other hand, after the start of the irrigation project, the total number of respondents who had reported food self-sufficiency hadgrown to the overwhelming majority of 94.74%. This shows that the number of households who had become sustainably food self-sufficient had increased very significantly in the project area with the start of the irrigation project.

At pre-project period, of the total 68 respondents who had reported food shortage, 91.17% of them had indicated that they were depending on external food support from the government or from humanitarian organizations while the remaining 8.83% were supplementing their household food needs from relatives or by purchasing from markets. However, during the post-irrigation period none of the respondents had indicated the option of seeking external food support to fill the food gap.

Table 15: Respondents food self-sufficiency before and after the project

S/N	**Food self-sufficiency**	**Number of respondent**			
		Before project	**%**	**After project**	**%**
1	Self-sufficient throughout the year	8	10.52	72	94.74
2	Not self-sufficient most of the year	68	89.48	4	5.26
	Total	**76**	**100**	**76**	**100**

Source: Field survey result, February 2013

The discussion with WUAs and extension workers had revealed that the project had already brought many different positive impacts among the households. Both focus group discussants had indicated that the realization of household food security was evident almost by all the participants. All seem to agreeunanimously that food security was no more a problem in the area and the current production efforts were striving not only for household consumption, but also for marketing to generate adequate income for improving living conditions.

In order to assess the severity of food shortage at household level, the study had managed to have insight into the number of meals per day that the sample households were having before the start of the project and later after the irrigation project. Prior to the project 46% of the respondents had indicated that they were having only one meal per day, 24% of respondents had two meals per day, 16% were getting three meals per day and the remaining 14% of the respondents had indicated that there were days when they pass without any food. After the initiation of the project, the overwhelming majority 93 % of respondents had indicated that they were having three meals per day, and only 7 % had indicated that they had two meals per day, none of the family had reported passing a day without food. This figures show that there was a very significant improvement in household consumption during the post project period than the pre project time (Table 16).

Table16: Number of meals per day for the sample households

S/N	Number of meals per day	Before the project	%	After the project	%
1	Once	35	46	-	-
2	Twice	18	24	5	7
3	Thrice	12	16	71	93
4	Without any meal on some days	11	14	-	-
	Total	**76**	**100**	**76**	**100**

Source: Field survey result, February 2013

5.2.7 Crop Production Constraints:

Regarding the question related to agricultural and crop production constraints, 89.43% of respondents had reported the existence of constraints during the pre-irrigation period and the remaining 10.57% had indicated that there were no constraints as such. On the other hand, for the situation during the post-irrigation period, almost half or 49% of respondents had claimed that there were no constraints while the remaining 51% had reported the presence of crop production constraints (Table 17).

Table 17: Crop production constraints in pre and post project period

S/No	Do you crop production constraints	Before project		After project	
		No	%	No.	%
1	Yes	68	89	37	49
2	No	8	11	39	51
	Total	**76**	**100**	**76**	**100**

Source: Field survey result, February 2013

Table 18: Major agricultural constraints of respondent households

S/No	**Major crop production constraints**	**Number of respondents**			
		Before project	**%**	**After project**	**%**
1	Inadequate and erratic rain	59	87	-	-
2	High prevalence of pests	4	6	-	-
3	Inadequate irrigation water	-	-	2	5
4	Lack of pesticides	1	1	-	-
5	Farm land shortage	4	6	-	-
6	Lack of seeds	-	-	-	-
7	Fall in prices of crops	-	-	31	84
8	Lack of extension support	-	-	4	11
9	Crop diseases	-	-		-
	Total	**68**	**100**	**37**	**100**

Source: field survey result, February 2013.

Respondents had also pointed out that they were not in position of producing enough food grains for their household consumption due to different constraints during the pre-irrigation project period. Of the total 68 respondents who reported the existence of food constraints, the overwhelming majority of 86.76% had reported that inadequate and erratic rainfall as the major constraint, 6% had reported lack of adequate land for crop production and another 6% had indicated high prevalence of pests and one person had reported lack of pesticides as the major problem. Regarding the crop production constraints in the post irrigation period, of the total 37 respondents who had reported the existence of crop production constraints, the overwhelming majority of 84% had reported decline in the price of crops as the key problem, while 11% and 5%had indicated lack of extension support and lack of adequate irrigation water respectively, as constraints towards agricultural production (Table 18).

5.2.8 Major Household Constraints

Other than household agricultural constraints and the resultant food shortage, the respondents had indicated the existence of diverse problems at household level. Before the start of the project,the overwhelming majority92% had reported both food and water shortage to be the major problem, 7% had indicated water as the only problem and one respondent had reported food shortage as the only main problem for the particular household. The situation in the post-project period had shown that the overwhelming majority 85 % of the respondents had indicated that their families had no specific problem. However, 7% of the respondents had reported fodder shortage for their animals; the other 5% had indicated both food and water shortage as their household challenges and the remaining 3% of respondents had reported water shortage as the only problem they were facing. The water shortage is related to lack of clean potable water (Table 19).

Table 19: Major household problems in the project area

S/No	Major household constraints	Number of respondent			
		Pre-project	%	Post project	%
1	Food shortage only	1	1	-	-
2	Water shortage only	5	7	2	3
3	Both food and water shortage	70	92	4	5
4	Fodder shortage for animals	-	-	5	7
5	Had no any problem	-	-	65	85
6	Others	-	-	-	-
	Total	**76**	**100**	**76**	**100**

Source: Field survey result, February 2013.

5.2.9 Household Coping Mechanismsagainst Food Shortage:

Table 20: Copping mechanisms against household food shortage

S/No	Major Copping mechanisms	Number of respondent			
		Pre-project	%	Post project	%
1	By purchasing food from markets	3	4.17	4	100
2	By gathering wild foods	-	-	-	-
3	By seeking support from relatives and friends	3	4.17	-	-
4	By getting support from government and humanitarian organizations	66	91.67	-	-
6	Others	-	-	-	-
	Total	**72**	**100**	**4**	**100**

Source: Survey result, February 2013.

The project population was employing different coping mechanisms to overcome the severe food shortage that was prevailing in the pre-irrigation period. Over 91.67% of respondents had claimed that they were getting external support to overcome the household food problem,4.17 % had indicated that they were seeking support from relatives and friends, while another 4.17% of them had reported purchasing food from markets. All the four respondents who reported food shortage in the post irrigation project indicated that they are bridging the gap by purchasing food from markets, but none of the respondents said they are getting any external food assistance this time (Table 20).

Table 21: Duration of respondents' dependence on food aid in pre-irrigation project period

S/No	**Number of months**	**Number of respondents**	**Percentage**
1	2-4 months	17	25.76
2	5-6 months	47	71.21
3	7-8 months	1	1.52
	9-10 months	1	1.51
	Throughout the year	-	-
	Total	**66**	**100**

Source: Field survey result, February 2013.

From among the 66 respondents who reported that they were forced to obtain food support from external sources, such as the government and humanitarian organizations, to cope with the then prevailing household food shortage, 51.51% of them were getting such support for 2-5 years, 16.67% of them were receiving food support between 6-10 years, while 31.82% had indicated that they were getting the support between 11-20 years. However, during a given year the great majority 71.21%

of respondents had claimed getting food support for 5-6 months, 25.76% of them were for 2-4 months, while 1.52% and 1.51% of respondents were depending on external food support for 7-8 and 9-10 months, respectively. This shows that in a given year, the majority of the respondents were relying on food support during most of the months in a year. It is only for a very limited number of months that they were at situation of food self-sufficiency (Table 21).

5.2.10 Livestock Situation:

In arid zone where crop failure is frequent, farmers consider livestock as an essential livelihood component for theirsurvival. Generally, income from livestock includes sales of live animals such as oxen, cows, goat,donkeys, etc., and also livestock products like milk, butter and others. Other farm products such as hens andeggs are also sold to raise income to purchase food crops and other industrial products used forhousehold consumption. The most important contribution of livestock to agricultural production in the study area was the use of oxen as drought power for plowing and threshing. Milk, meat and hides from cattle and small ruminants were relatively less important by-products, but manure is used as fuel and as fertilizer. Sheep are kept mainly as a secondary investment and a source of cash in times of need. Donkeys are widely used as draft animals. Poultry are widely kept and used for egg production and home consumption. Livestock productivity was low for all classes of animals. This was attributed to long spell of feedstress and heavy parasitic burdens. Liver fluke, lungworm and intestinal worm infection are reported by the farmers to be major problems in the project area. Parasites are transmitted through stagnated water in canals and ditches and waterlogged areas created by uncontrolled irrigation water.

The current livestock holding among the irrigators generally did not show any increase. The reason given was that irrigation and livestock production both require more care and are labor intensive. The farmers couldn't afford to run both practices simultaneously in an efficient manner. The major causes for the reduction of the livestock population were also lack of open space for grazing as most of the land in the command area was irrigated and occupied by crops. The other related reason was

fodder shortage, because, as major crops grown in irrigated farms were vegetables, and they do not leave crop residues during the dry seasons.

Table 22: Livestock holding in pre and post project period for sample respondents

S/ No	Type of livestock	Number of livestock					
		Pre-project	Price per animal	Total value	Post project	Price per animal	Total value
1	Oxen	114	1900	216,600	132	9200	1,214,400
2	Cow	93	1,200	116,600	91	6,100	555,100
3	Calf	47	600	28,200	46	2,100	96,600
4	Goat	127	150	19,050	85	800	68,000
5	Sheep	288	200	57600	365	700	255,500
6	Donkey	64	300	19,200	45	1,100	49,500
7	Other, specify	-	-	-	-	-	-
	Total	**733**	**-**	**457,250**	**734**	**-**	**2,239,100**

Source: Field survey result, February 2013.

The great majority of the respondent 71 % had noted that the income that was generated from livestock sale was low and was not adequate to meet their financial needs during the pre-project period. They had indicated that the price of live animals was quite low, in order to meet the cash need of the households, and one had to sell many animals. Only 29% of the respondents had claimed that they had been earning better income from the livestock they raise and sell in the market. The focus group discussion had further revealed that the price that the people were obtaining from livestock sale was so low due to the general low price prevailing at the time. Also, the animals they sell were not physically large enough and the amount of cash they earned from the sale of one single animal was not adequate to meet household cash demands in most cases. Regarding the current livestock price situation, the overwhelming majority of respondents had said that the price is better and has

significant share in their household income. They had reported that even though there is a general trend of decline in the livestock population, the price trend was on the rise and people were able to generate attractive cash from any sale. They had reported that the small animals like sheep, goats and poultry and their products are handy and lucrative for farmers day-to-day cash needs.

There was a very significant difference regarding the total value of livestock between the pre and post project period. Even though there was no noticeable increase in the livestock population in the post project period, the total value for each category was much higher during this period than during the pre-project time. The significant increase in the value of the livestock during this post project period was related to the rapid increase in the price of the livestock during the last four or five years. The price of each category of the animals has tripled or more (Table 22).

5.2.11 LivestockHolding of Respondents:

Respondents had indicated that there was a general trend of slow increase in the livestock holdings in the post project period in the area. Of the total 76 respondents, 90.79% had stated that livestock possession in the post project period had increased as compared to the pre-project time. A few, 5.26% had reported that there was a declining trend in their livestock holding and the remaining 3.95% of respondents had indicated that there was no change in the number of livestock they owned during the pre and post project period (Table 23).

Table 23: Livestock holdings during post irrigation project period

S/No	Livestock situation	No. of respondents	%
1	Increased	69	90.79
2	Decreased	4	5.26
3	No change	3	3.95
	Total	**76**	**100**

Source: Field survey result, February 2013.

Table 24: Contributing factors for livestock increase and causes for decline

S/No	Contributing factor	No. of resp.	%	Causes for decrease	No. of resp.	%	Overall total	
							No	%
1	Increase in animal feeds from crop residues	41	59.42	Lack of adequate animal feeds	-	-	41	53.95
2	Adequate and reliable water sources	4	5.80	Decrease in grazing land	-	-		5.26
3	Increase in animal feeds (grass types introduced with the irrigation)	12	17.39	Scarcity of labour for livestock herding and rearing	7	100	19	25.00
4	Increase in income from irrigation to buy more livestock	9	13.04	Lack of unreliable water sources for livestock	-	-	9	11.84
5	Increase in income from irrigation for better veterinary services	3	4.35	Increase in livestock diseases after irrigation	-	-	3	3.95
	Total	**69**	**100**	**Total**	**7**	**100**	**76**	**100**

Source: Field survey, February 2013.

Different contributing factors were mentioned for increase in livestock holdings. Of the total 69 respondents who had mentioned increase in livestock holdings, over half of them,59.42% had indicated the factors for the increase was the improvement in animal feeds generated from crop residues. The next group 17.39% had indicated that the

contributing factor for the increase was the improvement in animal fodder such as grass types introduced with the irrigation project. However, 13.04% of them had mentioned that improvement of household income had enabled farmers to buy more livestock, whereas, the remaining 5.80% had stated the existence of adequate and reliable water sources.4.35% had reported that the improvement of income had enabled them to access better veterinary services (Table 24).

On the other hand, all the 7 respondents had pointed out that the causes behind the decrease were the scarcity of labour for livestock herding and rearing as the productive members of the household labour forces were engaged in the irrigation works (Table 24).

Figure 6: Photos of sample household livestock holdings
Source: Pictures taken during the study field work, February 2013

5.2.12 Water Source for Livestock:

All respondents had indicated that the source of water for their livestock was river water prior to the start of the irrigation project, while the majority 71% of the respondents had mentioned that the source of water for their livestock was the same river during the post irrigation project period. On the other hand, 29 % of the respondents had indicated that the current source of water for their livestock is irrigation water (Table 25). During the different focus group discussions, most

respondents had mentioned that water was not a problem for livestock raising during the pre-project period as the Awash River was passing through the area. Livestock can travel a considerable distanceto the river and the project area population were converging their livestock in accessible manner even before the start of the irrigation project. The situation in the post-irrigation project had improvement for some of the irrigators in terms of distance because the livestock can easily access water from the nearby irrigation canals, even though such accessibility was reported to cause damage to the irrigation facility in some instances (FGD).

Table 25: Source of water for livestock in pre and post project period

S/N	Water sources	Number of respondents			
		Pre-project	%	Post project	%
1	Pond	-	-	-	-
2	River water	76	100	54	71.00
3	Hand dug well	-	-	-	-
4	Deep ground water	-	-	-	-
5	Irrigation water	-	-	22	29.00
	Total	**76**	**100**	**76**	**100**

Source: Field survey result, February 2013.

5.2.13 LivestockMarketing and Income:

When asked about livestock marketing, the overwhelming majority of the respondents had said that there was a scarcity of market opportunity for livestock during pre-project period. Also, during focus group discussion, the overwhelming majority of the respondents had reported market problem. The major markets where the local people took their livestock for sale were Doni, Bofa, Bole, Dhera, Jimmate and Adama Town in some cases. Some of these market centers were located far away and the distance had created difficulties for the local people to access them. Regarding the current situation of livestock marketing, the respondents had indicated the existence of similar

problems.They were required to travel long distances to reach most of the market places. As there was no improved infrastructure and livestock transportation facilities, farmers face similar challenges as before in livestock marketing.

5.3 MANAGEMENT OF IRRIGATION PROJECT:

5.3.1 The Tibila Irrigation Scheme Management Unit (TISMU):

Large-scale irrigation systems to be sustainable and be cost effective, it needs to have efficient operation and maintenance systems supported by technical knowledge and skill and accurate planning and budgeting. The success of irrigation systems relies on the strength, ability, and commitment of the irrigation management organizations and the user community in managing, keeping and proper utilization of resources of the scheme and other associated resources. Achieving trust, willingness, commitment, and encouraging a sense of ownership and responsibility of the water users also contribute to the success of the irrigation scheme. In large-scale irrigation scheme, therefore, the formation, development, strength, technical capability, and financial capability of the management organization are five factors that lead to success.

In accordance with the policy framework for large and medium scale irrigation development in Ethiopia, management and operation of the schemes are the joint responsibility of the state irrigation agency, cooperative promotion and input supply desks, district and village level administrative and legal entities and farmers and their organizations. In view of this, therefore, the management of the Tibila Integrated Irrigation Project was delegated to the government scheme management unit and Water Users Association (WUAs) formed at completion of the construction. WUAs are now incharge of water allocation, distribution, conflict management and maintenance (Tibila Irrigation Scheme, O&M Report, 2009).

The Tibila Irrigation Based Integrated Development project is one of the large scale irrigation project implemented in Oromia regional State constructed and made operational in recent years. The project has government established and budgeted scheme management unit. In view of the magnitude of the complexity of the irrigation

project management, the Oromia Water Works Construction Enterprises (OWWCE) has established an autonomous institution responsible for Management, Operation and Maintenance (MOM) under its umbrella known as the Tibila Irrigation Scheme Management Unit (TISMU). In addition to TISMU, various autonomous institutions that have different responsibility have also been established in the project area.

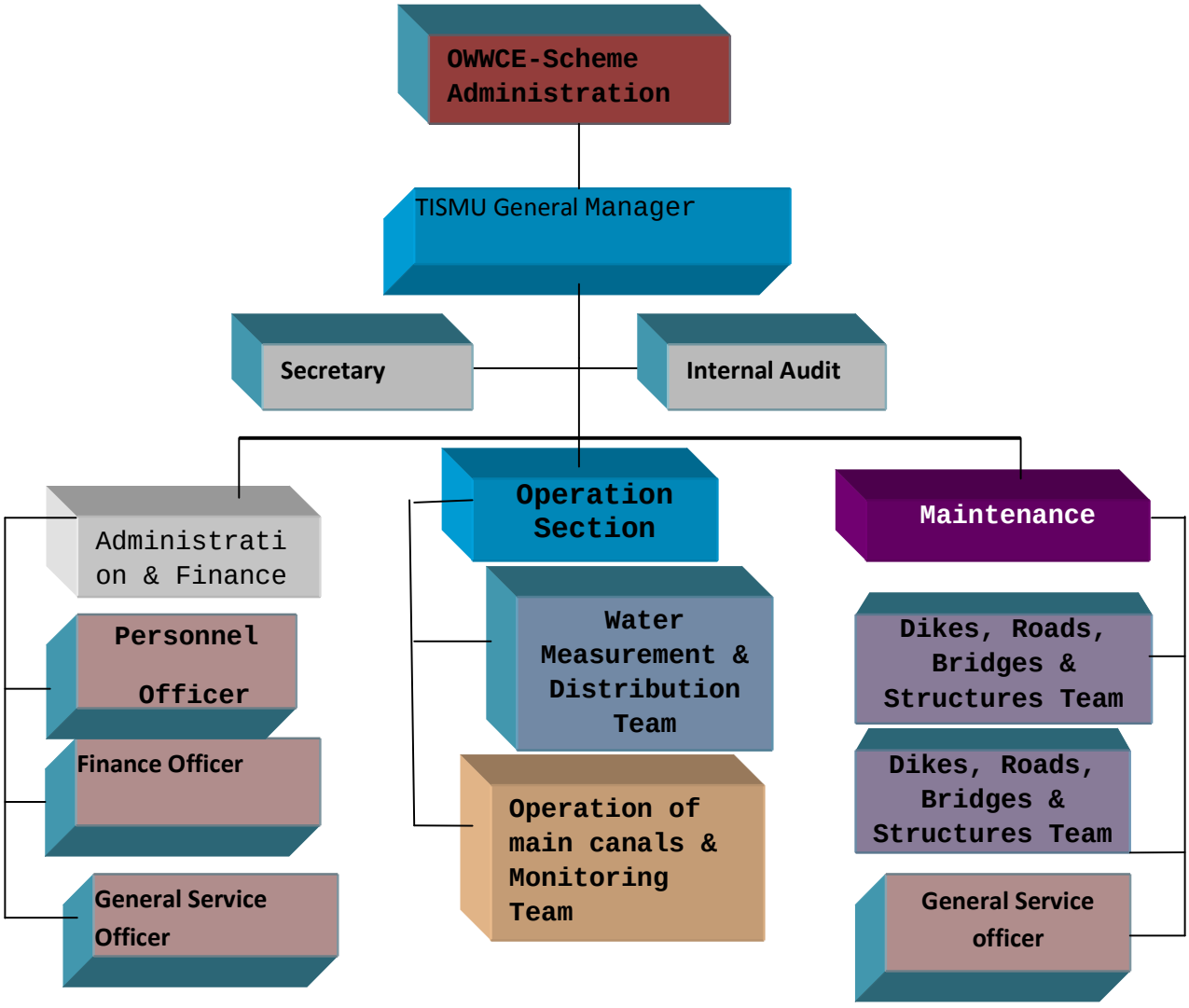

Figure7: Organizational structure of the Tibila Irrigation Scheme Management Unit

Source: *Oromia Water Works Design and Supervision, enterprise (OWWDSE), 2009, Tibila Irrigation Scheme Organization and Management Report, 2009.*

The roles and responsibilities of the government assigned scheme management unit are to distribute enough water according to the demands of the irrigation farms, control, register and report the amount of water flowing to the irrigation farms, monitor the level of water available to ensure adequate water for irrigation and also to avoid excessive water releases that may cause damage to downstream developments, register water usage and collect water charges, maintain headwork and conveyance systems including irrigation and drainage network consisting of headwork, primary canals, secondary canals, tertiary canals and main drain. Also, the unit is responsible for the protection of main canal from damages and undesirable elements, technical assistance for the operation and maintenance of the structure in close coordination with the water user associations, assessment and establishment of water rate and collect fees, construction and maintenance of service roads and inspection of paths along canal networks.The unit has organizational structure and manpower arrangement of General Manager, Operation Section, Maintenance Section, Administration & Finance Section and Advisory staff (Ibid, 2009).

5.3.2 Irrigation Water Users Cooperative (IWUCs):

Directly below the government project management unit, there is community based management structure called Irrigation Water Users Cooperative (IWUC). Each IWUC adopted the name of the irrigation area for which it is responsible. The IWUC isresponsible for the management, operation and maintenance of irrigation infrastructures starting from tertiary head to regulator gate. This gate delivers water to the tertiary canal from the secondary canals. Each cooperative has a Management Committee and dispute Resolution Committee. Each IWUC has a General Assembly, which is assembly of water users from each Secondary Canal irrigation area. This general assembly is called for the election of the IWUC Management Board. The General Assembly (all members of water users within a given hydraulic boundary of secondary canal) is the Supreme Governance Organ of each IWUC. The IWUC Executive Council of each user cooperative is the Supervisory Organ of the Water Users Groups.

IWUCs are semi-autonomous entities established under TISMU umbrella and responsible for the management, operation, and maintenance of the system below the secondary canal level. The cooperative also responsible for the provision of agricultural research services, extension services, credit facilities, marketing, capacity building, and the like.

Regarding the Tibila Irrigation based development project, the original proposed community-based and participatory management was to establish community structures such as Irrigation Water Users Unions at highest level, below the union structure to establish Irrigation Water Users' Cooperative that are to conglomerate into a union, below the cooperative to establish Irrigation Water Users' Groups and the different groups are supposed to be constituted into the cooperative structure. However, the current practical implementation shows that the Irrigation Water users' Cooperative is replaced by a structure called Irrigation Water users' Associations (IWUAs) and so far, the union structure is not implemented. Therefore, in place of the cooperatives there is an association of water users.

Each Irrigation water users' association is constituted by the General Assembly of all the members of water user associations of each secondary canal. The Assembly is also mandated for the election of the IWUA Management Board and executive bodies. The General Assembly is the Supreme Governing Organ of each IWUC. While the board members are responsible for the overall follow-up and regulation of each IWUC, the Executive Council is the Supervisory Organ of the Water Users Groups. Each IWUC has sub-committees such as Maintenance Committee, Management Committee and dispute Resolution Committee.

Irrigation users are settled at a strategic location and responsible for the management, operation, and maintenance (MOM) of the diversion weir, irrigation infrastructures, and canal systems. This, of course, requires developing the management and technical capacity of the farmers so that they would effectively and efficiently manage their resources and use their scheme in a sustainable manner. Management encompasses the administration of the financial and technical matters related to operation, and maintenance of the irrigation and drainage system and other pertinent structures.

The organizational structure for IWUAs have the general assembly at top of the structure which constitutes all Water Users members of the concerned Secondary canal, the executive council, the management committee, the dispute Resolution Committee, and the technical staffs.

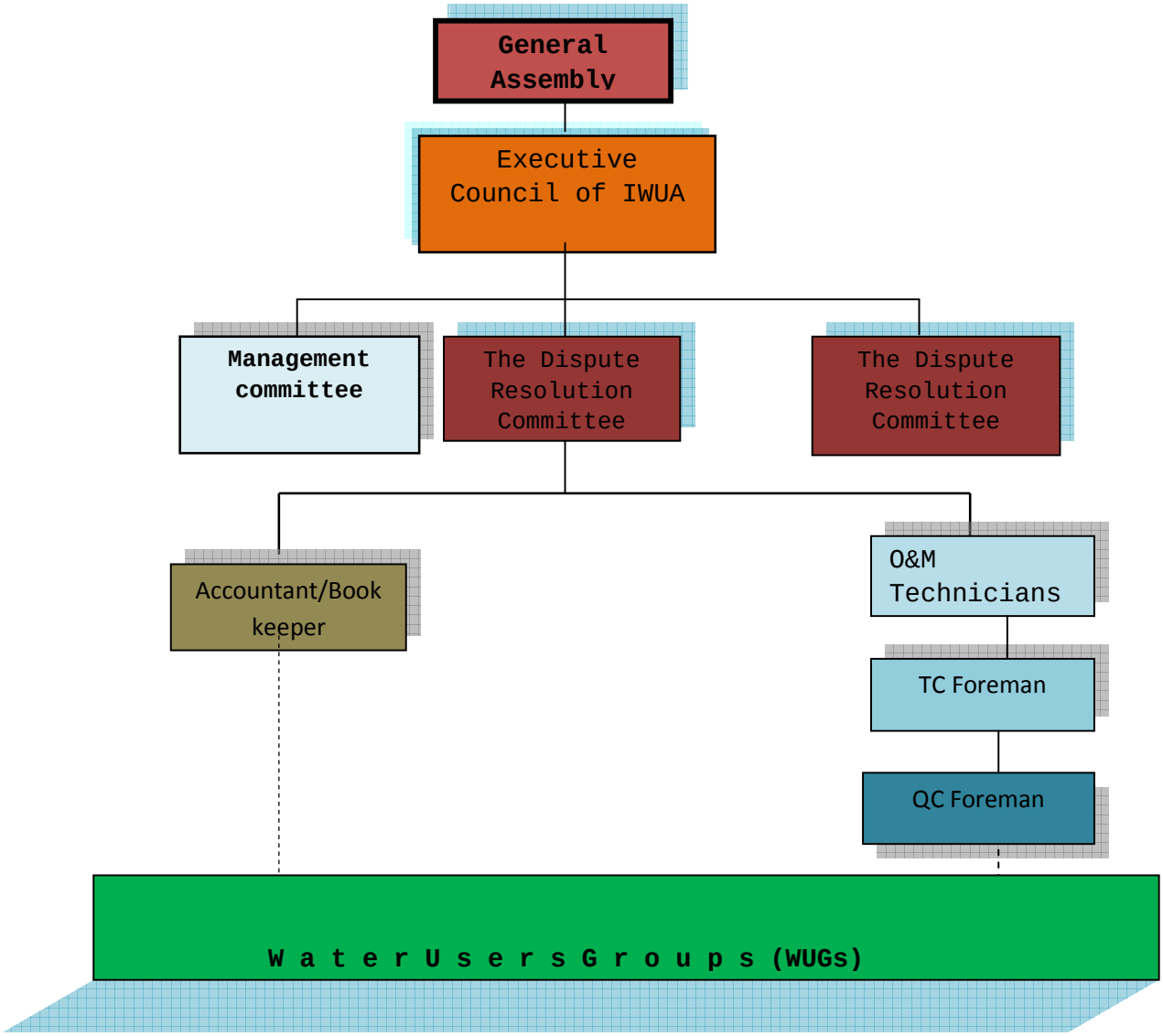

Figure8: Water Users' Cooperatives Organizational structure

Source: *Oromia Water Works Design and Supervision, enterprise (OWWDSE), 2009, Tibila Irrigation Scheme Organization and Management Report, 2009.*

The functions of each of the above structures are as described hereunder:

The General Assemblyincludes all IWUC members, within the given SC irrigation area. It is the highest authority of the IWUC. Its main function is to select their representatives including the Management Board, and Dispute Resolution Committee and to approve or disapprove the management plans. Here all irrigation water user members within each Secondary canal irrigation area are considered to be the 'General Assembly' of the given Irrigation Water Users ***Cooperative*** (IWUC).

- The IWUC is supposed to elect an Executive Council from either a general assembly of farmers or from farmer's representatives appointed by the farmers (a representative assembly from each commands areas).The representatives will elect a chairman who has responsibility for the day-to-day supervision and management of the IWUC Management Body. The IWUC Executive Council chairman is responsible for the appointment of the IWUC staff.

- The Management Committee was planned to be staffed by salaried manager and other necessary staffthat are directly responsible for the execution of the mandate given by the IWUC Executive Council and responsible for day-to-day Management of the system below thetertiary and quaternary canal systems. As there is no cooperative at this particular time the management committee is established under the IWUAs and managed by elected committee members.

- The Dispute Resolution Committeeat IWUA level is responsible to resolve any disputes arise within the Secondary canal among the member of the IWUC.

- Water User Group are farmer groups at the local level where the number of small farm units is so high that it is impossible for each one to be provided with services such as agricultural extension. This generally leads to the need for water users' groups to be formed for the purpose of organizing water distribution and maintenance work below the watercourse outlet. The TISMU can hardly ever afford the staff, which would be required for the direct management of numerous small channels and field outlets. Therefore, in order to realize efficient operation and maintenance of the project, the farmers were further organized into a group based

on the tertiary blocks Section. The group will be led by elected foreman and will be responsible for the operation and maintenance activities within the block.

Tertiary Canal Foremen are salaried staff responsible for the supervision of all Quaternary Canals Foremen (4-10) and are responsible for some 60 to 100 ha water distribution and infrastructures maintenance. The number of Water users is between 60 and 200 depending on land distribution and average area of each land holding. Therefore, each water user's group has members of 60-200 people in each tertiary canal area.

Theoretically, Irrigation Water Users' Associations (IWUAs) are responsible for management, operation, and maintenance of irrigation infrastructures, water distribution and system maintenance, assessment and collection of water charges or similar fees, and assistance and extension to farmers on water management. However, in view of the magnitude of the complexity of the project management, the farmers lack adequate knowledge and experience to manage such large scale irrigation scheme as a whole. In addition, the period of preparing the farmers for full management of the scheme, that is, when they are supposed to take over the full management of the scheme as individual or as association, can be a long period of time (which can take a minimum of 10-15 years, even more in Pastoralist Areas).

According to the scheme management unit staff, until the farmers reach their full capacity to manage the project, Oromia Water Works Construction Enterprise (OWWCE) is mandated to "Build, Own and Operate" the scheme, in addition to its main objectives of construction. In other words, the enterprise is vested with the responsibility of constructing, owning, and managing the scheme. Consequently, OWWCE has direct responsibility for the Management, Operation & Maintenance of the Main Canal and Secondary Canals, Infrastructures, and overallsupervisory role for Tertiary and Quaternary Canals. In general, water management activities, which include operation, maintenance, and collection of water charges/fees of Tibila Irrigation scheme, will remain under the responsibility of OWWCE.

5.4 IMPACT OF THE IRRIGATION PROJECT:

5.4.1 Positive Impacts:

5.4.1.1 Agricultural Production/Yield situation:

Production and productivity has increased and currently, the farmers can produce more agricultural crops from small plot of landthan pre-project period. In addition to household consumption, farmers were producing cash crops for marketing. The 76 participants in this study were tilling a cumulative total of 53.75 hectaresof land area and were able to ensure household food security for over 382 family members with extra produces for marketing. As per the data obtained from the survey, the information from the three districts of the Agricultural and Rural Development Offices and from FGDs made with extension workers in the project area had revealed, the average yield per hectare of the respective crops using rain-fed agriculture was 13 quintals of ***Teff,*** 22quintals of maize, 29 quintals of sorghum, 22 quintals of haricot beans. However, according to these sources, the yield per hectare using the irrigation facility was 15 quintals of ***Teff***(not produced by irrigation), 56 quintals of maize, 33 quintalsof sorghum, 246 quintal of onion and 229 quintals of tomato crops.Assuming that the 76 sample households use the total 53.75 hectares of plots areas under their holding for the production of the two major and strategic crops of onion and maize in equal proportion, the total annual production can be estimated at 4,515 quintals of maize and 19,833 quintals of onion with the expected three rounds of production in a year by using the irrigation water.

5.4.1.2 Household Income:

Because of the project, income of the project communities has increased. According to the information obtained from the district agricultural offices and extension workers, from the total 2,500 hectares of irrigated land that was under active utilization, the project participants can generate a conservatively estimated annual income of Ethiopian Birr 239,346,000.00 from the sale of the two major crops of maize and onion in a year. This is equal to around USD 13,297,000.00. The assumption is that farmers working on the total 2,500 hectares of irrigated land use one fourth of it for maize

production and another one fourth for onion production. Also, farmers are expected to undertake production of both crops three times in a year. Furthermore, the expected price fluctuations of these crops from year to year and from time to time weretaken into consideration while estimating the overall annual income. This estimation tallies with the information gathered from the focus group discussion conducted with WUA members and extension workers. The two groups had indicated that the average minimum income was ETB 20,000.00-30,000.00 (USD 1,111.00-1,667.00), the medium income ranging from ETB 50,000.00-80,000.00 (USD 2,778.00-4,444.00) while the maximum is reported to be from ETB 200,000.00-300,000.00 (USD 11,111.00-16,667.00).

The respondents further had indicated that there was significant increase in household income from the sale of irrigation crops in the post irrigation project period. Among the respondents 61.84% of them had reported that they had increased household income in a very significant way after participation in the irrigation project. Whereas,35.53 %of the respondents had stated that they had moderate increase of income and the remaining 2.63% had indicated that there was no change to their household income after the irrigation project. For those respondents who had reported significant increase in household income, the average annual income earned from crop sale was over ETB 10,000.00 (USD 556.00) in a given cropping round. The major reason for the increase in the household income as reported by the respondents was due to focusing on the production of cash crops with the introduction of irrigation project. Such change in the agricultural production practice has brought significant increase in household income.

5.4.1.3 Households' Food Security:

The result of the study had shown that after project participants had begun producing irrigated crops, 94.74% of them had been able to produce sufficient food grains for household consumption for a year and some extra for marketing. As a result, except the four sample respondents who hadreported foodinsecurity as of yet, the overwhelming majority of the respondents have ensured food security at household

level and become self-sufficient due to the scheme. According to the focus group discussants, most were harvesting two or three times a year. On the basis of the data obtained from the result of this survey and concerned government offices and focus group discussions with irrigation participants and extension workers, in the past, large number of people in the project districts were suffering from recurrent drought and climate change for many years (20 to 30 years) and dependent on food aid throughout the year.The survey result indicates that there was no single irrigation participant household depending on food assistance from the government or any other humanitarian organizations during the post-irrigation period (Table 26).

Table 26: Household food security situation after participation in the irrigation project

S/No.	**Household food security situation**	**No. of respondents**	**Percentage**
1	Attained food security and improved living condition	72	94.74
2	Not achieved food security	4	5.26
	Total	**76**	**100**

Source: Field survey result, February 2013.

Regarding the number of meals per day, 93% of the respondents had reported as having three meals per day, while 7% reported as having two meals and none of the respondents had indicated lower than two meals per day. The respondents had also reported that there was a significant increase in the quantity and improvement in the quality of food they were taking at household level. Therespondents had further stated that their diet includesmaize or ***teff,*** vegetables, fruitsharicot beans, meat and other animal products. Therefore, the data presented is clear sign for the significant improvement in household food security for project participants.

Table 27: Contributing factors forimprovement of household food security

S/No	Contributing factors	No. of responses	Percentage
1	Household income improved significantly	52	36.11
2	Agricultural production and productivity have increased and able to produce food for consumption and income	72	50.00
3	Able to buy new seed varieties, improved farm tools, fertilizers, pesticides	9	6.25
4	Able to send children to school	11	7.64
	Total	**144**	**100**

Source: Field survey result, February 2013.

5.4.1.4 Livestock Situation:

Farmers in the project area were undertaking agro-pastoralist farming practice. In mixed crop-livestock system, the opportunity that irrigation provides not only enabling intensified crop production, but also increases animal feed through increased crop residues, which may reduce the pressure on grazing land. According to the information obtained from the FGDs with WUA members and extension workers, the physical situations of the livestock and the quality and amount of yield people are getting from the animals have improved tremendously after the irrigation project.Farmers were managing well and utilizing fodder that can be grown by the use of irrigation. Livestock productivity was increasing and hence household income from the livestock was on the rise. Obviously, livestock production was one of the very important aspects of income generation for households in the irrigation project area. Besides the sale and generation of income from the livestock, the project participants were closely integrating different range of livestock benefits such as draught power, transport, and

manure production to sustain soil fertility and they were also using the livestock as wealth.

The FGD discussants had indicated that livestock products such as milk, butter, cheese were mostly consumed at household level, contributing to diversification of diet. Traditionally, selling of livestock products especially milk was not widely accepted due to cultural taboo and it is consumed mostly at household. Therefore, the consumption of milk is very useful especially for children's' better growth and health. Small animals such as goats and sheep were kept mostly for sale at a time when cash is crucially needed for settlement of different household financial commitments. The feed requirement of these animals is not as big as larger animals since their feed was usually depend on grazing and browsing.

With regard to livestock and livestock products, women focus group discussants had indicated that after the introduction of the irrigation system, their family diversified production crops and succeeded to harvest up to three times in a year. In addition, theadvantage of irrigation was not only limited to generating high income from cashcrop but the volume of milk they get from cows hadalso increased. As the women attested, in theabsence of irrigation they used to get a quarter to a half liter of milk per day from a cow for only six monthsduration. But now, thanks to the irrigation, on average they managed to get up to one and half litter ofmilk per day from the same cow. If all things go normal, theywere confident that they wouldcontinue milk of the same volume for a year.

5.4.1.5 Creating Job Opportunity:

Since irrigated agriculture is labour intensive, the project has created jobopportunity for large number of landless youths residing in and around the project area.As the WUA FGD participants had indicated, they need more labour force for planting seedlings,cultivating, uprooting weeds, and harvesting crops. For this reason, besides thefamily labour, more hired labour was used in irrigation activities. Source of labour wasmostly from the surrounding areas, including towns such as Doni, Bofa, Awash

Melkassa, Jimmate and others. Also, these FGD participants had reported that labourers were coming from farther away and from the different parts of the country. According to information obtained from the Jeju DistrictAgricultural and Rural Development Office, job opportunity had been created for thousands of youthswomen. The office had further indicated that the employment linkages were relatively strong in the area. For instance, jobopportunity had been created for many landless young people, especiallyfor poor women.

According to the FGD with the extension workers, there were many women and young girls who were engaged in the selling of local beverages(*tella*) and bread mostly to those daily labourers.Othergroups of external beneficiaries consist of village traders, whole sellers, brokersand local governments. For instance, brokerage and other intermediaries were benefiting as a result of cash crop markets. Accordingto the informationfrom focus group discussion, the average annual income of thesebrokers range from ETB 15,000-25,000 (USD 833.00-1,389.00) depending on market situations. Another important advantage of the irrigation scheme was its contribution in minimizing the migration oflandless from the area to other places in the search of opportunities. Irrigation being the maineconomic activity had helped the surrounding poor people to work and earn income in their locality without travelling to distance places.

5.4.1.6 Asset Creation and Investment:

With increased income generated from irrigation farm, farmers usually invest their income in different assets. Household assets might include land, livestock, farm tools, and cash on hand and bankdeposits, a house and its contents. Usually, the rural dwellers construct corrugated roof houses. As focus group discussions had revealed, prior to the project, people used to live in simple grassthatched huts and there were very limited corrugated roof houses. Households were living a very subsistence way of life. The majority had no extra income for saving. During a large part of the year, a great majority of the households were depending on external assistance for food and livelihood.

Table28: Assets created after participation in the irrigation project

S/No	Asset type	No. of responses	Percentage
1	Corrugate roofed house	44	49.44
2	Bought household furniture (bed, sofa, tables, chairs and others	30	33.71
3	Invested in productive assets (farm tools, inputs, livestock and others)	15	16.85
4	Have not made any asset creation	-	-
5	Others	-	-
	Total	**89**	**100**

Source: Field survey result, February 2013.

According to the information obtained from focus group discussants, physical observation of the area and the present study, besides the land and livestock they own, 44% of sample respondents had already constructed corrugated iron sheet roofed houses, 34% of the respondents had bought household furniture such as beds, sofas, tables, chairs and salon and kitchen cabinets. Some households even bought TV sets, refrigerators and other amenities that were usually restricted to urban households. About 17% of the respondents had stated that they had farm assets, such as, farm tools, farm inputs, livestock and others. As focus group discussants had stated, some people had started saving in the nearby banks with the help of saving and credit association, which was established in the area recently. Individuals were able to save money in the bank by themselves. Also, many families were able to their children to nearby schools (Table 28).

The focus group discussants had further indicated thatpeople had owned standard household furniture, such as, television, refrigerator, quality beds, chairs, tables, sofas and the like. The income generated from the irrigated crops had enabled farmers to lease at the nearby urban centers and construct houses, buy motorbikes for

transportation, deposit cash in banks. Almost all household heads and spouses and older children in a family had mobile phones.

The FGD participants, community members and traders and service providers in the small towns around the irrigation project area had further attested the positive implications of irrigation on investment.The prevalence of expanding investment inhotels, Kiosks, butchery, Barbary, local drink houses, tea rooms, shops, etc were evident at Doni and to lesser extent at Bofa towns. Almost all owners of the abovepetty trading and services had elaborated during the interview that they believed irrigation had played avital role in creating favorable condition to strengthen their business. They had also confirmed thatirrigating farmers were among their major customers. In addition, traders that come fromAddis Ababa, Adama and Dire Dawa cities to buy vegetable products were their other important costumers.As a result, most hotels had already increased their capacity in quantity and quality ofservices.

5 .4.1.7Backward and Forward Linkages:

As briefly discussed in the main body of this study, the Tibila irrigation command area is found in one of the most drought-prone and food insecure areas in the region. Until the start of the irrigation project, the study area was categorized as food insecure and used to receive food aid from the government and non-governmental organizations. In this regard, although irrigation has not been practiced in the study area, its role as coping mechanism to mitigate the effects of drought has already shown vividly noticeable results. With regard to the impact of irrigation development in the economic life of people, the result of the survey had shown that different economic linkages had emerged and had helped people inside and around the study area. There were different linkages created because of irrigation though they were in infant stage of development. These linkages were production linkages, consumption linkages, investment linkages and employment linkages.

These linkages had prevailed either in the form of backward and forward modality or in one of it in each case. For instance, the production of cash crop had created job

opportunity for many landless young people especially poor women that subsist as farm laborers. The increased income obtained by farmers as a result of irrigation had created high demand for modern farm inputs and farm implements and other different household furniture and utensils. Farmers demand for non-agricultural products such as food oil, kerosene, salt, soap, sugar, cloths, etc. Also, farmers were capacitated to purchase industrial goods such as motorbikes, TV sets, refrigerators and even cars in some instances with the increase of their income from irrigation.

Figure 9: ***Sample photo of a house and household furniture owned by project participants***
Source: ***Photo taken during the study field work, February 2013***

5.4.1.8 Enhancement of Social Position/Status:

Extension workers and community leaders had indicated that the earlier community members in the current irrigation area used to have very low social status as a collective community group because of the high level of poverty they had been experiencing prior to the project. Both focus group discussants had attested that communities in a better- off areas used to refrain themselves from marrying girls from and giving their own to the project area community in those days. The level of poverty was so abject that the community in the project area were discriminated against and used to occupy very low social status in the eyes of the different community groups in the surrounding areas. However, both the extension workers and the WUA leaders

and members had indicated that there is a complete shift in the social position of this community in a couple of years after the start of the project. Nowadays, people are not only seeking for marriage with the boys and girls of the community, but there also is high trend in moving into the area in search of jobs and opportunities.

5.4.2 Negative Impacts of the Irrigation Project:

5.4.2.1 Neglect to Livestock Production:

There were few fodder plants on the course of irrigation canals. Vaccination and diagnosis of sick animals were undertaken at lower level while the other veterinary activities were carried out. Neglecting livestock and concentrating only on crops obviously affect farmers whose source of income is essentially depend on crop livestock integration. In this respect, irrigation should also benefit the livestock sector. For instance, livestock provides the most valuable and cheaper farm input, manure, which is very essential to maintain soil structure and fertility. The output of livestock products such as milk, milk products, meat, hides and skins can also be a significant source of income if the benefit of irrigation is properly channeled to this sector. Generally, livestock production in the study area was hampered by multiple factors such as feed shortage, low productivity of local breed, disease prevalence, insufficient veterinary services, poor animal husbandry practices and undeveloped market infrastructure.

5.4.2.2 Pollution by Insecticides and Chemicals:

Both farmers and extension workers have indicated that there was high trend of environmental and water resources pollution in the project area caused by high usages of insecticides and chemicals for weeds, protection of crops from diseases and for increase in farm productivity. Both groups had concern that the effects of these substances can be very negative and costly in the long run to the ecosystem and livelihood of the project population. One can assume that the extension workers might be expressing their concern from their technical know-how and professional background. On the other hand, the equal concern expressed by farmers deserves

attention because their concern emanates from their day-to-day observations and practical experiences.

5.4.2.3 Technical Limitations:

The focus group discussion with farmers had revealed the existence of serious limitations in the design and construction of irrigation canals. Farmers had pointed out that the canals had limited capacity and were not in a position of accommodating high water volume passing through them. Farmers had further stated that there were many incidents of water breaking the canals or overflowing them and thereby damaging farm fields. Also, farmers had pointed out the occurrence of high sedimentation due to the faults in the technical design. Extension workers had indicated that people and animals were living in the command area and this had caused regular damages to the irrigation canals. There were many social activities in the irrigation command area and such incidents had negative effects on irrigation structures and crops therein. The extension workers had the opinion that the original plan was to make the irrigation command area free from human residence and animal interference, but the plan was not implemented. The social activities and movement of livestock in the irrigation areas were causing damages to structures, such as, irrigation canals and road networks.

5.4.2.4 Social Disturbances and Incidents of Crime:

Extension workers and farmers had revealed the prevalence of high social disturbances, gradual shift of traditions, norms and values of the original community with the migration of diverse people to the area. These new comers were diverse and they converge into the project area from different background and socio-cultural settings and had high potential for influencing the local socio-cultural contexts and creating chaotic situations. Both discussion groups had stated that they were witnessing high incidents of crime, cheating, theft and greedy behaviours and actions. FGD discussants had the opinion that such undesirable behaviours and actions had encroached into the area with the new comers.

5.4.2.5 InefficientUse of Water:

Inefficient use of water was observed in the project area. Leakages from unlined canals through the earthen dam structure or from breakages of cemented canals system and faulty use of irrigation water were the major problems in the study area. Over using water than was required for satisfactory crop production can lead to inefficient use of fertilizer and over leaching of soils, increase the favorable conditions for pests, and leaves the soil in a more degraded conditions. This was becoming the point of conflict in the water user association among most of the water user associations in the irrigation area. The other problem observed was the use of flood irrigation. Use of extended length of tertiary canals and furrows creates an over run of water causing erosion on other fields. This situations calls for a combination of physical and social measurements to control the situation before further damage is caused.

5.4.2.6 IrrigationWater and Health:

Water-borne diseases account for a substantial part of the total incidence of diseases in the rural population. It is directly related to water use system adapted by the farming community. It is believed that the problem is more severe in irrigated agricultural system where irrigation water is used for human as well animal consumption, directly without any treatment. The greatest danger associated with drinking water is contamination by human and animal excrement. Fecal of human, as well as, animalswere left in the open system in the field and around homestead area. Rainfall washes the excreta directly into the irrigation water which becomes source of water borne parasites. It was also found out in the study that the design of irrigation systems, which was supposed to avoid stagnant water to prevent negative health impacts of irrigation, was not properly working. This was also aggravated by the inefficient use of water in most of the schemes.

Water breaks furrows and ponds in depressions outside the farm. This had created favorable condition for vector and water borne diseases like malaria, sischotosmiasis, and lungworms. According to the data collected from Doni public clinic, malaria, upper respiratory tract infection and parasites were most frequent diseases. Farmers were using the Awash River for human and animal consumption without any treatment. This had increased the incidence of diseases in irrigated areas.

5.4.2.7 Lack of Market Linkages:

Farmers had reported lack of market for their produce as a critical problem. They had indicated the unavailability of systematic and organized market linkages and supports from the project management unit. On many occasions farmers were forced to abandon the onion crop and/or feed it their livestock because of dramatic drop in prices. The focus group discussants had stated that there were times when the total sale of the production becomes less than the cost of harvesting the crop. Farmers were of the opinion that the drop in the selling price of their production was man-made in most cases. They had indicated that it was due to lack of proper market linkage and neglect by policy measures that they had fallen prey to intermediaries. Farmers were powerless on individual basis or even by getting organized to take their produces to markets elsewhere because these intermediaries had strong networking with merchants in small towns and cities that with a single communication they can deny them any buyers in the open market. Farmers had no choice other than sell their crops at farm level and price was decided by the intermediaries. The network between the intermediaries and merchants rendered the producers helpless and disadvantaged.

6. CONCLUSION AND RECOMMENDATIONS:

6.1 CONCLUSION:

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

This study was conducted with the primary aim of looking for the impacts of irrigation based integrated development project in one of the semi-arid areas onfood security situation by taking as a case reference the Tibila Irrigation Based Integrated Development Project. It was to identify the key positive impacts of the said irrigation project on the improvement of living conditions of the irrigation population that was realized during the last four years of the project life. Also, on the way of identifying the positive impacts and the good practice that the project was manifesting, efforts were made to identify the negative impacts, risks and vulnerabilities evident among the project communities. Due attentions were accorded to identify and document the project interventions planned and implemented to deal with the problems of poverty and food insecurity and the situations that were prevailing in the area.

Based on study findings the following conclusions can be drawn:

- Household vulnerability, food insecurity and the overall poverty situations were the main threat of the households and community members in the project area prior to the start of the irrigation project. Household survey respondents and focus group discussants of the water users associations, farmers and extension workers had indicated the existence of abject poverty, vulnerability and extreme food insecurity in the area prior to the project. Lack of dependable and reliable water sources, prevalence of drought, erratic and insufficient rainfall, lack of appropriate

technology and improved inputs for agricultural production and livestock development were reasoned to be the major causes and factors and driving forces for the prevalence and expansion of poverty and lack of means of livelihood for the project population by the time.

- The findings of this study had revealed that farmers were able to produce more agricultural crops from small plot of land, had ensured household food-security and had become self-reliantwith the irrigation project. The livelihood of project participants was changed in that they were able to construct corrugated roof houses, lease land and build houses in urban centersand purchase different household furniture. Farmers had been able to access improved health services, send their childrento schools and some even had started saving in the nearby banks. Other social services like hotel, grinding mill, and shops had been opened in the area. The study had revealed that there was large improvement in livestock feeds coming from natural grass, forage development, crop residues and adequate and reliable source of water for livestock in the area. The project had created job opportunity for large number of landless youths and women residing in and around the project area and those job seekers coming from different parts of the country.

- The irrigation project has brought improvement in the household income in a sustainable way. Therefore, it can be safely concluded that irrigation-based rural development in semi-arid areas like Tibila community is appropriate and viable for improving household income and realizing household food security and improved living conditions for participant population with proper and efficient implementation of such project.

- There were some negative impacts of the project. The study had revealed that chemical sprays used by the farmers as insecticides were polluting the water. People in the irrigation area had no alternative source of water, forced to drink this polluted water with risk of immediate and long term health hazards. As people and livestock livedin the irrigation command areas, there was a high incident of damage

to the irrigation canals. Even though the sending of children and youths to schools, including the opportunity for higher education had increased with the introduction of the project, some youths had dropped out of schools with the opportunities created for easier cash earning. There were cases of social and cultural disturbances, such as,the incident of high crime rates.

- There was adecline in the level of poverty and improvement in household food security during the post irrigation period. Therefore, one can safely conclude that the irrigation project had brought household food security to the area in an irreversible way. Farmers had already started taking food security for granted and thinking in terms of the extra crop they could produce for market.

- The study had revealed that lack of organized and systematic market linkages and the inexistence of any support from the government. Farmers stand alone and at a loss, vulnerable and easy prey to brokers, intermediaries and traders. Inaccessibility to market and hence the very low price that farmers obtain from their agriculture produces were the most critical challenges of the project. It was reported that farmers sometimes leave crops, such as, onions on fields without harvesting because of fall in price. In some cases the cost of harvesting the onion becomes more than the actual cash to be generated from the sale of the crop and farmers make the cost benefit analysis and take such decision. However, the irony was that the price of onion might be high in cities and urban centers during such times and therefore, the drop in price for farmers had been man-made and caused by intermediaries and traders than the actual demand and supply situation.

- With the introduction of the irrigation project there is evidence of decline in livestock holding among the project participants. Lack of open space and limitation in grazing land and natural grass, the change in the agricultural practice of the population,more attention given to crop production than livestock rearing and other similar factors had contributed to the declining trend. The other negative aspect of the project was that with the advent of the project, the livestock population had

declined and/or remained constant due to scarcity of labour to share between livestock rearing and practicing irrigated agriculture, and shortage of grazing land in the vicinity. Farmers and extension workers were also focusing more and more on the production of cash crops at the expense of livestock development. However, in terms of livestock well-being, physical condition, yield and productivity, etc, the limited number of animals held by the irrigation households show very significant improvement. Today, people hold a few animals mostly through zero grazing method and yet get very high production.

- More or less, all project beneficiaries were happy with the implementation of the irrigation project. People have very positive attitude towards the scheme. They have practically experienced a significant positive change in their lives. People were quite delighted and interested to enumerate the positive results brought by the irrigation project. The accountability and sense of ownership have developed strongly in a relatively short period of time.

6.2 RECOMMENDATIONS:

Based on the study findings and conclusion, the following recommendations are proposed:

- There is a need to create mechanisms for building agreement and consensus between the water user associations and government and its technical and support manpower. Even though it is required to spend hundred and millions of financial and other resources to construct and put in place the irrigation infrastructure, the design, technical, engineering and other related hardware components of the project can be less difficult and complicated as compared to changing the attitude and developing the human resources, which are the end users of the whole infrastructure. Organizing the users into cooperatives, unions and networking of user households into functional, collaborative and effective social groups and organizations are the most difficult part to make any irrigation scheme a success.

Therefore, the experience of forming WUAs and working with the local human resources should be the reason for creating a new generation of engineers, technicians,and users, who have become experts in building the trust among each other. The on-goingchallenge is to ensure the continuation of mutual understanding on all levels of the irrigationsystem, so that areas where meeting the demands of users for reaching the potential productionas well as defining areas where real water saving could become reality with less cost can belocated.

- The Tibila Irrigation based development scheme in particular and any irrigation-fed rural development project in general should see agricultural extension as one of the vital components of the resources required for the effective, efficient, impactful and sustainable development. The extension service is responsible for simplifying research information and delivering it to farmers in an effective and easy to understand manner. The extension service is also a feedback mechanism to researchers on problems faced by farmers. The research-extension-farmer relationship should be viewed as an interdependent and inter-related continuum. Taking into account these vital roles of the extension services, extension facilities and extension workers should have expertise and specialization in human relations, communication skills, need to be principled, have virtues for human respect and dignity, have to be committed to teach and learn from and help farmers. Since the science of irrigation is complex and comprehensive, the irrigation extension worker must have diverse expertise and should have good relationships with subject matter specialists. Furthermore, the extension system and extension workers should see to it that farmers have sufficient resources and proper knowledge before facilitating them to adopt any new technology.

- Lack of proper market linkages was found to be the most critical challenges for the irrigation producers in the Tibila irrigation based development project. As witnessed all over the country and all urban centers, the prices of agricultural products are quite expensive for consumers beyond their purchasing power. However,farmers in the project area complain that the cash crops such as onion they produce are sold

at the cheapest prices year in and year out. The intermediaries and traders network conspire against the producers and fix artificial prices to maximize their profit. They leave the farmers without any options and force them to sell their products at the price they fix. Therefore, producers need organization and supports in accessing market outlets and opportunities. Organizing farmers into service cooperatives, putting in place market policies and regulation, advising farmers on ways of storing their produces at peak harvest time and sell later when prices are higher can be some of the mechanisms and methods for safeguarding farmers from the abuse and exploitation of brokers and traders. Also, it is important to strengthen the capacity of existing cooperatives in order to help farmers in supplying agricultural inputs and selling their products by transporting to big towns instead of selling at farm level. Also, there should be clear policies that support farmers to get reasonable price for their perishable vegetable produces.

- Members of the focus groups discussion told the researcher that irrigation land was distributed to the project beneficiaries (including landless youths) fairly. In addition, the government has provided improved seed varieties, pest control chemicals, fertilizers and fungicides to the farmers on time and most of the beneficiaries who can afford have benefited directly. However, some farmerswere unable to buy the inputs because of lack of financial resources and the chance of accessing credit facilities is non-existing or minimum. As a result, the poor farmers were forced to rent their land to other people who come from towns and cities in the surrounding areas or who come from distance places. Therefore, the government scheme management unit needs to find ways of availing credit services to the farmers. One way of availing such facility could be through organizing the needy farmers into saving and credit cooperatives or through collaborating with existing micro-finance institutions and other governmental and non-governmental organizations.

- Households have already ensured food security in a reliable way. Food is ever present in each and every household for children and other household members in the project command areas. Also, farmers have been capacitated to generate very

significant income from the cash crops they produce. There is a significant improvement in livelihood and living conditions. These changes and improvements need to be irreversible and sustainable. Some of the ways of ensuring sustainability are through teaching and raising awareness of farmers in saving practices and inculcatingsaving habits. Organizing farmers in savings and credit institutions is another alternative measure. There is a need to guide and enablefarmers to learn and develop attitude that the current affluence should be the basis for future investment and improvement in the living conditions in a sustainable way.Giving farmers information on how they can deposit their extra earnings in modern banking system can safeguard them from overspending and theft problems.

- Livestock development by tailoring the holding size, the quality and productivity of the sector to the local situation is one major way of diversifying household livelihood situations in the irrigation area. The current evidence in shortage of open space and grazing areas and the resultant effect of decline in livestock population can become the limiting factor in the livelihood situation of the population. The less attention given to livestock development by extension system and workers and the current concentration only on crop production is not healthy approach and there will be undesirable consequences in the long run. The crop production should be complemented with livestock development so as to diversify household nutrition, especially for children, and to improve household income. Therefore, it is recommended that crop production and livestock development should go hand-in-hand and both deserve to get equal and balanced attention to diversify the economic benefits of the population and make the two sectors interdependent and complimentary to one another.To overcome the feed constraint through appropriate intervention is very crucial to effectively manage the existing livestock potential as one of the strategies to transform the agricultural sector. Therefore, the benefits of irrigation should also be directed towards livestock. In this case, it is possible to grow improved forage crops all along the irrigation canals. In doing so, crops cannot be harmed or water shortage cannot be caused. Therefore, this and similar

other methods that help to increase animal feed by using irrigation water should be considered.

- The Tibila irrigation based development project need to undertake timely review and evaluation to identify the positive impacts and discern the negative consequences as well. There is a need to take inventory of both aspects of the project before it is too late in order to strengthen the positive impacts and take corrective measures for the negatives. It is understood that the project may have time frame for evaluation as set during the design stage. However, during the field work except the socio-economic study for the project,there was no documented baseline survey report or mid-term evaluation or any of that kind after the project has been in operation for over four years. Either there was a planning gap during the project design stage or implementation defect. Given the importance of assessing and gauging the positive and negative impacts of any project and the critical necessity of such exercises for irrigation project which is sensitive from technical and social and economic dimensions, it is recommended that the project need to have functional, relevant and action oriented evaluation for the project.

- Land degradation, water and environmental pollutions and the like ecological effects of the project need serious attention starting from the current life time of the project. In fact the possible negative environmental impacts of the project should have utmost consideration even during the designing stage. The project has been under implementation for the last four years. Therefore, assessment and review on the negative impacts require attention sooner than later. Extension workers and water users groups have raised their concerns on the pollution of the irrigation water by insecticides, fungicides, herbicides and other chemicals, salinity and sedimentations. They had stated that there are evidences that these problems are creeping up in a gradual manner.It is therefore, recommended that environmental impacts of the project should be assessed and analyzed in action-oriented research manner and proper corrective measures taken as early as possible.

- Currently, farmers are depending on one or two cash crops. Onion is the major cash crop to be followed by tomato to some extent. As revealed by water user association and extension workers, these two crops are preferred by farmers, and especially the onion is the most liked crop because it commands high price in the market and can be easily produced, harvested and preserved if required. However, it is the understanding of this researcher that dependence on one crop as source of income generation can have side effects such as the market can drop due to the increase in supply from the project itself or from elsewhere, the crop production can fail, the yield can decrease in the area due to different reasons, etc. During such times and situations, lack of diversification can be a limiting factor. Therefore, the project need to conduct research in the area of alternative cash and food crops that can be suitable for the area, introduce them and promote their adoption by farmers.

- Social disturbances and incidents of crimes are increasing in the area. Long existing community traditions, norms and values are getting eroded because new comers are converging in the irrigation area from different parts of the country. Investors, land leasers for irrigation farming, daily labourers, commercial sex workers, farmers from nearby or far areas, etc., are coming to the area for temporary employment or for permanent settlement. People from different urban centers and cities are migrating to the area in search of opportunities. Given the influx of these diversified people with different socio-cultural backgrounds bear heavy burden on the original social and cultural fabrics resulting in the deterioration of existing social traditions, norms and values. Also, the social services such education, health, water, electricity, telecommunication and others would stretch beyond limits. Therefore, there is a critical need to foresee and take proactive measures to identify the different social and economic problems, the different social evils that are cropping up in the area, the social service gaps, and take the necessary corrective measures to mitigate and control crimes, to provide the required social services with the active involvement and contribution of the project population.

ANNEXUREI: LIST OF REFERENCES:

Amenemhet III, Britannica Concise, http://concise.britannica.com/ebc/article-9006076/Amenemhet-III

Barker, R.; B. Van Koppen; and T. Shah, (2000), A global perspective on water scarcity and poverty: Achievements and challenges for water resources management, International Water Management Institute, Colombo, Sri Lanka.

Belete Yalew, Current Experience on Existing Small Scale irrigations, Ministry of Agriculture and Rural Development (MoARD), Addis Ababa, 2006

Bhattarai, M.; R. Sakthivadivel; and I. Hussain, (2002), Irrigation impacts on income inequality and poverty alleviation: Policy issues and options for improved management of irrigation systems, International Water Management Institute, Colombo, Sri Lanka,

Brown, E. P. & Nooter, R. (1992) Successful small-scale irrigation in the Sahel, World Bank technical paper number 171, The World Bank, Washington D.C.

Bruinsma J. ed., (2003), World agriculture towards 2015/2030: FAO perspective,

Bruinsma J.ed. , (2003), World Agriculture: Towards 2015/2050, FAO perspective,

Chambers, R. (1988), Managing canal irrigation: Practical analysis from South Asia, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, India,

Chitale, M. A. (1994), Irrigation for poverty alleviation. Water resources development,

De Silva, Sena (1998), Reservoirs of Sri Lanka and their fisheries, UN Food and Agriculture Organization, Rome, Italy,

Dessalegn Rahmato, (1999), Water Resources Development in Ethiopia: Issues of Sustainability and Participation, Addis Ababa, Ethiopia,

Dillehay TD, Eling HH Jr, Rossen J, (2005), "Pre-ceramic irrigation canals in the Peruvian Andes".Proceedings of the National Academy of Sciences,

Elinor Ostrom,Roy Gardner and James Walker (editors), (1994), Rules, Games, and Common Pool Resources, Ann Arbor, University of Michigan Press, USA,

Encarta Encyclopedia (2006),

Encyclopedia of Water Science, Publishers Taylor & Francis, last updated in 2011

Encyclopedia. Free dictionary.com/United+Nations+ Development,

EnvironmentalProtection Authority (1997), Environmental Impact Assessment Guideline-Volume I- Procedural Guideline, Addis Ababa, Ethiopia,

Environmental Protection Authority, (1997), EIA-Sectoral Guideline-Volume II–EIA Guideline for Agricultural Sector Development Projects, Addis Ababa, Ethiopia,

Facon,T.,Performance of irrigation and participatory irrigation management: Lessons from FAO's irrigation modernization programs in Asia,

FAO (Food and Agriculture Organization), (1998), FAO Statistics, Rome, Italy,

FAO, (1976), FAO Corporate document repository: Environmental impact Assessment of irrigation and drainage projects, Rome Italy,

FAO, (1976), FAO Corporate Document Repository: Organization, Operation and Maintenance of Irrigation, Rome, Italy,

FAO, (2000), The State of Food and Agriculture, Rome, Italy,

FAO, (2003), The state of food security in the world: Progress towards food summit and millennium development goals, Rome Italy,

FAO-ICID, Workshop on Agricultural Advisory Services and Participatory Extension on Irrigation Management, Canada,

FDRE National Legislative Bodies, (1995), Constitution of the Federal Democratic Republic of Ethiopia, Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia Environmental policy, (1997), Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia Ministry of Agriculture Natural Resources Sector,(2011), Guideline on Irrigation Agronomy-A tripartite Cooperation Between Germany, Israel and Ethiopia,Addis Ababa,

Federal Democratic Republic of Ethiopia Ministry of Water Resources, (2001), Ethiopia Water Sector Policy,Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia Ministry of Water Resources, (2001), Ethiopia Water Sector Program,Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia Ministry of Water Resources, (2001), Ethiopian water resources Management Policy (EWRMP), Addis Ababa

Federal Democratic Republic of Ethiopia Ministry of WaterResources, (2001), Ethiopian Water Sector Policy,Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia Population and Housing Census, (2007), Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia, (1991), Ethiopian Water Resources Management Policy, Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia, (1997), Environmental Policy,Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia, (2001), Ethiopian water sector strategy, Addis Ababa, Ethiopia,

Federal Democratic Republic of Ethiopia, (2007), Central Statistics Agency, Population and Housing Census, Addis Ababa,

Federal Democratic Republic of Ethiopia, Ministry of Water Resources, (1999), Ethiopian WaterResources Management Policy, Addis Ababa, Ethiopia,

Fekadu Moges, Teshome Afrasa and Mekuria Tafesse, (2000), Existing constraints and suggestedStrategies for enhancing investment in irrigated agriculture, agricultural workshop, Addis Ababa, Ethiopia,

Food and Agricultural Organization of the United Nations, Gesellschaft fur Techniche ZuSammenrbeit and International water Management Institute, (1999), Transfer of management services guideline, FAO, Rome, Italy,

GIZ (2003), Preparation of regulation for irrigation water users association, summary, Addis Ababa,Ethiopia,

Godfrey Rolles Driver, John C. Miles, (1952-1955), series, Ancient Codes and laws of the near East,

Habtamu, Gessese, (1990), Problems and Constraints in the Study, Construction and Management of Small- Scale Irrigation Projects, Paper Presented at the National Irrigation Policy and Strategy Workshop, Addis Ababa, Ethiopia,

Herve Plusquellec, (2002), is the daunting challenges of irrigation achievable? An article publishedon line: Copyright @2002 John Wiley & sons, ltd.

hppt:/www.comp.soln.com/PM1_whitepaper.pdf,

hppt:/www.etu.org.za>Toolbox>Local Government in South Africa,

hppt:/www.globaleducation.edn.a.edu.au/globaled/go/pid177, UN Feb. 2011,

hppt:/www.middletown (a.com/SUSTAINABLE DEVELOPMENT,

hppt:/www.softwareproject.org/project/_intake_reasons22.htm,

hppt:/www.volunteering_options.org/volunteeringDevelopment/,

hppt:/www.Who.int/trade/glossary/story 028/en/,

hppt;/www.Ifad.org/Irkm/theme/range/range_2.htm:

IFAD, (2001), Rural Poverty: New realities, new challenges and new opportunities for tomorrow's generation,

IndiraGandhi National Open University School Continuing Education, Rural Development Textbook, MRD 103, Block 2,

International Water Management Institute (IWMI), Southeast Asia Office, (2011),

Basic principles for sustainable participatory irrigation management, Colombo, Sri Lanka,

International Water Management Institute, (2003), How to establish Water Users Association: Practical steps for social mobilizers, Colombo, Sri Lanka,

Kandiah, A. (2001), Summary of findings of missions in selected countries in East and Southern Africa, Development and Management Service, Land and WaterDevelopment Division, FAO, Rome.

Kang, S. T. (1972), Irrigation in Ancient Mesopotamia. Water Resource Bulletin,

Lam, W. F. (1996) Improving the performance of small-scale irrigation systems: The effects oftechnological investments and governance structure on irrigation performance in Nepal, World Development,

Marothia, D.K. (2001), Institutionalizing common pool resources, New Delhi: Concept publishing Company, India,

Marothia, D.K., (2002), Institutional arrangements for participatory irrigation management: Initial feedback from central India,

Meinzen-Dick, R. (1997), Farmer participation: 20 years of experience and lesson for the future Irrigation and Drainage systems,

Mellor, J. W. (1999), Faster more equitable growth: The relationship between growth in agriculture and poverty reduction,

Mellor, J. W. (2001), Irrigation agriculture and poverty reduction: General relationships and specific needs. Workshop paper presented at the Regional Workshop on Pro-Poor Intervention Strategies in irrigated Agriculture in Asia,

Mellor, J.W. (1966), The Economics of Agricultural Development. Ithaca, New York: Cornell University press, USA,

Ministry of Agriculture of Burkina Faso, (2003),

Ministry of Finance and Economic Development (MOFED), (2006a),

Ministry of Finance and Economic Development of Ethiopia (MOFED), (2006), Building on Progress: A Plan for Accelerated and Sustained Development to End Poverty (PASDEP), Volume I: Main Text, Addis Ababa, Ethiopia,

Ministry of Water Resources, (1987), The Government of India,

Ministry of Water Resources, (2002a). Water sector development programme 2002–2016. Irrigation development program, Main report, MoWR, Addis Ababa, Ethiopia.

MoWR (Ministry of Water Resources), (2002b), Irrigation development program, Addis Ababa, Ethiopia,

MoWR, (Ministry of Water Resources), (2001), Ethiopian Water Resources Management PolicyAddis Ababa, Ethiopia,

MoWR, (Ministry of Water Resources), (2002), Water Sector Development Program 2002 – 2016, Main Report, Addis Ababa, Ethiopia,

Mrenna, D. (Ed.), (2001), Water policy reform: Lessons from Asiaand Australia: Proceedings of an International Workshop held in Bangkok, Thailand,

Oromia National Regional State, (2008), The Socio-economic Profile of Oromia, Finfinne (Addis Ababa), Ethiopia,

Oromia Water Works Design and Supervision Enterprise (2009), Tibila Irrigation Based Integrated Development:Project Socio-Economy Study Final Report, Finfinne (Addis Ababa), Ethiopia,

Oromia Water Works Design and Supervision Enterprise (OWWDSE), (2009),Tibila Irrigation Scheme Organization and Management Report, Finfinne (Addis Ababa), Ethiopia,

Oromia Water Works Design and Supervision Enterprise, (OWWDSE), (2009), Tibila Irrigation Based Integrated Development Project Agronomy Study Report, Finfinne (Addis Ababa), Ethiopia,

Oromia Water Works Design and Supervision Enterprise, (OWWDSE), (2007), Tibila Irrigation-Based Integrated Development Project Feasibility Study documents, Finfinne (Addis Ababa), Ethiopia,

Rodda, J. C. and Ubertini, Lucio, (2004), the Basis of Civilization-Water Science, InternationalAssociation of Hydrological Sciences (International Association of Hydrological Sciences Press,

Sampath, R. K. (1990), On some aspects of irrigation distribution in India. Land Economics,

SeleshiB.Awulachew (2006), Improved Agricultural Water Management: Assessment of constraints and Opportunities for Agricultural Development in Ethiopia, Addis Ababa, Ethiopia,

Seleshi, Bekele, Aster Demekew, Makonen Loulseged, Willibald Loiskandi, (2007), Water resources and irrigation development in Ethiopia, Federal democratic Republic of Ethiopia MOWR and IWMI,

Shad Manor, Sanguan Patamatamkul and Manuel Oh, editors, (1990),Role of Social Organizers in Assisting Farmers Managed Irrigation system: Proceedings of a Regional Workshop of the Farmer-Managed Irrigation Systems Network, Organized by theInternational Irrigation Management Institute (IIMI) and the Thaind Research on Irrigation Management Network (TRIMNET) andheld at Khon Kaen, Thailand from 15 to 20 May 1989, October, 1990, Colombo, Sri Lanka,

Shah, T. (1998), Water against poverty:Livelihood-oriented water resource management, Nepal,

Siebert, S. J. Hoogeveen, P. Döll, J-M. Faurès, S. Feick, and K. Frenken (2006), "The DigitalGlobal Map of Irrigation Areas-Development and Validation of Map Version 4", Tropentag,–Conference on International Agricultural Research for Development,

Smith, M. and Munoz, G. (2002), Irrigation Advisory Services for Effective Water Use: A Review of Experiences. Monteral, Canada,

Solomon Cherre (2006). Irrigation Policies, Strategies, and Institutional Support conditions in Ethiopia, Addis Ababa, Ethiopia,

Tanaka, Y. and Sato, Y. (2005), Farmers Managed Irrigation Districts in Japan: Assessing How Fairness May Contribute to Sustainability,

The great Soviet Encyclopedia, the free dictionary, 1926-1990 and 2002 onwards,

The World Bank/WBI's CBNRM Initiative, Gopal Naik and Amar H. Kalro, 1998),

UN Food and Agriculture Organization, (1985), Qanat Irrigation Systems and Home gardens (Iran), Globally Important Agriculture Heritage Systems, Rome, Italy,

UNDP/FAO, (1984), Assistance to land use planning in Ethiopia: Agro-climatic resources inventory forland use planning Vol. 1, Rome, Italy,

UNESCO, Water Users Associations for sustainable water management:

Experience from irrigationsector, Tamil Nadu, India, New Delhi, India,

United Nations Food and Agriculture Organization, Arid and Semi-arid Areas, (FAO 1987), hppt;/www.Ifad.org/Irkm/theme/range/range_2.htm: Challenges and Hopes for 2000s: The Rangelands of Arid and semi-Arid Areas: A Review.

Waiganjo Ch. and Paul E.N, (2001), The effects of existing land tenure systems on land use in Kenya today, International Conference on Spatial Information for Sustainable Development, Nairobi, Kenya,

WAPCOS, (Water and Power Consultancy Services), (1990), Preliminary Water ResourcesDevelopment Master Plan for Ethiopia, Final Report, Vol II, Ethiopian Valleys Development, Addis Ababa, Ethiopia,

WCD (World Commission on Dams), (2000), Dams and developments: A new framework for decision-making. London, UK: Earthscan Publishers,

Wegerich, K. (2001), the Potentials for Success: Uzbek Local Water Issues Study Group. School of Oriental and African,

World Bank (1993). Water resources management: A World Bank policy paper, Washington, D. C.:The World Bank,

World Bank (2006). Managing water: A World Bank Water Resource Assistance Strategy for Ethiopia, Agriculture and Rural Development Department,

Yerkcan, M. (2003), Management Turning over and Participatory Management of Irrigation Schemes,

ANNEXURE II: QUESTIONNARIRE FOR PROJECT BENEFICIARIES

I. PERSONAL DATA

1. Respondent name (optional) _____
2. Peasant association (PA) name _____
3. Farm sites/ Block number _____
4. Sex

   Male = 1 _____ Female = 2 _____

5. Age _____ Years old

6. Marital Status

Not married = 1 Married = 2 Divorced = 3 Widow /widower = 4

7. Total number of household members

Male = 1 _____ Female = 2_____ Total _____

8. Level of your Education

Illiterate = 1 Read & write = 2 Primary Education = 3 (1-6) Junior Secondary Education (7-8) = 4 other specify ---------- = 5

9. Role in the household

Household head = 1_____ House wife = 2 _____ Household member = 3 _____

II. BENEFICIARIES' SITUATION BEFORE THE PROJECT

10. What were the main sources of your family income before the project?

Crop cultivation only = 1 _____

Livestock Production only = 2 _____

Both Crop cultivation and Livestock Production = 3 _____

Off-farm activities only = 4 _____

Had no occupation at all = 5 _____

Other specify = 6

_____

_____

11. What source of water were you using for crop production before the irrigation project?

Rain water = 1 _____ Pound =2 _____ Small scale irrigation = 3 _____

other source = 4 ----------, specify ----------

12. Previously, before the start of the irrigation project, did you have your own land?

Yes = 1 _____ No =2 _____

13. If your answer to Q 12 is yes, how much was the land size (in ha)

< 0.5 = 1 _____

0.5-1 = 2 _____

1-2 = 3 _____

3-4 = 4 _____

Above 4 = 5 _____

14. If your answer to Q 12 is yes, were you using the land for?
    Crops cultivation=1 ------- grazing land =2 --------- for both = 3 ----------
15. Before the start of the irrigation project, did you have any experience in irrigation works?
    Yes = 1 ---------- No = 2 ----------
16. If you were using the land for cultivation of crops, what were the major crops you were growing using rainfall, average annual yield (in quintal) and selling prices (in descending order)?

Type of crops	Code	Yield in quintals Per hectare	Market price per quintal	Remark
Maize	1			
Sorghum	2			
Haricot beans	3			
Onion	4			
Garlic	5			
Tomato	6			
Papaya	7			
Potato	8			
Other	9			

    Others = 9, specify
    _____
    _____
    _____
17. Before the project, did you produce enough for your household consumption by using rainfall?
    Yes =1 _____ No =2 _____
18. If your answer to Q 17 is no, what were the major constraints with regard to crop production?
    Inadequate and erratic rainfall = 1 _____ High prevalence of pests = 2 _____ Lack of pesticides = 3 _____ Crop disease = 4 _____ Lack of

adequate land for production = 5 _____ other = 6, specify

_____

_____

_____

19. Before the irrigation project, what were the problems that your family was facing?
    Food shortage only=1 ----------
    Water shortage only=2 ----------
    Both food and water shortage=3 ----------
    Fodder shortage for animals= 4----------
    Had no any problem=5----------
    Other =6 ----------, Specify ----------
    ----
20. Can you remember how many times a day you were able to feed your family before the start of the irrigation project?
    Once per day = 1 ---------- twice per day = 2 ---------- Thrice per day = 3 ----------
    - There were days when we go hungry without any food =4 ----------
21. What was your major stable food before the project?
    Maize = 1 --------- Sorghum = 2 ---------- Mainly milk =3 ---------- Other = 4 ---------, specify ------
    ----
22. Were you used to encounter sever food shortage before the start of the irrigation project?
    Yes = 1 ---------- No= 2 ----------
23. If yes, how did you overcome the problem?
    By purchasing food from markets =1 ---------- By gathering wild foods = 2----------
    By seeking support from relatives and friends =3 ---------- By getting support from government and humanitarian organizations = 4 ---------- Others = 5 ------, specify ------
    ----
24. If you were you forced to get food support from external sources, for how many years were you getting such support? ---------- Years.
25. For how many months of each year were you getting food support?

2-4 = 1 -------- 5-6 = 2 ---------- 7-8 = 3 ---------- 9-10 =4 --------- Throughout the year =5 ----

26. If you were having livestock as a means of family income before the project, Indicate average no. of livestock you owned & their selling prices.

Type of Animal	**Code**	**Number**	**Price per animal**	**Remark**
Oxen	1			
Cow	2			
Calf	3			
Goat	4			
Sheep	5			
Donkey	6			
Camel	7			
Other, specify	8			

27. If you owned livestock, what was your source of water for your livestock before the start of the irrigation project?
Pond = 1 _____ River water = 2 _____ Hand dag well = 3 _____ Deep ground water = 4 _____ other = 5, specify
_____

28. If you owned livestock before the project, did you get enough income from them to cover your household consumption and other hh needs?
Yes =1 _____No =2 _____

29. If your answer to Q – is yes, what was/were the contributing factor/s?
Existence of good grazing area = 1 _____ Availability of adequate water = 2 _____ Availability of good veterinary service = 3 _____ Existence of good market =4 _____ others = 5
_____
_____

30. If your answer to Q 29 is no, what were the major constraints?
Shortage of grazing land =1 _____ Lack of water for the livestock = 2 _____
Animal disease = 3 _____Lack of market =4_____Livestock death due to drought =5 _____

31. If your family main source of income was/were petty trade, did you get enough income for your family subsistence?
Yes =1 _____ No =2 _____

32. If your answer to Q 31 is no, what was/were the reason(s)
Lack of market =1 lack of transportation =2 lack of initial capital =3 other = 4, specify -
---

III. BENEFICIARIES' SITUATION AFTER THE PROJECT

33. How did come to participate in the irrigation project?
By own interest to be organized in the irrigation water users association = 1 ----------
Recruited by extension agent = 2 ---------- Was in the irrigation catchment area and automatically included in the project =3 ---------- Included in the project by the kebele official = 4 ----------
Other = 5, specify ----------
---

34. For how long you been the user of the irrigation project? For the last ---------- years.

35. How much land you own currently? (in ha)
< 0.5 = 1 _____
0.5-1 = 2 _____
1-2 = 3 _____
3-4 = 4 _____
Above 4 = 5 _____

36. How did you get the present irrigation land?
I had my own land before the project =1 ---------- From Land tenure =2 ---------- Rent =3 ---------- Inherited from family = 4 ---------- Bought from individual farmer = 5 ---------- By other means = 6 , specify ----------
---

---

37. What are the major crops you are growing using irrigation, average annual yield and average selling prices?

Type of crop	Code	Yield in quintal Per hectare	Market price	Remark
Onion	1			
Tomato	2			
Garlic	3			
Maize	4			
Sorghum	5			
Haricot	6			
Papaya	7			
Potato	8			
Other	9			

38. For what purpose are you growing the irrigation crops?

Household consumption =1 ---------- Marketing =2 ---------- both =3 ---------

39. After you began producing irrigation crops did you able to produce enough for your household consumption and other household needs?

Yes =1 ---------- No =2----------

40. If your answer to Q 38 is for market, where are you selling your irrigation crops?

Type crop	At farm	District town	Other small towns	Take to big cities
Maize				
Sorghum				
Tomato				
Potato				
Papaya				
Haricot				

Onion				
Garlic				

41. How much average income or cash you are able to generate annually from the sale of the irrigation crops you produce?

    500-1000 birr =1---------- >1000-2000 birr = 2 ---------- >2000-4000 birr = 3 ---------- >4000-6000 birr = 4---------- > 6000-10000 birr =5 ---------- >10,000 birr= 6 ----------

42. Are there any factors, which constrain your crop production performance?

    Yes =1 ---------- No = 2 ----------

43. If your answer to 42 is yes, what are the factors?

    Lack of adequate irrigation water =1 ---------- Lack of pesticides = 2 ---------- Lack of seeds = 3 Lack of extension support = 4 ---------- Fall of price of crops = 5 ----------

    Other = 6 ------- specify ----------

44. Is there any change in your livestock holding after the establishment of the irrigation project?

    Increased = 1---------- decreased = 2---------- No change = 3----------

45. If the answer to Q 44 is increased, what is/are the contributing factor (s)?

    Increased in animal feed from crop residue = 1 ----------

    Adequate and reliable water source for livestock 2 ----------

    Increased in animal feed (grass types) introduced together with irrigation = 3 ----------

    Increased income from irrigation to buy more livestock = 4 ----------

    Increased income from irrigation for better veterinary service = 5 ----------

    Others = 6 ----------, specify ----------

46. If the response to Q 44 is decreased what is (are) the root cause (s) for the decrease?

    Lack or inadequate animal feed = 1 ----------

    Decreased grazing land due to irrigation project = 2 ----------

    Scarcity of labour for livestock keeping and rearing due to irrigation works = 3 ----------

Lack or unreliable water source for livestock = 4 ----------

Increased livestock diseases after irrigation project = 5 ----------

Lack of veterinary services = 6----------

Other = 7----------, Specify ----------

---

47. Indicate average no. of livestock you have currently (after the project) & their selling prices.

Type of animal	Code	Number	Market price	Remark
Oxen	1			
Cow	2			
Calf	3			
Goat	4			
Sheep	5			
Camel	6			
Donkey	7			
Others	8			

48. After you began using the irrigation facilities, what asset you were able to create from the income you got from the sale of the irrigation produces?

Corrugated roofed house = 1 --------- Bought household furniture (Bed, sofa, tables, chairs and others) = 2 ---------- Invested in productive assets (farm tools, inputs and livestock) = 3 -----

Not made any asset creation = 4 ---------- Other = 5, specify ----------

---

49. Currently, what are the major problems that your family is facing?

Food shortage = 1 ---------- Water shortage = 2 ---------- Both food and water shortage = 3 ---------- Fodder shortage for animals = 4 ---------- have no any problem= 5 ----------

Other = 6 ----------, specify ----------

50. How many times a day you are able to feed your family after participating in the irrigation project?

Once per day = 1 ---------- twice per day = 2 ---------- Thrice per day = 3 ---------- There were days when we go hungry without any food =4 ----------

51. What is your major stable food after the project?

Maize = 1 --------- Sorghum = 2 ---------- Mainly milk =3 ---------- Other = 4 ---------, specify ----------

52. Do you think after participation in the irrigation project, you are able to improve household food security and living conditions?

Yes = 1 ---------- No = 2 ----------

53. If yes to Q 52 in what way (s) you have improved the food security and living situations?

Agricultural production and productivity has increased and I am able to produce enough food for my family =1----------,

Income of my family has increased more than before the project =2 ----------

I am able to buy new seed varieties, improved farm tools, fertilizers, pesticides etc, =3 ----------

I am able to send my children to school = 4---------- Other = 5 specify ----------

54. If your answer to Q 52 is no, what is (are) the reason(s)?

Shortage of adequate land size =1 ---------- Lack of appropriate market =2----------

Failure of crops due to pests = 3 ---------- Lack of pesticides = 4 ---------- Crop disease = 5 ------ Other=6

Specify ----------

55. Due to the cause (s) indicated in Q 54, are you encountering food shortage after participating in the irrigation project?

Yes = 1 ---------- No= 2 ----------

56. If your response to Q 55 is yes, what is (are) the root cause (s)?
Low yield of food crops from irrigation = 1 ---------- Inability to farm the household irrigation plot (due to sickness, lack of farm tools, lack of inputs, etc) = 2 ---------- inability to sell of food crops on markets to generate cash = 3 ---------- Large family size to feed = 4
Other = 5 ---------, Specify ----------

57. How do you overcome the food shortage?
By purchasing food from markets =1 ---------- By gathering wild foods = 2----------
By seeking support from relatives and friends =3 ---------- By getting support from government and humanitarian organizations = 4 ---------- Others = 5 ------, specify -------
---

58. Are you currently getting any external food support?
Yes = 1 ---------- No = 2 ----------

59. If you are you forced to get food support from external sources, since when you are getting such support? ---------- Years.

60. For how many months of each year are you getting food support?
2-4 = 1 -------- 5-6 = 2 ---------- 7-8 = 3 ---------- 9-10 =4 --------- Throughout the year =5 ----

61. Is there any negative impact you faced due to the implementation of the project?
Yes =1---------- No =2 ----------

62. If your answer to Q 61 is yes, what are they?
Animal disease due to irrigation =1 ---------- Malaria outbreak =2 ---------- Loss of grazing land =3 ---------- Loss of farm land to other irrigation participants = 4 ---------- Other= 5, Specify ----------

63. Have you ever faced any conflict with neighboring farmers because of the project?Yes = 1 ---------- No = 2 ----------

64. If the answer to Q 63 is yes, what is (are) the cause(s) of the conflict? (In descending order)
Water distribution = 1 --------- Lack /shortage of grazing land =2 ----------Land redistribution = 3 ---------- Migration of other people to the area = 4 ----------
others = 5 ---------- specify ----------

---

65. If the answer to Q 63 is yes, what measures were taken to resolve the conflict?
Reconciliation by elders =1 ---------- Sought decision from water users' association leaders =2 ---------- Sought official decision from local administration = 3 ---------- went to local court = 4 ---------- The problem still remains unsolved = 5 ---------- Other = 6 ----------, specify ----------

66. Did you get extension support?
Yes = 1---------- No = 2 ----------

67. If your answer to Q. 66 is yes, in what way you get the extension support?
Advice on agronomic practice =1---------- Training on agronomic practicing= 2 ---------- How to use improved crop varieties & agricultural technologies = 3 ----------
Water abstraction & management = 4 ---------- Markets and marketing = 5 ----------
-- Procurement of agricultural inputs (seeds, fertilizers, pesticides) = 6----------
Advice on saving and money management = 7 ---------- Advice on produces storage and preservation = 8 ---------- Other = 9 ----------,
Specify ----------

68. What is (are) your over all comment (s)

ANNEXNURE III: CHECKLIST FOR FOCUS GROUP DISCUSSION (FGD) WITH WATER USER ASSOCITION (WUA) LEADERS

Date of Discussion ----------

Time of Discussion ----------

Duration of discussion----------

Discussion Facilitator: Name ---------- Signature ----------

1. District ---------- Name of Peasant Association: ---------- ---------- Farm site/Block ----------

2. List of FGD participants

S/No	Name	sex	Age	Education level	Responsibility in WUA
1					
2					
3					
4					
5					
6					
7					
8					

3. Name of water user association:

4. Year of establishment of the WUA

5. Number of size of WUA members: Male ---------- Female ---------- Total ---

6. When was the current WUA leaders elected?

7. Who elected the WUA leaders?

8. Tell us the process of election:

9. What are the key criteria for the election of WUA leaders?

10. The terms of duration of WUA leaders in leadership is for ---------- years.

11. Tell us the organizational structure of the WUA:

12. How do you observe the representation of WUA members and leaders? How is the level of participation and decision making by leaders and members regarding the affairs of the WUA?

13.. How are women headed households and other marginalized groups included in the irrigation project?

14. What selection criteria are employed to include the above group of people?

15. What special supports are provided to them?

16. Describe the extent of improvement of the food security and the overall living condition of these people:

17. How do you rate the importance of establishing water users association? Do the leaders and users recognize the importance?

18. Does your WUA have by-laws? How was the by-law prepared? (when, by whom, how it was endorsed, etc?)

19. Explain the importance of the by-law. List the key benefits of having WUA by-law:

20. List the functions of WUA:

21. List the role of WUA leaders:

22. List the key capacity building supports provided to WUA and its leaders:

23. Who provided the capacity building supports? Explain the specific periods:

24. What are the major problems of WUA members? Explain the causes of these problems:

25. What are the causes of the above problems?

26. How are the WUA members and leaders solving these problems?

27. Do you observe conflict among the WUA members and leaders? Explain the key conflict types and their causes:

28. What are the major damages of the irrigation facilities? Who or what causes these damages? The problems and consequences thereof:

29. Who undertakes the cleaning, maintenance and up-keep of the irrigation facilities? Who covers the cost? Do the WUA members and leaders participate? What external supports are therein?

30. Do the WUA members pay water user fees? How much and at what interval they pay? Who collects the water fees? The water fee is used for what purpose(s)?

31. Do you think that there is fair and equitable water distribution among all WUA members? If not, what cause such inequitable distribution? What measures do the WUA leaders, extension workers and government officials take?

32. Explain on the major benefits obtained by WUA members from the irrigation project:

33. Explain on the food security situation of the irrigation project participants before and after the irrigation project: How was the food security situation improved?

34. Do you think the introduction of the irrigation project improved household income and how?

35. Are there undesirable consequences or negative impacts evident due to the introduction of the irrigation project?

36. Do you have relationship with other WUAs? Explain the purpose(s) of relationship, benefits obtained or the disadvantages occurred thereof?

ANNEXER IV: CHECKLIST FOR FOCUS GROUP DISCUSSION (FGD) WITH EXTENSION WORKERS

Date of Discussion ----------

Time of Discussion ----------

Duration of discussion----------

Discussion Facilitator: Name ---------- Signature ----------

1. District ---------- Name of Peasant Association: ---------- ---------- Farm site/Block ----------

2. List of FGD participants

S/No	Name	sex	Age	Education level	Responsibility/Position
1					
2					
3					
4					
5					
6					
7					
8					

3. Do you recall the key problems manifested in the area before the start of the irrigation project? List the major problems and their root causes:

4. Can you tell us the major crops produced in the area before the start of the irrigation project?

5. Can you recall and tell us the livestock situation before the start of the irrigation project?

6. How you describe the living condition of the population in the area prior to the start of the irrigation project?

7. When was the construction of the irrigation facilities have been completed and the project started functioning in full momentum in the area?

9. What selection criteria are employed to include the above group of people?

10. What special supports are provided to them?

11. Describe the extent of improvement of the food security and the overall living condition of these people:

12. What are the benefits and positive impacts of the irrigation project?

13. Has the irrigation project brought sustainable improvement in household food security in the project area? Explain:

14. Has there been sustainable improvement in household income? Explain:

15. Explain the major changes and overall improvement realized with the introduction of the irrigation project:

16. Mention the key negative impacts and side effects of the project:

17. Do you observe change in farm practice and ways of life of the participants of the irrigation project?

18. What are the major crops produced in the irrigation area?

19. Can you tell us the yield per hectare for each of the above crop?

20. What are the key problems faced by irrigation participants?

21. What measures have been to taken to solve these problems?

22. List the supports and services provided to the participants by you and other government professionals and officials:

23. Does the irrigation area population have adequate infrastructural facility to transport their produce to market? Explain:

24. Do the irrigation area population have reliable market access to sell their produces? Explain:

25. What key lessons are to be drawn from the project?

26. Explain about the strengths and weaknesses of the water users association leaders, strengths, Weaknesses:

27. What recommendations you would propose for the way forward?

ANNEXNURE V: CHECKLIST FOR IN-DEPTH INTERVIEW WITH KI OF RELEVANT PROFESSIONALS AND GOVERNMENT OFFICALS

Date of Discussion ----------

Time of Discussion ----------

Duration of discussion----------

Discussion Facilitator: Name ---------- Signature ----------

1. Personal data:

   Name of key informant: ---------- Sex: ---------- Age: ----

   ---------- Education level:---------- Organization: ----------

   ---------- Position: ----------Number of years of work experience in the area: ----------

2. Do you recall the key problems manifested in the area before the start of the irrigation project? List the major problems and their root causes:

3. Can you tell us the major crops produced in the area before the start of the irrigation project?

4. Can you recall and tell us the livestock situation before the start of the irrigation project?

5. How you describe the living condition of the population in the area prior to the start of the irrigation project?

6. When were the construction of the irrigation facilities completed and the project started functioning in full momentum in the area? Why was it became necessary to start irrigation project in the area?

7. What were the trends of food security in the past three years among the irrigation community?

8. How are women headed households and other marginalized groups included in the irrigation project?

9. What selection criteria are employed to include the above group of people?

10. What special supports are provided to them?

11. Describe the extent of improvement of the food security and the overall living condition of these people:

12. How do you view the strength and weaknesses of the irrigation systems? (in relation to technical, social and organizational and administrative aspects:
13. What were the major events of food insecurity in the area for the last ten years and how much it was serious?
14. What are the major environmental problems in the districts in relation to the introduction of the irrigation project?
15. What are the benefits and positive impacts of the irrigation project?
16. Has the irrigation project brought sustainable improvement in household food security in the project area? Explain:
17. Has there been sustainable improvement in household income? Explain:
18. Explain the major changes and overall improvement realized with the introduction of the irrigation project:
19. Mention the key negative impacts and side effects of the project:
20. What are the key problems faced by irrigation participants?
21. What measures have been to taken to solve these problems?
22. List the supports and services provided to the participants by you and other government professionals and officials:
23. Does the irrigation area population have adequate infrastructural facility to transport their produce to market? Explain:
24. Do the irrigation area population have reliable market access to sell their produces? Explain:
25. Explain about the strengths and weaknesses of the water users association leaders, strengths, weaknesses:
26. What key lessons are to be drawn from the project?
27. What recommendations you would propose for the way forward?

MASTER'S PROGRAMME IN RURAL DEVELOPMENT

RESEARCH PROJECT PROPOSAL

Project Title: ASSESSMENT ON THE **IMPACT OF IRRIGATION ON FOOD SECURITY IN SEMI-ARID AREAS: With Particular Reference to Tibila Irrigation-Based Integrated Development in Oromia Regional State, Ethiopia**

Submitted to: Indira Gandhi National Open University
Department of Rural Development

Study Center: St. Mary's University College
Student Name: Megerssa Fida Gemeda

Addis Ababa
March 2012

PROFORMA FOR SUBMISSION OF MA.(RD) PROPOSAL FOR APPROVAL

Signature:	.....
Name:	Dr. Mengistu Huluka
Address of Guide	----------

Name and Address of the student:	Megerssa Fida Gemeda Telephone +251 911 48 77 97
Enrollment No.:	109100694
Date of Submission	August 2012
Name Study Center	St. Mary University College
Name of Guide:	Dr. Mengistu Huluka
Title of the Project:	Assessment on the Impact of Irrigation on Food Security in Semi-Arid Areas: With Particular Reference to Tibila Irrigation-Based Integrated Development Project
Signature of the student:	----------
Approved/Not Approved	.....
Date:	.....

PROJECT PROPOSAL ON
THE IMPACT OF IRRIGATION ON FOOD SECURITY IN SEMI-ARID AREAS:(With Particular Reference to Tibila Irrigation-Based Integrated Development Project)

1. INTRODUCTION:

Agricultural development and food security have drawn much attention from development academicians, practitioners and policy makers and the world communities in general for the last many decades. The concepts of agricultural development, rural development, food security, livelihood security, intensive agriculture, rain-fed agriculture, irrigation-based agriculture, etc., have been circulating much within the local and international development arenas in recent decades. All the concerned bodies have been dealing with these and other similar issues for the purposes of finding ways and means of realizing agriculture led rural development and attaining food-centered household livelihood security for the multitude of the people in rural areas of the third world.

However, with the intention of realizing immediate impacts on agricultural development, alleviating the situation of rural people through rural development, most of the agricultural and rural development concerns have been emphasizing high priority on sedentary agriculture practiced in productive highlands and mid-highlands. The major part of the other rural population residing in arid and semi-arid areas practicing pastoralist and semi-pastoralist economic bases have been neglected in most cases. As a result, the pastoralists and semi-pastoralists living in almost all the countries of the third world were forced to occupy the peripheral and remote social, economic and political status.

In the recent decades, however, in the process of speeding up agricultural development, mitigating the socio-economic problems and to bring about equitable development in rural areas, development strategies have started rendering due attention to situations of the populace in the arid and semi-arid areas. Development planners, policy makers, researchers and rural development practitioners have realized that rural development efforts cannot be effective, impactful and complete without the development of the erstwhile by-passed pastoralist and semi-pastoralist communities of the world.

One of the major challenges for the development of these communities is lack of water resources for agricultural development and large livestock population. To overcome this challenge, many developing countries such as India, Ethiopia and some others have been undertaking irrigation-based agricultural development for the communities in these areas.

The importance of irrigation project has been increasingly recognized as one of the strategies to enhance food-self-sufficiency and ensuring livelihood security at the household and community levels. Irrigation improves agricultural production and productivity by solving the problem of water shortage caused due to the unpredictable rainfall in dry regions. Developing the available water resources for irrigation is necessary to bring large areas under agricultural development to achieve the goal of food security. Irrigation is also a means of increasing income generation, creating job opportunity, ensuring occupational shift for pastoralists and semi-pastoralists to settled agriculture, guaranteeing livelihood security for many households and generally promoting economic dynamism (EWRMP, 1991).Lowland areas are frequently affected by drought and irregular rainfall. The implementation of irrigation schemes become crucial to maintain agricultural production in these areas in order to ensure increased crop yields and enhanced livestock production.

The Federal Democratic Republic of Ethiopia is making concerted efforts to expand irrigation of all categories, including rainwater harvesting, with the prime purpose of alleviating food insecurity, extreme rural poverty, and contributing to the national economic and social development in the country. The government has approved the Water Resources Management Policy in 1999 and Water Sector Strategy in 2001. The overall goal of the policy is to enhance and promote all national efforts towards the efficient, equitable, and optimum utilization of the available Water Resources of Ethiopia for significant socio-economic development on sustainable basis (Ibid, 1991).

As part of the development strategies, a number of small, medium and large scale irrigation projects have been launched in different parts of the country. At least, the country has come to realize the importance of decreasing the dependence on rain-fed and supplementing this with irrigation-based agriculture. To such ends, more and more efforts are underway by the federal and regional governments.

The Tibila Irrigation-Based Integrated Development Project is one of such projects implemented in Oromia Regional State, in the districts of Jeju, Merit and Sire to improve the food security and the overall livelihood conditions the target population.

This study is termed as, “The Impact of Irrigation on Food Security in Semi-Arid Areas with particular emphasis on Tibila Irrigation-based Integrated Development Project.” This project has been planned and implemented by the regional government of Oromia. The establishment of the project began in 2008 and most of the construction works was completed in 2011. The project is located in three adjacent districts of Jeju, Sire and Merti in Arsi Zone of Oromia.

The project is situated at a distance of 130 kms from the country's capital Addis Ababa and about 95 kms away from the zonal capital Assela. The project is about 50 kms away from the main asphalt road that traverses between Addis Ababa, Adama and Assela Cities. The gross command area of the irrigation project is about 7,000 hectares and the net irrigable area is 6,000 hectares including 10 farm blocks. Currently, the existing beneficiaries of the project are 3,258 and have a total of 17,351 people. However, since 0.75 hectare is allotted household, the holding capacity is more than 8,000 households and more than 40,000 individual household members TIBIDP, Socio-Economic Study, 2009).

The overall objective of the current study is to contribute to the pool of research and knowledge in the area of irrigation-based agricultural development in the country. Also, the study aims at contributing to the socio-economic development of the Tibila Irrigation-Based Development Project among the target communities and the population in the surrounding environs through the knowledge, informative lessons and experience and feasible recommendations to be generated by the study.

The study specific objectives are to assess and evaluate the impact of the project on household food security and livelihood situations of the target community, the extent of socio-economic development achieved so far, assess the level of community-based administrative and management structures put in place and made functional, look into communities' attitude towards the irrigation project, and assess market situations for agricultural production and identify constraints if any.

2. DEFINITION OF TERMS:

There are some key terms used in this project title which need definition and explanation. In the context of this study the key terms and concepts are defined as follows:

2.1 Irrigation:

Irrigation may be defined as the science of artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of livestock and landscapes and re-vegetation of disturbed and degraded soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growing in grain fields and helping in preventing soil consolidation. Irrigation systems are also used for dust suppression, disposal of sewage, and in mining. Irrigation is

often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area (Irrigation Wikipedia, The Free Encyclopedia).

Irrigation is one of the most intensive types of farming, and it developed in desert, semi-desert, and arid zones and in regions that have inadequate moisture at certain times of the growing season. Very high guaranteed yields of agricultural crops are obtained by irrigation farming. It is 3-5 times higher than in dry farming. Repeated sowing and inter-planting (such as fodders with crops) are used extensively, making possible the most productive use of land and provision of livestock with fodder. In the world as a whole, irrigation farming occupies about 16 percent of the area under cultivation, but it produces as much as the un-irrigated area.Irrigation is practiced in all parts of the world where rainfall does not provide enough ground moisture. In areas of irregular rainfall, irrigation is used during dry times to ensure harvests and to increase crop yields.The sources of irrigation water are surface flow such as river, stream, run off and snow melt, and ground water or water wells which are excavated for brining ground waterto the surface for irrigation (Encarta, Encyclopedia, 2006).

The term irrigation, in this study, refers to the irrigation development project that has been implemented by diverting the Awash River to improve the food security situation of the targeted people in the three districts of Jeju, Sire and Merti of Oromia Regional State.

2.2 Development:

Development is a complex issue, with many different and sometimes contentious definitions. A basic perspective equates development with economic growth. The United Nations Development Programme uses a more detailed definition. According to the UN; development isto lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community (hppt:/www.volunteering options). Achieving human development is linked to a third perspective of development which views it as freeing people from obstacles that affect their ability to develop their own lives and communities. Development, therefore, is empowerment. It is about local people taking control of their own lives, expressing their own demands and finding their own solutions to their problems (Encyclopaedia. Free dictionary.com).

The United Nations Development Program proposed the concept of sustainable human development as an alternative development paradigm.The approach regards people's well-being as the goal of development. Unlike previous development approaches, it sees economic growth not as an end in itself but as one of the means to improve human conditions.Human development is the widening of people's choices in life. It means having the privilege to choose one's life direction over another

because of preference rather than lack of opportunity. Knowledge, health and longevity, livelihood and political freedom provide its bearers with greater chances for a better life. People who are poor, unhealthy and illiterate simply have fewer choices in life. Sustainable human development is concerned with widening choices of people not only of the present generation, but future generations as well. As such, it aims for the regeneration of the environment and natural resources (hppt:/www.middletown…).

Therefore, development has many meanings depending on the context it is being talked about. In this study,it is the positive change and transformation of the communities targeted by the "Tibila Irrigation-Based Integrated Development" in their income, food security, in their ways of living, attitudes and behaviours as a result of their access to the irrigation facility, extension services, improved agricultural inputs, agricultural skills, adequate and timely information services. Development in this context means the transition of the targeted community in the irrigation area from pastoralist and agro-pastoralist way of life to irrigated agriculture in a settled manner leading to the quantitative and qualitative improvement in the income and household food security and the general living standard of the targeted project community.

2.3 Integrated Development:

We all know that life in any given community is the interplay among and interdependence, interrelationships and integration of different social, economic, cultural and political aspects. These factors contribute and shape the development and prosperity or underdevelopment and poverty situation of the community in any given locality. Therefore, community development can only be meaningful, impacting, beneficial and sustainable, only when the planning and implementation follow an integrated development approach.

Rural poverty is caused primarily by a limited access to resources in one context. This limitation may result from an imbalance between population and available resources. Besides the problem caused by population growth, access to resources is quite often limited for the rural poor because of the existing socio-political situation. Here, the limited access to resources is deliberate, and the result is that the available resources are underutilized because of obstacles of a socio-cultural and political nature. For example, landless people cannot obtain land for cultivation. Subsistence farmers have difficulties in obtaining credit. Such scarce means of production hinder the production process for the subsistence, poor and marginalized farmers in a great deal.

Therefore, it becomes clear that integrated development is more than economic growth. The necessary political decisions will not come from change in production methods and economic situation alone. They also require a change in the social and political infrastructure and change in the

power structure. Integrated development is a goal and a methodological approach at the same time. The goal is to include the neglected masses of rural poor in the process of increasing the well-being of mankind. The approach for reaching this goal is the application of a package of well-balanced strategy of economic and socio-cultural and political nature.

An Integrated Development Plan is a super plan for an area that gives an overall framework for development. It aims to co-ordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area. It should take into account the existing conditions and problems and resources available for development. The plan should look at economic and social development for the area as a whole. It must set a framework for how land should be used, what infrastructure and services are needed and how the environment should be protected (hppt:/www.etu.org.za.).

In this study, integrated development denotes the transformation of the targeted communities from the previous pastoralist and agro-pastoralist way of life into modern crops and livestock farmers with the application of improved irrigated agriculture system. The integrated development in this context signifies the change and transformation in the various aspects of the target population. The change and transformation of household economic bases to crop production in an integrated manner with livestock production, improvement in household income and food security, improvement in community organization, social position and decision-making and empowerment. The integrated development also signifies that there is the linkage of the target community with the different urban centers through production marketing and infrastructure development.

2.4 Food Security:

The United Nations defines food security as all people at all times having both physical and economic access to the basic food they need (hppt:/www.globaleducation.edn.au, 2011).The World Food Summit of 1996 defined food security as existing, when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (hppt:/www.who.int/trade).Commonly, the concept of food security is defined, as including both physical and economic access to food that meets people's dietary needs as well as their food preferences (Wikipedia: the Free Encyclopedia.en.).

In this study food security is defined as: (1) Availability of food in sufficient quantities on a consistent basis for the project targeted households. (2) Accessibility of the same households to food with the capacity of having sufficient resources to obtain appropriate and adequate foods for a nutritious diet. (3) The development of capability to utilize the available and accessible food based on knowledge of

basic nutrition with adequate water and sanitation. The food security status of the project targeted households is therefore measured in terms of the availability, accessibility and utilization of food by all family members in consistent and sustainable manners.

2.5 Arid and Semi-arid Areas:

Arid and semi-arid areas are defined as "areas falling within the rainfall zones 0-300 mm and 300-600 mm, respectively. Because of the short growing period (1-74 days for the arid areas and 75-119 growing days for the semi-arid areas), these areas are not suitable for cultivation. Rainfall patterns are unpredictable and are subjected to great fluctuations. Drought occurrence is more frequent in arid areas than in semi-arid arid areas. For example, according to Elis (1992), drought occurs every five years in Turkana District of Kenya (200-500 mm annual rain), whereas it occurs every 8-12 years in the Massai Region (300-700 mm annual rainfall) (UNFAO, FAO, 1987).

The Tibila Irrigation Project Area is categorized as semi-arid area with annual rainfall is about 670 mm. The monthly rainfall varies from 6-129 mm and characterized by erratic and uneven distribution. The climate of the area is hot with erratic, variable rainfall and unreliable for agricultural activities.Monthly minimum and maximum temperature of the area ranges from 9^0c to 25^0c.Monthly minimum and maximum temperature of the area ranges from 9^0c to 25^0c (OWWDSE, TIBIDP: Agronomy Study, 2009). Economic activities of the area are mostly livestock production but people in the area are generally practice mixed agriculture consisting of livestock and crop production. In recent years people in the area tend to intensify crop production due to population pressure and shortage of pasture land which has aggravated land resources degradation and enhanced aridity.

2.6 Evaluation:

Evaluation is a step-by-step process of collecting, recording and organizing information about project results, including short-term outputs or immediate results of activities and project deliverables and immediate and longer-term project outcomes or changes in behavior, practice or policy resulting from the project. It is a systematic method for collecting, analyzing, and using information to answer questions about projects, policies and programs,particularly about their effectiveness and efficiency (en.Wikipedia.org/…). In both the public and private sectors, stakeholders will want to know if the programs they are funding or implementing are actually having the intended effect, efficiency and impact.

Evaluation is considered to be an essential tool of development administration. It is a performance or achievement audit that assesses systematically the impact of the project both in

quantitative and qualitative in relation to the stated objectives, targets and course of action, assesses the efficiency of the project, identification of factors, and provides feedback to decision makers (IGNOU, MRD 103).

Common rationales for conducting an evaluation are for response to demands for accountability, demonstration of effective, efficient and equitable use of financial and other resources. It is also the recognition and measurement of actual changes and progress made and the identification of success factors and gaps that need improvement.

The major challenges in evaluation are getting the commitment to do it, establishing base lines at the beginning of the project, identifying realistic quantitative and qualitative indicators, finding the time to do it, getting feedback from stakeholders and reporting back to them.

In this study, the evaluation will examine critical issues like impact of the project on the way of life, food security and living conditions of the targeted community, the attitude of the people towards the project, the role of the Water Users' Association and Extension Workers on the management of the project. The evaluation will be based on the socio-economic study conducted prior to the project implementation, and will be measured against the stated project objectives and expected impact of the project on the targeted community.

2.7 Project:

A project, by definition, isa temporary activity with a starting date, specific goals and conditions, defined responsibilities, a budget, a planning, a fixed end date and multiple parties involved."[17] A project in business and science is typically defined as "a collaborative enterprise, frequently involving research or design and careful planning in order to achieve a particular aim ((Wikipedia, the Free Encyclopedia). Projects can be further defined as "temporary rather than permanent social systems that are constituted by teams within or across organizations to accomplish particular tasks under time constraints. Project objectives define target status at the end of the project, reaching of which is considered necessary for the achievement of planned benefits. They can be formulated as SMART criteria (Specific, Measurable, Achievable, Realistic and Time bounded) (hppt:/www.comp.soln.com).

The Tibila Irrigation-based Integrated Development Project is one of the irrigation schemes launched in Oromia Regional State at the present. The main objective of the Tibila Irrigation Development Project is to tackle the problem of food security and thereby enhance further development endeavors in the project area and its surroundings. It has been envisaged that through the implementation of the irrigation project the general livelihood and the living standard of the people in the project area

and its environs will improve. The realization of this development project will induce and enhance the all-round development in the socio-economic, agro-economic and social and cultural conditions of the target population and the surrounding areas.

3. STATEMENT OF THE PROBLEM:

Ethiopia is one of the countries depending heavily on rain-fed agriculture. The country's agriculture is remotely linked to modern farming system such as improved inputs, irrigation technology and improved farm practices. However, productivity of rain-fed crop farming has dropped, and the agricultural sector is now unable to provide the basic requirement of food to the citizens. Traditional farming practices, environmental degradation, cost of external agro-inputs, recurrent drought, and high population pressure has aggravated the present food problem in the country. This implies that the need for launching irrigation development projects to achieve the objectives of increasing yield of crops, livestock production, and protecting the environment. Over the past few decades, irrigated agriculture has become more important. Presently, implementation of many irrigation projects is under way, the majority of which being in the Awash Valley where the proposed study area is located.

Many agricultural development policy makers, academicians and development practitioners have the view that the country can reverse the current low agricultural productivity, recurrent drought and consequent water shortage for agriculture and human consumption and eliminate the ever looming food insecurity through irrigation-based agricultural development. The recurrent food crisis has prompted the country to seek different agricultural methods and technologies that increase productivity and agricultural production. One of the alternative methods is irrigation development in dry seasons of the year in highlands and semi-highlands and at all times in semi-arid regions of the country. The government of Ethiopia has accorded due emphasis to irrigation development in recent years and many big, medium and small scale irrigation projects and schemes have been started. The projects are benefiting many thousand households and millions of their members in the different parts of the country.

According to the studies conducted by researchers, Ethiopia has a huge potential for irrigation-based agriculture, but the country, so far is able to utilize its potential in a minor scale. For example, according to the study by Yalew Belete (2006), "the country has an annual surface runoff of close to 122 billion $m^3$and ground water resources of about 2.6 billion m^3. The estimated irrigation potential of the country is about 4.3 million hectares but only 6% of which

has been developed. It can be generalized that even though the country has a huge potential for irrigation agriculture, in terms of both available land and water resource, the bulk of this potential is still untapped (Belete Yalew, 2006).

Currently, the Government of Ethiopia has emphasized the development of the subsector to tap fully its potentials by assisting and supporting farmers to improve irrigation management practices and the promotion of modern irrigation systems. The sector could be used to reduce household risks associated with crop failures resulting from droughts. To develop and properly use the available water recourses for agriculture and other uses, the government has enacted Water Resources Management Policy and Water Sector Strategy in 1999 and 2001 respectively.

The erstwhile only rain-fed agriculture of the country has gradually started mixing and integrating irrigation supported agricultural production on step-by-step basis. One of the extensively irrigation-fed agriculture is practiced is the Awash Valley by utilizing the Awash River. This valley and the river have been the typical example and starting point of the country's efforts in the development of the irrigation technology. This has been going on for the last many decades. The other parts of the country are taking lessons and precedence from the irrigation development of this famous river and its irrigated valley.

The implication is therefore, such that Ethiopia's development and progress in irrigation-based agriculture is yet at infancy level. The country is so far highly dependent on rain-fed agriculture and such strong dependence on nature is considered to be one of the critical reasons for the ever-threatening food crisis. However, the irrigation-based agricultural development and all its accompanying technologies and its technical knowledge are gathering momentum in the country. The policy makers, planners and rural development and agricultural development practitioners all have recognized that in order to make the country self-sufficient in food production, one of the viable measures is to tap the water resources of the country. Utilization of the various rivers and other surface water such as lakes, ponds, streams, capturing precipitation of the huge run-off, development and utilization of the abundant underground water, etc., are some of the major outlets for food self-sufficiency.

The study area, the Tibila Irrigation Based Integrated Development Project is one of the government projects planned and implemented to alleviate the problem of food insecurity of the community in this semi-arid locality. The areas had been drought-affected for a long time and

the people residing there area were leading their livelihood under pastoralist and agro-pastoralist conditions. The implementation of this project was crucial to improve and ensure food security at household level. It is important, therefore, to study the changes brought about in the area due to the implementation of this project. The finding of this study will also help different organizations to apply the strengths of the project in the implementation of other similar projects and learn more from its limitations.

During the socio-economic study of the Tibila Irrigation-Based Project which was conducted prior to the actual start of the project, the study identified "different development constraints such as:

- Recurrent drought due to erratic and inadequate rainfall,
- Problem of food insecurity which affected the livelihood and welfare of the people in the irrigation catchment areas,
- Prevalence of pests, and lack of adequate pesticides to prevent and control pests,
- High prevalence of livestock diseases and shortage of drugs for livestock treatment,
- Severe shortage of livestock feeds mainly due to recurrent drought, inadequate and erratic rainfall,
- Lack of organized and well developed market in the area,
- Low capacity of the local population to undertake irrigation schemes,
- Low level of literacy,
- Shortage of adequate road network and low market access
- Low access and control of the women in the area over resources,
- Lack of awareness regarding family planning,
- Prevalence of harmful traditional practices (HPT) (OWWDSE, TIBIDP: Socio-Economic Study, 2006).

Therefore, the current study will make detail assessment on the changes and improvement on the above and other aspects of the irrigation area population in the course of the project implementation. Apart from the food security situation and overall livelihood of the project population, the study will assess and determine the extent of change and development registered among the study population in the above constraints.

4. OBJECTIVE OF THE PRESENT STUDY:

The main objective of this study is to contribute to the socio-economic development of the Tibila Irrigation-Based Integrated Development Project among target communities and the population in the surrounding environs through the knowledge, informative lessons and experiences and feasible recommendations to be generated by the study.

The specific objectives of the study are:

- To investigate the impact of the Irrigation Project on household food security and the overall livelihood situation of the target communities and the population in the surrounding environs.
- To assess the extent of community-based administrative and management structures and systems, identify strengths including successes and promising practices and limitations that have impending factors.
- To assess market situations for agricultural production in the irrigation project and identify constraints.
- To draw constructive lessons and document new knowledge and feasible working systems and strategies and furnish specific, actionable, and practical recommendations for further improvement of the project and realization of optimal benefits to the target population.

5. HYPOTHESES:

The hypotheses framed for this study are as follows:

- The irrigation-based integrated development has contributed significantly to the household food security and livelihood situation.

- Community-based administrative and management structure and approach for irrigation project has proven to have direct correlation with community participation and ownership.

- Inequitable share of water resources has been a challenge and may have been source of conflict among community members.

- Poor market access and linkage may have been benefiting intermediaries at expense of primary producers and has been hindering production in the long run.

1.5. SIGNIFICANCE OF THE STUDY:

The principal objective of the irrigation development strategy is to exploit the agricultural production potential of the country to achieve food self-sufficiency at the household and national levels. Specific objective is to expand irrigated agriculture, improve irrigation water-use efficiency and agricultural production efficiency, and develop irrigation systems that are technically and financially sustainable (Ethiopian Water Sector Strategy 2001).

Irrigation-fed agriculture for subsistence farmers and/or agro-pastoralist communities residing in semi-arid areas of countries such as Ethiopia for ensuring household food security and improving the living conditions of the population is new and yet to take root in the country. The introduction of this form of agriculture is at very infancy stage and the study on the impact of the technology on the household food security among drought prone communities has huge potential for showing the significance of the practice, learning from the lessons, pinpointing the shortcomings and limitations of such projects. Therefore, this study will strive to contribute to the pool of knowledge, information and lessons to be drawn from the medium and large scale irrigation systems designed and implemented for poor farmers in arid and semi-arid areas in the country.

1.6. RESEARCH METHODOLOGY:

1.6.1. Study Coverage:

The study was conducted among the target communities of Tibila Irrigation-Based Development Project. The target communities are from the two adjacent districts of Jeju and Sire. However, the Merti District which is the third irrigation district is excluded from this study as the construction of the irrigation facilities were yet to be completed and it would be a bit earlier for coverage in this study. The three districts are administratively found in Arsi Zone of Oromia Region. Arsi Zone is one of the 19 administrative zones of Oromia Regional State. This zone is located at central part of the region. Four Peasant Associations (PAs) and about 67.6% of the project beneficiaries are from Jeju district, while about 17.6% and

15% are from the Sire and Merti districts, respectively. Peasant Associations (PAs) are the lowest administrative units in rural Ethiopia. All the households and household members who are the direct beneficiaries of this irrigation project are the coverage or the universe of this study.

1.6.2. Sampling:

In the first instance, a non-probability purposive sampling method was used and out of the three districts two of them including Jeju and Sire districts were covered automatically by the study. The inclusion of the two districts was therefore, on purpose and no sampling technique was employed to select the two irrigation districts. The third irrigation district called Merti district was left out of the study on purpose because the construction of the irrigation facilities is yet to be completed. Three irrigation blocks (Blocks VIII, Ix and X) are located in the Merti District and as stated above these blocks were excluded from this study on purpose.

On the other hand, multi-level random sampling method was found to be suitable to select from the irrigation project blocks and households to achieve the objectives of this study and the following multi-level random sampling methods and techniques were employed to select the exact study blocks and households:

- A probability simple draw sampling was used to select the two PAs from the four PAs of Jeju district, while an automatic inclusion of the irrigation PA of Sire district was made on purposeful basis because only this one PA is part of the project from the specific district.

- From the total seven irrigation blocks located in the two districts, four irrigation blocks located in the selected PAs were covered by the study. Such purposive inclusion was to widen the scope and coverage of the study at block level. This way the study did cover the four blocks out of the seven blocks located in the five PAs covered by the project from the two districts.

- Based on the number project participants in each of the blocks a proportionate number of sample households were selected in simple random sampling technique. Accordingly 18

respondents were selected from Block one, 17 respondents from Block two, 30 respondents from Block five and 11 respondents were selected from Block six. Overall, seventy six respondents were chosen on random basis. A systematic random sampling method was used to single out the exact study households and individual respondents. Every household head in the sample household was considered automatically as respondent of the study. However, where the household head was not around and most likely to be absent during the study period the spouse of the household head or where such person is not found, any eligible member of the household above 18 years of age was considered for interview.

- Representative selection from water user association leaders, extension workers and key informants from relevant line departments and government officials were made and covered by this study.

Table 1: Sampling Design

S/No.	Peasant Association (PA)	Farmingsites or Blocks	No. of respondents				
			Beneficiary households	Members of water users' Association	Extension workers	Professionals and other key informants	Total
I	II	III	IV	V	VI	VII	VIII
1	Kolobo Hawas	Block I	18	12	7	4	**41**
		Block II	17	8	6	-	**31**
2	Hurutadore	Block V	30	10	6	4	**50**
		Block VI	11	9	6	-	**26**
	Total		**76**	**39**	**25**	**8**	**148**

As we can see from the above table, 148 respondents including 76project beneficiaries, 39 water users' association leaders and members, 25 extension workers and other project staff; 8 professionals from the relevant line departments participated in this study. It is believed that the data obtained from the different group of respondents through appropriate data collection methods have the scope and potential of providing an overall situation of the project.

1.6.3. Data Collection Tools:

In this study, any single data collection tool is believed to have only limited relevance and adequacy in meeting the overall and specific objectives of the study. Hence, it is planned to use different tools to collect the data so as to have better and accurate understanding of the research topic and its essence. The following data collection methods will be employed:

- One of the main methods of the study is the quantitative study to be employed with the beneficiaries of the project and Water Users Association Leaders. For this aspect of the study the main tool of data collection shall be an interview schedule using questionnaire. We will have two distinct interview schedules for both categories of the respondents. The interview schedules shall contain close-ended questions in most cases. Also, some open-ended questions will be included. The interview schedules will be pre-tested, standardized and finalized prior to actual administration of them with the study respondents.

- A focus group data collection method and tool will be used with the extension workers and Water Users Associations' (WUA) leaders. Groups of WUA leaders and extension workers in an appropriate number or size will participate in each focus group discussion to collect information on appropriate issues. Guiding question checklist will be employed in the focus group discussions.

- In-depth interview data collection method will be followed while discussing with government officials, professional and the like key informants. All the list of questions to be prepared for discussion with the key informants will be open-ended and will serve as a guiding checklist. The questions will focus on technical issues in most cases.

- Secondary data collection method will be employed to collect relevant data from the Districts Agricultural and Rural Development, local administrations and other offices.

- Non-participant observation shall be yet another method of data collection. A non-participant observation shall be employed for issues on which the data is difficult to be collected reliably by way of interview.

1.6.4. Data Analysis:

As one of the important stage in social research, very critical emphasis will be accorded to data processing and analysis in this study. Particularly, all the relevant data processing operations such as editing, coding, computing of the scores, and preparation of master charts and the likes will have the required consideration and application. For coding, three master-code sheets will be prepared, one sheet for the beneficiaries, another sheet for the members of WUA and the third sheet for project staffs, professionals, officials and other relevant key informants.

Once the data coding, computing of scores, editing, cleaning, etc., are completed the data analysis will be done using Statistical Package for Social Science (SPSS). As a preliminary data analysis, the use of frequency tables, percentages and cross tabulation relevant to nominal as well as ordinal type of measurements will be employed. Interval or ratio type of measurements will be analyzed using several descriptive statistics such as means, standard deviation, minimum, maximum, range, etc. Every precaution and efforts will accorded to establish relationships and comparisons between the pre and post project situation and scenarios in the process of data management and analysis.

7. CHAPTER PLAN:

The F**irst**C**hapter** shall comprise an introduction part. In the introduction part attempts will be made to give background to the study, elaborate on the statement of the problem, describe on the objectives of the study and highlight on the significance of the study. Also, in this chapter the methodology of the study with all its issues of study coverage, sample framework, data collection tools, data analysis, etc., shall be provided.

The **Second Chapter** shall deal with the conceptual framework of the study. The relevant and key concepts that are part of the present study will be discussed on in this chapter.

The **Third Chapter** of the study report will discuss on review of literatures related to the subject matter under the present study. The literature review will emphasize on relevant studies and related secondary information. The report will abstract such earlier studies and theoretical articles and papers and incorporates them under this chapter.

The **Fourth Chapter** shall explain the socio-economic and physical profile of the study population and study area respectively. Brief descriptions on the social and economic conditions of the project population and physical aspects of the study area will be part of this chapter.

The **Fifth Chapter** will present detail study findings and discussions. Based on the study objectives, hypotheses, research methodology and corresponding interview schedules and checklists, this chapter will provide findings and related discussions in a relevant and appropriate ways.

The **Sixth Chapter** will provide conclusion and recommendations relevant to the study. The conclusion will be drawn in a study-tailored manner. Feasible, relevant and actionable recommendations will be provided based on gaps and limitations in order to suggest the way forward and provide directives for the Tibila Project under the present study.

At end of the above chapters, there will be appendixes which shall include interview schedules, references and other important attachments.

LIST OF REFERENCES:

Belete Yalew, (2006), Current Experience on Existing Small Scale irrigations, Ministry of Agriculture and Rural Development (MoARD), Addis Ababa,

Encarta Encyclopedia, 2006

Encyclopedia. Free dictionary.com/United+Nations+Development…

Federal Democratic Republic of Ethiopia (1991), Ethiopian Water Resources Management Policy, Addis Ababa, Ethiopia,

hppt:/www.comp.soln.com/PM1_whitepaper.pdf

hppt:/www.etu.org.za>Toolbox>Local Government in South Africa,

hppt:/www.globaleducation.edn.a.edu.au/globaled/go/pid177, UN Feb. 2011,

hppt:/www.middletown.com/SUSTAINABLE Development Definition

hppt:/www.softwareproject.org/project/_intake_reasons22.htm,

hppt:/www.volunteering_options.org/volunteeringDevelopment/…,

hppt:/www.Who.int/trade/glossary/story 028/en/,

hppt;/www.Ifad.org/Irkm/theme/range/range_2.htm: Challenges and Hopes for 2000s: The Rangelands of Arid and semi-Arid Areas: A Review,

Indira Gandhi National Open University School Continuing Education, Rural Development Textbook, MRD 103, Block,

Oromia Water Works Design and Study Enterprise, (OWWDSE), 2009, Tibila Irrigation Based Integrated Development Project Socio-Economy Study,Addis Ababa, Ethiopia,

Oromia Water Works Design and Supervision Enterprise (OWWDSE), (2009), Tibila Irrigation Based Integrated Development: Project Agronomy Study,

Oromia Water Works Design and Supervision Enterprise (OWWDSE), (2009), Tibila Irrigation Based Integrated Development: Project Socio-Economy Study, Addis Ababa, Ethiopia,

United Nations Food and Agriculture Organization, (FAO 1987), Arid and Semi-arid Areas,

wikipeda, the free encyclopedia (en.wikipedia.org/wiki/project