ASSESSING THE CHALLENGES OF SUSTAINABLE WATER SUPPLY IN THE HARARI REGION: THE CASE OF HARAR TOWN

BY:

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This is to certify that the thesis prepared by Asnake Zemenay Zeamanuel entitled: ASSESSING THE CHALLENGES OF SUSTAINABLEWATER SUPPLY IN THE HARARI REGION: THE CASE OF HARAR TOWN and submitted in partial fulfillment of the requirements for the degree of Master of Arts (Water and Development) complies in the regulations of the University and meets the accepted standards with respect to originality and quality.

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Acronyms

BPS	Booster Pumping Station
CBOs	Community Based Organizations
DFID	Department for International Development
FGD	Focus Group Discussion
GEO	Global Environment Outlook
GDP	Gross Domestic Product per Capita
HHs	House Holds
HWSSA	Harar Water Supply and Sewerage Authority
KII	Key Informants Interview
MCT	Main Collection Tanker
MDGs	Millennium Development Goals
MoWR	Ministry of Water Resources
NGOs	Non- Governmental Organizations
O&M	Operation and Maintenance
SPSS	Statistical Package for Social Science
UNEP	United Nations Environment Programme
WAC	Water for African Cities
WAE	Water Aid Ethiopia
WASH	Water and Sanitation for Health
WTP	Willingness To Pay
WB	World Bank
WHO	World Health Organization
WSP	Water and Sanitation Program
WSS	Water supply and Sanitation
WUP	Water Utility Partnership

Glossary of Some Terms

Water Supply Service: Providing water for domestic, commercial, industrial and social use.

Domestic Use: Water used for drinking, cooking, sanitation or for other similar purposes.

Industrial Use: Putting water to industrial uses and includes use of water for the production of industrial inputs, making and assembly of products.

Commercial use: Putting water to business related activities such as hotels, bars, recreational areas, markets, car washing, gardens and watering animals.

Social Use: Putting water to social purposes and includes the use of water in hospitals, in religious institutions, educational institutions and government institutions.

Municipal Use: use of water in cities for purposes other than commercial use, domestic use, industrial use and social use.

Water Work: Any structure such as pipe line, dam, and reservoir designed to get or store or purify or discharge or control water.

Water supply: refers to human use of water such as drinking, water for livestock use, water for industrial use, and water for municipal use (MoWR, 1999: IV-V).

Willingness to Pay: felt need of the community to pay for improved water supply.

Improved Water Supply: Provision of water in good quality or safe for health, good quantity or the required amount of water is available for use any time throughout the year; and collection of water need not take much of your time and effort.

Safe Water: the water protected from contamination.

Price Fairness of the price: the level of price that makes the community to be able to buy water supply services.

Operation and Maintenance (O&M) Costs: Operation costs include fuel, staff salaries for the water point, and cost of water treatment chemicals etc. whereas maintenance costs include labor, tools, equipment, spare parts, etc. costs.

Coverage: refers to the proportion of people served with the adequate levels of water supply.

Full Cost Recovery: Covering operation and maintenance, debt servicing and depreciation costs of water supply scheme.

Partial Cost Recovery: Covering operation and maintenance costs of water supply scheme.

Household: any unit of habitual residence where some consumption and/or production may be undertaken in common and where some members may recognize culturally defined relationships of kinship and/or affinity where the members are related in some way.

Kebele: the smallest administrative unit under city or town administration.

Bega: Dry season in Ethiopia

ABSTRACT

Assessing the Challenges of Sustainable Water Supply in the Harar Town

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This study provides empirical findings on challenges of sustainable water supply systems in Harar town. Harar town has been experiencing multiple problems in getting potable water supply in adequate quantity and quality. Even if after the installation of the modern Dire Jara water supply system which has expanded its service by drilling a number of boreholes, still the demand is not satisfied and a number of people do not have access to adequate amount of potable water. Descriptive statistics on major household characteristics (household size, age, sex, marital status, educational level and income source) and key aspects or checklists of sustainability (bases for water delivery, responsibility to fetch, the satisfaction level of the existing water supply systems, efficiency and equity of water supply management service, and water tariff setting) and water supply coverage were discussed. The study has confirmed that Harar town water supply service could not cover the demand of the town with present existing capacity. At present the coverage of water supply is only 40 percent in terms of population. All areas of the town could not get equal and proportional service. Central parts get more water supplies while the peripheral areas remain without water. In addition to this, the tariff set is neither affordable for the majority nor generates sufficient revenue to sustain the service. The majority of victims of the problem are the poor as they cannot afford connection charges. As a result, they are exposed to unprotected sources and buy water from vendors at high price. The root causes of the challenging problems are institutional, financial, human and material resource constraints. Taking this into consideration government has been implementing short, intermediate and long term plans in order to alleviate the problem. The major copping strategies for the challenges are synchronizing different water sources, conserving water sources, family planning, demand management, demand oriented supply, participating different actors, mobilizing financial resources, and staffing organizational structure with skilled personnel and equipping it with material facilities.

Key words: Water supply, demand for water, production, distribution, consumption, tariff, willingness to pay, cost recovery: Harar.

CHAPTER ONE

1. INTRODUCTION

1.1. Background

Water is the most important of all public services. It is the most essential necessity of life after oxygen. Anything that disturbs the provision and supply of water therefore tends to disturb the very survival of humanity. Former U.N. Secretary General Kofi Annan once said," All resources that nourish life owe their existence to water ...From the tiniest algae to the giant mammals along with everything they live on, feed on, and make possible their breeding are the creations of water "(Informer, third ed.vol. 1, 2010). Thus, "All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs"(Mar del Plata Water Conference 1977).

Although water covers about 70 percent of the Earth's surface, only 1 percent of it is available for drinking. It is understood that our body is made up of about 70 percent water and that it controls virtually every aspect of our health. The importance of water is not only limited to drinking but also cooking, bathing, washing and other activities. Where provisions for water and sanitation are inadequate, the diseases that arise from contaminated food, water and hands are among the world's leading causes of premature death and serious illness (http://www.epa.gov/docs/owmitnet/water-efficiency/pubs/supply.htm).

In the world today the challenges facing many countries in their struggle for economic and social development is increasingly related to water. One of the international goals set for the year 2015 in the United Nations Millennium Declaration and in the plan of implementation of the world summit on sustainable development is reducing the proportion of people without adequate access

to water and basic sanitation by one-half. While access to sufficient and clean drinking water may be taken for granted in the developed world, problems with access are most severe in the developing world, where more than 5 million people perish every year from water-related diseases, and more than 1 billion people suffer without access to water for their basic needs(http://www.geotimes.org/may05/feature_worldwater.html).

Africa has the lowest water supply and sanitation coverage of any region in the world. More than 30% of Africans residing in urban areas currently lack access to adequate water services and facilities. In the year 2000, World Health Organization (WHO) estimated that Africa contains 28% of the world's population without water access to improved water supplies, and 13% of the world's population without access to improved sanitation. Only 62% of the people in African countries have access to improved water supplies, and only 60% have access to improved sanitation (WHO 2000, p 6).

The Water Utility Partnership, an organization that deals with capacity building of water supply and sanitation utilities in Africa, has noted that: "public water services in many African countries have been assigned to a single water authority and the abilities of governments to deliver water adequately have been negatively affected by a number of factors. First, urban water systems are characterized by heavy water and financial losses. Second, Africa is cited as a continent with high rate of urbanization more than any other continents in the world. Between 1995 and 2005, the urban population is expected to grow from 300 to 700 million, and by 2020 it is expected that over 50% of the population in African countries will reside in urban areas" (Water Utility Partnership (WUP), Africa, 2003).

According to World Health Organization (WHO), in order to meet the recently established Millennium Development Goals (MDGs) of halving the no served population by 2015, urban Africa requires about 6000 to 8000 new connections every day. This will call for strong political commitment backed by resources and action if governments are willing to prevent the widening gap between served and no served households.

Sustainability water service is defined as that water continues to be available for the period for which it was designed in the same quantity and at the same quality as it was designed (www.thewaterpage.com). Sustainable improvement in water and sanitation conditions is essential for the poor to reduce income losses due much time spent in collecting water. Besides, reduce the cost of health services especially for water related diseases, improvements in education enrollment and attendance through better school sanitation; reduce home duties for water collection or caring for siblings, especially for girls, reduced drudgery and time on collection of water, especially for women (MOWR, 2002:3).

In Ethiopia, millions of people lack access to clean water although the country has several rivers that do not cease to flow. Similar to the urban water sector in many developing countries, there are serious constraints to meet the challenge to provide adequate water for all urban residents. Water supply shortages and quality deterioration are among the problems which require greater attention and action. Various strategies are always being developed to make water accessible to all inhabitants. However due to insufficient structures coupled with rapid population growth and urbanization, the gap between demand and supply of water continues to widen.

Ethiopia's abundant water supply has not yet benefited the population to any significant extent. Access to adequate water supply and sanitation services are among the lowest service in the

country (MoWR, 2004). It can be anticipated that the situation can be worsen over the coming decades especially in the localities which are hydrological deficient (Desalegn, 1999). Harar as one part of the eastern Ethiopia, which has hydrological deficiency, is now suffering from lack of adequate water supply.

The specific area (Harar town) water supply is about 100 years old, originated with the development of spring sources until the development of the present system in 1966 with Lake Alemaya as its source. However; due to recent increase in population and irrigation activity around the lake area combined with environmental changes the water level in the lake has dropped and it is hardly meeting the ever increasing domestic and industrial demand of the town (MoWR, 2004).

1.2. Problem Statement

In a specially-commissioned survey for United Nations Environment Programme (UNEP) dubbed GEO-2000, 200 leading scientists from 50 countries around the world identified a scarcity of clean water as one of the most pressing problems facing humanity. It was found out that 20% of the world's population lacks access to safe drinking water (http://www.grida.no/geo2000/pressrel/water.html).

In the developing countries in particular, governments face problems of provision of social facilities, especially the supply of sufficient water of good quality at a reasonable price to their citizens. Although the number of people with access to safe water and sanitation grew between 1980 and 1990, population growth erased any substantial gain, especially in urban areas. Between 1990 and 2000, an extra 900 million people were born in places without water and sanitation (http://www.itt.com/waterbook/mega_cities.asp).

The condition of Ethiopia in this regard is not different from the general situation of the developing countries. The total population that has access to water services in 2000 was around 15,200,000 with a national coverage of 24%. The rural areas share was only 6, 698,000 people. It aggravates the infant mortality rate of180 per 1000, very low economic productivity and low female enrolment ration in school. This is more serious in the rural population that has virtually no sanitation facilities, while in the country as a whole only eight percent of the population has access to sanitation (Desalegn, 1999).

Due to the aforementioned problem, the residents of Harar town, one of the towns in Ethiopia, currently get water once in a week or two weeks for just few hours, which is very much inadequate for everyday activities of household like for drinking, cooking, cleaning utensils,

washing clothes etc. As a result residents are forced to go to places far from their home. Besides, they also buy water frequently and incur additional cost.

Moreover, the shortage of water supply in the town has caused various problems on the community. To cop up with the water supply shortage, they use different alternative sources regardless of its quality. As a result, the overall health of the population has deteriorated with water related diseases and families have to spend some money for the consequential illness. In addition, the region spends 35% of its drugs budgets on combating such diseases compared to 8% for other regions (HWSS, 2002).

Furthermore, female members of households carry the entire burden of water problem, because they are the one who travel to different places where they can get water, carry the water 'Jeri can' and do all the aforementioned domestic activities which is difficult to attain without adequate supply of water. This affects their working hours at home and outside home.

Thus, the issue of sustainability is critical when resource scarcity and equity matters are raised. Sustainability of water supply projects and of the benefits they deliver is some of the overriding concerns of the sector. In recent years, there has been an increasing focus on, and understanding of, the design and implementation phases of water supply projects as part of efforts to make projects more successful and work more efficiently (Sara et al, 1997). Sustainable use of water resources needs greater attention, such as better planning and follow ups, better operation, maintenance, and management.

Different researches have been conducted in the area. For instance, Harar water supply and sanitation project (unpublished doc.) has studied about the availability of water sources in the area and Emnet (2006) also studied about coping urban water shortage, and so on. But the stated

research works in the specific area has not directly addressed the concern of the proposed study, "Assessing the Challenges of Sustainable Water supply in Harar".

Therefore, the purpose of this study is to investigate factors that affect sustainability of water supply in the study area. To this end this study is expected to give answer to the following question: - "What are the major challenges for sustainable water supply in the study area?"

1.3. Objectives

1.3.1. General Objective

The main objective of the study is to assess the challenges for sustainable water supply in the town.

1.3.2. Specific Objectives

1) To examine the current water supply and demand status of the town.
2) To identify causes that limits the sustainable provision of existing water supply in the study area.
3) Assess the possible solutions.

1.4. Research Questions

The study has attempted to answer the following basic questions.

1) What are the current water supply and demand status of the town?
2) What are the causes for limiting that sustainable delivery water supply in the town?
3) What are the possible solutions to address the problem at hand?

1.5. Significance of the Study

The findings of this study will provide a different perspective and baseline knowledge about water supply challenges in Harar. It can also help policy makers and executive bodies at different administrative levels as an input in policy making and facilitates its implementation in the sub-sector. Moreover, the findings of this research work gives insight for researchers and students interested in similar research theme for further investigation in the area. In general, it will also help to fill the gaps on the data which are not adequately addressed in quantitative methods

1.6. Scope and Limitation of the Study

Sustainability of water schemes includes a number of aspects such as technical, financial, environmental, social and institutional. However, this research did not cover all the aspects of sustainability in relation to the objectives mentioned in this study. One limitation of the study is that experts at HWSS office were not interested to give better information as most of them have limited experience in relation to water supply system. Absence of well-documented and consistent data from the HWSSA was another drawback that limits the study. The scope of the study was specific to three kebeles of Harar town and it covered only 90 households from a total of 4,432 households of the selected kebeles. And the study was focused on assessing challenges for sustainable water supply.

1.7. Organization of the Study

The study is divided in to five chapters. Chapter one is introduction which contains the background, statement of the problem, objectives, research questions, significance of the study, scope and limitation, and organization of the study. Chapter two provides review of related literatures. Chapter three comprises methodology which includes: area description, research strategy, sampling design, data source and type, methods of data collection and data analysis. Research findings are described and discussed in chapter four. The last chapter, chapter 5, presents the conclusion and recommendations of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. The rationales of Sustainable water supply

Water is crucial for human survival and economic development. The provision of adequate supply of potable water in urban areas in both developed and developing countries is essential for life. In relation to this, Alebel (2004) and Churchill (1987) mentioned that in developing countries the provision of adequate potable water in addition to drinking, cleaning etc. improves health by reducing incidence of water related illnesses such as diarrhea, cholera, and the like. This also helps to reduce both the mortality and morbidity rates and the number of working days lost and increases the GDP. Reducing the incidence of illness will help to slash demand for improved medicine and eases balance of payment problem facing least developing countries. As such, available evidence suggests that there is a very tenuous link between improvements in health and investments in water supply and sanitation services Asefa Delisho (2006:12).

In addition to health improvement, studies by Mekonon (1983), Hofkes, (1986) WHO (1986) in Yimer (1992:3) have shown that the provision of sufficient potable water for people within reasonably short distance from a reliable and acceptable source is a precondition for the people's well-being and sustainable economic progress. Hofkes stated:

> *Factors such as time and energy saving in the collection of drinking water and a substantial reduction in the incidence of disease can contribute to development, provided that the time and energy gained are utilized economically...as many of 80 per cent of all diseases in the world are associated with unsafe water (p.3 - 5).*

Therefore, safe, adequate and accessible supply of water together with proper sanitations is surely the basic need and essential component of primary health care. In addition to that Deieter and Hedeerson in Yimer (1992:4) stated that:

> *Because of an inadequate and undesirable water supply economic loss may result, man power may be wasted, production of consumer goods and food may decline, fire protection may become impossible and schemes for urban improvement such as housing and sanitation may fail.*

Regarding this, the Ethiopia Water and Sanitation Program (WSP, 2002:1) identified the nature of linkage between WSS and poverty reduction. According to the sectoral program, a sustainable improvement in water and sanitation condition is essential to the poor to;

- reduce income losses due to excessive time and energy spent in collecting water;
- increase income earning potential through increase in productivity;
- reduce cost of health services especially for water related diseases such as diarrhea;
- increase income from cattle that depend on water; and
- increase the quality of life of the poor through: Positive impacts on maternal and child health, improvements in school enrollment and attendance, better schools sanitation, reduced home duties, drudgery and time spent on water collection particularly for girls and women.

Ministry of Water Resources (MoWR) (2000:2) also considered the following as the basic benefits that especially women get from water supply scheme:

- time and energy saving as the result of which they participate in other development activities;

- adequate and clean water for cooking and sanitation and hence, better health;
- appropriate type of public points that fit the type of water container they use.

Therefore, the demand for safe, adequate and accessible urban water activities mainly in third world countries has been increasing over-time as a result of the rising standard of living and the population increase resulting from natural growth, as well as rural-urban migration. Under such circumstances planning for water delivery system in both short-run and long-run is critical to ensure that the population receives adequate water supply.

Research has shown that water supplies in sub-Saharan Africa, particularly those relying on hand pumps, often demonstrate low levels of sustainability. The key causes for this include inappropriate policy or legislation; insufficient institutional support; unsustainable financing mechanisms; ineffective management systems; and lack of technical backstopping. The problem will only be solved by adopting a holistic approach to planning and implementation rather than focusing on one issue (Niyi et.al, 2007).

In the last three decades, literature in the water supply sector has shown that sustainability of water supply structures has become positively associated with small-scale initiatives, which maintain public participation (Davis and Liyer, 2002). Involving the users in the planning, implementation, operation, protection and maintenance of water supply systems meaningfully is the key to sustainability. Community members' contributions might take the form of money, labor, material, equipment, or participation in project-related decision-making and meetings (Davis and Liyer, 2002).

Over the past three decades, experience has shown that water and sanitation activities are most effective and sustainable when they adopt a participatory approach that acts in response to genuine demand, builds capacity for operation and maintenance and sharing of costs, involve community members directly in all key decisions, develop a sense of communal ownership of the project, and uses appropriate technology that can be maintained at the village level. Also important are educational and participatory efforts to change behavioral practices (USAID, 2009).

The human body's basic water requirement depends on climate, work load and environmental factors. If the work load is high and the season is dry the family use large amount of water per day, whereas the family size increases the amount of water consumed by one person per day will decreases relative to the one that small number of family sizes. However, Gleick (2006) defined the minimum requirement for human body and found that it is between 3 and 10 liters per day. The amount of water needed for other purposes, including cooking or hygiene, is more variable and depends on cultural habits, socio economic factors and types of water supply in terms of quantity, quality and availability:

Gleick (2006) stated that the international acceptable standards for water requirements for basic needs, commonly referred to as basic water requirement (BWR). BWR is defined as water requirement in terms of quantity and quality for the four basic needs of drinking water, human hygiene, sanitation service and modest household needs. This standard is defined by WHO guide line as 20 liters per capita per day (Admassu et. al, 2002).

When springs are used for multiple purposes such as domestic use, livestock watering, irrigation and tanker supply, care should be taken to prevent contamination of water used for human

consumption (Muthusi et.al. 2007). Relative to hand dug wells natural or developed springs is easily contaminated by different contaminant agents.

The effective operation and maintenance (O & M) of water supply systems is crucial element for the sustainability of the water scheme. The community management of water supply systems on operation and maintenance (O & M) is not successful, if financing resources are not available and frequent supports are not provided (Binder, 2008). Budgeting sufficient funding for water supply systems is an important issue for sustainability and proper maintenance but not only one.

Binder (2008) states that, "increasing the budget allocation for water supply systems are very important, but that is not the only thing to meet the challenges of achieving the Millennium Development Goals (MDGs)." Enhancing the capacity of the operators' related to the choice of appropriate institutional management is also mandatory to achieve the Millennium Development Goals (MDGs).

2.2. Approaches to water supply

2.2.1. Supply oriented approach

The supply oriented water supply approach focuses on technical elements and monopolistic public service delivery (Mani; 2000:20). This had failed to deliver the required levels of services and adherently resulted in the use of several alternatives to substitute and augment the piped water supply.

It is now realized that the conventional "supply oriented" planning has aggravated the gaps in service delivery. As stated by Mani (2000), supply orientation is found to be:

Economically inefficient, as low-income countries find it impossible to recover the costs of large-scale piped networks, high costs are incurred in pumping and transferring water over long distances and a growing demand is created for more government subsidies. Moreover, piped services are priced well below the full costs of service provision, there by subsidizing the affluent, and leading to chronic budget deficits and dependence on external finance.

Socially inequitable, as certain consumers, generally the poor and low income groups residing in the slums and urban fringe areas are excluded from the use of these services; and **environmentally hazardous**, as supply orientation in the water sector stresses the hydrological limits of the region and inflicts environmental costs.

Water supply and sewerage are customarily planned for large, centrally controlled, technology-intensive piped networks with a greater emphasis on production and distribution of water than on maintenance of the system and analogous construction of sewerage facilities. Regarding this, Howe and Dixon in (Mani, 2000:20) identified donor lender and host country factors as follows:

Donor-lender factors are the bias towards construction, desire to sell available technology and maximize aid flow, failure to provide training for O&M and inadequate budgets for post project evaluation; **host-country factors** are the desire for prestige, opportunities for corruption, lack of inputs from consumers, lack of adequate skills in the construction and operation and maintenance, lack of accountability, inefficient service charging, and shortage of personnel for monitoring.

2.2.2. Demand oriented approach

A demand oriented approach focus on service consumers' needs and willingness to pay(WTP) full costs of services, competitive markets, and broader participation of the private sector, non-governmental organizations (NGOs) and community-based organizations(CBOs). Now this approach is being incorporated into water supply and sanitation strategies.

The demand oriented approach is potentially more economically efficient as demand oriented infrastructure delivery consists of competitive markets, and broader participation of the private sector, or water surrogates. Social responsibility also increases as demand orientation requires greater responsiveness to users' needs and fairness, and participation of the private sector, Non-Governmental Organizations (NGOs) and Community-Based Organizations (CBOs) in service delivery. Environmental degradation is minimized as a demand management in the water sector is valuable in ensuring that a limited supply of water is distributed to match the optimal use pattern for the resources.

Mani (2000:21) identified the significant differences between traditional systems of planning service coverage and emerging patterns of service consumption; prevailing service pricing and expenditure and WTP for services; and mandated institutional arrangements for service delivery and emerging partnerships with NGOs, CBOs, and the private sector. To achieve a demand orientation, these differences need to be bridged. Planning for service coverage can be improved by considering the economic, social, and environmental impacts of heterogeneous consumption along with assessing consumer needs for services.

Service charging must be based on consumption and WTP while discouraging the use of alternatives and incorporating negative externalities on the environment. Partnerships with

NGOs, CBOs, and the private sector must be further emphasized through clear definition of roles and responsibilities and mitigation of financial and political risks. A demand orientation can be achieved through policy reform as well as training for changing roles and responsibilities.

2.3. General Concept of Sustainability

The issue of sustainability first arose within the environmental movement and attempts to protect natural resources and ecological systems from over-extraction and shocks or stresses and then became important from the 1970's onwards. However, it has also been extended to incorporate other dimensions like economic, social and institutional. For example, the idea of economic sustainability which is achieved only when a given level of expenditure can be maintained over time or related to the resilience to risk of net benefit flows over time by World Bank (OED;2003). The concept also incorporates institutional or management questions, in that sustainability is achieved when prevailing structures and processes have the capacity to continue their functions over the long term (DFID; 2000).

The World Commission on Environment and development (Brunt land, WECD, 1987) defines sustainability as "development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs" (Tadele Mugero, 2008).According to International Institute for Sustainable Development, USA; "To be sustainable, development must improve economic efficiency, protect and restore ecological systems and enhance the well-being of all peoples." It is also defined by State of sustainability strategy 2003. "Sustainability is meeting the needs of the current and future generations through integration of environmental protection, social advancement and economic prosperity."

A number of simple definitions for sustainable development have been developed by different organizations. Among various meaning of sustainability three aspects are found to be common elements in the definition of sustainability. Such elements are: - the scarcity of available resources, the interdependence of human activities of both the present and future generations, and issues of equity in distribution of a benefit (Misgina, 2006:18).

Recently, the issue of sustainability has found some space in the corporate sector, whereby businesses are considering impacts of their activities, not only in economic terms, but also with respect to environmental quality and social equity. For many organizations, from both the public and private sectors, the practical application of "sustainability" translates into broader governance issues about how different institutions and actors can work to maintain economic, environmental and social benefits over time.

2.4. Understanding of Sustainable Water Supply System

A sustainable drinking water supply system involves a number of issues that are internal and external to the community. According to Zelalem (2005:15), the following are key issues that are of a paramount importance to sustainable and/or community managed water supply systems:

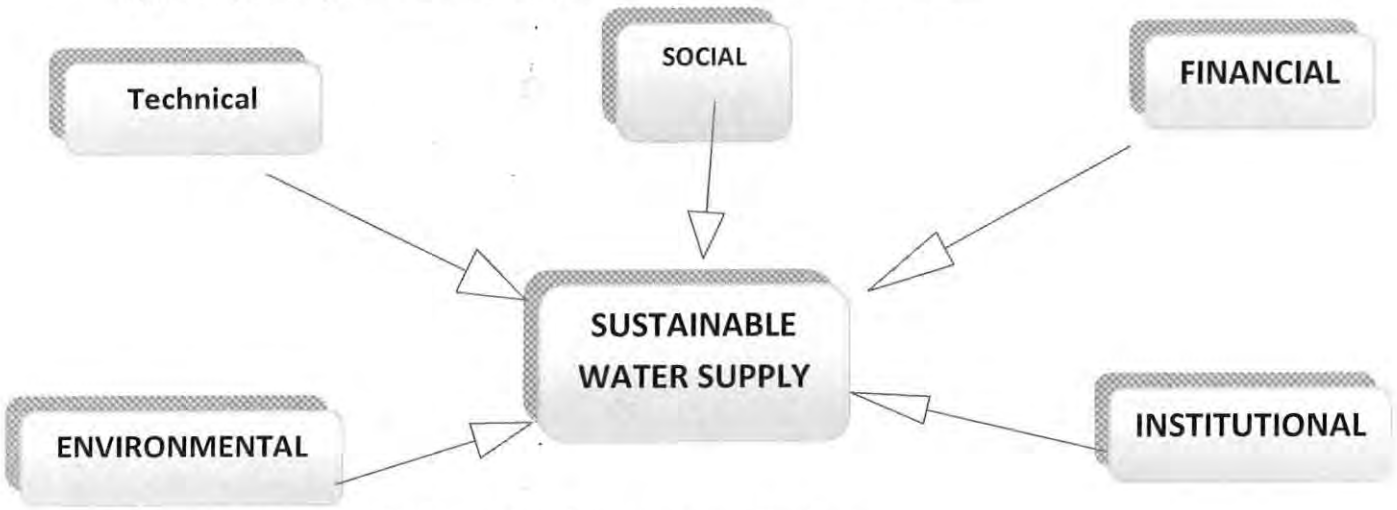
- Community participation and involvement
- Women's participation and involvement
- Cost-sharing and cost recovery
- Community awareness raising and education
- Water resource and baseline survey
- Repair and maintenance service
- Water users management body and structure

- CBOs and conflict management
- Management capacity building/management procedures of water committees
- Technology
- Institutional support
- Demand driven approach in identification of user group

2.5. Conceptual Framework

In general, understanding and measuring sustainability is difficult. However, from the literature review, the author has summarized the following basic elements and formulated a conceptual framework as shown in Figure 2.1:-

Figure 2:1, Conceptual Framework of the research and determinant factors



Source: Adapted by the researcher from Literature Review.

A weakness in one of these can lead to failure of the system and could affect the long term sustainability of water supply systems.

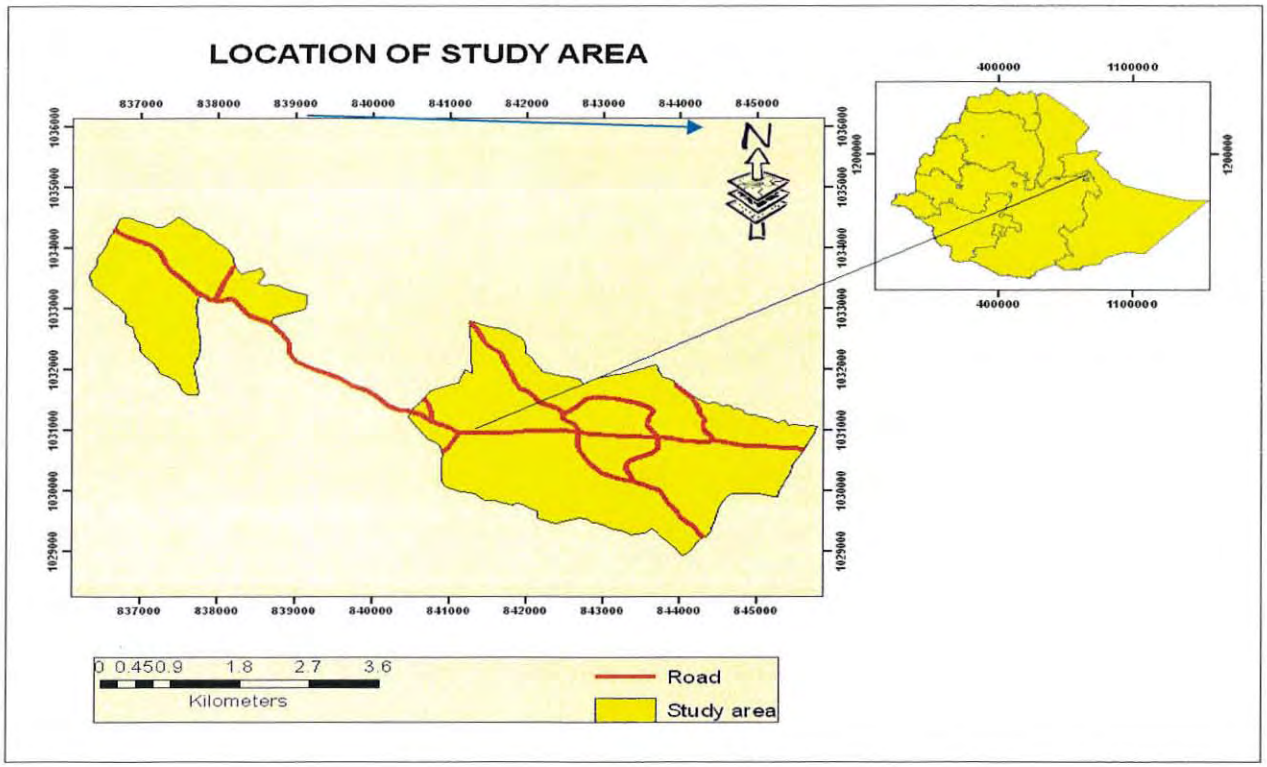
CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Overview of the study Area

Harar is one of the most famous and historical town of Ethiopia and the capital city of Harari region. It is found in the eastern part of Ethiopia. It is located at 42° 90′ E, 9°19′ N and lies on a hill side that slopes roughly in the direction west to east and at an elevation approximately between 1800 and 2200 meters above sea level. Harar is one of the 9 regional government and 2 administrator councils in the country. It is one of the smallest in area and population size. Harar is sometimes spelled like Harrar, Hārer, or Harer. It is the only urban center in the region. The climate of Harar is 'Woina-Dega'. Its annual rainfall varies between 750 -850 mm. It has an average temperature of 25°c. The total land area is 850 km^2,out of which 60 hectare areas are encompassed by the Jegol wall, which has 3342m length. The town is strategically located over the great area of the Danakil Depression to the north, grassland savannahs to the south, and the fertile Harar Mountain to the east (Gibb, 1997) as sited in (Emnet, 2004). Geographically 18 kebeles are found together but the rest 1 Kebele (Hamaressa) is found apart from the town. These two bodies of the town are connected by two rural kebeles but connected by the main road which takes to Addis Ababa (www.wikipedia.org).

From Wikipedia, the free encyclopedia(Harar enclosed within the city wall, *Jegol*)



Harar

Harar / Location within Ethiopia / 9°19′N 42°7′E /

3.1.1. Population of the study Area

Harar has a population of 183, 415 in 2007. Out of which 61% of them live in Harar town. 92, 316(50.3%) were male and 91,099(49.7%) were female (CSA, 2007). The annual population growth rate between 2000 and 2005 was 3.8 percent. The population density is estimated to be 4, 473 p/km2. Life expectancy is 55.6 for male and 54.7 for women between 2000 and 2005 (HRSO, 2004 as cited in Emnet, 2006). Harar is found 525 km away from Addis Ababa.

3.1.2. Selection of the study Area

The choice of Harar as a study area from major towns of the country was due to the researcher's personal experience of severe water scarcity in the area for more than a decade. There were several attempts done by governments and NGOs to resolve the problem of water scarcity through the expansion of water schemes. However, the problem is aggravated from time to time.

3.2. Research Design

The research used a cross sectional research design and data were collected on more than one case at a single point in time using the combination of both qualitative and quantitative methods. This research used to collect, generate and analyze the relevant primary and secondary data on the existing condition of water supply factors that impede provision of safe and adequate water supply and the socio-economic implication of water inaccessibility to the community. The qualitative approach was preferred to gather rich and in depth information to catch the real situation on challenges of sustainable water supply systems.

3.2.1. Data Type and Source

The major strategy of the study is qualitative and it was finalized by quantitative approach. Thus, both quantitative and qualitative data were collected to counterbalance the limitation of the one

by the other. Qualitative data was generated through Focus Group Discussion, Key Informant Interview and Personal Observation to supplement, complement, validate and triangulate data obtained from sample households. The quantitative data was obtained from Household Survey.

On the other hand, the data input for this study was both primary and secondary source. The major sources of secondary data was from government and non-governmental publications, annual and inventory reports, previous studies, books and websites.

The main source of primary data were collected from sample households, participants of Focus Group Discussion and Key Informant Interviews that were made with water facility supplying government and non-government agencies. In addition, Personal Observation and informal discussion with users were conducted to get direct information.

3.2.2. Sampling Design and Sample size

The research used a combination of the random and purposive sampling techniques to select respondents, key Informants and Focus groups discussants (FGD). Random sampling was preferred to select sample population for household survey since they can give relevant information for the study from their experience. Purposive sampling was used to select key informants and FGD.

To carry out the study, the researcher has selected 3 kebeles out of 19 kebeles in the research area. It covered only 90 households from a total of 4,432 households of the selected kebeles. And the study was focused on assessing challenges of sustainable water supply. According to the information the researcher obtained from the MoWR, the selected town faces sever challenges on water supply schemes. Thus, the kebeles were purposively selected.

The total populations of the study in the selected kebeles were the list of residents in each Kebele which was taken from the kebeles' administrators. As to the sample size determination, from among different methods, the one, which has been developed by Carvalho (1984), as cited by Zelalem (2005), was be used. The method is presented in the table 3.1

Table 3.1: Sample size determination

Population size	Sample size		
	Low	Medium	High
51-90	5	13	20
91-150	8	20	32
151-280	13	32	50
281-500	20	50	80
501-1200	32	80	125
1200-3200	50	125	200
3021-10000	80	200	315
10001-35000	125	315	500
35001-150000	200	500	800

Source: Carvalho (1984), Zelalem 2005

Taking into account the resemblance of the sample kebeles, resource and time limitation, a low sample size were applied in accordance with the given population size. A sample size of 90 households was selected from the total population of 4,432 households on the basis of systematic sampling.

3.2.3. Methods of Data Collection

Data on factors that hinder the sustainable functioning of water supply schemes were gathered through employing multiple methods of data collection. Thus, Household Survey, Focus Group Discussion, Key Informant Interview and personal observation were also being vigorous instruments to directly observe the existing water supply problems in the study area. Prior to the actual collection of data, pre-testing of the materials was made to check its validity and clarity. Then after, necessary modifications were taken accordingly. The researcher has recruited three enumerators to ease the work based on educational background (primary and secondary school teachers), knowledge of Amharic and Harari languages, familiarity with the culture of the community and previous experience in data collection. The researcher has closely followed up the actual process of data collection.

House Hold Survey:-Primary data concerning all relevant variables such as problems related to water supply systems, and role of water board, utilization of facilities, financial, technical, and institutional issues were collected through structured questionnaires. The total household from the sample Kebeles were 90 respondents (Low sample size) from the total population. It was also provided an opportunity to investigate new things and reduces the probability of non-response, although the method demands time. Thus, closed and open ended questionnaires were prepared in English and translated into Amharic to collect the required information from households.

Key Informant Interview/KII/:-A key informant interview was particularly important in generating information related to institutional, technological, and efforts made so far to improve problems related to sustainability of water supply systems. Hence, views of water supply agencies (experts and heads) were important as they have better knowledge of the case in point. The respondents were from different groups such as Kebele leaders, NGO workers in the area.

Generally the research has used a total of seven key informants. Out of seven key informants two of them were from Kebele leaders, two from water supply agencies, and three NGO workers were selected purposively based on their responsibility and their knowledge about water supply systems. It was undertaken by a kind of an in depth semi-structured interview guide line.

Focus Group Discussion/FGD/:-The primary data collected from sample households was enriched by additional information obtained through focus group discussion. It was conducted with recruited groups by Kebele administrator from each Kebele. This helps to understand how people discuss the water issue as member of a group rather than simply as individuals. Three FGD was held in the three sample Kebeles with 6 participants. Each group has included

proportional number of women and men participants. Checklists were prepared and used to guide the FGD.

3.3. Data Analysis

There were two levels of data analysis. Quantitative data generated from different sources was analyzed using simple descriptive statistical tools like frequency, mean, standard deviation and percentages. Qualitative data collected using focus group discussion; key informants interview and personal observation were triangulated, organized and analyzed accordingly. The data was being analyzed using statistical software, i.e., SPSS version 17.0. In the households each respondent was coded with numbers so that the situation in each household for the different questions in the questionnaire could be analyzed. Questions in the questionnaires were identified by a variable name and within variables there were values and value labels for identification of responses from the respondents. After coding the information from the questionnaires, template for entering data in the computer program was created. The coded data was then entered in the

SPSS version 17.0 computer programs where frequencies, multiple responses, mean, standard deviations and cross tabulations was computed during the analysis.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

In this chapter, the results of the research are presented and discussed.

4.1. Institutional framework and capacity

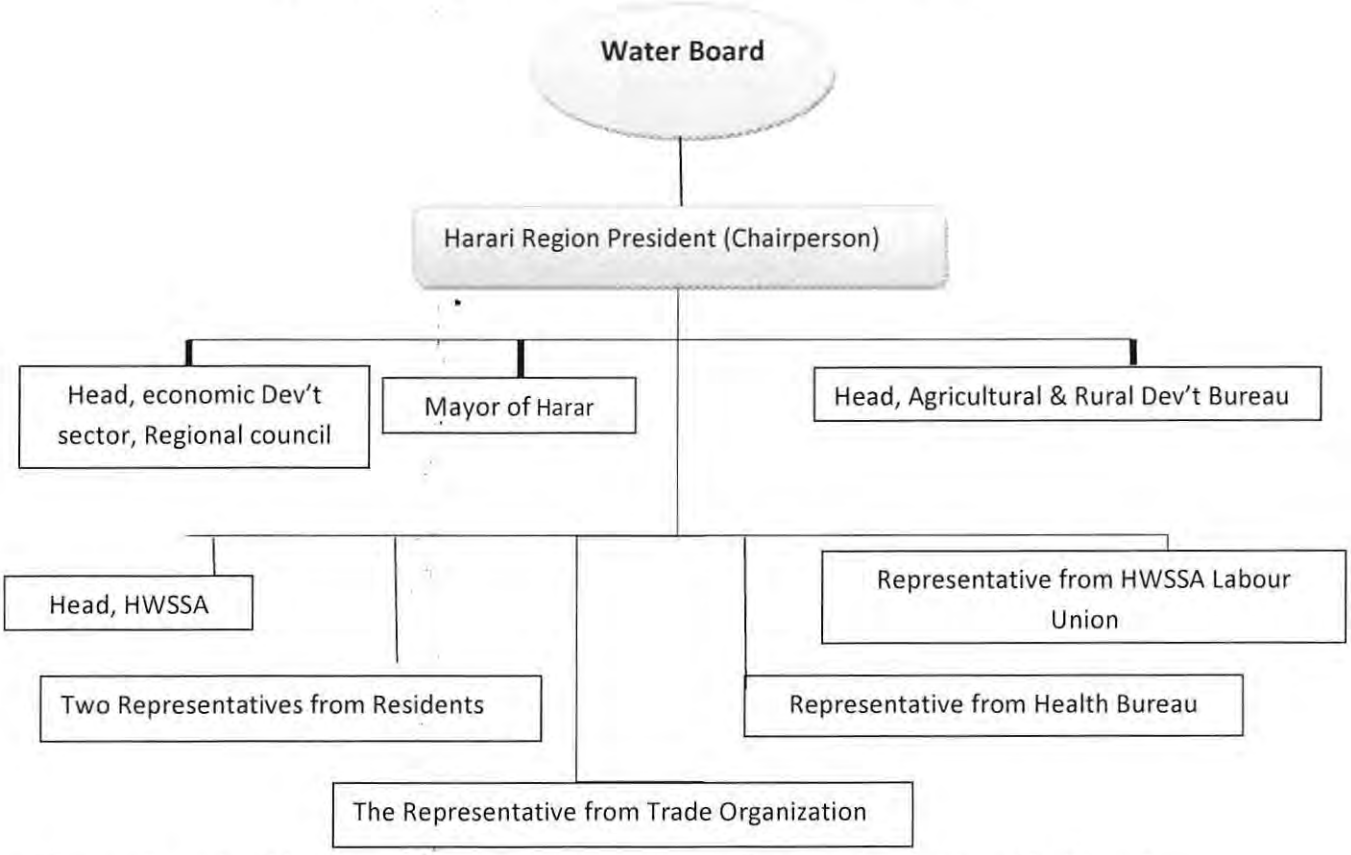
4.1.1. Institutional set up of HWSSA office

The Harar City Water Supply and Sewerage Service Authority (HWSSA)is the responsible governmental organ for the delivery of water supply service. Harar Town Water Supply and Sewerage Service Authority (HWSSA)is managed by a Board composed of: the Harari Region president (Chairperson); Head of the Economic Development sector from the regional council; Head of Harari Region Agricultural and Rural Development Bureau; Mayor of Harar City; 2 city residents; 1 representative from Harar city trade organization; 1 from the Health Bureau; 1 representative from the HWSSA labor union; and the general manager of HWSSA.

According to WAC II program 2007, there is no focal unit dealing with gender and poverty in the HWSSA. All board members are men. Women are not represented on the existing Board. However, the Harar Region Women's Affairs Office is a member of the steering committee. HWSSA is responsible for the provision of water supply for the town of Harar but some private sellers provide water from protected and unprotected dug wells, at a higher price, and especially so during the dry seasons. Although the utility office does not recognize the private suppliers, it tolerates them due to the acute shortage of water in the city. HWSSA has 12 mandates from the Harari Regional State to manage the water supply and sewerage provision for city residents. The chart below depicts organizational structure of WSS authority of Harar town.

According to information obtained from the City Manager for the WAC II and other staff, HWSSA has neither policy on gender mainstreaming nor a focus on slum dwellers and informal settlements. The total workforce of the utility is 219, of which 31 are women and 188men. There are eight management and decision making positions. Only one is held by a woman, and that is in the Finance Division. Women employees in the utility office are found in lower positions such as clerical work and include secretaries, cashiers, cleaners, messengers, and an accountant. The majority of female employees have education that ranges from grade 8 to 12. According to information obtained from female employees, there is no discrimination in salaries for the same jobs being done by men or women; however, women do not have equal opportunity for training.

Chart 4.1: *Organizational Structure of Harar Town WSSA*



Source: *Formulated by the author from reports that was conducted in the 17 cities of the Water for African Cities (WAC) II Programme.*

The organizational structure of HWSSA has three functional Divisions - Administration, Finance, and Operation and Maintenance. The HWSS office located in Harar town administers the Harar water supply systems and reports to the management Board. The HWSS office is responsible for operation, maintenance, and management of WSS of Harar town.

The sustainability of water supply facilities mainly depends on operation and maintenance (O & M) of the system. However, it has been found that O & M of facilities are in a poor state of condition and hence the sustainability of the systems is at stake.

In relation to this, the following adverse conditions were identified as problems related to O & M functions of HWSSA:

- Lack of spare parts;(or the recently imported were defective spare parts)
- Absence of laboratory equipment;
- Lack of trained personnel who fully understand how to operate the systems;
- Poor financial management and paucity and
- Inadequate planning are the main ones.
- Absence of town plan for old system networks

Table 4.1; Personnel Profile of HWSSA, 2010

No	Division	Permanent Employee		Temporary Employee		Contract Employee		Total Number of Employee	
		M	F	M	F	M	F	M	F
1	Management	42	12	54	–	–	–	96	12
2	Finance	15	7	–	–	–	–	15	7
3	Customers	–	3	–	–	–	–	–	3
4	Planning	2	–	–	–	–	–	2	–
5	Technical	52	1	–	–	9	–	61	1
6	Rural WSS	9	6	5	2	–	–	14	8
Total		**120**	**29**	**59**	**2**	**9**	–	**188**	**31**

Source: Harar Water Supply and Sanitation Authority (**HWSSA),** 2012

As it can be observed from the table 4.1, Harar town WSS Authority has insufficient and unqualified personnel for effective management and governance. There are only 149 permanent employees most of whom do not have appropriate education and training in water supply service delivery (From Human Resource section document, HWSS office).

4.2. Survey analysis

4.2.1. Age Distribution of Respondents

Out of the total of 90 respondents that have been interviewed in the survey, 56(62.2 per cent) and 27(30.0 per cent) were adult and youth age group respectively. The average household age in the sample household is 37.2 years and ranges from 16 to 65.

Table 4.2; Age Group

Category	No of Respondents	Percent
Youth(15-29)	27	30.0
Adult(30-64)	56	62.2
Old(>64)	7	7.8
Total	**90**	**100.0**

Source: Household survey, 2012

4.2.2. Sex Distribution of Respondents

As the issue of water is more of the concern of women, more emphasis was given to female member of households. Accordingly 72.2 percent of sample household respondents are females, whereas 27.8 percent of the total sample household respondents are male (Table 4.3).Out of the total of 90 respondents that have been interviewed in the survey, 25 and 65 were males and females respectively.

Table 4.3 Sex of Respondents

Category	Number of Respondents	Percent
Male	25	27.8
Female	65	72.2
Total	**90**	**100.0**

Source: Household Survey 2012

4.2.3. Marital Status of Respondents in the study areas

There are four marital characteristics among the respondents in the sample communities. These are the singles, the divorced, the married, and the widowed. About 13(14.4%), 9(10%), 17(18.9%) of all respondents were single, divorced and widowed respectively while about51 (56.7%) were married. More often, the quantity of water used is related to the household size, hence the married households are likely to be high consumers of water. The interest of this group is therefore not surprising. It must be noted that household water fetching exerts a lot of pressure on large households in the area where almost all adult members are expected to partake in the water supply activity.

Table 4.4 Marital Status

Category	Number of Respondents	Percent
Single	13	14.4
Divorced	9	10.0
Married	51	56.7
Widowed	17	18.9
Total	**90**	**100.0**

Source: Household Survey 2012

4.2.4. Household size of Respondents

The output of the sample household survey shows that most of sample household sizes are between 4 and 6 which is 53.3 percent of the total sample population. And the average household size is found to be 5. While the maximum is 9, the minimum is 2 (Table 4.5).

Table 4.5 Family Size

Categories	Number of Respondents	Percent
1-3	27	30.0
4-6	48	53.3
6-9	15	16.7
Total	**90**	**100.0**

Source: Household Survey 2012

4.2.5. Household Occupation

Table 4.6 shows that the majority of sample households are business/petty trade which are 44(48.9) percent. 24(26.7) percent of the total sample households are government employee. In addition, 8(8.9) percent of households are engaged in daily laborers and retired. Moreover, 14(15.6) percent of the total sample households are others like students and house wife.

Table 4.6; Income Source of Family

Categories	No of Respondents	Percent
business/petty trade	44	48.9
government employee	24	26.7
daily labor or retired	8	8.9%
Others	14	15.6
Total	**90**	**100.0**

Source: Household Survey 2012

Regarding toilet facilities of the sample households (Table 4.7), out of the total sample households 71(78.9 percent) have toilet facilities among which 6(6.7percent) is flush toilets and 45(50.0 percent) is pit latrines. 20(22.0 percent) and 19(21.1 percent) have neither flush nor pit latrine, but use in group toilets and open fields or river courses respectively. In areas where there is shortage of water supply and frequent interruption, pit latrine is the preferable toilet facility than the flush toilet of the modern technology. This is because of the fact that pit latrine does not need water after defection. In addition to this, they can easily be constructed by the low income communities.

Table 4.7: Toilet facilities

Category	Frequency	Percent
Flush / pour flush toilet	6	6.7
Pit latrine	45	50.0
Use group (public) toilets	20	22.2
No facility / bush / field/ river courses	19	21.1
Total	**90**	**100.0**

Source: Household Survey 2012

4.2.6. Educational Background of the Respondents

As most of the respondents are females main emphasis was given to the educational background of the mothers or those who are responsible at home concerning about water management. The result shows that 37(41.1 percent) of the total sample households are at the primary level, 39(43.4 percent) of the total sample household have completed grade 12 and above grade 12(secondary level). However, 14(15.6 percent) of the total sample households are unable to read and write (see Table 4.8). This implies that the majority of sample households have better educational background. This might be because in Harar town there are a number of primary schools, high schools and private and government colleges which can give them a better educational opportunity. With regard to domestic water quality improvements, education is one major factor which will help them in how to use water resource in a better way.

Table 4.8: Educational Level

Categories	No Respondents	Percent
Illiterate	14	15.6
Primary school	37	41.1
Completed Secondary school	7	7.8
Above 12	32	35.6
Total	**90**	**100.0**

Source: Household Survey 2012

4.2.7. Need for Social Services

Household survey respondents were also asked about what social services they need to be provided primarily and secondly. As table4.9 shows, 79(87.8%) of respondents have indicated that they desired water supply,6(6.7%) and 5(5.6%) of the respondents replied that they preferred health and power supply (electricity) services are their first priority respectively. Surprisingly, no household respondent showed interest in telephone and road facilities supply. This may be

because of household respondents suffering in scarcity of water supply condition for at least two decades in the study area.

Table 4.9: Most Necessary Services

Category	Number of Respondents	Percent
Health	6	6.7
Water	79	87.8
Power Supply	5	5.6
Total	**90**	**100.0**

Source: Household Survey 2012

4.3. The Status of the Existing Water Supply Condition

4.3.1. Source of Water Supply

The former water supply for Harar town was designed and constructed in 1960 taking Lake Alemaya as a source, which is situated at road distance of 20 km from Harar town. The Lake was totally interrupted since the beginning of the second month of 2004 (HWSSA's disclosed at a meeting held on Feb.13, 2004). And totally disappeared in 2005(interview with Professor Chemeda, Haromaya University). Without any additional supplementary source it was forced to serve for more than forty years. The reasons for the fast decrease of the level of the lake were mainly due to highly increased population in the town, silting (gullies), and the increasing usage of the water by the surrounding farmers for irrigation for 'chat' and other crops.

The existing source of water supply for Harar town is **ground water**. Seven non-functional and six functional wells were drilled by Immediate Rehabilitation Programme in '*Epha-Bate*' around Alemaya and pumps were installed at three of the wells and connected to the main water supply line (interview with Ato Adil, Head of O and M of HWSSA). Ten more wells which have high quality problem were rehabilitated in different kebeles of the town to increase the supply of water. A tanker truck was providing service since August 2004 for those kebeles where the

problem is critical. Individual companies such as TOTAL Ethiopia, UNICEF that provided a truck with a trailer including all operational costs, were also involved. Besides these, a local NGO called DERASH rehabilitated a water well and installed a pump in one Kebele benefiting three thousand people.

The well field at Dire Jara which located about 22 km North West of Dire Dawa town consists of 17 boreholes and 12 of them have started water supply services for Harar town on October 2012(too late for planning period).The groundwater investigations in the Dire Dawa area suggest that it has potential for large-scale development. The water source at Dire Jara well field is believed to be adequate up to the 2012 water requirement. For the second phase, up to 2022, the well field at Hursso, 27 km west of Dire Dawa, could be used.

4.3.2. Alternative source of water

To overcome the existing water problem an important portion of households in the selected kebeles use various sources of water 67(74percent) and 67(74percent) of the sample households used tanker(public stand pipe) and water vendors as their alternative sources respectively, 53(59percent) use water well and 30(33 percent) uses rainwater. More surprisingly, none of them uses less than 2 sources of water (Table 10).

Table 4.10: Alternative source of water the respondents use.

Alternative source	Number of Respondents	Percent
Tanker (public stand pipe)	67	74
Vendor	67	74
Water well	53	59
Rain water	30	33

Source: household survey 2012
Note: the total number is more than 90 because one household uses more than one alternative source.

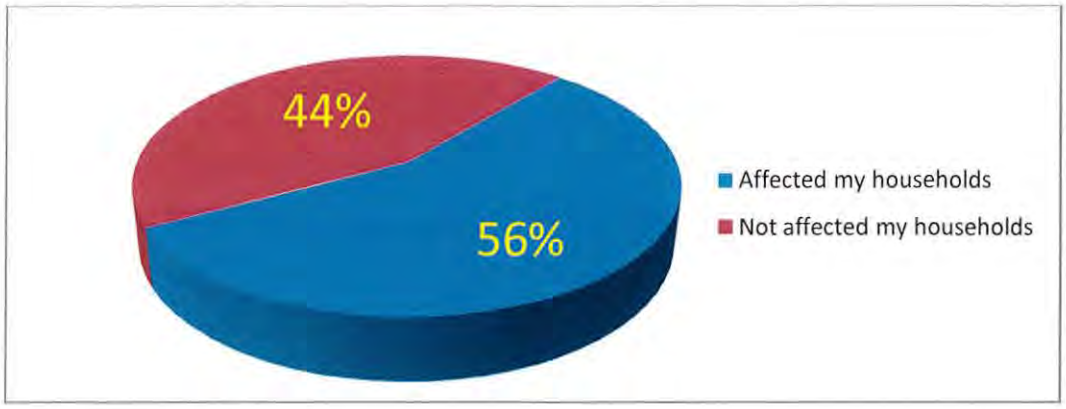
In Harar town there is a serious water supply problem. According to the information gathered from the HWSSS, from the sample respondents, and as the researcher also observed, the

inhabitants get tap water once in a week or in 15 days only for few hours. In some places where the topography is a bit higher, the water has no power to reach to their tap after 1995 E.C. These households get tap water once per three or four months. Even some of them have never seen tap water for about years.

It is stated that safe water supply is a platform for wellbeing of individuals and further development activities. One of the basic objectives of providing a piped water supply is to make available to the consumers pure and wholesome drinking water. However, the absence of this crucial element in Harar forced the inhabitants to use different alternative sources which have exposed them to water borne diseases.

Regarding water borne diseases, the output of the household survey shows that more than half of the study population 50(56percent) was affected by water born disease (see Figure4.1). Moreover, according to the data from Harari Health Bureau Statistics Department, water born disease is one of the top ten diseases in the region. Furthermore, the region spends 35% of its drugs budgets on combating such diseases compared to 8% for other regions (HWSS, 2002). However, 40(44 percent) of sample households reported that they were not affected. Among those 56 percent who have been affected by water borne diseases, most of them responded that they were at least affected once in a year. According to the FGD diarrhea, giardia and amoeba were a common phenomenon. It could happen four two or five months in a family.

Figure 4.1: The water borne disease from the main or alternative sources



Source: household survey 2012

4.3.3. Water Production

The current production of water depends on 16 boreholes, all of which are integrated to one water supply system and are administrated by Harar town Water Supply and Sewerage Service Office. The gross water production capacity of these boreholes is 268l/s. The Dire Jara well field consists of 12 new boreholes which have already been developed with a capacity of 200 l/s. The additional boreholes with a capacity of 68 l/s are constructed at the well field increasing production capacity to 268 l/s. All the boreholes will be connected to a 2000 m^3 Collector Reservoir from which the transmission pipeline will transfer the water to Harar and the other towns raising it about 840 meter above sea level via 4 booster pumping stations to a 4000 m^3 reservoir at the highest point in Dengego. Pump houses, staff houses and administrative buildings and access roads are constructed at the well field and the booster stations. Equipment and chemicals for groundwater monitoring havebeen provided.

However, the actual production of water has been lower than the maximum capacity, because the boreholes do not work for 12 hours /day without break. There are considerable discrepancies between actual water production and the expected yield (personal interview with Ato Adil, Head

of O and M of HWSSA). According to him the boreholes produce under their capacity. As a result of under capacity production rate and frequent interruption in the operation time of wells, the actual production of water is substantially lower than the expected amount. Production of water also varies with season (Bega, Kiremt) due to seasonal variability of yield and total well hours worked. Generally, Water production depends on yield, operation time and number of wells on operation. In addition to under capacity rate of production, limited number of boreholes, and operation time of wells which lower down the actual production of water, the high percentage of water loss has further reduced the actual amount of water supply.

As regard to these problems the interviewed respondents including households and different sections of the society identified incompatibility of the supply with population growth and the expansion of the town; frequent interruption of the supply especially in Bega season (February - April); and the limited capacity of WSS office in terms of technical personnel, finance, materials such as machines, equipment, spare parts and fittings etc. as the major problems among others. So, most of the inhabitants are using water from nearby tankers. The following table 4.11 depicts the response of respondents upon their satisfaction by the existing water supply.

Table 4.11: Satisfaction Level of the Existing Water Supply Service of Harar town

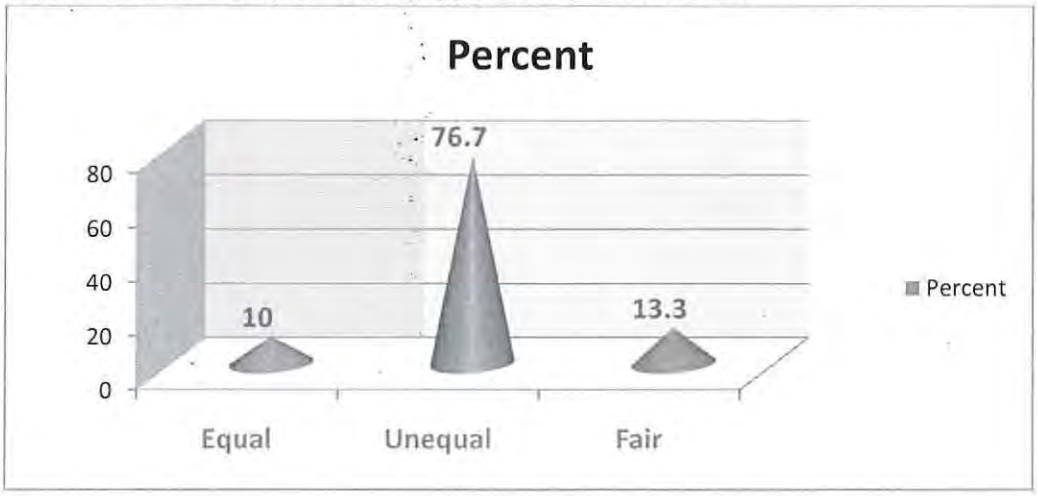
Sr/No	Existing Water Supply is	Number of Respondents	Percent
1	Very Satisfactory	2	2.2
2	Satisfactory	19	21.1
3	Unsatisfactory	63	70.0
4	Non respondent	6	6.7
	Total	**90**	**100.0**

Source: Household Survey 2012

As indicated above from the table 4.11, above, 70 percent of the respondents is not satisfied by the existing water supply. This implies that even though additional boreholes were drilled by the

Dire-Jara Project for the town, still the demand of the society is not met by the existing supply of water. This is because of failures of O and M to connect the old system with the new one, difficulties of pumping water about 840 m vertically above sea level from Dire-Dawa, hardness of water which is causes for system failures and defective of materials. As a result the amount of water that reaches the inhabitants is not adequate, as the regional government hoped for. The other reason is the existing water supply is characterized by inequitable and inefficient distribution system; low coverage; unscheduled frequent interruption and less quality (Figure 4.2). 69(76.7%) of the respondents were irritated (not happy) with the current water supply service management. They complained both in unevenly distribution and coverage water supply in Harar town. The FGD have confirmed these issues in the same way with the above discussion. But the HWSS office replied to the researcher that inequality in distribution is mainly due to the topography of the town.

Figure 4.2: The Equity of Water Supply Management Service



Source: **Household Survey 2012**

4.3.4. Water Distribution

The system of distribution is the most important aspect of water supply in any community. The type and efficiency of water supply system greatly affects the rate of household consumption.

The process of distribution starts from the place of production or the source of supply, in this case from the boreholes. All the boreholes are working by electric power. There are also a number of diesel generators. The Dire Jara water supply system is the first sophisticated and difficult system in Ethiopia as observed KII from Abdul Hakim, IT engineer in HWSSA. The vertical interval between Dire Jara well field (Aselisso) and the highest point in Dengego is 840masl. As a result pumping stations need high electric power to transfer water from one booster pumping station to another more than the normal power requirement (wastage of energy). This implies the energy sources of water supply are inconsistent and power cut may occur. The Electric cost for the water supply from Dire Jara was ten million of ETB for a year (Ato Adil, head of O and M for HWSS office).The HWSSA cannot afford this rising oil and power costs. This also leads to power cut. Power cut means complete interruption of water supply. Thus, options should be looked in the log-run to mitigate this problem. One possible way of mitigating such problem is using solar energy instead of electric power and diesel generators.

The raw water is drawn off from each borehole and then pumped through rising main to the four booster pumping stations (BPS). From there, the disinfected water by chlorination is conveyed to elevated tanks with a volume of 2000m³ collector reservoirs and then to 4000m³reservoir at the highest point in Dengego, located about 60 km from the first BPS. From this tank, water flows by gravity to Main Collection Tankers (MCT) located in the Harar town and then to distribution lines and Collection Tankers (MT) divided by eight zones used as public stand pipes. From there water is distributed to the different parts of the town through pipelines of different sizes. Finally, the water reaches the consumers in two types of water supply systems, meter connection and public water points or stand pipes.

Obviously, the importance of reservoir as part of the distribution system is to guarantee a continuous supply of water at the time of interruptions in the process of production. This indeed, depends on the number and capacity of reservoirs and on the relative ground elevation where they are situated, if water is to be distributed by gravity.

Picture 4.1: One of eight tankers found in Harar (Amir Nur 01 Kebele, Jegol)

Source: Household Survey (Photo by the researcher) 2012.

However, it can be well pointed out that the present reservoirs, the rate of meter connection and the spatial distribution of public stand pipes or water points can seldom meet the demand of the community.

Frequent interruptions in production coupled with limited capacity of reservoirs and unfair distribution of water points on one hand and the growing need on the other hand are ever widening the already existing unbridgeable gap between the demand for and supply of water. This unbridgeable gap between demand and supply of water has caused negative outcomes to the community. The first challenge is that shortage of water supply led to poor personal hygiene and

environmental sanitation. The second challenge that was encountered by the community is exposure to unprotected water sources that caused water borne and related diseases (giardia, amoeba and typhoid) which in turn penalize the poor medical costs. The third challenge is this unprotected alternative water sources such as streams and unprotected or traditional hand-dug wells that are found at long distance (averagely 2.5 Kilometers for single trip) from their home have caused imposed opportunity costs of time, energy and labor during water collection. The fourth challenge is that shortage of water forced the community to buy water from vendors at high costs (additional costs).

Table 4.12: Is water equally distributed over the whole town?

Categories	Frequency	Percent
Yes	**11**	**12.2**
No	**79**	**87.8**
Total	**90**	**100.0**

Source: Household Survey 2012.

Household survey respondents were asked about whether water is equally distributed or not. Table 4.12 indicated that 79(87.8 percent) of the respondents replied that water is not equally distributed in Harar town and the rest 11(12.2 percent) of respondents answered that water is equally distributed. The Household survey respondents were also asked the reason behind inequitably distribution of water, table 4.13 showed that 36(40 percent) 26(28.9 percent) of the respondents believed that it is due to scarcity of water and management problem respectively. 12(13.3 percent),2(2.2 percent) and 10(11.1 percent) of the respondent said that lack of maintenance, system distribution failures, and topography respectively. From FGD and KII revealed that, water is unequally distributed because of the topography of the town. As a result, the FGD confirmed that the old town of Harar (Jegol) received water repetitively than the new town (out of Jegol compound).

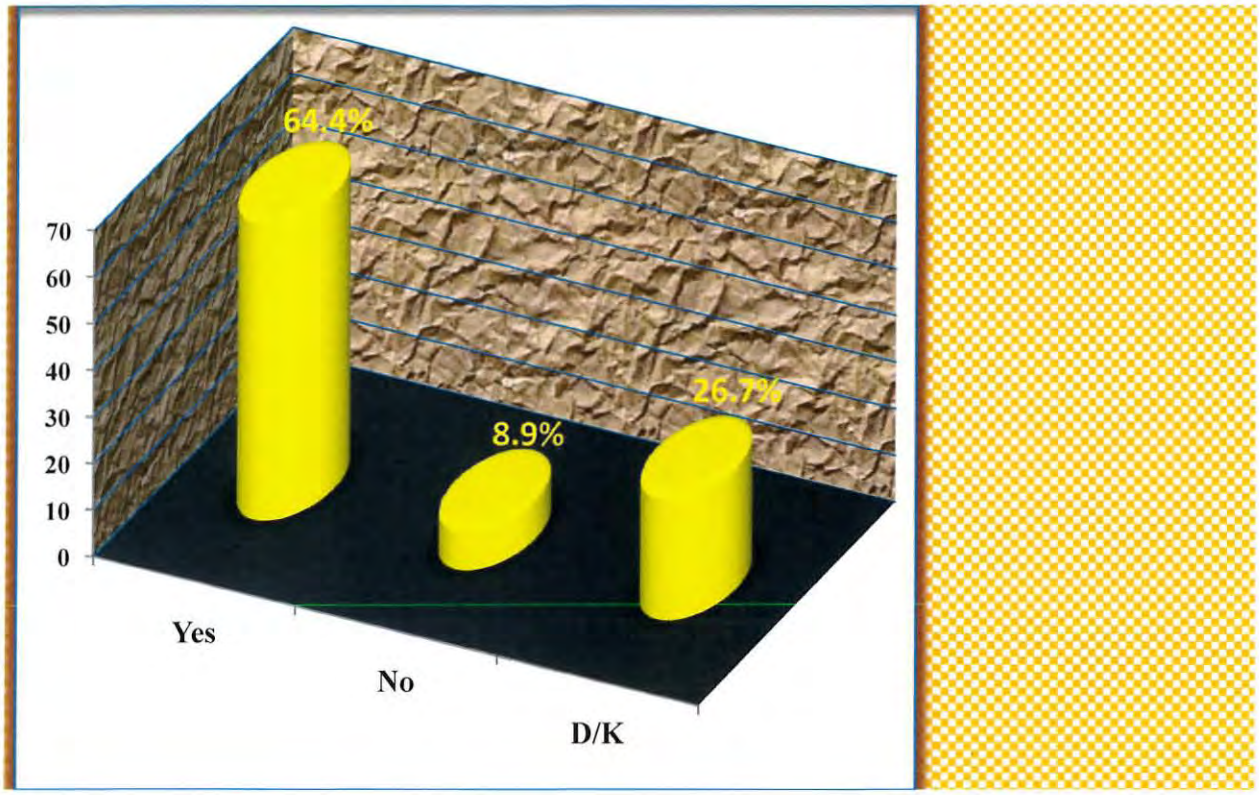
Table 4.13: Reason for unequally distribution of water

Category	Frequency	Percent
Scarcity	36	40.0
Management	26	28.9
Lack of Maintenance	12	13.3
System Distribution Failures	2	2.2
Topography	10	11.1
Non Respondents	4	4.4
Total	**90**	**100.0**

Source: Household Survey 2012

Out of the sampled households, 80 percent revealed that the regional government is fully responsible for providing water in Harari region, while 20 percent of the respondents have no information about responsibility for water supply activities in their home town. This implies that the responsibilities and authority of government's towards providing water particularly in the towns are so essential in supporting the majority of poor urban dwellers.

Figure 4.3: Leakage at Different Level



Source: Household Survey 2012

As shown in figure 4.3;58 (64.4 percent) of the Households Survey respondents replied that there are leakage in the town, 8(8.9 percent) of the respondents said that there is no leakage in their residential area and 24(26.7 percent) of the respondents said that they did not know whether there is leakage or not in the town.

Table 4.14, indicates the reasons for leakage and out of the sampled households 36(40 percent) and24(26.7percent) of the respondents said that lack of maintenance and operation, and System distribution failures were the major causes for leakage at different levels respectively.

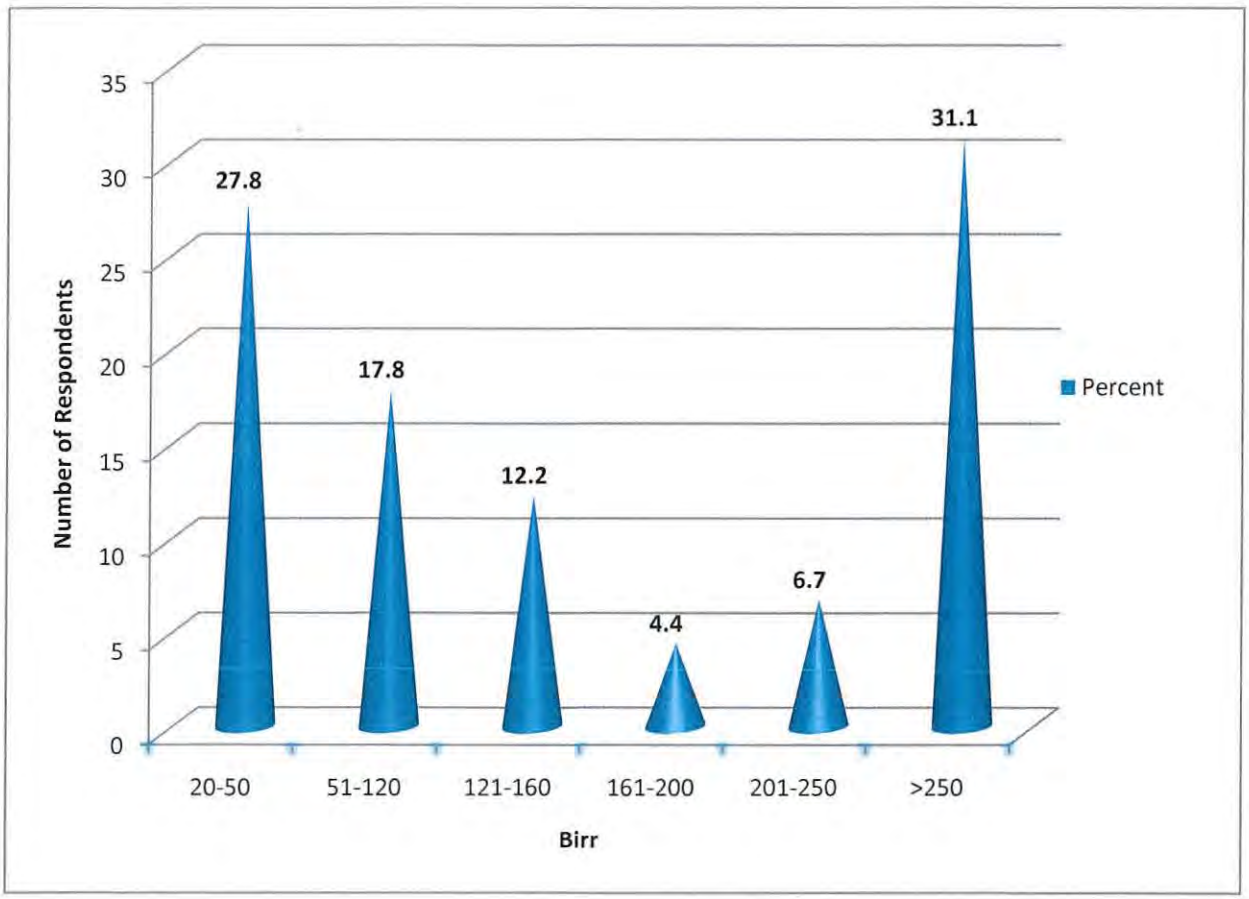
Table 4.14: Reasons for Leakage.

Reasons for Leakage	Frequency	Percent
Lack of Maintenance and Operation	36	40.0
System Distribution Failures	24	26.7
Non Respondents	30	33.3
Total	**90**	**100.0**

Source: Household Survey 2012

The water supply shortage in the study area has challenged dwellers in different aspects. One of the challenges is additional cost incurred by purchasing water as a commodity. Figure 4.4shows household's monthly expenditure for water (excluding the payment for tap water). In other words it does not include the monthly fee paid for the tap water service for HWSSA. Out of the sampled household 27.8 percent have spent 20-50 birr per month however, 17.8 percent of the total sample households expenditure ranges from 51- 120 birr. Moreover, 12.2 percent of household expenditure ranges between 121-160 birr. Even though4.4 percent and 6.7 percent of them fall in the expense ranges between 161-200 birr and 201-250 birr category, and 31.1 percent of sample households monthly water expense is more than 250 birr. The highest additional expense among the three kebeles was observed in Amir Nur 01 Kebele with in Jegol compound. The KII confirmed that most of the Harari people who reside in the Jegol compound have been consumed more water than others, it may be because of their religion system and the type of houses (slums) forced them to wash their cloths as well as take bath more than three times per day.

Figure 4.4: Additional Expenses during Inconveniences per month.



Source: Household Survey 2012

According to the United Nation, standard households should not spend more than5 percent of their monthly income (Alebel, 2005). However, most of the sample population spend more than what is acknowledged by the UN standard. This expenditure has affected the poor residents of the study area. Households in the study area buy 20 liters of water for 1.50 cents. Sometimes the price goes more than 3birr for 20 liters of water from public tankers and vendors including labor and transport cost. The costs will depend up on the distance (human labor and Bajaj). For drinking water they also used to buy water filled in a 1 liter bottle for 1birrfrom vendors. Thus, they spend considerable amount of money because of shortage of water.

Vanwijk (1995) stated that when there is water supply shortage in urban areas households has no choice except to buy water from water vendor so that they spend much amount of money for that. Emnet (2005:49) described the situation in the study area as follows "residents in Harar town pay for water, transportation, daily laborer, etc. Hence, significant portion of household's income is highly devoted to afford water". Plus a study conducted by Harar water supply and sanitation project explained the expenditure for water by residents in Harar town as follows:

> Residents of Harar are paying between 50 birr and 100 birr for a cubic meter of poor quality water from vendors (compared to the recently increased average tariff of 2.15 birr per m^3) during "normal" rationing which increases to 300 birr per m^3 during periods of more severe shortages.

4.3.5. Water Coverage

The distribution system covers mainly the central part of the town including Amir Nur Wereda (Jegol compound) 'Kebele' 01, 02, 03 and 04 including both 'Kebele' 11 and 12 with total coverage of 38 per cent. As per the official data of HWSS office currently about 40% of the residents are customers of HWSS office, having private meter connection.

Most of those inhabitants who do not have access to their own piped system draw their water from public standpipes or buy from vendors who collect water from nearby source on 'Bajaj' or buy from their neighbors or somewhere else who have their own private connection and sell it at higher price.

The spatial extension of pipeline over any settlement area is surely a pre-condition for supplying the community with piped water. The efficiency of water supply is therefore, determined primarily by the density of pipelines which in turn has influenced by other socio-economic and

physical factors. Among these factors, the number and spatial distribution of public water points, regularity of water supply and income level of the community are the major ones.

In spite of its importance, the spatial extension of pipelines is confined to some parts of the town. Most parts of the peripheral built up areas of the town are currently beyond the reach of pipelines. People living in these areas of the town highly suffer from absolute absence of water supply around their residence. They usually go far off distances in search of water and carry it along and also spend much time even in queuing up near the water taps. Although there is no documented data about the density of pipelines, the researcher observed through unstructured interviews with different respondents that the pipeline network is very sparsely laid.

The problem of line extension is further aggravated by steady and rapid spatial expansion of the built up area crossing the existing municipal boundary of the town, and has influenced the pipeline extension which in turn influenced meter-connection. The challenges that are encountered by the community due to absolute absence of water supply around this new building up and peripheral area are high burden of people per public water points. This implies that many people are queuing at water points for long time which may eventually result in tiredness for water collectors. Sometimes queuing at water points also creates disputes (wrestle and tussle) among those waiting in a line when queue jumping occurs.

Distributing water through house connection use is obviously the most convenient system of water supply for households. However, the installation of the residential meter connection involves much higher cost which most of the households in the community under consideration (the poorest of poor) could not afford. Because of financial and other socio-economic factors, the rate of private meter connection for household service in Harar town is very low (see table 4.15).

Table 4.15: Number of Sampled HHs without and With Meter Connection.

Type of Meter Connection	Number of Respondents	Percent
Private meter connection	36	40.0
Shared (public) meter connection	17	18.9
Without Private meter connection (PMC)	37	41.1
Total	**90**	**100.0**

Source: Household Survey 2012

As can be seen from table 4.15, out of the total sample households only 36(40 percent) of these households have private meter connection and 17(18.9 percent) of the total households have shared meter connection. 37(41.1 Percent) of the sample households are without private meter connection.

The implication of this finding can be expressed in terms of principles of optimal use of water: equity of access, efficiency of use and sustainability of the source. The first implication is that high variation in number of households with and without meter connection shows there is no equity of access to potable water supply. The second implication is that available water is distributed to few numbers of the community in large amounts rather than administering to the majority of the community in small amounts so that the few community with large amount of water supply can use /consume water as they wish without giving due consideration to waste of water. Eventually such unequal/unfair distribution of water leads to inefficient use of water by few members of the community. Last but not least, the majority of the people did not get adequate potable water means they are forced to use other alternative sources. This consumption of water from heterogeneous sources leads to depletion of water resources and implies absence of optimal use in terms of sustainability of the source.

An inter 'Kebele' variation in the proportion of households with meter connection service might have emanated from differences in income level of HHs, pipeline density and distance from the

source of water supply. Due to such constraints households face serious shortages of water supply. They, therefore, collect water for any kind of household use from other sources or from water vendors which obviously costs them a considerable time, energy and money.

The impact of this is that households lost their income and time which has led to low productivity, burden on home duties and drudgery (labor) especially on girls and women. However, the issue of fairness and full cost recovery is still paradoxical to solve such problems of variations in access to social services including potable water. Charging high tariff to cover full cost means the poor cannot afford the charge. Again when low price is set or water is provided freely, revenue becomes low thereby resulting in inability to cover the full cost and to sustain the service unless it is subsidized by the government.

The Ethiopian Water Resources Management Policy has also clearly emphasized on the implementation of cost recovery tariff structure as government subsidy is becoming out of question. This modality is in order to provide efficient and sustainable service through a sound financial and technical management of the system. The policy has also given concern to the ability of the poor to pay by the term (category of) "social tariff" in which the poor are charged less by assuming that the well-to-do consumers will cross subsidize water supply.

The position of the researcher here is that water supply should be charged rather than being free, but the way of charging customers should be based on their self-selection of the service and volume of water consumption. This means the poor and other customers should select the service type in accordance with their income level and the price would be charged based on volume of their water consumption. This can enable efficient use and sustainability of water supply.

4.3.6. Water Consumption

In urban communities the problem related to household water consumption patterns involve various components even though it effects vary from one urban center to the other and among communities. Among other factors physical and socio-economic factors are the major ones.

According to the former system, the total maximum daily consumption estimated for the town of Harar amounts to 5000m³/24hour. The system has also served the satellite city of Alemaya, Aweday, Hamaressa and others rural villages along the Alemaya to Harar road. For these rural areas the quantities assumed were 10lit/sec (864m³/day). Together with the rural population the total water consumption was calculated to be 5864m³/day (24 hours). The total water consumption was assumed to extract 5000m³/day from Lake Alemaya at a rate of 60l/s, whereas the remaining deficit was assumed to be filled from the nearby springs which have discharge rate of 316m³/day at that period. With this assumption the filter units and the pump capacity was designed to work on 60liter/s discharge rate (HWSSA, official magazine, Sofi special edition).

From the above history it can be understood that, the water deficit in the Alemaya water supply system that was aggravated, is not a recent phenomenon rather it was conceived in the origin of the design itself. The researcher observed through unstructured interviews with different respondents that the water supply of Harar and the surrounding area was only designed for drinking and washing, and did not considers non-domestic demands. On the other hand the per capita consumption, which used for the design purpose, was very low both for town and rural beside these the design did not consider for the real development that has brought high water consumption rate. The springs which were considered in the design to supply 316m³/day was

totally went out of the water system due to various reason and left the burden on the Alemaya water supply system.

The existing water supply from the Dire Jara well field, which is located about 22 km North West of Dire Dawa town consists of 17 boreholes and 12 of them have already started water supply services for Harar town on October 2011.As it was discussed above, there are physical factors that can be affected water consumption. The first and the most influential factor that affected water consumption of urban inhabitants in Harar town is the nature of the source of water with respect to quantity and quality. Low quantity was expressed as a more serious problem by different sections of the society interviewed for their water consumption. With regard to its quality the suggestion given was that even though the water is treated, it is not somehow good because the water has suspensions of impurities and small particles. Moreover, it causes water borne and water related diseases that attack the family with amoeba, giardia, typhoid and etc. Besides this the water from Dire Dawa has the problem of quality. Regarding this, the researcher observed from KII and the HWSSA that the water from Aselisso, Dire Jara well field has the problem of salinity (hardness of the water). Sample households were asked about the quality of all sources of water they use for domestic purposes. Majority of the respondents did not have good awareness towards their water quality 53(58 percent) of them replied that they do not trust the quality of water they use for domestic purpose and the rest 37(42 percent) of them have no any complain about it (Table 4.16). According to WHO (2006) guideline, drinking water should be free from any colors, odor and taste that would be offending to the customer.

Table 4.16: Frequency of respondents towards water quality

Households response	Number of Respondents	Percent
Yes, It is clean water	37	42
No, It isn't clean water	53	58
Total	**90**	**100.0**

Source: household survey 2012.

The other physical factor which affects the use of water within each household is the physical distances of housing units from the water point. For instance, public point or "Bono" water users walk average distance of 400m for a single trip. When it comes to distance to water points, as listed by United Nations and WHO, a household should get acceptable, abundant and safe drinking water supply minimally with in less than 200 meter radius which is in average less than 10 minutes' walk (www. wikipedia.org).

Water supply has welfare benefits, particularly when time and energy on water collection is reduced (Davis et al., 1993:9; IRC, 2003:2). Hence, a good source of water is one that can be collected with relatively short time and located within a reasonable distance (WB, 2002:98). In view of that, household respondents were asked to tell the distance between the water source and their home and the total time required to go to the source and back home. The findings are revealed in table 4.17.

Table 4.17: Distance from the Main Source

Category	No of Respondents	% of Total N
1m - 300m	41	45.6%
350m - 500m	16	17.8%
550m - 1000m	21	23.3%
>1km	12	13.3%
Total	**90**	**100.0%**

Source: household survey 2012.

As shown in the table 4.17, the large percentage 57(63.4 percent) of the respondents replied, their main drinking water source was located within 500 meters distance from their home. Of these, 41(45.6 percent) households reported that the main drinking water source was placed in less than 300 meters distance. The remaining 21(23.3 percent) and12(13.3 percent) households confirmed that their home is 550m to 1000m and above1km far from the main drinking water source in that order.

Table 4.18: Time required to the nearest source of water

Category	No of Respondents	Percent
0:30' - 1:30'hrs	43	47.8%
2:00 - 2:30hrs	39	43.3%
Above 3:00hrs	8	8.9%
Total	**90**	**100.0%**

Source: household survey 2012.

The survey result also revealed that, the total time taken to collect water in 82(91.1 percent) households was less than 2:30hrs, and 8(8.9 percent) of the respondents revealed that the total time taken from their house point to the main source of drinking water was above 3hrs. The FGD confirmed that the time required to the nearest public tanker increases when the queuing up time is added and it also varies from season to season.

Harar town's ladies when they start to complain about the time they spend for water collection they start by saying "...'Time is gold' but . . ." after mentioning this quotation they have so many things to say, "Time is water in Harar, Time is bronze, No time for ladies in Harar, ..." and so on. This is how they usually describe how precious their time is but simply lost in traveling and waiting in along queue to collect water. Box 1 is a speech of one lady in Kebele 16 complaining how the time she spends for collection of water affects her living condition.

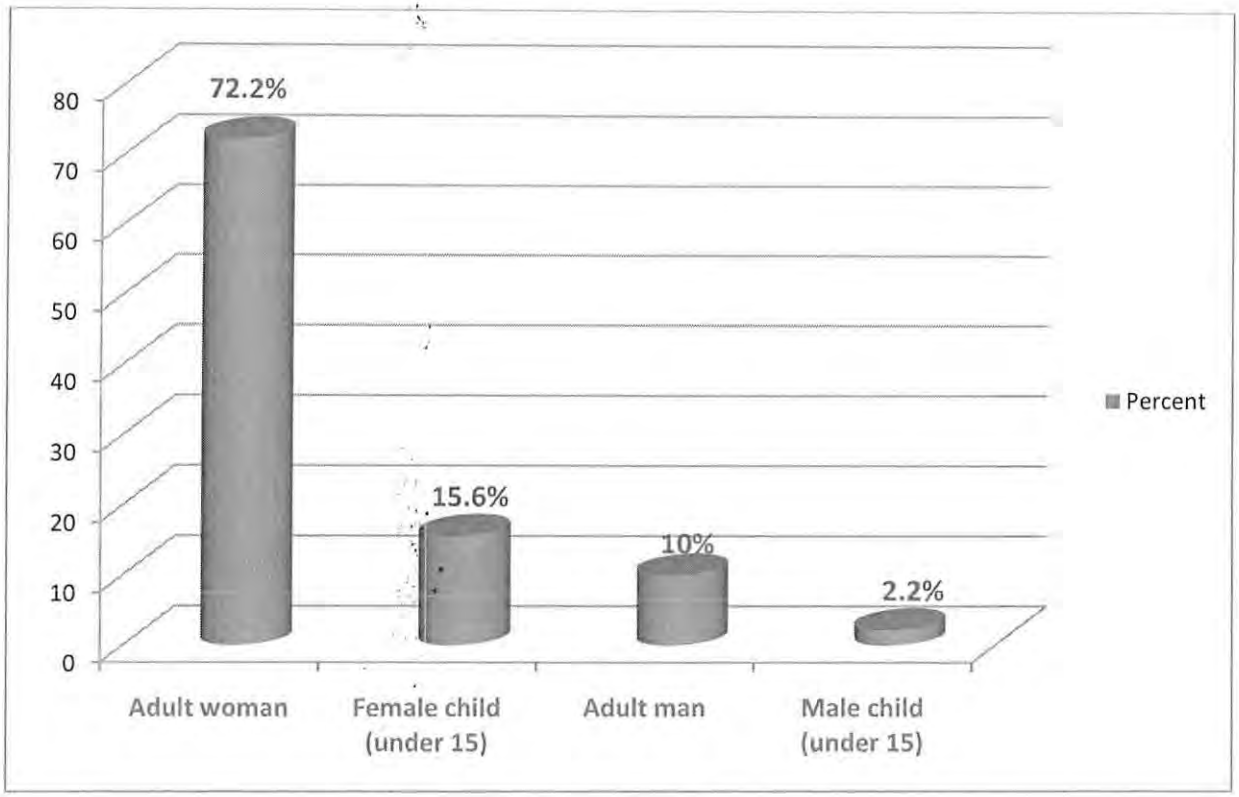
Women in the study area have so many responsibilities inside and outside. They spend their time for various productive purposes. Nevertheless, the absence of piped water supply added great burden by taking their time through fetching and absenteeism from school. Because they always bear the burden of fetching water, they miss out opportunities for productive activities or leisure time.

Box 1.

I don't have much time to fetch water because my family income mostly depends on the 'injera' I sell. My husband is a bricklayer. He leaves home early in the morning looking for a job. I have two children both below 5 years old. As you can see there is no water (she went to the tap to check if there was water, and there was not). In our village water arrives every 15 days. For the consecutive three and four days after the water arrives I don't have much problem because I store in all my household materials I have. However, if there is no water I can't do anything at all. If I go to fetch water I know I am going to spend the whole morning there. Under such circumstances I really get confused what to do and things get miserable because, if I do not go to fetch I can't bake 'injera' because there is no water and if I go, no one will be at home to sell even the baked 'injera', therefore; many customers go to another place. The time I spent in collecting water annoys me a lot. The worst thing is such a situation could happen three or four times in a single week especially in the next week (when there is no supply at all).

Source: Household survey 2012.

Figure 4.5: Responsibility to fetch water in Harar Town



Source: Household Survey 2012

As figure 4.5displays adult women and girls collect water in the majority of households. Among the total sample households 79(87.8 percent) of them reported that adult women and girls always take the responsibility to fetch water for the family.11(12.2 percent) of the respondents replied that adult man fetch water for the family. 65(72.2 percent) of households get their water supply only through the mother. For 14(15.6 percent) of sampled households' only girls fetch water for the family. Whereas among the total sampled households only 9(10 percent) and 2(2.2 percent) of the respondents reported that Adult man and boys fetch water for the family respectively. Absenteeism from school by girls is quite high as a result of the time spent for collecting water and it is also exposing them for incidences of rape. This indicates that in Harar the burden of collecting water is exclusively left for females. It can be recognized and assured that Harar's

context is similar to any developing countries that women and girls are the main collector of water. Box 2 is about a lady from Kebele 17 describing the challenges of Harar water supply in her village. The researcher got the lady in a long queue waiting for her turn to get water from public tanker.

Box 2.

I honestly don't know where to start. Here everything is challenging. In this village we have never seen tap water since1996 E.C. Thus, we entirely depend on vendors and public tankers. We look for water everywhere, every day. As you can see me I am pregnant. Do you think I have to be here today?

Of course I don't carry the full 'Jeri can' but I have to come here and get in the queue before it gets so long and a daily laborer will take it home. As you can see the queue is already so long. If I am lucky I will go back with water if not.... (She finished it with silence and sadness on her face).

Look at your time; it's going to be 11:00 am. I was here before 07:20 am but the truck has not come yet (truck that transport water to the public tanker) imagine all of us here have no idea when the truck is going to come. But we know it's coming today.

The problem is because the residents who use this tanker are many in number, after waiting all this time and the strong sunburn, some of the people you are watching here might go home without water and continue looking for water in other places.

Can you imagine there is nothing to eat at home I didn't cook anything. After the truck arrives I have to stay again sometimes till it becomes my turn. It is after I go back home that I'm going to cook. It's so boring.

Source: Household survey

Picture 4.2: *Long queues at public water tanker /Harar town/*

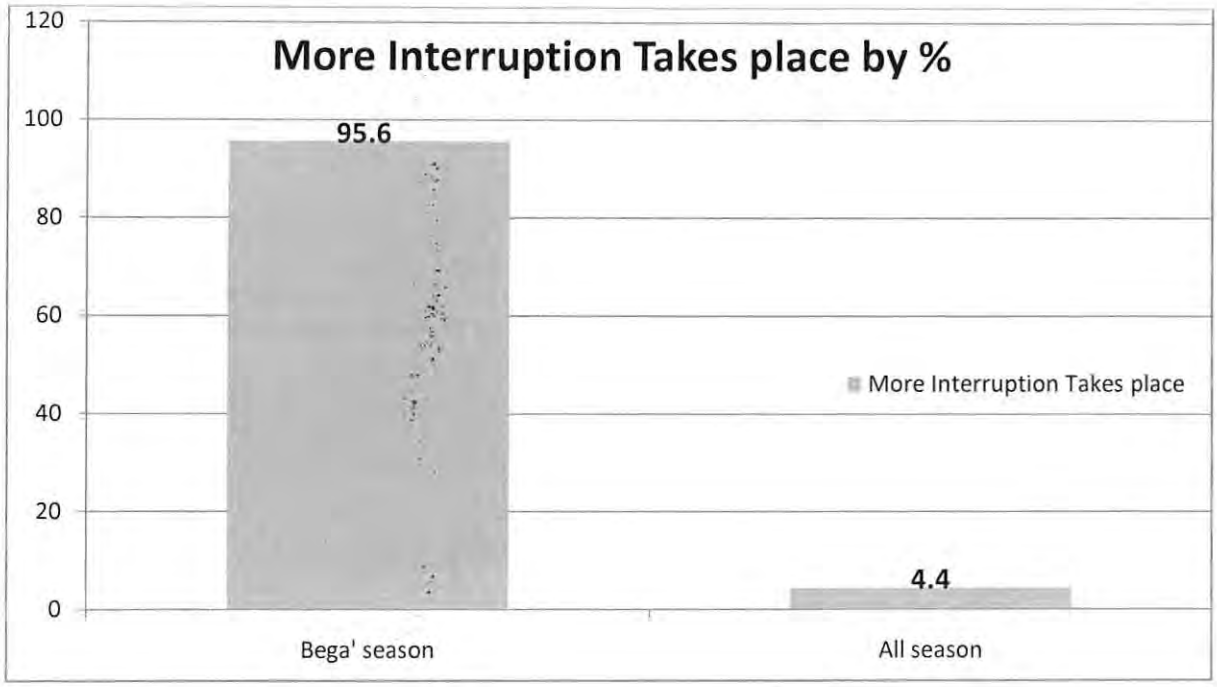
The rate of water consumption also depends on the pressure of the water system. One of the problems of water supply system in Harar town is inadequacy of pressure to satisfy the need of the people. Pumping distribution method needs energy to force the water from the main sources that is found in the lowland area to the Main Collection Tanker, MCT on the highland of Dengego and then to the consumers even though gravity system is there also. This incurred power cost. In addition to this, power failures mean complete interruption in the water supply system and then less consumption.

When such unexpected power cut or failure occurs and complete interruption is caused, the households face different challenges as mentioned in the preceding sections that in turn lead to low productivity, low income. Thus, it is important to think about the appropriate technology that is cost effective to solve such problems. For instance, in the long run using solar energy as the source of power will be more appropriate and cost-effective technology as well compared to

using diesel generators which require fuels and oils as its inputs that cost huge amount of money for HWSS office.

There are also other factors mentioned as reasons for water interruption in Harar town. These include: break down of pipes, official decision for both electric and diesel motors to take a rest per day, technical problems such as inability to fit the spare parts, lack of spare parts and skilled man power. These factors affect the amount of water supplied and then the amount of consumption. Unlike other resources we have no substitute for fresh water. Thus, to overcome such serious problem due consideration should be given to the conservation and assurance of supply. One more important way is conserving and recharging the natural ground aquifer by afforesting water catchments that can regulate flow of water as well as helps to reduce the transfer of sediment into the reservoir. Moreover, waste reduction and introducing reuse of wastewater for purposes such as gardening non-edible flowers, using for cleaning latrine and etc. through continuous education programme might help the conservation effort of water resources. The survey result also showed 86(95.6 percent) of informants responded the water supply interrupts during 'bega' season and 4(4.4 percent) responded interruption occurs in all season both 'kiremt' and 'bega' season (see figure 4.6).

Figure 4.6: Seasonal Variation in Water Supply Interruption



Source: Household Survey 2012

When such unexpected interruption takes place households encounter multi dimensional problems. In addition to the challenges mentioned in the preceding sections HHs are exposed to high cost of drinking soft drinks and mineral water, at schools students leave school specially Muslims since they cannot take bath after using the latrine. Of course, priority is given for Harar hospital through providing water by tanker-truck. Frequent Interruption of water supply has also direct impact on economic activities. For instance, interruption of water supply creates a problem on house construction in the Harar town. This seasonal variation in interruption of water supply implies the need for harvesting rain water during rainy seasons for dry seasons, when more interruption occurs. This might help to minimize the problem of shortage of water and its consequences during the dry season.

In order to establish the pipe lines, some households had to be displaced from their residence. This situation has created conflict between the project and the rural people living all the way between Harar and the source of the boreholes (Aselisso). In order to settle the problem the project has paid about 4 million birr for compensation which was 3 times greater from the expected cost (Discussion with Ato Abdul Hakim, IT Engineer, HWSSA).

4.5. Major Problem of Water Supply in Harar

Rapid growth of population: the steady growth of town's population due to natural increase and migration coupled with the expansion of the town imposed high burden upon the utility office of Harar town, HWSSA and it becomes difficult to accommodate the ever growing population. The problem is exacerbated by the failure to design optimum use of water for the town due to underestimation of population growth based on national population growth rate (3.0%) while the growth rate for Harar is beyond that growth rate.

Inadequate water supply: There are limited numbers of boreholes with limited potential yield. The supply decreases more during the dry season. In addition to this, there is frequent interruption of the supply due to problem of power to transfer water from one pumping station to another up to four stations vertically above from Dire Jara to the highest point in Dengego, which reduced the actual production to be less than the expected amount. There are no mechanisms developed to solve these challenges. Even the existing different sources of water are not synchronized to modern water supply; conserving or recharging natural ground aquifer such as afforesting water catchments areas that can regulate flow of water is not exercised. Moreover, curbing waste water and reusing for different purposes is not introduced to the community.

Unfair distribution of Water: The rate of meter connection and the spatial distribution of public stand pipes or water points do not meet the demands of the community. The distribution system covers mainly the central part of the town; and the area where different organizations are concentrated. Most parts of the peripheral built up areas of the town are currently beyond the reach of the pipelines.

Loss by leakage: In addition to the under capacity rate of production which lowers down the actual production of water supply, about 40% of water supply is still leaking at different level (Discussion with Ato Adil). Therefore, water loss has further reduced the amount of water supply that can reach the customers. This challenge is exacerbated by choice of inappropriate technologies that cannot meet appropriate standards. Measures to enhance sustainability of urban water supply schemes should emphasize on choice of technology and development of supply chains in relation to technology choices that makes access to durable spare parts and fittings easier and cost effective.

Limits to water consumption: Various physical and socio-economic factors limited water consumption by households in Harar town. To mention some of them: inadequate supply and poor quality, the physical distance of housing units from water point, unreliable distribution due to weak pressure and frequent interruption etc. Among these factors, which limit the amount of water consumption, interruption of water supply is a more serious problem. During unexpected water supply interruption households encounter multidimensional problems as mentioned in the preceding sections. The growth of the town in terms of population, household size and income has also its own influence upon the water consumption by households.

Unfair tariff and connection charges for the poor: the water tariff set by the Harar WSS office and the Board of Harar town water supply for private connection and its connection charges is unfair to the poor segments of the community. This is because of the fact that those who consume more volume of water pay low price due to the price set in this manner and also the high connection charges. This implies that the tariff subsidizes the urban rich, as they are the one that can afford and consume more than the poor and can also sell from their private meter for the poor at higher price than the price they paid for HWSS office.

Management problems: management problems caused by inefficient organizational structure, understaffing, low salaries and lack of staff motivation and inability of the WSS office to retain trained and experienced staff is the main constraint to service delivery (observed from KII).

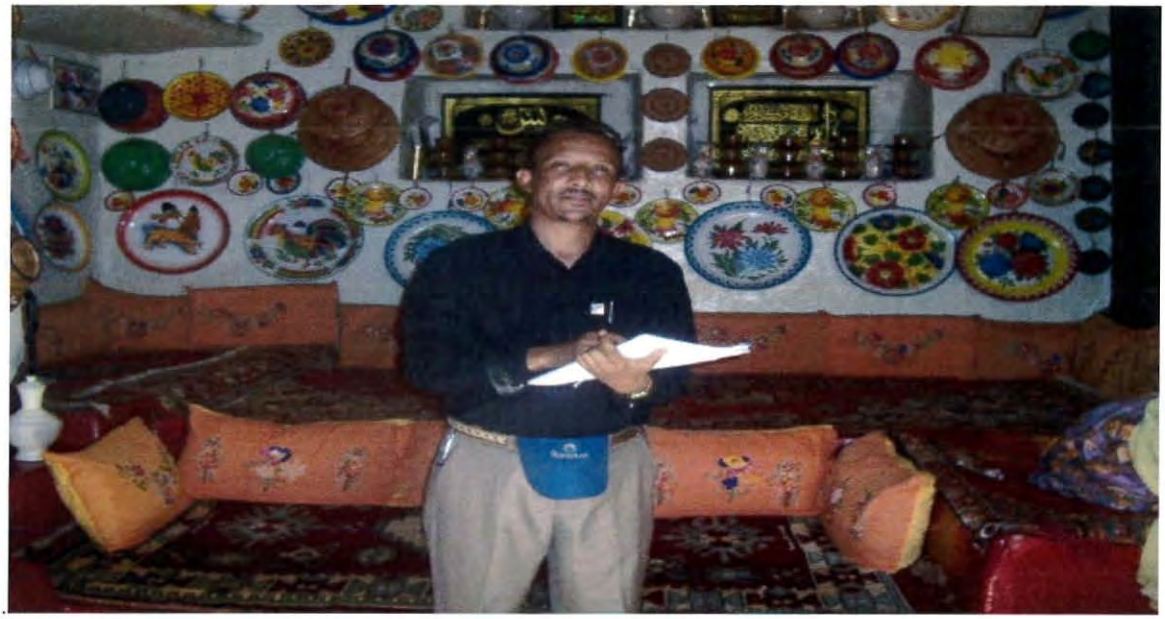
Lack of institutional coordination: major stakeholders, in Harar town water supply activities, have no coordinated linkages among the bureau and HWSS office except for technical support, implementing construction works of water which is its responsibility and in Board decision in which the regional president is the chairman. Different professionals are not incorporated in Board members to exploit their technical knowledge. The community is represented by the two-delegated members. Thus, the poor institutional coordination hampered the efforts to achieve HWSSA goals.

Limited budget /funds: Delivery of urban water supply requires a high level of investment. Lack of sufficient funding has limited the quantity and quality of water supply service of the HWSSA. Moreover, lack of effective cost recovery mechanism has inhabited the HWSSA from sustaining even the existing service and fulfilling its mandates.

Lack of capacity: Shortage of skilled manpower is the critical issue faced by the HWSS office. This constraint is also the most limiting factor in the fulfillment of its desired service provision. In addition to this, inadequate equipment facilities and other material resources further exacerbated the nature of the problem. The researcher observed through unstructured interviews with different respondents that more than two million birr has been lost due to defective materials.

Low community participation in decision making: Individuals and communities, the private sector and NGOs have very important roles to play in the implementation of WSS activities and in the achievement of water supply schemes. However, there is no participation of these important stakeholders in Harar town water supply service activities except the two community members participating during Board decision. HWSS office is the only mandated government body to supply water for Harar town inhabitants to satisfy their need. Thus, it is difficult for WSS office alone to meet the ever-growing demand of the population. Involving the community during planning, implementation and operation phases of the scheme and delegating those helps to create sense of ownership to ensure the sustainability of the water supply scheme. In addition to this, it is also important to establish water committee with membership of women and well developed reporting format and system to get feed-back on issues of water supply.

Picture 4:3 Focus Group Discussants in Harar Palace and Researcher's Follow up in Jegol.



Source: Field Observation, March, 2012

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The water supply of adequate quantity and acceptable quality is one of the basic needs of human beings, but the provision of potable water in Harar town has been inefficient and poor in quality. The situation is getting worse due to the population growth and spatial expansion of the town which outstripped its ability to supply sufficient water for inhabitants.

The existing sources of potable water for Harar has been underground water which reaches the customers through meter connection and public water points. However, since the source is only from underground water which is characterized by decreasing water table, especially during peak dry season, the amount of production is not adequate even for those who have access to it. The amount of production is also further reduced by less well working hour, limited number of boreholes and loss by leakage.

Moreover, the state of water supply in the town in terms of coverage both in spatial and population, reliability, accessibility, and sustainability is not at the required standard. The rate of meter connection is low and the distribution system is inefficient. The major constraints of distribution system identified are low density of pipelines network, limited number of public water points and their unfair distribution, low capacity of reservoirs and inadequate pressure in the pipe. As a result, water consumption is affected in the town due to these physical factors in addition to socio-economic factors such as population growth, household income and size that affected their water consumption.

The water tariff set in the town is also not fair and did not cover cost of the service to fulfill the principles of cost recovery. This is because of the fact that the price is not charged based on volume of water consumption. After certain limit of consumption the customers pay low price for higher volume of water consumption. Such price charging, subsidized the rich and favored water vendors. The majority of the victims of the problem are the poor as they cannot afford the connection charges.

Thus, it is observed that the water supply approach in the town is concentrated on traditional systems of service coverage, service pricing and mandated institutional arrangements for service delivery rather than identifying self-selection of the service type, consumers' willingness to pay, consumption based service charging and emerging partnerships with NGO, CBOs and private sector.

Because of these poor functioning of the existing water supply service most of the households in the town are willing to pay higher price for improved water supply service if government provides it. This prevalence of willingness to pay implies that there is further demand as well as the existing water supply service is not convenient for the customers so that they need better service at higher price. Thus, HWSS office could have generated sizable revenue if it could provide better water supply than the existing one.

Therefore, the problems of water supply in Harar town are multidimensional in terms of both efficiency and equity. Among the problems identified acute shortage of water supply, inequitable and inefficient distribution system, low coverage, unfair price and the resultant limited consumption are the major ones. These problems imposed different challenges on inhabitants

such as lose of time, energy and money; exposure to water borne and related diseases which penalizes the poor medical cost and pay high price for water vendors (additional cost).

The root causes of these problems and challenges are management problems: inefficient organizational structure, under staffing, lack of staff motivation; lack of institutional coordination; lack of sufficient funding and capacity and absence of community, private, CBOs, and NGOs participation in the implementation of WSS activities.

Thus, policy and planning on development of adequate, reliable, fair, sustainable and effective water supply should be established based on a better understanding of the existing impediments in water supply management and with the idea of improving water supply service and the interest of people and their willingness to pay.

5.2. Recommendations

Improving the existing water supply services in terms of quality, quantity, reliability and sustainability means; upgrading the socio-economic welfare of the people in the town. Thus, the following measures need to be taken to reverse the existing challenges:

Conduct detail study: conduct detail study on both underground and surface water and merge both sources to create potential source of water supply if financial and environmental conditions allow;

Demand oriented supply: design future water supply strategy based on demand orientation, i.e., self-selection of the service type by customers rather than past trends and population figures;

Demand management: manage the demand by controlling waste or loss from pipe leakage and consumption through the use of meters and tariffs that are set in accordance with volume of water consumption;

Community participation in decision making: involving the community and CBOs at all levels of water supply program and allow private sector involvement in different components of water supply service such as provision of pipes, meters, equipment, machines etc. In addition to this, NGOs should take part in the rehabilitation of already constructed projects to minimize financial burden of the mandated agency, HWSS office;

Mobilize resource: mobilize resources required to bridge the financial gap. This may include organizing donor's conference, meetings with individual donors and introducing water supply development program at meetings of the general public;

Short term credit: since the poor segments of the urban community cannot afford the cost of meter connection charges, pipes, meters and other necessary inputs should be provided on the basis of short term credit in the form of either individual or group lending to enable the poor people to afford the services;

Equitable distribution: water points and pipes ought to be evenly distributed in order to address the problem of the low income group. Moreover, installation of additional public water points would narrow down the gap between demand and supply taking into consideration the number of people, density and distance between water points;

Strengthen the institutional capacity: the institutional structure should be staffed with qualified personnel and equipped with required facilities;

Flexibility of rules and regulations: rules and regulations regarding staff salaries and benefits should be flexible realizing that required staff otherwise may not be available;

Creating conducive environment: It would be advisable if the government takes necessary steps to create conditions conducive for participation of the private sector in program implementation activities.

Conserving water resources: Water resources should be conserved and recharged by the natural aquifer covering the water catchments with forests that can regulate water flow and minimize reduction of water table.

Water recycling: this refers to waste curbing and reuse of waste water for purposes such as gardening non-edible flowers, cleaning latrine and etc.

Rainwater harvesting: rainwater harvesting gather water during rainy season for the sake of solving shortage of water during peak dry season would help harness the prevailing challenges. However, technical support should be given for the community how to harvest and use it.

Synchronization of water sources: water sources can be used for different purposes. Potable water can be used for drinking and cooking purpose while other sources such as traditional hand-dug well, river, spring and rain water can be used for clothes washing, animal watering, floor washing and bathing etc. In addition to this, by chlorinating, boiling and filtering those other sources they can also be used for drinking and cooking functions/ purposes and this can mitigate the shortage of potable water supply.

Using water reservoirs: containers are the guarantee for frequent interruption of water supply. They solve the problem of complete absence of water supply by storing water. Therefore, it is important to agitate the community to have containers to overcome absence of water supply especially during peak dry season.

Employing appropriate technology: appropriate technology that can meet appropriate standards and can have adequate spare parts and fittings should be applied. Even in the long term the use of solar energy rather than diesel generators would be appreciated. This can minimize the rate of interruption. Moreover, advantage of using pit latrines rather than modern toilet facilities should be given due consideration as they do not need water after defection and can save water consumption. But they should be spaced at reasonable distance from water sources.

Controlling squatter settlements: illegal spatial expansion of the town across the municipal boundary of the town makes the extension of pipelines and then distribution of water points

difficult and leave out the firing/ peripheral areas out of the reach of potable water. Therefore, rules and regulations ought to be set to control such illegal settlements around the town.

Application of cost recovery principles that can afford the poor: On the whole, relative level of access to potable water in urban areas is estimated to be high. However, the poor lack access. The challenge is the existing paradox between charging high tariff to cover full cost and fairness of the poor. In other words, high tariff means high revenue but unfairness for the poor. Thus, the solution might be setting "social tariff" that leads to charge the poor less by assuming revenue from the rich can cross subsidize water supply. In addition to this, both poor and rich communities should select the type of service in accordance with their income status and the price should be charged based on the volume of their water consumption which can ensure efficient use and sustainability of water supply.

Ensuring the principles of optimal use of water: The available water should be equitably distributed to the community to ensure equity of access. This equitable distribution of water to the community not only ensures efficient use of water but also leads to consumption of water from homogenous sources and maintains sustainability of the source thereby curtailing its depletion.

Finally, I recommend that the various industries in the town, especially Harar beer factory, are using enormous amount of water compared to the domestic consumption. Therefore, they have to consider on how to treat and reuse their own waste water, because it highly minimizes the shortage of domestic water supply in the town.

References

AkliluGetnet(2009). Factors that affect sustainability of rural water supply schemes in Basso Libenworeda, M.A. Thesis, A.A.U.

AssefaDelisho(2006).Urban Water Supply: Urban water supply, the case of Assosa Town: AddisAbaba, Ethiopia.

Admassu, Mengesha, AberaKumie, MisganawFantahun (2002) Sustainability of Drinking Water Supply Projects in Rural of North Gondar, Ethiopia, *Ethiopian J.Health Dev.* 2003; (3):221-229.

Binder D. (2008). Sustainability of Water Service Delivery in Rural Environment: Past Approaches and the Way Forward February 2008.

BIK Engineering PLC (2003): Urban Water Supply Tariff and asset Valuation Manual, BG and Gambella Regional States, Addis Ababa.

Briscoe, J and de Ferranti, D (1988).Water for Rural Communities: Helping People Helpsthem selves. Washington D.C: The World Bank.

Cain Nicholas (2005).Challenges to clean water worldwide. Retrieved November 20, 2006, fromhttp://www.geotimes.org/may05/feature_worldwater.html

CSA (Central Statistical Agency) (2008). Summary and Statistical Report of the 2007 Population and Housing Census: Population Size by Age and Sex

Davis J., Garry G. and Wood, M. (1993). Developing and Managing Community Water Supply.UK: Oxfam Publications.

DessalegnRahmato (1999). Water Resources Development in Ethiopia: Issue of Sustainability and Participation, Forum for Social Studies (FSS), Addis Ababa, Ethiopia.

Emnet (2006).Coping Urban Water Shortage: M.Sc. Thesis, A.A.U.

Gebrehiwot M. (2006). An Assessment of Challenges of Sustainable Rural Water Supply: The Case of OflaWoreda in TigrayRegion.Msc Thesis, Regional and Local Development Study (RLDS). A.A.U. Ethiopia.

Global Environment Outlook (GEO-2000).online version| UNEP/GRID Arendal-publication

Gleick P. (2006). The World's Water 2006-2007. The Biennial Report on Freshwater Resources.Island Press, Washington, D.C.

HWSS (2002).Harar water supply and sanitation: Harari WSS Regional monthly magazine.

Informer(2010): Quarterly published bulletin by The Research and Graduate program of AAU

Lyer, P., Davis, J., Yavuz, E. & Evans, B. (2002). Rural Water Supply, Sanitation and Hygiene: A Review of 25 Years of World Bank Lending(1978–2003): Water Supply & Sanitation Working Notes, World Bank.

Mani Devyani ed. (2000).Investigating a Demand Orientation in Water andSanitation Delivery, an Annual Journal of United Nations Center for Regional Development, Nagoya, Japan.

Muthusi F.M., Mahamud G., Abdalle A., Gadain H.M. (2007).Rural Water Supply Assessment,Technical Report No-08, FAO-SWALIM, Nairobi, Kenya.

MoWR. (2004). Water Sector Development program Report. Addis Ababa.

Ministry of Water Resources (MoWR) (2002). Water Sector Development Prgoramme 2002-2016, Water Supply and Sanitation Programme, 2002.

Ministry of Water Resources (MWR) (2002). Water Supply and Sanitation Inputs for Ethiopia Full PRSP, Water and Sanitation program, Background Report for the MWR, Sector Financing Working papers, No 2.

NiyiGbadegesin& Felix Olorunfemi(2007). Assessment of Rural Water Supply Management in Selected Rural Areas of Oyo State, Nigeria. ATPS Working PaperSeries No. 49 (African Technology Policy Studies)

OED (2003).Internal Guidelines and Criteria for OED Project Evaluations. June. Washington, DC: OED

Sara and Katz (1997). Making Rural Water Supply Sustainable: Report on the Impact of Project Rules, by Jennifer Sara & Travis Katz, UNDP World Bank Water and Sanitation Program, 1997

TadeleMugoro (2008). Challenges for Sustainability of Water supply Services in Rural Area: The case of Alaba Special Wereda, SNNPR, Addis Ababa, Ethiopia

USAID (2009). Environmental guidelines for small-scale activities in Africa: Chapter 16 waterand sanitation.

United Nations Environment Programme (UNEP) (2000).Tackling the global water crisis. Retrieved August 10, 2006 from http://www.grida.no/geo2000/pressrel/water.htm

WASH (2005). Financing water, sanitation and hygiene in Ethiopia: Making every drop count Water, Sanitation and Hygiene for all (WASH), Tearfund 2005

WaterSense, Water supply and use in the United States. Retrieved 22 May 2006 from(http://www.epa.gov/docs/owmitnet/water-efficiency/pubs/supply.htm)

Water Corporation(2008).Water Forever, Sustainability assessment.pdf.

Water Aid (2011).Sustainability Framework fromhttp://www.wateraid.org/documents/sustainability_framwork_2011_final pdf.

World Health Organisation (WHO), (1992).Freshwater. Retrieved September 5, 2006

fromhttp://www.unep.org/geo2000/english/0067.htm

WHO & UNICEF (2000). "Global Water Supply and Sanitation Assessment 2000 Report" World Health Organization and United Nations Children's Fund, 2000

Water Utility Partnership (WUP), Africa, (2003).Better water and sanitation for theurban poor. Retrieved May 22 200 from http://www.wupafrica.org/toolkit/resources/pdf- files/

Water Aid (2002).Guidebook to Global water issues. Retrieved October 19, 2006 fromhttp://www.itt.com/waterbook/mega_cities.asp

www.wikipedia.org

Yimer Mohamed (1992). Factors Affecting Household Water Supply and Consumption in Nazareth, Addis Ababa.

ZelalemGetachew (2005). Determinants of Sustainable Rural Water Supply

System in Ethiopia. A Case of Two Rural Water Supply Systems Amuye Serra and HabruSeffu Schemes , MA. Thesis, A.A.U.

ZemenuAwoke(2012). Assessment of Challenges of Sustainable Water Supply: Quarit Wereda, Amhara Region

_____ (2008).the consequences of shortage of safe water supply on the socio- economic aspects of households in Harar town.

_____(2003). Harar, Water supply and Sanitation Project(unpublished doc.)

APPENDICES:

QUESTIONNAIRE WILL BE COMPLETED BY THE HOUSEHOLDS

ALL ANSWERS WILL BE KEPT CONFIDENTIAL

A.GENERAL BACKGROUND

1. Kebele name _____
2. Sexes _____
3. Ages _____
4. What is your current marital: - a) Single b) Divorced c) Married d) Widowed
5. Religion? a) Muslim b) Orthodox Christianc) Protestant d) Catholic e) Others, specify _____
6. House ownership: - a) Private b) Government c) Rent d) Other _____
7. Income source of the family: a) Business/Peaty trade b) Government employeec) Daily labor or retired d) Farming e) If others specify _____.
8. Education Level
   a) Unable to read and write (illiterate) b) Some Primary school (1-8 Grade)
   c) 12 Grade completed. d) Above 12
9. Number of family member's_____.
10. Which two social services you need most provided with? (Health, Education, Water, Road, Electricity, Telephone, etc.)1st_____ 2nd_____

B. STATUS OF THE EXISTING WATER SUPPLY SOURCES

Issues related with water source, consumption, quantity and current status.

1. What is the main source of drinking water for your household?

Sources	Wet season(*Kiremt)*	Dry season(*Bega)*
Rainwater harvesting		
Water vendor		
Water well		
Tanker (public stand pipe)		
Other (specify)		

2. Time required to the nearest alternatives source of water (_____ minutes; _____ hours).
3. How much distance to your house from the main source?
   a) In meters _____
   b) In kilometers_____
4. From Qn. No.1.Which one is your secondary source of water for drinking at this time?
   _____

5.For what domestic purpose do your family used water from the main and alternative sources?

a) Drinking
b) Cooking
c) Washing Cloths
d) Bathing

If others specify_____

6. What is the main source of water used by your household for other purposes, such as cooking and washing?
   a) Public tap/standpipe
   b) Tube well/borehole
   c) Protected dug well/Unprotected dug well
   d) Cart with small tank/drum
   e) Tanker-truck
   f) Surface water (river, dam, lake, pond, stream, canal, irrigation channels)
   g) Other (specify)
7. Who usually goes to this source to fetch the water for your household?
   Probe: Is this person under age 15 years? What sex? Circle the code that best describes this person:-
   a) Adult woman
   b) Adult man
   c) Female child(under 15)
   d) Male (under 15)
8. Do you treat your water in any way to make it safer to drink?
   a) Yes b) No c)D/k
9. What do you usually do to the water to make it safer to drink?
   a) Boil
   b) Add bleach/chlorine
   c) Strain it through a cloth
   d) Use a water filter (ceramic, sand, composite, etc.)
   e) Solar disinfection
   f) Let it stand and settle
   g) Other (specify)
   h) D/K
10. The water born disease from the main or alternative sources:
    a) Affected my households
    b) Not affected my households
11. What container do you use to fetch water mainly? _____
12. What is the queuing up time at the water point? (Min_____,Max_____)
13. What kind of toilet facility do members of your household usually use?
    a) Flush / pour flush toilet
    b) Pit latrine
    c) Use group (public) toilets

d) No facility / bush / field/ river courses

14. What type of connection usually uses for water supply for your HHs?
    a) Private meter connection
    b) Shared (public) meter connection
    c) Without PMC
15. Do you know the total amount of water used in your house? Please indicate units of measurement (_____liters per day, liters per week).
16. On average how frequently do you receive piped water?
    a) Once a day
    b) Twice a day
    c) Once a week
    d) Daily
    e) Continuous
    e) Twice aweek

Others

Describe.....

.....

17. Is this water good for drinking(clean)?
    a) Yes
    b) No
18. If NO, please state why?
    a) Chemically unfit
    b) Turbidity
    c) Salinity
    d) Carries insects
19. Who is responsible for providing water in your town?
    a) GOs
    b) CBO/NGO
    c) Private operator
    d) Doesn't know
20. The satisfaction level of the existing water supply services (systems) of the town:
    a. Very satisfactory
    b. Satisfactory
    c. Unsatisfactory
21. What is the efficiency of water supply water supply management services of the town
    a. Good b. Medium c. Low d. Poor
22. How the equity of water supply management service looks like ?
    a. Equal b. Unequal c. Fair
23. Is water equally distributed over the whole town? a. Yes b. No
24. If 'no' why? Give your reason _____.
25. Are there leakages at different level? a.Yes b. No
26. If 'Yes'what are the reasons?
    a. Lack of maintenance and Operation b. System distribution failure

27. Is priority given to hospitals or schools or others, specify it _____.
28. More interruption takes place in: - a) *'Bega'* *b)' Kiremt'* season.
29. Comment on additional expenses for water: _____ Birr /month.
30. What are your comments for achieving sustainability of water services in your town?

WATER TARIFF SETTING:

1. Do you pay for water?
   a) Yes b) No
2. If YES, how are you billed for water charges?
   a) By flat rate charge b) Based on meter reading
3. If NO,

why?.....
.....

4. The existing water price of Harar town is:
   a) Fair
   b) Unfair
5. Are you willing to pay for improved water supply?
   a) Yes b) No
6. If YES, WTP values per *'Jeri can'* _____Birr.

CHECK LIST FOR FGD

ALL ANSWERS WILL BE KEPT CONFIDENTIAL

1. What is your main source of water supply?
2. How much in time/ far is the main source from your residence? (in time and distance)
3. What is the alternative source? When do you use the alternative source?
4. For what purposes do you use the water from the main source and alternatives?
5. What are the major challenges of sustainable water supply system of the town?
6. If the scheme gets dry during some period in a year, when does it dry (which months)? If the scheme provides low quantity of water, what do you think the reason to be for the low quantity of water supplied by the scheme?
7. What do you suggest about water supply management in your town?
8. Comment on possible solutions to address water supply problem at hand?

KEY INFORMANT INTERVIEW (KII)

ISSUES (POINTS) WILL BEDISCUSSED WITH WATER EXPERTS.

ALL ANSWERS WILL BE KEPT CONFIDENTIAL

1. How is the technical capacity of HWSSA to manage the system? Regarding training.
2. How much is the water use tariff? Who was set? Did it take in to account the different socio-economic conditions of the society (users)?
3. How do you explain the functionality of the systems in the town developed?
4. How do you see the schemes capacity/ability to meet the water demand of its user community?
5. Have your organization followed demand driven approach?
6. Are there any complaints by the user community on the quality of the water delivered?
7. What is the trend of demand over supply of water in the town?
8. Do you think water is fairly distributed over the town?
9. How do you see water supply management of the town?
10. What are the major solutions that can be raised to overcome the challenges of water supply system?

KEY INFORMANT INTERVIEW (KII)

ISSUES (POINTS) WILL BE

DISCUSSED WITH KEBELE WORKERS.

1. Are there any complaints by the user community on the quality of the water delivered?
2. What are the major challenges of sustainable water supply system of the town?
3. If the scheme gets dry during some period in a year, when does it dry (which months)? If the scheme provides low quantity of water, what do you think the reason to be for the low quantity of water supplied by the scheme?
4. How do you see water supply management of the town?
5. What are the major solutions that can be raised to overcome the challenges of water supply system?
6. What do you recommend for sustainable use of the water supply scheme?

KEY INFORMANT INTERVIEW (KII)

ISSUES (POINTS) DISCUSSED WITH NGOS.

1. Are there any basic functionality differences in schemes developed by the GO and NGOs? *If yes, why?*
2. Do you have rules and regulation for the town to govern andmanage the water supply system?
3. Have your organization followed demand driven approach?
4. What problems do you see in the processes of implementing water supplysystems?
5. What are the major problems faced during management of water supplyservices?
6. What are the major solutions that can be raised to overcome the challenges of water supply system?
7. What do you recommend for sustainable use of the water supply scheme?
8. Do you have special criteria for tariff setting? If so, explain it.
9. Do you give training for the community members about water use and willingnessto pay

DECLARATION

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

Declared by Asnake Zemenay Signature

Approved by (advisor) Mulugeta Fesha Signature