



ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF PUBLIC ADMINISTRATION AND DEVELOPMENT

MANAGEMENT

**THE CAUSES AND IMPACTS OF URBAN WATER SCARCITY ON HOUSEHOLDS:
THE CASE STUDY OF BURAYYU TOWN ADMINISTRATION**

BY: KUMESSA GEBRE

NOVEMBER, 2016

ADDIS ABABA, ETHIOPIA

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**A THESIS SUBMITTED TO THE COLLEGE OF BUSINESS AND ECONOMICS,
ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE DEGREE OF MASTERS OF ARTS IN PUBLIC MANAGEMENT AND
POLICY SPECIALIZATION IN DEVELOPMENT MANAGEMENT**

**NOVEMBER, 2016
ADDIS ABABA, ETHIOPIA**

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MANAGEMENT**

This is to certify that the thesis prepared by Kumessa Gebre Regasa entitled, “**Causes and Impacts of Water Scarcity on Households: the Case of Burayyu Town Administration**”, which is submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Public Management and Policy (MPMP) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Approved By Board of Examiner

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DECLARATION

I, Kumessa Gebre, have been a student of Master of Public Management and Policy in the Department of Public Administration and Development Management, College of Business and Economics (CBE), Addis Ababa University (AAU), Addis Ababa since September, 2014.

I hereby declare that the thesis entitled, **“The Causes and Impacts of Water Scarcity: The Case of Burayyu Town Administration”**, for the Master Degree of this university, is my own piece of original research work.

This thesis is submitted for the Master of Arts (MA) in Public Management and Policy, under the direct supervision and guidance of my advisor Dr.Jemal Abbagisa. I also assert that this thesis has not been submitted earlier for the award of any other degree or diploma anywhere else.

Candidate’s name: Kumessa Gebre Regasa

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Date: October, 2016

Acknowledgement

Above all, I would like to thank God for giving me strength and patience until I complete this research.

Next to God, I would like to give my deepest gratitude to my advisor Dr.Jemal Abbagisa for his advice, encouragement, collaboration and constructive comments from the beginning to the end of this paper.

My special thanks go to my wife Mesay Gudisa who encourages me for the beginning and completion of this master program.

I would also like to thank all the staff of Burayyu Town Municipality, BTWSS and Burayyu Town Health Center for their effort and cooperation in providing relevant data for this research.

LISTS OF ACRONYMS

AU	Africa Union
BTWSS	Burayyu Town Water and Sewerage Service
CBOs	Community Based Organizations
OCED	Organization for Cooperation and Economic Development
EEPCO	Ethiopian Electrical Power Corporation
HPA	Health Protection Agency
L/pd	Litre per Day
M ³	Meter Cube
MDGs	Millennium Development Goals
MoFED	Ministry of Finance and Economic Development
MoWR	Ministry of Water Resources
NGOS	Non Governmental Organization
ODA	Oromia Development Association
Proc. No	Proclamation Number
SEI	Stockholm Environmental Institute
SIWI	Stockholm International Water Institute
UK	United Kingdom
UN	United Nations
UNDESA	United Nation Department of Economic and Social Affairs
UNDP	United Nation Development Program

UNESCO	United Nation Economic, Social and Cultural Organization
UNWWDR	United Nation World Water Development Report
US	United States
USA	United State of Africa
WASH	Water, Sanitation and Hygiene
WSP	Water and Sanitation Program
WSS	Water and Sewerage Service
WHO	World Health Organization
WWC	World Water Council
WWF	World Water Fund

ABSTRACT

The objective of this research is assessing the causes and impacts of water scarcity on households: the case study of Burayyu Town Administration

The major determinants of water accessibility are distance, time and quantity of an individual consumes per a day. The paper analyzes households` water use through random sampling of the total of 19,546 household's and asked 120 households using structured questionnaire. SPSS software has been used for data analysis. The major indicators of water scarcity are the Falkenmark indicator, the social water index, and the basic human water requirement. The survey result shows that more than half of the households suffer from water scarcity. The sampled households' have the amount of water consumption in per individual were 10 liters per day. Amount of water demand liter per day exceeds supply in the study. Water is considered to be accessible if an individual consumes 1700m³ per year according Falkenmark indicator. The individual in the town receives 9m³per annum which is absolute scarcity. The causes of water scarcity are fast urbanization and population growth, lack of capacity, and inadequate finance. The impacts of the water scarcity have brought on households are the economic and health impacts.

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CHAPTER ONE

Introduction

1.1 Background of the Study

The human uses of water include domestic, agricultural and industrial uses the amount of each varies depending on minimum needs, water availability, economic development and urbanization (UNWWDR, 2015).

In developing regions, people use far less water per capita for personal use than in developed regions. In Africa annual per capita water withdrawals for personal use is only 47 litres of water per day and in Asia, 85 litres per day. In contrast, comparable water use in the UK is estimated at 334 l/pd and in the USA, 578-700 l/pd. As to be expected, around the world freshwater demand per capita is rising as countries develop economically. These increasing withdrawals of water are reflected in all 3 major categories of use: rising industrial demand, rising domestic demand and increasing reliance on irrigation to produce food (UNWWDR, 2015).

Despite the rising of these demands, there are challenges related to access of water. These water challenges or water scarcity can be measured in quantity, quality and equity. The quantity refers to demands for freshwater exceed the naturally occurring, renewable supplies, quality refers to much of the limited water is being polluted from growing volumes of human, industrial and agricultural waste, and Equity refers to the same water is desired simultaneously by different sectors within a single society or nation or by different countries wherever it flows through an international border (Lalзад, 2007).

Ethiopia like any other developing countries has many constraints to make potable water easily accessible. To improve access to safe clean water, the government of Ethiopia has prepared a water and sanitation policy document as an integral part of the country's water management policy. MoWR (1999) clearly indicates the right of every Ethiopian to get access to adequate and quality water to satisfy their basic needs in order to achieve rapid socio economic development through better health care and productivity.

The situation in Burayyu town is not exceptional and this study will deal with the causes and impacts of this water scarcity.

1.2 Statement of the Problem

There is a problem of water supply in developing countries in general and Ethiopia in particular. There is a great discrepancy between developed and developing countries on amount of water an individual receives per annum. The Falkenmark indicator of water scarcity puts 1700m³ of water as a standard to qualify the adequacy of amount of water an individual must receive annually.

The individual persons used 10 litres per day. The populations of Burayyu town have a problem of clean water supply. The majority of the populations have a problem of water scarcity (Burayyu Town Socio-Economic Profile, 2015). In the town, the average days the water flow per month is two days per a month.

In the town, the population accessed to water supply is inadequate. Thus, assessing the causes and impacts of water scarcity on households in the town is in the question form. What are the causes of water scarcity in Burayyu town? How much the water supply in town's effective? What are the consequences of inadequate urban water supply in the town? What are some possible solutions to address the problems of water supply of the city?

These questions are the core problems of the study areas how to investigate access to potable water. Therefore, this study is designed to examine the causes and impacts of water scarcity on households in the town.

1.3 Objectives of the Study

In order to assess the challenges of water supply in Burayyu town, the researcher has the following general and specific objectives. Both objectives are discussed separately as given below:

1.3.1. General Objective

Despite its rapid growth, the households of Burayyu town do not receive regular flow of piped water. Therefore, the general objective of this study is to assess the causes and impacts of water scarcity in the town.

1.3.2. Specific Objectives

The specific objectives of this study include the following:

1. To identify causes of water scarcity in the Burayyu town.
2. To assess the institutional performance of Water and Sewerage Service of the town.
3. To evaluate the consequences of inadequate urban water supply in the town.
4. To suggest some solutions for addressing the problems of water supply of the city.

1.4 Research Questions

In order to achieve the above mentioned research objectives and seek answers for the stated research questions the following major research questions were designed:

1. What are the causes of water scarcity in Burayyu town?
2. How much the water supply in town's effective?
3. What are the consequences of inadequate urban water supply in the town?
4. What are some possible solutions to address the problems of water supply of the city?

1.5 Significance of the Study

Since the research focuses on assessing the challenges of sustainable water supply in Burayyu town, it is expected to increase the knowledge and up to date information on urban water supply systems and its adverse impacts on the urban population.

It will also serve as an information source for policy makers in the water sector, the community and environmental advocates.

1.6 Scope of the Study

Burayyu town has many problems such as water, housing, transportation, telecommunication, power, and others. Of these town problems, the research deals with the water problem of the town because water is basic and its scarcity affects other problems. There are many human uses of water such as water use for agriculture, industry and services. However, this paper deals with the water scarcity of the town at domestic level. This selection of the water problems even at

problem of domestic water use is due to a difficulty of covering all the problems at once due to time and capacity limitations. The town was selected because of its fast growing nature and there were no research so far conducted on water supply in the area. Further, since I am living in the area of the study, I have personally experienced many water supply challenges in the town. The research focuses on water supply of the town from 2010-2015.

1.7 Organization of the Thesis

This paper is organized as follows:

Chapter one deals with introduction, background of the study, statement of the problem, significance of the study, scope of the study, objectives of the study , research questions and limitation of the study.

Chapter two deals with literature review which deals with the sources of water, measurements of water accessibility, causes of water scarcity, institutional performance in urban water supply, impacts of the scarcity of water and solutions for addressing the problems of urban water supply.

Chapter three focuses on methodology which includes research design, data source, data collection instruments and tools, and data analysis (data interpretation).

Chapter four deals with assessing the causes and impacts of water scarcity in the Burayyu town. Chapter five which is the final chapter of the thesis deals with conclusions and recommendations.

1.8 Limitation of the Study

It was very difficult to make interviews with some officials as they made appointment repeatedly to give information and not available on the appointment dates.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Uses of Water

The human being uses water for domestic, agricultural and industrial uses. The amount of water used in a country depends on minimum needs, water availability, economic development and urbanization (UNWWDR, 2015).

On a worldwide basis, the amount of water for domestic use which includes drinking, cooking and sanitation are small compared with other uses because it only accounts for 10% where agriculture and industry account for about 70% and 20% respectively. As stated above, the amount of water needed varies depending upon economic development. In Africa, an estimated 88% of all freshwater use is for agriculture, 7% for domestic purposes and 5% for industry. In Asia, an estimated 86% water for agriculture while industry accounts for 8% and domestic use, 6%. In Europe, most water use is for industry, at 54%, while agriculture accounts for 33% and domestic use, 13% (UNWWDR, 2015).

The amount of water for domestic (personal) use also varies depending upon a country's level of economic development. In developing regions, people use far less water per capita for personal use than in developed regions. In Africa annual per capita water withdrawals for personal use is only 47 litres of water per day and in Asia, 85 litres per day. In contrast, comparable water use in the UK is estimated at 334 l/pd and in the USA, 578-700 l/pd. As to be expected, around the world freshwater demand per capita is rising as countries develop economically. These increasing withdrawals of water are reflected in all 3 major categories of use: rising industrial demand, rising domestic demand and increasing reliance on irrigation to produce food (UNWWDR, 2015).

The amount of water use also indicates the extent of urbanization in a country. Low levels of water use in several developing countries indicate difficulty in obtaining freshwater, partly because piped water systems are uncommon in rural areas. Two-thirds of the world's populations in developing countries get their water from public standpipes, community wells, rivers and

lakes or rainfall collected off roofs. So, water use significantly increases with development and urbanization (UNWWDR, 2015).

Ethiopia like other low income African countries uses greatest percentage of water for agriculture because agriculture (including livestock) is the main source of livelihood and income generation for the majority of Ethiopians today. Then it uses water for domestic and industrial purposes (Hendrix, 2012).

2.2 Sources of Urban Water

The sources of urban water supply can be surface, ground and rain water (Sijbemsa, 1989). Surface water includes rivers, lakes, tanks, streams, oceans, artificial reservoirs and sea water. A water from a dam can be one form of surface water due to a dam is built and a reservoir is formed, water inside the reservoir is ready to be pumped to the water treatment plant for treatment, followed by distribution or storage in service reservoirs (UN-HABITAT, 2003).

The quantity and quality of surface water depend upon the conditions of the surface or catchment area over which it flows. It is the main source of water supply in many areas. Surface water is prone to contamination from animal and human sources. As such it is not safe for human consumption unless subjected to sanitary protection and purification before use (Sijbemsa, 1989).

Rain water refers to rain is that collected from surfaces (by roof or ground catchment) and stored in a container, ponds, tank or cistern until used. This water is the purest water in nature yet it tends to become impure as it passes through the atmosphere. It picks up suspended impurities from the atmosphere such as dust, soot and microorganisms and gases such as carbon dioxide, nitrogen and ammonia. In regions where rainfall is abundant and frequent, rainwater can be a good source of water supply for individual families and for small communities. The storage of rainwater is particularly important in areas with a long dry season (Sijbemsa, 1989).

Ground water is portion of the total precipitation which has percolated downward into the porous space in the soil and rock where it remains, or from which it finds its way out to the surface. It is water used by humans comes mainly from land such as wells, springs, etc. It tends to be of higher microbiological quality having undergone natural soil filtration. However, it is relatively

difficult to extract. Compared to other water sources more technology and energy is needed to bring water from within the earth up to the surface (Sijbemsa, 1989).

A hand-dug well can be one source of water which is one of the traditional methods for water supply system in rural areas of the developing countries, and still most common. These dug wells are made by hands, therefore, there is some restriction in some circumstances, for instances, certain types of ground, such as clays, sands, gravels and mixed soils where only small boulders come across (Water Aid, 2011).

According to UN-Habitat (2006) water service provision options are public tap, private tap and domestic resellers.

Stand pipes/public tap; It is a public water point from which people can collect water. Many low income households that are unable to afford a household connection are relying on public water points.

Private tap; It is a water service pipe connected with house plumbing to one or more taps.

Domestic resellers; It is when households with a private tap water are selling water to their neighbors.

2.3 .WHO Measurements of Water Accessibility

There is no one internationally recognized standard to measure water accessibility. According to UN-HABITAT (2003) access to safe water is the share of the population with reasonable access to an adequate amount of safe water. In urban areas the water source may be a public fountain or a stand pipe not more than 200 meters away from households and the adequate amount of water which is needed to satisfy metabolic, hygienic and domestic requirements usually about 20 litres of safe water per person per day. This minimum quantity however vary depending on whether it's an urban or rural location and whether warm or hot climate.

In using distance as indicator of water accessibility, the criteria is measuring the proportion of population with access to adequate amount of safe drinking water located within a convenient distance from the user's dwelling. The distance parameters are different for rural and urban

areas. For rural areas, it is obtaining water within 1- 1.5km whereas access to water is obtaining water within 200meters in urban areas (WHO, 2004 and WHO/UNICEF, 2010).

Accessibility of water in terms of quantity is subject to the needs of the population following the event but there is still debate over the level of quality required (HPA, 2012). However, the minimum standard set by UNESCO is obtaining 15-20 litres for individual in each day (HPA, 2012 and WHO/UNICEF, 2010).

Using time as a standard for water accessibility, the time spent to fetch water is taken into account. Accordingly, the followings are standards set by WHO (2003) for measurement of access to water:

If more than 30 minutes spent to fetch water, there is no access to water.

If between 5 minutes - 30 minutes spent to fetch water, there is basic access.

If water is fetched within 5 minutes, there is intermediate access to water.

If water is fetched below 5 minutes, there is optimal access to water

Taking into account the above measurements, one billion people in the world still lack access to safe water at this time the problem is serious in sub-Saharan Africa where only 16% of people had access to drinking water (UNWWDR, 2016).

2.4 Benefits of Water Accessibility

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 attached to the drinking but also to cooking, bathing, washing and other activities. Thus, 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 (WHO, 2007).

Access to safe, sufficient and affordable water is one of the basic indispensable human right as well as a prerequisite for improving the overall life of a society. The provision of sufficient potable water for peoples within reasonable distances from a reliable and acceptable source is essential for people's wellbeing and sustainable economic progress (WHO, 2010).

The lack of suitable supplies of water lies at the root of many of the difficulties experienced by developing countries. Besides fulfilling basic life requirements, water availability is a cornerstone of satisfactory sanitation, public health, agricultural production, industry, recreation, environmental maintenance, and urban development (UNICEF, 1999).

Therefore, there are a number of potential benefits to improved access to water supply, in addition to the reduction of disease. That is the reasons why many communities give for placing a high priority on improved water supply usually relate to benefits beyond health. These benefits are of particular importance to women. A closer, clean source of water can produce immediate and far-reaching improvements on women's lives (UNICEF, 1999).

2.4.1 Health benefits

Water is well known for its revitalizing properties. Yet even though it is essential to health, it frequently gets overlooked as one of the six basic nutrients, along with carbohydrates, fats, vitamins, proteins and minerals. This can result in vulnerable individuals missing out on the support and guidance they need to help maintain a healthy level of hydration (WHO and UNICEF, 2005).

The medical evidence for good hydration shows that it can assist in preventing or treating ailments such as constipation, urinary infections, kidney stone, heart disease, low blood pressure, diabetes, and skin conditions (WHO and UNICEF, 2005).

Improving hydration brings well-being and better quality of life for patients. It can allow reduced use of medication and prevent illness. It is good healthcare and dietary practice – and the right thing to do. Providing fresh water also demonstrates care of patients in a way that relatives and friends can see and enjoy (WHO and UNICEF, 2005).

2.4.2 Development Benefits

Water has been vital to the development and survival of civilization. The first great civilizations arose in the valleys of great rivers-in the Nile valley of Egypt, the Tigris-Euphrates valley of Mesopotamia and the Huang Ho valley of China. All these civilizations built large irrigation systems, made the land productive and prospered. Civilizations crumbled when water supplies failed or poorly managed. Many historians believe the Sumerian civilization of ancient

Mesopotamia fell because of poor irrigation practice (WHO, 2007). Water is quite literally a source of life and prosperity and a cause of death and devastation. Aside from the air we breathe, freshwater is our most precious resource, something upon which all life depends. Throughout history humans have tended to take fresh-water for granted, generally assigning little value to it beyond their immediate needs. That is probably because it seemed to be in abundant supply (WHO, 2010). Water has always played, and continues to play, a central role in human societies. It is an input, to a greater or lesser extent, to almost all production (in agriculture, industry, energy, transport, by healthy people in healthy ecosystems. For poor countries it is a key to improving food security and reducing poverty. It is also a force for destruction catastrophically through drought, flood, landslides and epidemic, as well as progressively through erosion, inundation, desertification, pollution and disease (WHO, 2010).

Access to essential resources and services has come to be recognized as positively related to development such that inaccessibility or lack of access is cited as lack of development or symptoms of underdevelopment. To the extent that improved access to essential services has become an accepted part of measure of development and standard of living (SIWI, 2005).

2.4.3 Convenience Benefits

Everybody wants water as close as possible to his home, simply because it is more convenient. Thus, convenience is an important consideration as health benefits. In some societies and situations, convenience is also related to the security of women, which is water supply closer to home can minimize the risk of abduction, rape and assault. Besides, when girls are forced to carry heavy loads of water over long distances, there is a danger of lasting spinal column and pelvis injury and deformations. Thus, closer water sources minimize these problems (UNICEF, 1999).

Studies have shown that women who walk long distances to collect water can burn as much as 600 calories of energy or more per day, which may be one third of their nutritional intake. Closer sources of water can thus improve the nutritional status of women and children and this in turn improves their health and wellbeing (UNICEF, 1999).

Women and girls can spend many hours a day collecting water from distant sources and thus the time saved by having a safe water source closer to the household can be very significant. The time saved is used for other productive economic and social activities (WHO, 2010).

2.5. Urban Water Governance

The target on equitable, participatory and accountable water governance will require strong political commitment, appropriate policy and legal frameworks, effective institutional structures, efficient administrative systems and capable human resources. It will also require investments in water infrastructure, renewal, operations and maintenance (UNWWDR, 2015).

A study estimates that one dollar of water and sewer infrastructure investment increases private output (gross domestic product) in the long-term by US\$6.35 and yields a further US\$2.62 output in other industries. These benefits accrue in terms of jobs created, final output and private sector investment (WWDR, 2015 as cited in Krop et al., 2008). Experiences from cities around the world have shown that it is possible to improve the performance of urban water supply systems and increase revenue and profits, while continuing to expand the system and addressing the needs of the poor, provided that there is strong leadership and good governance (UNWWDR, 2015).

The water service delivery must be demand oriented which focuses on consumers' needs and willingness to pay full costs of services, competitive markets, and broader participation of the private sector, non-governmental organizations (NGOs) and community-based organizations (CBOs). It is economically efficient and socially responsible as it consists of different stakeholders. On the contrary, there is supply oriented water supply approach which focuses on technical elements and monopolistic public service delivery. This approach is found to be economically inefficient as full costs of service provision are covered by government and 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 (Meseret, 2015).

The important principles in water governance are allocation and distinguishing roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities; managing water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales; encouraging policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use; adapting the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties; producing, updating, and sharing timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy; ensuring that governance arrangements help mobilize water finance and allocate financial resources in an efficient, transparent and timely manner; ensuring that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest; promoting the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders; Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making; promoting stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation; encouraging water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations; Promoting regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed, (OECD, 2015).

2.6. Domestic Water Supply

Domestic water use takes the form of drinking, washing, cooking, gardening, sanitation, and service industries such as restaurants. The amount of water people apply to household purposes tends to increase with rising standards of living and variations in domestic water use (UNWWDR, 2015).

According to Meseret (2015) private tap water is the most the satisfactory for domestic water use because it is important to meet:

Public health objectives: by ensuring better quality and access,

Commercial objectives: by facilitating cost recovery and revenue generation,

Social objectives: by improving access for the poorest and enhancing security and safety and

Environmental objectives: by enabling better demand management and water conservation.

Worldwide domestic water use accounts for 8 percent whereas agriculture accounts for 69% and industry and energy account for 23%. A pattern of use varies greatly from country to country, depending on levels of economic development, climate and population size. Africans for instance devote 88 percent of the water they use to agriculture, mostly irrigation, while highly industrialized Europeans allow more than half of their water to industry and hydroelectric production (UNWWDR, 2015).

2.7. Water Scarcity

The term ‘water scarcity’ is regularly used by the media, government reports, NGOs, international organizations such as the UN and OECD, as well as in the academic literature, to highlight areas where water resources are under pressure. However, despite its frequent use, there is no consensus on how water scarcity should be defined or how it should be measured. According to Lalzad (2007) water scarcity can be measured in quantity, quality and equity. The quantity refers to demands for freshwater exceed the naturally occurring, renewable supplies, quality refers to much of the limited water is being polluted from growing volumes of human, industrial and agricultural waste, and Equity refers to the same water is desired simultaneously by different sectors within a single society or nation or by different countries wherever it flows through an international border.

Some of the most commonly used methods of measuring water scarcity in quantity are: the Falkenmark Indicator (Water Stress Index), Basic Human Water Requirements, and the Social ‘Water Stress Index.

2.7.1. The Falkenmark Indicator

The Falkenmark indicator is perhaps the most widely used measure of water stress. It is defined as the fraction of the total annual runoff available for human use. Based on the per capita usage,

the water conditions in an area can be categorized as: no stress, stress, scarcity, and absolute scarcity (Falkenmark, 1992).

Table 2.0. Water barrier differentiation proposed by Falkenmark (1992)

Index (M ³ per capita)	Category/Condition
>1,700	No stress
1000-1700	Stress
5,00-1,000	Scarcity
<500	Absolute scarcity

Individual usage is the basis for the Falkenmark Water Stress Index and therefore provides a way of distinguishing between climate and human-induced water scarcity (Falkenmark, 1992).

2.7.2. Basic Human Water Requirements

Gleick (1996) developed a water scarcity index as a measurement of the ability to meet all water requirements for basic human needs: drinking water for survival, water for human hygiene, water for sanitation services, and modest household needs for preparing food. The proposed minimum amount needed to sustain each is as follows:

1. Minimum Drinking Water Requirement: Data from the National Research Council of the National Academy of Sciences was used to estimate the minimum drinking water requirement for human survival under typical temperate climates with normal activity is about 5 litres per person per day.
2. Basic Requirements for Sanitation: Taking into account various technologies for sanitation worldwide, the effective disposal of human wastes can be accomplished with little to no water if necessary. However, to account for the maximum benefits of combining waste disposal and related hygiene as well as to allow for cultural and societal preferences, a minimum of 20 litres per person per day is recommended.
3. Basic Water Requirements for Bathing: Studies have suggested that the minimum amount of water needed for adequate bathing is 15 litres per person per day.

4. Basic Requirement for Food Preparation: Taking into consideration both developed and underdeveloped countries, the water use for food preparation to satisfy most regional standards and to meet basic needs is 10 litres per person per day.

The proposed water requirements for meeting basic human needs gives a total demand of 50 litres per person per day. International organizations and water providers are recommended to adopt this overall basic water requirement as a new threshold for meeting these basic needs, independent of climate, technology, and culture (Gleick 1996). Both Falkenmark and Gleick developed the “benchmark indicator” of 1,000m³ per capita per year as a standard that has been accepted by the World Bank (World Bank, 2015).

2.7. 3. The Social Water Stress Index

The Social Water Stress Index deals with how economic, technological, or other means affect the overall freshwater availability status of a region. Accordingly, the capability of a society to adapt to difficult scenarios is a function of the distribution of wealth, education opportunities, and political participation (A. Brown and M. D. Matlock, 2011)

2.8. Causes of Water Scarcity

There are many causes which create water scarcity to urban dwellers. Among these lack of capacity, inadequate finance, population growth and rapid urbanization are some of them (UN-HABITAT, 2003).

2.8.1. Lack of Capacity

Capacity includes the human, technological, infrastructural, institutional and managerial resources (Moraa, 2012 and Wallace et al, 2008). The lack of capacity of these stakeholders in water service is a great problem which creates water scarcity. The components of capacity mentioned above goes hand in hand with development of a given country. In countries where there is development, the problem of capacity is not challenging as in countries which are underdeveloped. This is true in Africa in general and Ethiopia in particular. Despite there are many stakeholders that have to be capable for effective water supply, the level of capacity expected of each stakeholder should not be equal. For example the public sector holds resource

and institutions and its level of capacity should never be compared with the capacity of other stakeholders.

2.8.1.1 The Lack of Institutional and managerial Capacity

A considerable challenge to address equitable water allocation especially in developing countries is the lack of capacity at the country level to provide effective water governance. In general, developed countries have greater technical, financial, and administrative capacity to address these issues whereas there the contrary is true in developing countries. The prevailing conditions give the impression of fragmented responsibility over water resources, including multiple government agencies responsible for water management, which typically operate in isolation and in competition for funds. Even if there is a capacity to develop regulatory frameworks, many of the countries in these regions lack the capacity to implement and enforce regulation concerning water management issues (UNEP, 2004).

Given the rapid pace of urbanization, the institutional capacity of local and national governments and water utilities to increase investments and manage the delivery of services is becoming critical, especially in cities with old and poorly maintained water and sanitation infrastructure and cities in the developing world. High rates of unaccounted for water (mainly due to leakages), unsustainable tariffs and weak systems of governance are typical manifestations of the growing capacity gaps in many urban areas. Leakage results in loss of revenue, higher chances of drinking water contamination and outbreaks of waterborne diseases, which will further reduce water service quality and the consumers' willingness to pay (UNWWDR, 2015).

The target on equitable, participatory and accountable water governance will require strong political commitment, appropriate policy and legal frameworks, effective institutional structures, efficient administrative systems and capable human resources. It will also require investments in water infrastructure, renewal, operations and maintenance (UNWWDR, 2015).

2.8.1.2 Lack of Technological Capacity

Innovative technologies are essential to overcome barriers to water supply and distribution problems. Technological capacity includes the development and application of new technologies, the technical skills needed to efficiently construct, operate and manage a technical solution, the translation of information regarding to promote informed decision-making when implementing a technical solution, the availability and accessibility of spare parts (Sijbemsma ,1989). Thus, most systems and facilities of water supply are poorly constructed, designed and utilize technologies that are not appropriate (MoFED and UNDP, 2005).

2.8.2. Inadequate Financing

Water services remain rather low on the scale of policy priorities, despite well-documented contributions to human and economic development. When compared with other development sectors, particularly education and health, sanitation and drinking water services receive a relatively low priority for both official development assistance (ODA) and national expenditure (UNDESA, 2013). This under-prioritization of water directly contravenes a State's obligation to expend maximum available resources to promote the progressive realization of the human right to water and sanitation for all persons, without discrimination.

Financing for water resources management is also usually a low priority, in spite of it being a cornerstone of economic growth (SIWI, 2005).

In most countries, funding for water infrastructure comes from government allocations, although many developing countries still depend on external assistance to fund water resources management and utilities. This is neither adequate, nor sustainable. Most countries report that information required for adequate financial planning in the water services sector, such as information on users and their potential contributions, is insufficient. Costs of infrastructure operation and maintenance are often neglected or not well factored into water mobilization projects. As a result, many water systems are inadequately maintained, leading to damages, losses, unreliability, and decreasing quality and quantity of service to users. Financing is reported to be particularly inadequate for sanitation, with drinking water absorbing the majority of funding available particularly in developing countries (WHO, 2012). Financing for wastewater treatment is chronically neglected (UNWWDR, 2015).

For example, according to the 2014 Water Supply and Sanitation Millennium Development Goal-Needs Assessment Report by the government of Ethiopia, there is US\$197 million financial gap for water and sanitation sector per year in Ethiopia.

In addition, poor targeting of aid and a multiplicity of actors and structures compound the financial shortfall. Prioritization of spending plays a key role, with many developing countries investing only a small fraction of money into water compared with military spending. For instance, military spending in Ethiopia is 10 times greater than that spent on water and sanitation (UNDP, 2006).

2.8.3. Population Growth and Urbanization

Rapid urbanization, increased industrialization, and improving living standards generally combine to increase the overall demand for water in cities. By 2050, global water demand is projected to increase by 55%, mainly due to growing demand from manufacturing, thermal electricity generation and domestic use, all of which mainly results from growing urbanization in developing countries access to drinking water is actually deteriorating where the most rapid urbanization is outpacing public services. The situation is worse in sub-Saharan Africa, where urbanization is happening most rapidly. In this region, the percentage of people who enjoyed piped water on their premises, which is the preferred option for urban areas, actually decreased from 42% to 34% (WHO and UNICEF, 2014). This clearly indicates that access to ‘safe’ drinking water sources continues to be a major problem in cities in the developing world.

Population growth and rapid urbanization will create a severe scarcity of water. In less developed countries, urban population will grow from 1.9 billion in 2000 to 3.9 billion in 2030, averaging 2.3% per year. Besides having less or not invested in urban infrastructure, Africa is urbanizing faster than any other region. Between 1990 and 2025, the total 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 (UNPP, 2006).

With this rapid increase in urbanization, it will be difficult for cities to meet the rising demand for freshwater with agriculture at the same time becoming increasingly dependent on irrigation. Rapid urban growth in developing countries puts tremendous pressure on their old and inadequate water supply systems. For example, Jakarta’s water supply and disposal systems were

originally designed for 500,000 people, but in 1985 the city had a population of nearly 8 million and today it is more than 15 million. The city suffers continuous water shortages and less than 25% of the population has direct access to water supply systems (Lalзад, 2007 as cited in WWC, 2000).

Cities have become the place where development challenges and opportunities increasingly come face to face. In 2014, 3.9 billion people, or 54% of the global population, lived in cities, and by 2050, two-thirds of the global population will be living in cities (UNDESA, 2014). Furthermore, most of this growth is happening in developing countries, which have limited capacity to deal with this rapid change. Cities impact the hydrological cycle in several ways by: extracting significant amounts of water from surface and groundwater sources; extending impervious surfaces thus preventing recharge of groundwater and exacerbating flood risks; and polluting water bodies through the discharge of untreated wastewater. Since much of the water consumed by cities generally comes from outside the city limits, and the pollution they generate also tends to flow downstream, the impact of cities on water resources goes beyond their boundaries. Cities also import significant amounts of food, consumer goods and energy from outside the city, which requires large amounts of water at the point of production, transportation and sale. This virtual demand of cities greatly exceeds direct water use (WWC, 2000).

According to UNWWDR (2015) cities provide opportunities for more sustainable use of water, including treating used water to standards that enable it to be used again. They are well positioned to rapidly adopt conservation measures, and the concentration of people in compact settlements can reduce the cost of providing services such as water supply and sanitation. Furthermore, cities can connect with their hinterlands and support the protection of water resources in their surrounding areas by actively engaging in watershed management.

Population growth is one of the main drivers of fresh water demand. Most projections estimate that the world population will stabilize at between 8 and 9.5 billion people by around 2050 and that most of this growth will take place in the developing world (UNDP, 2006). Population growth not only triggers direct domestic water consumption but also the consumption of agricultural, industrial and other products, and energy use. Population of the world has tripled in the last century, but global water use has increased six-fold (WWC, 2000).

A growing population consumes more food which, in turn, requires larger volumes of water. Irrigation-based agriculture has contributed 80% of the increases in food production since the 1960s. Hydropower accounts for almost 20% of worldwide electricity production, and there is potential for further growth, especially in developing countries (UNDP, 2006).

2.8. 4 Climatic Changes

One of the factors for the water scarcity in a given area is climate change. It will likely decrease natural water storage capacity from glacier/snowcap melting, and subsequently reduce long-term water availability for more than one-sixth of the world's population. It increases the vulnerability of ecosystems due to temperature increases, changes in precipitation patterns, frequent severe weather events, and prolonged droughts. It will also affect the capacity and reliability of water supply infrastructure due to flooding, extreme weather, and sea level rise. Most existing water treatment plants and distribution systems were not built to withstand expected sea level rise and increased frequency of severe weather due to climate change (Pacific Institute, 2009).

The rising of the standard of living in developing countries which tends to result in higher per capita water requirements, especially through shifts in demand for different food crops are also a cause for water scarcity (Lloyd's, 2010).

The growth of the economy brings water scarcity because increasing of the domestic, agricultural and industrial uses of water and the maintenance of water supplies to energy production (for instance, cooling water for thermal power plants, or river flows for hydropower (Lloyd's, 2010).

2.9. Impacts of the Water scarcity

Although water and sanitation are the primary needs of human being, water scarcity has many side effects which include healthy and economic impacts (UN-HABITAT, 2006).

2.9.1 The Health Impacts of Water Scarcity

These health impacts of water scarcity can be seen in bringing waterborne diseases and the absence of sanitary domestic water that are leading causes of death worldwide. For children under age five, waterborne diseases are the leading cause of death. At any given time, half of the world's hospital beds are occupied by patients suffering from waterborne diseases. According to

the World Bank, 88 percent of all waterborne diseases are caused by unsafe drinking water, inadequate sanitation and poor hygiene (Meseret, 2015).

Whenever people's basic needs go unfulfilled, community health status suffers. This is best illustrated in areas struck by natural disasters or humanitarian crises. The breakdown of access to safe water and sanitation is invariably followed by a breakdown in international health security. Investing in water security therefore also means investing in health security, and in sustained poverty alleviation (WHO, 2002).

About 20% of the world's population lives in countries where water is scarce, or where they have not been able to access the natural sources available. At present 1.1 billion people lack access to safe water and 2.6 billion lack access to proper sanitation. Climate change is affecting water resources in both developed and developing countries in the North, rainfall is increasing, while in the South, drought periods are becoming longer (WHO, 2002).

Every year there are 3–5 million cholera cases and 100,000–120,000 deaths due to cholera. WHO estimates that only 5–10% of cases are officially reported. The overall increase in the number of cholera cases for the decade 2000–2010 was 130% (WHO, 2010).

Cholera is endemic in regions with poor socio-economic conditions, rudimentary sanitary systems, absence of wastewater treatment, and where public hygiene and safe drinking water is lacking. The risk of cholera outbreaks intensifies during humanitarian crises, such as conflicts and floods, and displacement of large populations (United Nations World Water Assessment Programme, 2012).

When water is scarce, people will have to rely on drinking water sources that may not be safe, and they cannot wash themselves, their clothes or their homes properly or often enough to prevent infection. This will encourage people to store water for drinking and for domestic use in their homes which will increase the health risks posed by household contamination of drinking water. It will also create favourable conditions for the breeding of *Aedes* mosquitoes, which transmit dengue and dengue haemorrhagic fever. Breeding of malaria vectors may also increase in some places. It will bring inadequate sanitation which increases infestation with fleas, lice and other insects. There are also diseases associated with this combination of factors such as trachoma, plague and typhus (WHO, 2010).

Poor quality water may also carry diarrhoeal diseases such as cholera, typhoid fever, salmonella, poliomyelitis, other gastrointestinal viruses and dysentery. For example in Ethiopia in 2016, the lack of clean water has resulted in the outbreak of cholera, with its symptoms of watery diarrhea and vomiting. This disease has affected the health of population (WHO,2007 and WHO,2009).

The second health impact of water scarcity is sanitary problems. Sanitation is a group of methods to collect human excreta and urine as well as community waste waters in a hygienic way where human and community health is not altered. Sanitation is the collection, transport, treatment and disposal or reuse of human excreta, domestic wastewater and solid waste, and associated hygiene promotion. It is a system to increase and maintain healthy life and environment. The main objective of sanitation is to decrease the spreading of diseases by adequate waste water excreta and other waste treatment, proper handling of water and food and by restricting the occurrence of causes of diseases (WHO, 2007).

Adequate sanitation systems include both facilities and behaviors that form a hygienic environment and reduce people's exposure to disease-causing organisms. More than one third of the world's population does not have access to improved sanitation – a sanitation facility that ensures hygienic separation of human excreta from immediate human contact, thereby preventing infection caused by the ingestion or contact with human faeces (the 'faecal-oral' route of transmission). 1.1 billion people practice indiscriminate or open defecation.¹⁴ This situation represents a significant and constant barrier to human and economic development, through direct impact on health, as well as broader impacts on wellbeing and poverty. Essential part of sanitation is building and maintenance education on sewerage systems, wash up and toilet facilities (Water Aid Report, 2011).

8% of the global disease burden is caused by diseases related to unsafe sanitation. Unsafe sanitation is a major risk factor for diarrhoeal disease, the biggest cause of death in children under the age of five in sub-Saharan Africa and the second leading contributor to the global disease burden. Further, poor hygiene practices are a major risk factor for respiratory infections, the leading contributor to the global burden of disease. Lack of access to WASH is strongly associated with further diseases and infections, including intestinal infections, trachoma and others. Diarrhea causes more deaths in children under five years old than HIV/AIDS, malaria, and measles combined (Water Aid report, 2011).

A household is considered to have adequate access to sanitation if a waste disposal system, either in the form of a private toilet or a public toilet (i.e. latrines at markets, bus terminals and lorry parks, patient and staff latrines at health facilities, teacher and pupil latrines at schools) shared with a reasonable number of people, is available to household members (UN-HABITAT, 2006).

In other word, safe waste disposal through the provision of latrines is a major priority as it creates the first barrier to direct and indirect excreta-related diseases. In the field, water supply and hygiene education, which would include sufficient water supply and soap; latrine maintenance; and the actual training and education, are important complements to latrine construction (UN-HABITAT, 2006).

According to Meininger, Oldenburg and Otterpohl (2008) the majority of the existing toilets in urban areas of Ethiopia are simple pit latrines, which face a variety of problems like pit collapsing and flooding. Also the need for digging of new pits once the old one is filled is considered a drawback of this conventional technique. The use of septic tanks is impeded by factors like the lack of desludging facilities (e.g. vacuum trucks) and missing sludge management concepts).

Centralized sewerage systems are usually not within reach of the municipalities due to the high costs for sewers and treatment facilities. For example, the sewerage system in Addis Ababa caters only for about 3% of the city's population. In addition, many Ethiopian cities face difficulties in implementing a water-based sanitation system (i.e. water-flushed toilets) as a result of water shortages and inappropriate water supply systems (WHO, 2010).

According to WHO (2004) access to sanitation includes safety and privacy in the use of these services. Coverage is the proportion of people using improved sanitation facilities such as public sewer connection, septic system connection, pour flush latrine, simple pit latrine and ventilated improved pit latrine. Sanitation improvements have to meet the perceived needs of the intended users among which;

Convenience: Women in particular dislike having to walk long distances to relieve themselves.

Comfort: People dislike the smell of excreta and public toilets in densely populated communities are generally appalling.

Safety: Defecation sites are dangerous places for women and children.

Status: Families are ashamed when they cannot offer guests proper toilet facilities.

There are numerous technical options for waste management, many of which, if properly designed, constructed, operated and maintained will provide adequate and safe service as well as health benefits. It is necessary to choose technically, economically and financially feasible options for sustainable waste management. Equally important is the involvement of all stakeholders playing a role in sanitation development, including users (or customers), community organizations, authorities and entrepreneurs (WHO, 2010).

On-site sanitation is the main form of excreta disposal in most sub-Saharan African cities and will remain the most appropriate level of service for the urban poor in the medium term. Despite heavy public investment in sewerage systems in most primary and some secondary cities, typically only 10-15% of the urban population benefit from access to the sewer network.

Offsite systems are forms of sewerage where part or all of the excreta are transported away from the household for treatment or disposal at a central point. Sewerage may be conventional (typically, connected to flush toilets and household grey-water, and in many cases storm-water) or modified where only liquid matter is piped away (small-bore sewerage) or where sewerage works on a non-constant flow principle (shallow sewers) and does not take storm-water (WHO,2010).

Where open channels are used for foul sewage and no alternative is possible, they should be routed away from populated areas and have raised sides to limit the ingress of rainwater (WHO, 2010).

Sanitation is a challenging issue of today's world especially in poor countries where inadequate resources and awareness of community. Thus, it would be decent to launch community teaching and expanding community driven programs, encouraging local institutions such as; civil society organizations, community based organizations and private investors on the sector.

In general, to win the battle against poor sanitation in developing countries like Ethiopia, several programs has to applied otherwise sanitation is a rampant threat of health in these countries.

2.9.2. Economic Impacts

Water affects the economy of a country in many respects. Rivers and streams are used for transportation, acid rain leads to forest damages and health problems caused by water pollution not only reduce the quality of life but also entail economic costs. From an economic perspective, water is an input that is needed directly or indirectly for the production of most goods and services. Water is needed for irrigation in agriculture, serves as a coolant in power stations and is used for cleaning purposes in the chemical industry (SIWI, 2005 and UNEP, 2004).

Naturally, water plays the most important role in agriculture. Water in industry is used for cooling, transportation and washing, as a solvent and can also directly enter the final product. The principal users of freshwater in industry are thermal and atomic power stations that need large amounts of cooling water. In addition, the chemical industry, metallurgy, the wood, pulp and paper industry, the textile industry as well as mechanical engineering use considerable freshwater. The characteristics of industrial water use depend to a large extent on the water supply system in use (SIWI, 2005).

Water scarcity poses considerable and different types of risk for projects/businesses and their financial backers. These financial risks are financial losses due to disruption of operations: increased financial investments due to required water treatment, either for water use, or wastewater treatment; loss of an anticipated revenue base due to cancelled or delayed growth and expansion in a region due to quality, quantity, or stakeholder considerations (WWF, 2010 and UNEP, 2004).

As a result, financial institutions, which deal with those companies/projects, whether as bankers, investors or development aid organizations, face a variety of potential water scarcity risks. Many of these risks may not become apparent through the standard financial analysis/due diligence processes, and as a result some financial institutions were found in this project to have suffered losses due to unexpected water related problems affecting their customers or investments (UNEP, 2004 and The Pacific Institute, 2009).

The materiality and risk potentials for a financial institution can vary depending on the nature of business partners (borrowers or investments), business sector and region of operation, and the client's capacity to anticipate and manage these risks (UNEP, 2004).

Economic growth seems to be dependent on high levels of access to safe drinking water. Access to safe drinking water is already beginning to decline in the emerging markets due to growing demand for supplies of an increasingly scarce resource (The Pacific Institute, 2009).

Furthermore, the quality of drinking water is in decline in many parts of the world, and increasing socioeconomic barriers, such as rising water prices, mean that fewer people have access to safe drinking water (The Pacific Institute, 2009 and WWF, 2010).

Water scarcity also brings additional costs on residents because of failure of plumbing and increased costs of water for example through purchasing bottled water (The Pacific Institute, 2009).

2.10. Water and the Three Dimensions of Sustainable Development

The outcome document of the 2012 United Nations Conference on Sustainable Development (Rio+20), *The Future We Want*, recognized that ‘water is at the core of sustainable development’ and its social, economic and environmental dimensions. Water is the lifeblood of the planet and of critical importance for all socio-economic development (UNDESA, 2012).

From a social perspective, there are obvious connections between access to safe and adequate quantities of water and health, for drinking first, but also for hygiene and sanitation at the household, community and national levels (UNDESA, 2012).

Access to safe and predictable sources of water is essential to addressing the multiple forms of deprivation related to poverty directly through drinking water and its relation to human health, but also indirectly since water is required in most economic activity (UNWWDR, 2015).

Economically, addressing lack of safe drinking water and sanitation will lead to long-lasting effects on human capital and growth. Recent estimates suggest that, globally, the benefits of achieving universal access to sanitation outweigh the costs by a factor of 5.5 to 1, whereas for universal access to drinking-water the ratio is estimated at 2 to 1 (WHO, 2012).

Sustainable management of water resources and related infrastructure can greatly increase productivity in the agricultural and food sector. Achieving more efficient water use is crucial considering that production and consumption of agricultural products alone account for over

70% of water withdrawals in many developing countries (UNDESA, 2012). Beyond the primary economic sectors, water is also crucial to all other economic activities, most notably through its role in energy production, mining and tourism. Water scarcity could be an important obstacle for the expansion of the power sector, especially in Asia, southern Africa and the Middle East, where the demand is set to grow rapidly. Water can also lead to economic losses due to water-related hazards, which have risen greatly in the last decade (UNWWDR, 2015).

2. 11. Key Water Challenges Related to Sustainable Development in Africa

The key water challenges related to sustainable development in Africa are water infrastructure for economic growth; managing and protecting water resources; global changes and risk management in Africa; water governance and management; financing water and sanitation sector; and education, knowledge, capacity development and water information(AU, 2014).

Currently, only 5% of the Africa's potential water resources are developed and average per capita storage is 200 m³ compared to 6,000 m³ in North America. Only 5% of Africa's cultivated land is irrigated and less than 10% of hydropower potential is utilized for electricity generation (WHO, 2012). This occurs in a situation where only 57% of the population has access to modern energy services (mainly electricity), which are becoming less reliable with the accelerating rate of urbanization in most of the region's major cities. In 2012, three years before the end of MDGs, on average about 36% of the population did not have access to improved water resources and 70% still did not have access to improved sanitation (WHO, 2012).

2.12. Water Resources and Demand in Ethiopia

Ethiopia uses water for hydropower, agriculture, livestock, irrigation, domestic purposes and others. It holds a total of 3.5 km³ storage capacities in nine large and medium dams (more than 15m height and/or more than 3 million m³). Due to a suitable topographic setting, most of the country's rivers exhibit falls and extreme gradients suitable for the construction of dams and gravity-driven hydropower generation turbines. Hydropower is the most dominant source of energy for the national grid, with an estimated potential of about 30,000 MW. However, in terms of its utilization, only 2.6% i.e. 767 MW has been developed so far (SEI, 2006).

Agriculture (including livestock) is the main source of livelihood and income generation for the majority of Ethiopians today. As noted above, agriculture is the single largest sector contribution to GDP, and coffee is a major export product from agriculture activities. Future overall country development is also by and large expected to be driven by the progress in the agricultural sector. The combination of lack of storage and spatial and temporal variations in rainfall largely limits most farmers to one crop per year. Ethiopia's cattle population, one of the largest in Africa, puts additional pressure on water and land resources (SEI, 2006).

2.13 .Urban Water Supply in Ethiopia

Despite abundant surface and groundwater resources Ethiopia is one of the lowest rates of access to water supply, sanitation, and hygiene in Africa. According to the WHO and local nongovernmental organizations, the figure was closer to 22 percent. The WHO estimated that only 13 percent of the population had access to sanitation (WSP, 2011).

Each local government in Ethiopia contains a 'Woreda WASH Team' responsible for all aspects of water and sanitation development in the district, including management and oversight of scheme construction, provision of maintenance support, and financial management (Hendrix, 2012).

Regarding financial management, the major source of finance for the urban water sector is the government treasury provides which is channeled directly to regions and woredas via a federal block grant. There is also donor funding for urban water supply and sewerage which is principally financed by standalone project lending and by on-lending to utilities from the Water Resource Development Fund. However, both the finance from government treasury and donor insufficient to cover even the expenses required for 10 days of local travel to field sites (WSP, 2011).

MWR (2002) stated that issues of poor sector capacity and low level of expenditures for WSS are interlinked and lead to a vicious circle – as low level of investments create low demand for technical and manpower inputs in WSS sector, the capacity remains underdeveloped. The resulting low sector capacity, means low allocations and expenditures are curtailed.

The sustainability of water supply facilities mainly depends on a timely and regular maintenance and operation of the system. However, in most developing countries, including Ethiopia, it has been found out that operation and maintenance (O&M) of water supply facilities is in a poor state of condition and the sustainability of the scheme is at stake. Regarding this, MWR (2002) identified the following underlying problems: inappropriate tariff setting without emphasis on full cost recovery; Lack of clear guidelines for urban tariff setting including issues related to fairness, and financial sustainability; Inappropriate or lack of institutional incentives for urban WSPs to achieve financial viability and improved operational performance; Poor technical and financial capacity among the urban service providers that leads to high levels of unaccounted for Water and Poor or non-existent consumer services and grievance handling system that leads to a lack of willing to pay user charges.

2.14. Urban Water Supply and Sanitation Policy in Ethiopia

Out of total water potential, only 3% of water resources have been used, of which only about 11% (0.3% of the total) has been used for domestic purposes. So, to solve this water problems the water supply and sanitation policy began in Ethiopia in the mid of 1988s. At that time the general policy of the government was to provide water and sanitation through its own public water sector institution with the supply side approach. In this regard in order to strength the government owned institutions, the military government (since 1975) nationalized the private sector driller and their equipment first absorbed by Ethiopian Water Works Construction Agency, which was later used to set up the autonomous Water Well Drilling Agency. The Ministry of Water Resources (MoWR, 2002) identifies the whole water sector was generally envisaged as a supplier of “free” services which failed to consider the scarce nature of water resource in the country. Tariff and cost recovery also could not get full attention due to the socialist economic policy implemented in the country. In the same way the sanitation part of the Water Resource Management policy sets the general framework along which sanitation is provided with the objective of enhancing the well-being and productivity of the people through the provision of adequate and reliable sanitation services.

The new sanitation strategy focuses in public sector subsidies on promotion and public facilities rather than subsidizing at the household level. This is an example of a cost conscious and well-conceived use of limited public resources in the areas where they are likely to do best.

The policy recognizes the inseparable nature of water supply and sanitation and requests the promotion of both an integrated and sustainable framework. Therefore, according to this policy, all water supply institutional setups have legal right to implement the integrated water supply and sanitation policy. In addition to these since the establishment of a Ministry for a water sector in 1995/96, a strategic and participatory approach has been introduced by bringing into place key sector reform initiatives. The National Water Resources Management Policy also requires urban centers to cover their investment , operation and maintenance costs, while rural WSS is required to cover operation and maintenance costs, with some cost sharing (up to 10 percent) for initial investment cost. The National Sanitation Strategy calls for a shift towards funding ‘sanitation promotion and leveraging resources’, and away from subsidy for hardware, and gives priority to low-cost, pro-poor solutions. Importantly, the financial requirements to achieve WSS targets are premised on the capacity to implement the approaches outlined in policy (MoWR, 2003).

Therefore, water supply and sanitation policy is an integral part of the country’s water management policy. In relation to the policy document (1999), the policy is believed to provide and impetus for the development of water supply for human and animal consumption.

It focuses on increasing the coverage, quantity, reliability and acceptable quality, taking the existing and future realities of the country into consideration. Upon implementation, the policy is expected to achieve the objective of the Ethiopian people to attain adequate, reliable and clean water service that meets the water user’s demand. The policy of supplying free water to any group except for emergency, leads in practice to an unfair situation. Since there are no enough funds to provide such free services, the rural and urban poor are the first to suffer. A better and much more equitable way would be to collect water charges from consumers and then improve and expand the system. Similarly, as stated by the policy envisages supplying improved potable water service for urban areas with tariff structures that are set based on “full cost recovery and self reliance”.

This full cost recovery program has the advantage of providing incentive for proper use; reduces waste and excessive consumption of water resources. Besides, it helps to release funds for other investment programs. The policy considers water as a social and economic good, and it is an integrated one. Full cost recovery requires charging consumers so as to cover the full cost of

project construction as well as the operation and maintenance of providing the service. Water development investments by their nature require huge amounts of money (SEI, 2006).

2.15. Institutional Arrangements for Water Service Delivery in Oromia

In Ethiopia, it is obvious that water service is provided by state through public institutions. The same case is true in Oromia region in particular. Therefore, it is essential to discuss the arrangements of such institution in Water Supply in Oromia. Accordingly, there are Oromia water resource development bureau at regional level, Water Resources Development Offices at all zones and Water Resources Development Offices at all woredas (Oromia Region Proc.No 74/2004).

2.15.1. The Oromia Water Resource Development Bureau

The Oromia Water Resource Development Bureau at the regional level is an executive organ responsible for the preparation of regional policies and regulations, study, design, supervision and regulation of water supply projects, build the capacity of zonal and woreda water offices, set water tariffs, construction of schemes (spring developments, small and large gravity schemes, motorized schemes, boreholes and shallow wells), contract out to the private sector. The planning and management of urban water supply and sewerage services are the responsibility of Urban Water Supply and Sanitation Service Enterprise town water board's (Proclamation no78/2004).

The major objectives of the enterprise are providing adequate potable water supply and sewerage services to the dwellers in and around specific a town; administer it is self on the bases of cost; recovering principle and the decision and guidelines of a board that could be establish to lead and regulate the enterprise; establishing the system that assesses to boost the effort being made to provide water supply and sewerage services including waste disposal in its work areas; providing potable and adequate water supply to the dwellers in and around the town; ensuring that the water supplied is to the standard of the World Health Organization; meeting the water supply demand of the town, it shall distribution lines and generally shall undertake water related works such as maintenance, rehabilitation and expansion under its jurisdiction. It can partially contract out some of its works to maximize efficiency; checking individual water tanks are clean and sanitarily properly kept; cooperating with other concerned organs go to the extent of closing down poorly handled individual water tanks (The Proclamation no 78/2004)

It shall use service charges it collected only for the development water works. It shall enter an agreement; shall procure or sell fixed and consumable assets; it shall poses' properties; it can sue or sued (Proclamation no 78/2004, article, 5). Organizations and Accountability of Enterprises: The Enterprises have a board, a general manager and the staff required for the performance of its duties and the enterprise is accountable to the board (Proclamation no 78/2004, article, 6).

Sources' of Fund for the Enterprise are: Water sales and charges from services of waste water works, loan, donations and grants both in cash and kind, fund assigned by the administration of the town and any other source of fund. Further the regional government may grant necessary support for the establishment and expansion of water supply services by assessing their capacity (Proclamation no 78/2004, article, 20).

2.15.2. Zonal Water Resources Development Offices

Zonal Water Resources Development Offices are the supporting arms of the Water Bureaus and are mandated to give capacity building and technical support to Woreda Water Offices and Town Water Supply Offices. In addition, they are responsible for coordinating activities, consolidating plans and reports of woredas and relaying requests from regional water bureaus and/or woreda water offices. In general, Zonal Water Offices are the links between Regional Bureaus and woreda Water Offices (MoW, 1999).

2.15.3. Woreda Water Resources Development Offices

Woreda water resources development offices are responsible for the monitoring of construction done by regional bureau or private contractors contracted by the bureau, investigation, design and implementation of small scale water supply schemes, whilst study and design of big schemes are undertaken by bureaus of water. Moreover, woreda level offices are responsible for providing technical support to town water supply offices, in towns where municipalities are not established. Woreda water offices are supported by a woreda water supply sanitation and hygiene team consisting of representatives of sector offices of health, education, women, and agriculture. Such teams are responsible for planning and implementation of water and sanitation activities (MoW, 1999).

CHAPTER THREE

3. METHODOLOGY

3.1 Research Design

In terms of its approach, descriptive and explanatory research type would be used for this study. The purpose of this study would be to assess the causes and impacts of water scarcity on households in Burayyu town. The Research used both qualitative and quantitative methods of data collection from its sample group as stated below.

3.2 Source of Data

Reliable data would be collected, from both primary and secondary sources as described below.

3.2.1 Source of Primary data

Household Survey: Household survey mainly focused on flow of water per a month and amount of water they use daily. In order to obtain quantitative primary data for this research work, questionnaires were performed with households who live in the Burayyu within study areas. The survey is intended to collect data from households “ view that associated causes and impacts of water scarcity”. It was conducted through questionnaires by researcher himself. The household survey were conducted on sample households those chosen from six kebeles of the town using structured questionnaire with household.

Hence, the description of essential and relevant data that considered to be the source of water supply, quantity of domestic water use per day (in litres), the causes of water scarcity and the impacts of water scarcity were gathered.

Key informants interview: Since the research was centered on the causes and impacts of water scarcity in the Burayyu town, it basically involves key informant’s interviews from Burayyu Town Water and Sewerage Service, Burayyu Town Municipality and Burayyu Town Health Center.

3.2.2 Secondary data

Secondary data of the study would be collected concerning its relevant from review of documents, books, earlier research, government publication, website, regional, zonal and district water offices (strategic plans and reports).

3.3 Sampling Procedures

3.3.1 Sampling Frame

There are 19,546 households currently residing in the Burayyu town. The town has presently six kebeles. This study intends to focus on 120 households out of the existing total household populations.

3.3.2 Sampling techniques

Among eight towns of Addis Ababa Surrounding Oromia Special Zone, Oromia Region, Burayyu town has been selected purposively. The reason for selecting the town was that it is one of the fast growing towns.

Taking the significance of this study into account, the random sampling techniques and purposive sampling techniques were utilized properly.

In total, 120 household heads were surveyed by random sampling techniques to conduct a research survey.

The entire field data collection covered 120 households out of 19,546 household populations of Burayyu town. These households certainly represent the total household due to the total households are homogenous and the increment of household does not bring different results. The field data collection lasted for 10 working days and all six kebeles were taken into account for the field work. The list of the kebeles is shown in table 3.1 below.

Table 3.1 number of households selected for field data collection from each kebele of the town

S/N	The Kebeles in Burayyu Town	Number of Households Interviewed
1	Leku Keta	20
2	Burayyu Keta	20
3	Gefersa Nonno	20
4	Gefarsa Burayyu	20
5	Gefarsa Guje	20

6	Melka Gefarsa	20
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Source: Burayyu Town Field work: 2016

In each kebele, a random sampling method was used to select the households. It should be understood that the selection of the sample of men and women did not come in to the issue because the unit of analysis of the study was not individuals, but households. Consequently every normal adult person in any selected household was therefore eligible and was made to answer the questions.

Field observation was carried out to observe what people go through when they search for water. This, in addition to the author's own four years of personal experience in the area as a resident was expected to be in support of or disagree with what others say, in order to enrich the research qualitatively.

Key personnels of the Burayyu Town Water and Sewerage Service were served with some questionnaires and interview to collect information needed for the study. Purposeful selection technique was used to sample the key personnels from the stakeholder institutions. The selection was based absolutely on who is in a position to provide the needed information. Some of the related informations were collected from the key personnel of Burayyu Town Municipality, and Burayyu Town Health Center. The table below listed some of the key personnel from the various organizations.

Table 3.2: Key Personnel who gave Information in some Institutions

S/ N	Institution	Position
1	Burayyu Town Water and Sewerage Service	Head of the Town Water and Sewerage Service
2	Burayyu Town Water and Sewerage Service	Officer of the Town Water Supply and Utility
3	Burayyu Town Municipality	Officer of Burayyu Town Plan and Budgeting
4	Burayyu Town Municipality	Officer of Burayyu Town Plan and Budgeting
5	Burayyu Town Health Center	Head of Burayyu Town Health Center

6	Burayyu Town Health Center	Healthy officer at Burayyu Town Health Center
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Source: Burayyu Town Field Work, 2016

3.4 Tools of Data Analysis

Statistical Package for the Social scientists (SPSS) was used to analyze the data obtained from the field. The results were presented in both quantitative and qualitative terms. They were in the forms of frequency tables. Inferences and calculations were made from these measures and compared with the existing literature to arrive at the conclusion of the study.

The falkenmark indicator of water scarcity was used as a standard to measure water scarcity in the town.

CHAPTER FOUR

4. RESEARCH FINDINGS, ANALYSIS AND INTERPRETATION OF DATA

4.1 Historical Background of Burayyu Town

The Burayyu town was founded in 1946 by a land lord of that area named Girazmatch Robi Kelecha. The term Burayyu is an Afan Oromo name referring to name of one black indigenous trees of the region.

The residence of the above person is called Lafa Robi Kallacha. This covers the areas along the Burayyu River to the east including the present day Burayyu Bricks Factory, the Total Gas Station and all along both sides of the main road. In those early days around 3000 people were settled on an area of less than 10 hectares (Socio-economic profile, 2015).

During the imperial era Burayyu was administered within the Menegasha Awuraja of Shewa province without being given any status of town administration. During the Derg regime, Burayyu used to have two different administrative entities namely an Urban Dwellers Association (UDA) and a peasant association. Accordingly, houses which are located between the center and the gefersa dam have been given numbers and fell under the jurisdiction of the UDA, and the remaining part of Burayyu was transferred to the peasant association. In 1996 the municipality of Burayyu town was established over the area between ketta and Gefersa. In 2005 both the rural and urban administrations were brought under one municipal urban administration.

4.2 Location of the Study

Burayyu town is located in the western fringe of Addis Ababa, along the Addis Ababa ambo road at about 15km from the center of Addis Ababa, Piazza. Astronomically the town extends roughly from $9^{\circ}02'$ to $9^{\circ}02' 30''$ N latitudes and $38^{\circ}03'30''$ to $38^{\circ} 41' 30''$ E longitudes. It is bounded by Addis Ababa city in the east, Sululta district in the north, Walmera district in the west and sabata hawas district in the south and northwest.

Burayyu town is presently under Special Zone of Oromiya Surrounding Finfine City Administration; in 2006 it has been granted 1stlevel town status (Socio-economic profile, 2015).

The existing built up area of the town is 5253.735hectares and the area under the town administration including the adjacent associations is 8900 hectares (Socioeconomic profile, 2015).

4.3 Topography

As the Burayyu town is situated at the southwest foot of entoto ridge, most of the existing built up areas of the town lies on rugged terrain (land profile with steep slopes, deep streams or river valleys with steep gradients, deep river /stream banks, gullies and ridges) with limited flat lands.

Altitude of the town in the north ranges from 2600 meter above sea level in the south at tinshu Akaki River to 2450 measured above sea level in the north at entoto ridge (Socio-economic profile, 2015).

4.4 Climate

The mean annual rainfall is about 1188mm. The highest rainfall concentration occurs from June to September.

The town is characterized by fast growth of industrial investment and currently there are about 212 manufacturing industries, 116 medium and 96 small scale industries more than 5756 permanent and nonpermanent workers are employed in the medium scale industries which have capital more than birr 1.18 billion (Socio-economic profile, 2015).

4.5 Population

The population count made by population and housing census conducted in 1999 E.C has considered here to see the trend of the population size of the town. The 1999 population census put the population size of the town at 63,889. based on the 1999 census, projected population of the town in year 2005 is 81,740. Whereas the population counted in year 2015 by Burayyu town municipality is around 114,126, and 19,546 households in Burayyu town.

Figure 4.1 Map of Burayyu Town (Burayyu town water and service annual plan of 2009 EFY)



4.6 Objectives, Organizational Structure, Vision, and Mission of the Burayyu Town Water and Sewerage Service

4.6.1 Organizational Structures of Burayyu Town Water and Sewerage Services

The Burayyu Town Water and Water Service has five departments with 75 total workers (59 males and 16 females). These departments include the Human Resource and Logistic Department, Procurement and Finance Administration Department, Water Supply Facility Department, Planning and Budget Coordination Department, and communication department. The organization structure of services are Oromia Water, Mines and Energy Office at the top, a Town's water board, a general manager, planning coordinator, administration of water supply facility, a department of purchase and finance administration, and department of human resource and logistic .

Figure 4.2 Organizational Chart of Burayyu Town Water and Sewerage Service

The town's water board is at the top and leads and regulates the water supply service as a supervisory body. The board shall consist of the following members who are appointed by the administrator of the town: -

- Representative of the Burayyu Town Administration Office-----Chair Person
- One person from Water Resources bureaus-----Member
- One person from health office-----Member
- One person from Women Affairs office-----Member
- One person from Finance & Economic Development office of the town-----Member
- One person from the branch office of EEPCO in the town-----Member
- One person from education office-----Member
- Two persons from customers of the Water Supply Enterprise-----Members

The Manager of the Enterprise shall be a non- voting participant in the Board

The major role and functions of town water boards are organizing the utility and direct its activities; examining and approve short, medium, and long term work plans and the budget of the Utility, follow-up and control its practical implementation, evaluate periodically its performances; submitting and having it approved the investment budget, follow-up and control its implementation; assign ing Head of the WSSS and discharge him for loss of confidence; examining and decide over requests of various allowances and benefits; examining and reviewing water tariff; forward same for decision to the organ of its accountability. Upon approval follow-up its practical implementation; putting in place a system of finance and property control, follow-up its implementation and pass appropriate decisions on audit report submitted to it by the Utility; submitting performance report periodically to the organ of its accountability.

4.6.2 The Objectives of Water and Sewerage Service

The main objectives of the Burayyu Town Water and Sewerage service are planning and development of water supply systems in all urban communities in the country; the provision and maintenance of acceptable levels of service to consumers in respect of quantity and quality of water supplied; the conduct of research relative to water and related subjects; the making of engineering surveys and plans; the construction and operation of works in the urban areas; submission of tariff proposals to the Public Utility Regulatory Commission (PURC) for review and final approval, and conducting of other related or incidental activities.

4.6.3 The Missions of the Burayyu Town Water and Sewerage Service

Generally, the major missions/functions of town water supply and sewerage services are the followings providing adequate and standard quality potable water supply to dwellers in and around a town; rendering sewerage services as case may be; administering itself on the basis of cost recovery principles and the decision and guidelines of town water board that lead and regulate the water supply and sewerage service; installing water distribution lines to provide the water supply service, and amending, maintaining, and repairing related water works find under it; delegating parts of its powers and duties to service providers (public authorities or organization or consultant) which enable it to carry out efficiently its duties; ensuring that any water sources are not polluted or contaminated, but are protected and conserved, to this end, it shall take the necessary actions including the closure of contaminated sources in cooperation and consultation with the concerned government organs as required; establishing a system that assists to boost the efforts being made to provide water supply and sewerage services including liquid waste disposal in its work areas; entering into contract, buy, sell, own, and lease movable and immovable property, and sue and to be sued in its name and carrying out other similar activities that assist for the attainment of its objectives.

4.7 Water Source and Water Coverage in the Town

The data collected from officials and the official documents of the Burayyu Town Water and Sewerage Service indicates that the sources of water for the town are ground water as indicated in table 4.1 below. From this table it can be concluded that the number of ground water is increasing from year to year. In 2011 and 2012 the number of ground water was 8, in 2013 it was 9, in 2014 it was 10 and in 2015 it was 13.

Table 4.1 Sources of Water Supply (BTWSS, 2009 EFY)

Year	Number	Coverage	Ground water
2011	8	44	Ground water
2012	8	56	Groundwater
2013	9	56	Groundwater
2014	10	81	Groundwater
2015	13	90	Groundwater

All households use private tap water the source of which is groundwater. They also use rainwater during rainy season for washing clothes and some other purposes other than drinking purpose as shown in table 4.2 below. 108 households or 90% household use water from hand dug well where some household have it in their compound and others buy from those who have privately.

Table 4.2 Response of Households on Sources of Water

Source of water	Number of household	%household
Private tap water	120	100
Rain water	120	100
Hand dug well	108	90

The official document of Burayyu Town Water and Sewerage Service indicates that the water coverage of the town was 53% in 2011, 56% in 2012, 69% in 2013, 81% in 2014, and 90% in 2015 as shown in figure 4.3 below.

Figure 4.3. Water Supply Coverage of the town

100					
50					
0					
	2011	2012	2013	2014	2015

Source: BTWSS, 2015

4.8. Accessibility of Water in Burayyu Town

The accessibility of water in the study area depends upon the regularity and the adequacy of supply. For the purpose of study, only households who are connected to the water supply system are taken into consideration. Frequency of flow of water has been a major concern for the inhabitants of Burayyu town and so the situation has been shown in the table 4.2 below on the basis of data collected from the households.

Table 4:3 Frequency of Flow of Water in Burayyu Town

Frequency of flow of water	Number of house hold	% household
Continuous	-	-
3 days per a week	5	4.17
Once per a week	40	33.33
Once per two weeks	60	50
Once per month	15	12.5

Source: Burayyu Town Field Survey

As indicated in the table 4:3, there was no respondent who responded there is continuous frequency of flow of water. 5 households or 4.17% households answered the frequency of flow of water is 3 days per a week. 40 households or 33.33% of households responded the frequency of flow of water in the town is once per a week whereas 60 households or 50% households responded the frequency of flow of water in the town is once per two weeks. 15 households or 12.5% household responded the frequency of flow of water is once per a month. All households responded there is no continuous flow of water. Therefore, they were asked to answer their options during water interruption. Accordingly, 86 households or 71.67 % household state that they store water through jerrican in case it is not suffice they buy ground water through jerrican from those household who have groundwater within their compound whereas 22 households or 18.33% household responded they have ground water as an alternative. The remaining 12 households or 10% household stated that they use stored water through jerrican or big tanks until the water comes again. The table below shows options of getting water during interruption:

Table 4.4 Options to Get Water during Water Interruption

Options to get water during water interruption	Number of house hold	% household
Having hand dug well within compound as an alternative	22	18.33
Storing sufficient water during the interruption	12	10
Store water and buy it during interruption in case the stored is not suffice	86	71.67

Those households who purchase water from those who have ground water were requested to respond the distances travelled to fetch water. As shown in table 4.5 below, 40 households or 33.33% household stated that they buy water from neighbors travelling 500m up to 1km whereas 30 households or 33.33% households stated that they purchase water travelling a distance beyond 1km. The remaining 16 households or 13.33% households stated that they purchase water

travelling a distance between 200m and 500m. In all cases, the distance travelled is far greater than 200m World Water Measurement Accessibility Standards. Therefore it is advisable for households acquiring larger storage facilities to minimize distance travelled to fetch water.

Table 4.5: Distances Travelled to Fetch Water

No	Number of households	% House holds	Distance travelled to fetch water from those house hold who have ground water within their compound
1	16	13.33	200m-----500m
2	40	33.33	500m -----1km
3	30	25	Beyond 1km

Source: Burayyu Town Field Survey 2016

It is also necessary to measure accessibility of water for households in terms of quantity of water consumed in litres per individuals. As shown in table 4.6 below, 10 households or 8.33% households stated that the individual consumption of water per a day is between 15-20 litres. 70 households or 58.33% of households responded the estimate amounts of water consumed in litres per individuals are between 10 litres and 15 litres per individual. 40 households or 33.33 % households responded the estimate amount of water consumed in litres per individuals is below 10 litres. Taking the average that an individual receives 10 litres per day and the total annual consumption will be 3600 litres .That is the individual annual water consumption will be 3.6m³. However, due to there is real data obtained from BTWSS, the water distributed to the resident in 2015 is 1,040,157m³ when divided by the total population of the town, 114,126, the water per-capita of the individual will be 9m³ which is the absolute water scarcity according to the falckenmark indicator.

Table 4.6: Estimated quantity of water consumed by Individuals

No	Estimate quantity of Water Consumed in Litres per Individuals	Number of households	%households
1	Within 15-20 Litres	10	8.33
2	Within 10-15 Litres	70	58.33
3	Below 10 Litres	40	33.33

This distribution may be based on the household size and what water is used for in the household. In the survey of 120 households, 50% of the households have a size of 6; 31% have

size 7 and 19 % of them have size 5. This means the majority of the households interviewed (81%) have household sizes ranging from 5 to 7, giving an average of 6 members in a household, which is normal in Burayyu town.

Table 4.7-Households Family Size

No	Households family size	Number of households	%households
1	6	60	50%
2	7	37	31%
3	5	23	19%

Source: Burayyu Town Field Survey 2016

As discussed above, 86 households or 71.67% household purchase ground water when there is no water flow. The material they use to fetch water is jerrican; the amount of litre it contains depends on preferences of households. The amount that households pay for a jerrican of water varies depending upon the range of distance between source and destination, and quantity of litre the jerrican contains as shown in table 4.8 below. The variation of payment depending upon the range of distance between source and destination emanate from additional costs some households incur to transport it to their home. 74 households or 86% households out the total 86 household who buy water stated that they pay 1 birr for purchase of water and 5 birr for laborer to transport to their home for jerrican containing 20 litres whereas 12 household or 14% households pay 2 birr for purchase of water containing 20 litres. 76 households or 88% households out of the total 86 households who buy ground water pay 1.5 birr for purchase of water and 6 birr for laborer to transport to their home for a jerrican containing 25 litres whereas 10 households or 12% households pay 2 birr for jerrican containing 25 litres.

The places where the water is bought are houses of some households who have ground water in their compound but do not have the license to sell from concerned government office. But the price set above may become a common price due to the regular flow of water is very limited and purchasing water from individuals for consumption becomes a normal life of households.

Table 4.8: Amount paid for a jerrican containing 20 and 25 litres

The Type of Jerrican	Numbers of household	% House Hold	Birr to be Paid for Purchase	Birr to be paid for transport	Total birr paid
A Jerrican Containing 20 Litres	74	86	1	5	6
	12	14	2	5	7
	-	-	4	5	-
	-	-	6	5	-
A Jerrican Containing 25 Litres	76	88	1.5	6	7.5
	10	12	2	6	8
	-	-	4	6	-
	-	-	6	6	-

Source: Burayyu Town Field Survey 2016

Cost of water is one indicator of water accessibility for households. Like other towns, the households are billed according the amount of meter cube of water used per month. The water meter rent is set progressively depending on the size of the water meter. The following table shows the existing monthly water meter rent.

Table 4.9: The Water Tariff of the Town

No	M ³	Birr
1	0-3	4.50
2	3-5	5.25
3	6-8	6.00
4	9-11	6.75
5	>12	7.50

Source: BTWSS, 2015

As stated above, imposing the above tariff on households for water consumption may not be a challenging cost despite the limited days of the frequency of flow of water makes it difficult to assess its accessibility in terms of costs.

4.9 Causes of Water Scarcity

In the table 4.2 shown above, there is no continuous flow of water in the town. Therefore the households are asked to answer the reason of such problem in table 4.10 below. Accordingly, 96 households or 80 % of the households were of the view that the causes of the water scarcity in the area was due to the fast expansion of the town and population growth, which the old existing pipelines cannot support, 78 households or 65% of households stated that lack of capacity of the Burayyu Town Water and Sewerage Service is a cause for water scarcity in the town whereas 12 households or 10% of households responded inadequate finance is a cause for water scarcity in the town.

Table 4.10: Causes of Water Problems in the Burayyu Town

Causes of water problem	Numbers of households	% households
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Population growth and urban expansion	96	80
Lack of capacity of the supplier	78	65
Inadequate fund	12	10

Source: Burayyu Town Field Survey 2016

Like the households of Burayyu Town, the officials of the Town Water and Sewerage Service were interviewed on the issue to identify the causes of water supply problems in the area. Accordingly, one cause of the water scarcity identified the fast expansion of the town and population growth. The springing up of industries in the area that use a lot of water is one instance of the fast expansion of the town. There are about 212 manufacturing industries, 116 medium and 96 small scale industries in both of which more than 5756 permanent and nonpermanent workers are employed.

The population of the town has also grown significantly from 10,027 in 2007 to 114,126 in 2015 and this significant growth has greatly affected the existing water utility of the town.

Another factor of water cause the collected data from officials of BTWSS indicate is topography of the town. Burayyu town is situated at the southwest foot of entoto ridge, most of the existing built up areas of the town lies on rugged terrain (land profile with steep slopes, deep streams or river valleys with steep gradients, deep river /stream banks, gullies and ridges) with limited flat lands. Altitude of the town in the north ranges from 2600 meter above sea level in the south at Akaki River to 2450 measured above sea level in the north at entoto ridge. This rugged train of the town has its own contribution in aggravating water scarcity in the town because the flow pressure of water is high at lower altitude and low pressure at higher latitude.

The officials also state there are ethical problems that affect the supply of water in the town which includes lack of commitment of the employee, corruption, and discrimination, and less initiative of workers to develop his/her skill.

The lack of capacity is also one of the cause of water scarcity in the town because decision is not on based on knowledge, there is less attention given to the main function, there is human resource gap, there is educational gap of workers, and there is no team spirit. For example, in

2008 EFY, The BTWWSS has produced 2,108,339 m³ of water and distributed only 1,040,157 m³ of water. This indicates the water produced is twice water distributed which also means that half of water produced is left undistributed. The source of this reason is lack of technology, weak capacity of workers, and the poor management by managers of the BTWSS (BTWSS, 2015).

The Gap in problem identification, planning, implementation, monitoring and evaluation due to false report not showing factual information on the ground is also a cause for water scarcity.

There is a gap of technologies to overcome water scarcity in the town. The facility of the water supply are poorly constructed , there is no ICT for transfer of information, gap in the technical skills needed to efficiently construct, operate and manage a technical solution, and problem of the translation of information to promote informed decision-making when implementing a technical solution, and others.

4.10. The Impacts of Water Scarcity

The respondents were also requested to answer the possible impacts of the water problems as listed in table 4.5. In this regard, 100% of the households stated the water scarcity in the area retards progress in all domestic and commercial activities in many ways.

To reduce the impacts on the economy, all respondents noted they purchase big tanks for collecting water, purchase bottled water for drinking and purchases water from neighbors and or incur cost for extraction of the hand dug well which all in one way or another affects their economy.

Another impact of water scarcity the housed holds stated is the health impacts. Accordingly, all respondents noted the scarcity of water affects their health through infectious disease such as typhoid, ameba, typhus and *Guardia* as shown in table 4.11 below. This incidence of infectious disease may emanate from consumption of collected water through big tanks and jerricans.

Table 4.11 Impacts of water scarcity in the town

Types of impacts	Number of household	% household
Impact on health (typhoid, cholera, ameba, guardia, and sanitation problems)	120	100
Impact on economy (costs incurred for purchase of water, water-cans and slowing down of domestic and commercial activities)	120	100

Source: Burayyu Town Field Survey 2016

The data collected from Burayyu Town Health Center indicated that the health impacts of water scarcity are related to the majority of top diseases in the town for the last five years. The severity of these diseases is increasing from year to year in the town and these include typhoid, typhus, Ameba, Guardia are the major among the many (Appendix II). Therefore, to alleviate the problems, both the community and the government office like Health Office, Municipality and BTWSS should work hard together to ensure the health of urban dwellers.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The source of water production for the Burayyu town is a groundwater and the households use rainwater during rainy season collecting from the drop of their home. In 2015, the number of ground water was 13 and this served as 90% water coverage in the town.

The Burayyu Town Water and Sewerage Service has distributed 1,040,157m³ of water to the 114,126 population of the town although it has produced 2,108,339m³ of water in 2015. The individual person has got 9m³ water per-capita from the annual water distributed and might have got 18. 5m³ if the annual water produced was distributed. In both cases, there is absolute water scarcity in the town according to Falkenmark indicator.

The water is scarce in the town and there are different factors such as lack of capacity, population growth and urban expansion, and inadequate finance for this.

The urban expansion which springing up of industries in the town consumes additional water in is one of the causes for water scarcity in the town. The population of the town has also town

grown from 81,740 in 2005 to 114,126 in 2015 where the existing facility has not matched with it.

The lack of capacity which consists of institutional, technological, human resource and management capacity has led to poor water governance. There is no technology to extract ground water efficiently and distribute it to the dwellers. There is also gap in technical skills needed to efficiently construct, operate and manage water supply projects.

Moreover, the lack of capacity of workers aggravates the water scarcity of the town. It consists of making arbitrary decision, giving less attention to the main function, educational gap of workers, and absence of team spirit among workers, the frequent human resource flow human resource. There are ethical problems of workers such as discrimination, lack of commitment, and corruption which are causes for the water scarcity in the town.

The topography of the town is rugged terrain and it retards the speed of flow of water.

The lack of institutional capacity which includes gap in problem identification, planning, implementation, monitoring and evaluation based on false report not showing factual information on the ground aggravates the water scarcity in the town.

The impacts of the water scarcity on the residents of the town include health and economic impacts. The health impact is manifested in waterborne disease and sanitary problems. The waterborne diseases are typhoid, ameba, typhus and Giardia. The economic costs incorporate money incurred for purchase of water, tank and jerrican for water storage.

5.2. Conclusion

This paper has focused on causes and impacts of water scarcity in the Burayyu town. Water is scarce in the world in general and Ethiopia in particular. This is true in Burayyu town due to households do not receive a regular supply of water. This problem increases from year to year at an alarming rate.

There are factors that create water scarcity: lack of capacity, population growth and urban expansion, inadequate finance, climate change and weak participation of private sector. The lack of capacity includes the lack of technological, institutional, managerial and human resource capacity.

The mismatch between the Population growth and urban expansion, and development of water infrastructure certainly creates water scarcity.

The finances to be allocated for the performance of function of the water service must be suffice for the plan designed to be implemented the insufficiency of which clearly brings scarcity.

The prolonged dry periods and severe drought, increased atmospheric and water temperatures increase water demand and increase quantities of water needed for industrial cooling.

The water scarcity brings health and economic impacts on people. The Health Impacts of Water Scarcity can be seen in bringing waterborne diseases and the absence of sanitary domestic water that are leading causes of death worldwide. The economic impacts of water scarcity brings financial losses due to disruption of operations: increased financial investments due to required water treatment, either for water use, or wastewater treatment; loss of an anticipated revenue base due to cancelled or delayed growth and expansion in a region due to quality, quantity, or stakeholder considerations.

Burayyu town is one of the special zones surrounding Addis Ababa City administration. It has six kebeles, 19,546 households and a population of 114,126. The source of water for the town is mainly groundwater. There is a serious water scarcity in the town .120 households were selected and Officials from Burayyu Town Water and Sewerage Service, Burayyu Town Municipality and Burayyu Town Health center were also taken into account in gathering relevant information for the research.

The households were requested to respond to structured questionnaires which mainly deal with the causes and impacts of water scarcity in the town. Accordingly, they stated lack of capacity, population growth and urban expansion, and inadequate finance are mainly the causes for such water scarcity.

The lack of capacity emanates from workers arbitrary decision, educational gap, and absence of team spirit of workers.

The lack of institutional capacity mainly poor production capacity of the water for the resident and poor management capacity of the manager aggravates water scarcity in the town.

The Burayyu Town Water and Sewerage Service has distributed 1,040,157m³ of water to the 114,126 population of the town although it has produced 2,108,339m³ of water. The individual person has got 9m³water per-capita from the annual water distributed and might have got 18. 5m³ if the annual water produced was distributed. In both cases, almost there is no water even for basic human requirement according to the falckenmark indicator of water scarcity.

The springing up of industries and the population growth of the town from 81,740 in 2005 to 114,126 in 2015 where the existing facility has not matched with it has created such water scarcity in the town.

The source of water in the town is groundwater which requires technology to extract efficiently and distribute it to the dwellers the absence of which makes difficult overcoming water scarcity in the town.

This water scarcity has brought health and economic impacts on the residents of the town. The health impact includes waterborne disease and sanitary problems whereas the economic impact includes costs incurred for purchase of water, tanks and jerricans.

5.2. Recommendations

► The outcome of the study indicates there is inaccessibility of water in Burayyu town especially there is low frequency of flow of water. In 2015, 2,108,339m³ of water was produced from the source of 13 ground waters despite half of it was distributed. Had the water produced been distributed the individual water per-capita was 18.5m³. This average water per-capita was very insufficient. For this reason, BTWSS should add water production so that the adequate flow of frequency of water can be achieved for those households that have private tap water.

► As mentioned above, the quantity of water produced was 2,108,339m³ and the quantity of water distributed was 1,040,157m³. As the data clearly indicates, the supplier of the town has distributed half of the water it produced. Therefore, there is a gap of capacity to distribute water already produced. The capacity of BTWSS should be built meaning the human, technological, infrastructural, institutional and managerial resources must be encouraged so as to achieve a committed public sector with high performance to solve the existing water problems in the town.

- ▶ Lack of inadequate fund is one of the causes for water scarcity in the town. There must be adequate fund allocated for the water service of the Burayyu town. Both government budget and official development assistance from donor countries and multilateral donors to the water supply and sanitation sector must be increased.
- ▶ Weak capacity is a major impediment to the provision of water and sanitation services and the sound management of water resources. An effort has to be made to build the capacity through requirements of graduates and skilled personnel so that the lack of institutional and human resource can be curbed.
- ▶ The lack of science and technology aggravates water scarcity of the town. Therefore, there must be improved applications of currently available science and technology that address current water shortages and the need to increase water availability. In addition, there must be science and technology that address the problem of water infrastructure in the town.
- ▶ The fast growing of population mismatched with the water services. In addition to speeding up of water infrastructure as one solution, fast growing of population must be reduced through family planning and reproductive health services.
- ▶ The urban expansion of the town must be matched with the development of water infrastructure of the town.
- ▶ The source of pipe line water for the town is ground water. The number of ground water must be increased as well as new sources of water supply to the town such as dam and reservoirs must be developed so that the production capacity of the Burayyu Town Water and Sewerage service can be increased.

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ANNEXES

ANNEXES I (QUESTIONNAIRE FOR SAMPLE HOUSEHOLDS)

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF PUBLIC ADMINISTRATION AND DEVELOPMENT MANAGEMENT

QUESTIONNAIRE

Dear respondents, this questionnaire is prepared as an instrument to conduct an academic research for the fulfillment of Masters of Public Management and Policy specialization in Development Management (MPMP) in Addis Ababa University College of business and Economics Department of Public Administration and Development Management. The main objective of the research is to assess the causes and impacts of domestic water supply in the Burayyu Town Administration of Oromia Regional State from 2011-2015.

Hence, the questionnaire attempts to assess the provision and challenge that constrain effective performance. Therefore, your honest response would be vital for the effectiveness of the study. All information you provide for this academic issue would be treated confidentially. So you are kindly requested to fill the questionnaire according to the instruction given for each item.

Please note that:

√There is no need to write your name.

√Each question has its own intervention to follow

√Return the questionnaire to the researcher, as soon as you complete filling it

Thank you

I. Questionnaires for Sample Households

NB: You are required to encircle one or more of the choices

a. Personal profile of the respondent

Age _____ Sex _____ Levels of education _____ Family size

Marital status _____ house ownership _____ Occupational status

_____ Monthly income _____

b. Detail questions about water accessibility.

1. What is the source of water for your private tap water?

A. Groundwater

B. Rain Water

C. Surface Water

2. On average how often do you receive piped water?

- A) Continuous
- B) 3 days per a week
- C) Once per a week
- D) Once per two weeks
- E) Once per month

3. If your answer for question Q2 is all except A, where do you get water during the interruption?

- A. Storing water through water tanks and others
- B. Private hand dug well within compound
- C. Buying water from those who Private hand dug well within compound
- D. Buying bottled water for drinking

4. If your answer for Q3 is C, how much do you pay in birr on the average for one jerrican of water containing 20 litres? A.1 B.2 C. 4 D. 6 E. Other

5. If your answer for Q4 is E, please specify the amount of money-----

6. If your answer for Q4 is C, how much do you pay in birr on the average for one jerrican of water containing 25 litres? A.1.50 B.2 C.4 D.6 E. Other

8. If your answer for Q6 is E, please specify the amount of money-----

9. If your answer for Q4 is D, how much do you pay in birr on the average for one bottle of water containing 2 litres? A.9-11 B.12—14 C.15-17

10. Which of the following reason is appropriate for tap interruption?

- A. urban expansion and population growth B. inadequate finance C. lack of capacity
- D. others

11. If your answer for Q10 is D, please specify the cause-----
12. If you don't have tap water or tap water is interrupted, how long do you take to the water source?
- A. ≥ 30 minutes
- B. between 5 minutes - 30 minutes
- C. within 5 minutes
- D. below 5 minutes
- E. Others
13. If your answer for Q4 is C, what round trip distance you spend to fetch water?
- A. 200m-500m B. 500m- 1km C. beyond 1km
14. What is your average daily water consumption in litres (for individual human consumption)?
- A. below 10 litres B. 10-15 litres C. 15-20 litres D. Others
15. What type of impacts the water scarcity brings on you?
- A. health B. economic C. others
16. If your answer for Q15 is B, what is the economic impact of water scarcity?
- A. purchase of tanks or jerricans B. purchase of bottled water C. slowing down domestic activities D. others
17. If your answer for Q15 is A, What is health impact of water scarcity?
- A. incidence of water borne disease (typhoid, ameba, typhus and Guardia) B. sanitary problems C. others
18. If your answer for Q15 is C, please specify-----
19. If your answer for Q16 is D, please specify-----

20. If your answer for Q17 is C, please specify-----

**ANNEXES II INTERVIEW AND SOME QUESTIONNAIRES FOR OFFICIALS OF
BURAYYU TOWN WATER AND SEWERAGE SERVICE**

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF PUBLIC ADMINISTRATION AND DEVELOPMENT

MANAGEMENT

QUESTIONNAIRE

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Please note that:

√There is no need to write your name.

√Each question has its own intervention to follow

√Return the questionnaire to the researcher, as soon as you complete filling it

Thank you

Personal information

Age _____ sex _____ your responsibility or position in the organization _____ years of experience in the office-----educational level-----

1. What is the source of water from which the water and sewerage service supply to urban dwellers in the Burayyu town?
2. What is the current coverage of water supply in the town?
3. Does the household who have private tap or water pipe line get the water continuously?
A.Yes B.No
4. If your answer for Q3 is A, how often and how long?
5. If your answer for Q3 is A, from where households get water during interruption?
6. If your answer for Q3 is A, what is the average distance the households travel to fetch water during interruption?

7. If your answer for Q3 is A, what are the causes for this water scarcity?

8. What are the impacts of water scarcity in the town?

9. What is the average amount of water an individual consumes in a day?

10. How household is billed for water?

11. Trend analysis of water supply to the town in five years

Year	Total households	Number of households connected to tap water	% increase in connection to tap water	% increase in connection for total 5 years
2011				
2012				
2013				
2014				
2015				

12. What was your production capacity of water in 2015?

13. What was your distribution capacity of water in 2015?

**ANNEXES III QUESTIONS FOR HEALTH OFFICIALS OF BURAYYU TOWN
HEALTH CENTER**

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF PUBLIC ADMINISTRATION AND DEVELOPMENT MANAGEMENT

QUESTIONNAIRE

Dear respondents, this questionnaire is prepared as an instrument to conduct an academic research for the fulfillment of Masters of Public Management and Policy specialization in Development Management (MPMP) in Addis Ababa University College of business and Economics Department of Public Administration and Development Management. The main objective of the research is to assess the causes and impacts of domestic water supply in the Burayyu Town Administration of Oromia Regional State from 2011-2015.

Hence, the questionnaire attempts to assess the provision and challenge that constrain effective performance. Therefore, your honest response would be vital for the effectiveness of the study.

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Please note that:

√There is no need to write your name.

√Each question has its own intervention to follow

√Return the questionnaire to the researcher, as soon as you complete filling it

Thank you

Personal Information

Age _____ sex _____ your responsibility or position in the organization _____ years of experience in the office _____ educational level-----

1. What is the status of sanitation facilities in Burayyu town?
2. Is there any health problems affecting the city's population due to water scarcity?
A.Yes B.No
3. If your answer for Q2 is yes, what are they?
4. What should be done to solve such problems?

ANNEXES IV QUESTIONS FOR QUESTIONS FOR MUNICIPALITY OFFICIALS

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF PUBLIC ADMINISTRATION AND DEVELOPMENT MANAGEMENT

QUESTIONNAIRE

Dear respondents, this questionnaire is prepared as an instrument to conduct an academic research for the fulfillment of Masters of Public Management and Policy specialization in Development Management (MPMP) in Addis Ababa University College of business and Economics Department of Public Administration and Development Management. The main objective of the research is to assess the causes and impacts of domestic water supply in the Burayyu

Town Administration of Oromia Regional State from 2011-2015.

Hence, the questionnaire attempts to assess the provision and challenge that constrain effective performance. Therefore, your honest response would be vital for the effectiveness of the study.

All information you provide for this academic issue would be treated confidentially. So you are kindly requested to fill the questionnaire according to the instruction given for each item.

Please note that:

√There is no need to write your name.

√Each question has its own intervention to follow

√Return the questionnaire to the researcher, as soon as you complete filling it

Thank you

Personal Information

Age _____ sex _____ your responsibility or position in the organization _____ years of experience in the office _____ educational level-----

1. What is the rate of the population growth of Burayyu town within five years (2011-2015)?
2. What are the total household populations of Burayyu town?
3. Is population growth matched with the water service facility of the town? A. Yes B. No
4. If the answer for Q2 is no, what is the reason for the problem?
5. Does the Office of Water Service of Your town get adequate fund for the provision of water service? A. Yes B. No
6. If the answer for the Q4 is no, what is the reason for the problem?
7. What measures should be taken to overcome this problem?