ASSESSMENT OF THE FACTORS INFLUENCING DOMESTIC PIPED WATER SUPPLY SERVICE IN KIGOMA MUNICIPALITY TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN NATURAL RESOURCES ASSESSMENT AND MANAGEMENT (MANRAM) OF THE OPEN UNIVERSITY OF TANZANIA

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CERTIFICATION

The undersigned certified that he has read and hereby recommends for acceptance by the Open University of Tanzania a dissertation entitled. **"Assessment of the Factors Influencing Domestic Piped Water Supply Service in Kigoma Municipality Tanzania"** in partial fulfilment of the requirements for the Degree of Master of Arts in natural resources assessment and management of the Open University of Tanzania.

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DECLARATION

I, William Manyama Mkama, do hereby declare that this dissertation is my own original work and that it has not been presented to any other University for a similar or any other degree award.

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Signature

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Date

DEDICATION

This work is dedicated to my ever-supportive wife Night Daniel Milambo and especially to my little son Adonias Mkama Manyama who has been deprived of fatherly love during the period of my stay in Bangwe, Kigoma researching.

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ABSTRACT

This study aimed at assessing the factors influencing domestic water supply service in Kigoma Municipality in Tanzania. It was guided by three objectives namely to assess the sources of domestic water supply in Kigoma Municipality; to examine the causes for shortage of household piped domestic water supply in Kigoma Municipality and to evaluate the impact of water shortage on people's livelihood in the locality. The study used a descriptive-explanatory research design to collect data from a randomly selected sample of 380 respondents. Data were organized and analysed by using IBM Statistical Package for Social Scientist (SPSS) computer program version 24. Findings showed that the major sources of domestic water supply at Bangwe ward was water tape. The alternative source was springs. The causes of poor distribution of water at Bangwe ward includes: population growth, poor water governance, higher rate of water bills, poor water management, shortage of rainfall and inadequate power supply. The overall consequences were increased household expenditure, time cost, declining student (Girls) performance, disease outbreaks mostly cholera and typhoid, rising social conflict and increasing women and girl's workload in the search for water. The study recommended for the government in collaboration with other water partners to institute intervention measures, which will ensure sustainable water supply services in the locality.

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LIST OF ABBREVIATIONS

DAWASA	Dar es Salaam Water Supply Authority
GDP	Gross Domestic Product
JPM	Joint Monitoring Programme
KUWASA	Kigoma Urban Water Supply Authority
MDG	Millennium Development Goals
NAWAPO	National Water Policy
NBS	National Bureau of Statistics
NSGRP	National Strategy for Growth and Reduction of Poverty
OECD	Organization for Economic Co-operation and Development
UN	United Nations
URT	United Republic of Tanzania
UWSAs	Urban Water Supply and Sewerage Authority
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1   Overview

This chapter introduces the study on assessment of domestic water supply service in Kigoma municipality. It presents the general introduction, background to the research problem statement of the problem, general and specific objectives of the study, research questions, and significance of the study and scope of the study.

1.2   Background to the Research Problem

At a global level, improving access to domestic water supply service has been an issue on the development agenda for a long time and still this service fails to reach a substantial proportion of the world`s population. Every year the problem becomes more of a challenge due to factors such as geographical changes, rapid population growth and increasing urbanization (UN, 2003).

The 2007 Household Budget Survey data conducted by global water supply and sanitation report shows inequities by wealth quintiles in access to water, with wealthier quintiles having much higher coverage. For example, the proportion of households with access to clean and safe water in the poorest and second quintiles were between 44 percent and 47 percent. On the other hand, proportions for the high quintiles were between 55 percent and 63 percent. Poor households were also found to be paying a disproportionately higher percentage of their income for water and were also paying more than wealthier households in absolute terms (Taylor, 2009).

The improved water supply service in Europe is high with 96 percent of the population having access; in urban areas 100 percent of the population has coverage while 87 percent of the rural population has coverage. In total, the region contains 728 million people. That without access to improved water supply represents 2 percent of the global population since 2015 up to the present time (Joint Monitoring Programme, 2015).

Sub-Saharan Africa (SSA) is one of the regions with low levels of coverage of water (WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2015). Like other least developed regions, SSA did not meet the MDG target but progressed during the Millennium Development Goals period, with 42 percent of its current population gaining access to improved drinking water since 1990 (WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2015). The region achieved a 20 percent point increase in the use of improved sources of drinking water (UN - UNICEF, 2015). The population of sub-Saharan Africa doubled during the Millennium Development Goals period (1990–2015). However, access to improved sanitation facilities increased by only six percentage points during the same period (WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2015).

Northern Africa and sub-Saharan Africa even though in one continent, have made different levels of progress towards the millennium development goals on water. North Africa has 92 percent coverage and was on the track to meet its 94 percent target before 2015. Access to water supply, sanitation, and hygiene water services is limited in Sub-Saharan Africa. 319 million people in the region did not have access to improved water, and 694 million lacked access to improved sanitation facilities in

2015. Alarmingly, a large body of evidence suggests that limited or no access to water services adversely impacts development outcomes such as health, limits access to educational and economic opportunities and hampers work efficiency and labour productivity (World Bank, 2016).

Developing countries of southern Asia, Latin America and sub Saharan Africa are the mostly affected region (Nkambule and Peter, 2012). Statistically, a survey conducted in 11 countries in Sub-Saharan Africa, shows the reality of unsustainable of water projects in rural areas of the continents. The percentage of functioning water systems in rural areas ranged from 35 percent – 80 percent. A study in South Africa documented that as many as 70% of the boreholes in the Eastern Cape were not functional (Nkambule and Peter, 2012). Likewise, in Tanzania, according to water point Mapping surveys conducted by the Water Aid in 51 districts, has clearly shown the true picture of the sustainability problems facing rural water supplies. Nearly half 46 percent of public water points (WPs) were found to be non-functional. Also, quarter 25 percent of two years old WPs were found non-functional (Water Aid, 2009; LVIA, 2013).

Such sustainability failure has been attributed by the top-down traditional management approach of Governments to rural water supply, which is mostly done by focusing on designing and constructing water facilities based on prescribed needs rather than sustainable development and services (Nkambule and Peter, 2012; Sara and Travis, 2008). Lack of community participation in management has also been identified as the main factor responsible for the failure of the water schemes in most developing countries (Harvey and Reed, 2007).

According to Clos (2011) Africa is the fastest urbanizing continent on the planet and the demand for water and sanitation is outstripping supply in cities. Africa as a continent despite of having many strategies to facilitate access to safe and clean water still there are number of health-related problems due to poor sanitation. The water and sanitation position in West and Central Africa are of particular urgency, as the region has the highest mortality rate of all developing regions. It is about 191 child death per 1000 live births. Recurrent outbreaks of cholera in both urban and rural areas underline the poor state of these regions basic living condition (UN, 2012). Africa is one of the two major regions with the least improvement in accomplishing the MDG on sanitation by 2015.

Despite its abundance of lakes, safe and clean water is in short supply in Tanzania and over 75 percent of people have no sanitation facilities. Distribution of safe and clean water in Tanzania is about 53 percent and sanitation facility has been made to 10 percent (WHO/UNICEF, 2012). Many utilities are barely able to cover their operation and maintenance cost through revenue collection due to low tariffs and poor efficiency. There are significant regional differences and the best performing utilities are Arusha and Tanga. The government of Tanzania has embarked on a major sector reform process since 2002. An ambitious national water sector development strategy that promotes integrated water resources management and the development of urban and rural water supply was adopted in 2006. Decentralization has meant that responsibility for water and sanitation service provision has shifted to local government authorities and is carried out by 20 urban utilities. These reforms have been backed by a significant increase of the budget starting in 2006, when water

sector was included among the priority sectors of the national strategy for Growth and Reduction of Poverty (NSGRP) (NBS, 2008).

Despite heavy investments brought in by the World Bank and the European Union, the utility servicing in Dar es Salaam has remained one of the worst performing water entities in Tanzania. About 5.4 to 6.3 million people out of 9 million people living in urban areas live in low-income area receive little or no attention at all as far as water and sanitation services are concerned (DAWASA, 2009). Determining data on access is particularly difficult because different definitions and sources are used, which results in significant discrepancies (UN, 2012).

In Moshi the reported connection rate is 45 percent although this also includes some industrial connections, in Morogoro the reported rate is 15 percent and in Dodoma and Iringa it is 13 percent. In Dar es Salaam the length of the sewer network is estimated at 188 kilometres, although only 4 percent of households have access to it. Waste water treatment plants are reported to operate in the municipalities of Morogoro, Dodoma, Iringa, Arusha, and Songea, and in the cities of Dar salaam and Mwanza (Nyamora, 2015).

The current population projection of Kigoma is about 164,268 inhabitants (Tanzania Population data, 2019), with growth rate of 4.8 percent. The main source of water is Lake Tanganyika where it is used for domestic purpose, fishing and navigation. Also, the water from Lake Tanganyika is used for other economic activities including among others industries, commercial centres, institutions and irrigation. Kigoma Urban Water Supply Authority (KUWASA) is government formed water utility which is responsible to supply water to the community of Kigoma.

Lack of reliable power supply has caused poor water supply situation to the extent that its capacity does not meet the demand of water users at Kigoma. Kigoma region generally is not connected to the Power National Grid. Lake Tanganyika is believed to be the biggest source of fresh water in the world with good water. Even so, such important water body is available; the surrounding communities like this of Kigoma/Ujiji Municipality, still experience a big shortage of water.

According to the study conducted by Moses (2008) in Kigoma to assess water supply system, it indicated that the current water supply is about 27 percent of the demand compared to the supply in 2007 which was 38 percent and in 2006 which was 50 percent. The only source of water supply is from Lake Tanganyika. Water is pumped to the storage tanks and then distributed by gravity scheme. The deficit in water was assessed and the main problems, namely technical and poor management, were discovered. Technical problems identified include inefficiency of supply infrastructure including pumping units, intake and distribution networks.

Most of the technical problems were caused by dropping of water level in the lake, old age of pipes and pumps and lack of reliable power supply for pumping water full time. Managerial problem includes poor billing system, low revenue collection and lack of qualified staff. Revenue collection covers only 96 percent of operating and maintenance costs and staffing ratio found to be seven employees per thousand connections where the billing is carried out manually. The low supply of water to the growing population of the locality has different socioeconomic consequences to the livelihoods of the indigenous population. Although there is a good number of empirical works on the subject, few (if any) have had a focus on the repercussion of

the inadequate water supply to the livelihoods of the people. It is on this line of inquiry that this study intends to address.

1.3   Statement of the Problem

Kigoma is among the few municipals in Tanzania which is endowed with adequate surface and underground water resources to meet most of its present needs which is 26,000m3/day. However, the water supply situation in the municipality is scarce that is 7123m3/day which is equivalent to 27 percent of total demand (KUWSA, 2007). Currently, according to Water Aid Report (2018), there are a number of rural water supply projects, which are in poor condition and about 30 percent of all constructed projects are not functioning properly. Disregarding increase in population; still the amount of water pumped every day decrease as days goes on and consequently, the water supply fails to meet the actual water demanded by the residents. The water supply shortfalls have different cause and consequences to the resource users in the locality. Unfortunately, there is still little empirical work done to address these issues. It is on this need that this study was set out to address the gap in question.

1.4   Objective of the Study

1.4.1   General Objective

 The general objective of this study was to assess the factors influencing domestic piped water supply service in Kigoma region.

1.4.2   Specific Objectives

The study was guided by the following specific objectives:

(i)   To examine the sources of domestic water supply in Kigoma Municipality.

(ii)   To evaluate the causes of insufficient household domestic piped water supply in Kigoma Municipality.

(iii)   To examine the impact of water shortage on people's livelihood in Kigoma Municipality.

1.5   Research Questions

The study was guided by the following research questions; -

(i)   What are the sources of domestic water supply in the study area?

(ii)   What are the causes of insufficient household domestic piped water supply in the study area?

(iii)   What are the impacts of water shortage on people's livelihood in the study area?

1.6   Significance of the Study

The findings from this study intends to provide relevant information on water supply service available at the area of study so as the government and other stakeholder will be able to promote sustainable service of water supply based on the available information concerning water supply in the area.

Lastly but not the least, water stakeholders and other development partners may use this study findings as a benchmark information to further their precision in decision making and policy formulation on matters concerning water policies and strategies for the implementation of water supply national wise since this study may provide a comprehensive outlook of key issues on policy formulation.

1.7   Scope of the Study

The study was conducted at Bangwe ward in Kigoma Tanzania by paying more attention on Water resource supply as an accelerator of social-economic emancipation of households by focusing much on assessing domestic water supply service. It also focused on water supply services to the households of Bangwe ward. Also due to limited time and funds, the study was not able to cover all wards of Kigoma region. Despite of those challenges' researcher coped with them by using funds to economize the budget as well as get assistance from assistant to cover the ward during data collection. Therefore, findings should be interpreted within the scope of study.

1.8   Organization of the Study Report

This dissertation comprised of five main chapters and several sections and subsections under each chapter. The main chapters in this report are as follows: Chapter one gives the general introduction of the topic concerned. Chapter two it gives the Literature review about the topic and Chapter three is methodologies applied to carry out this study. In Chapter four is data analysis and presentation, lastly summary, conclusions and recommendations given in Chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.1   Introduction

This chapter presents a review of the different literatures related to water supply service. It focuses on the definition of key terms, theory underpinning the study, empirical studies that have been done elsewhere both globally and locally; a conceptual framework as well as knowledge gap.

2.2   Definition of Key Terms/Concepts

2.3   Water Shortage

According to Falkenmark *et al.* (1989), water shortage refers to as the lack of access to adequate quantities of water for human and environmental uses. Since the question of access to adequate water is increasingly recognized in many countries as a serious and growing concern, the term 'water shortage' is regularly used by the media, government reports, nongovernmental organizations (NGOs), international organizations such as the United Nations (UN) and Organization for Economic Co-operation and Development (OECD), as well as in the academic literature, to highlight areas where water resources are under pressure.

2.3.1   Access to Water

WHO/UNICEF Joint Monitoring Programme (JPM, 2012) defines access to 'drinking water' as the "proportion of population using an improved drinking-water source" (UNICEF/WHO, 2012). This definition is often accompanied with a definition of access to basic sanitation. Critics contend that JMP's definition does not capture the

complex nature of water particularly from the perspective of the users. Kristof (2005), for example, introduces other variables which are important for assessing peoples' access to water and includes adequate quality, adequate quantity, reliability and convenience. Furthermore, Kayaga *et al,* (2009) substitute access to water with 'water use' arguing that mere provision of water does not necessarily indicate actual use by the people.

2.4   Theoretical Review

2.4.1   Water Supply Reliability Theory

The water supply reliability theory was propounded by Damelin *et al, (*1972). They developed computer simulation model that was used to evaluate reliability for specific water supply systems and defined a reliability factor in terms of shortages in annual delivery volumes. Water supply system reliability can be defined in terms of the shortage that results from failures of a system's physical components. A reliability factor for a single failure or for a selected time period can be defined in terms of the capacity lost during failure, which is measured as a fraction of the demand rate or the demand volume. Since the lost capacity is a random variable, so is the reliability factor, and its probability density function can be derived analytically from that of the lost capacity.

Reliability, defined as the probability that a given reliability factor will be achieved, can be increased by adding facilities, storage, pumping capacity and pipelines. The least-cost combination of facilities can be identified from the cost functions and the probability distributions of the reliability factor (Shamir and Charles, 1981).

The strength of the theory is that a supply system contains sources, treatment plant, storage reservoirs, pumping station, transmission and distribution pipes. Reliability of water supply can be measured by performance indices depending on single or combined random events, some of which are: The amount of water in the sources (stored plus inflow) is insufficient, the quality of water in the sources is too low to be treated adequately by the treatment plants, failure of the part or the whole treatment plant, failure of pumps, failure of pipes, failure of the power supply to pumps and increasing demands beyond what is expected, and beyond that can be supplied by the system including the storage.

As drinking water is essential to human life, society requires water distribution systems to function properly under both normal and abnormal conditions. This means that for a reliable water supply system, water must be (i) available on demand, (ii) delivered at a sufficient pressure for proper use, and (iii) safe in terms of quality.

Despite of the strength of the theory although reliability of a water supply system in general is a measure of performance in terms of the three factors indicated, undesirable events/failure will occur which will cause a decline or interruption in system performance. The reliability of a water supply system can be considered under three types of failure: mechanical, hydraulic and water quality failure.

Water supply reliability may be improved by means of a variety of measures, such as additional production capacity of sources, that is wells, pumping stations at surface sources, water treatment plants; Standby pumping capacity at wells or pumping stations; additional storage; Increased conveyance capacity of the transmission lines

from the sources; additional pipelines in the distribution system; and improved maintenance of pumps, pipes, and other components.

Mechanical failures, also termed component failures, may, for example, be pipe breakage, pump failure, power outages, or control valve failure. Changes in demand or in pressure head may result in hydraulic failures. These failures may be due to, for example, old pipes with varying roughness, inadequacy in pipe size due to increased water demands, insufficient pumping capacity, and insufficient in-system storage capacity. Water quality failure may be defined as occurrences where the concentrations of contaminants exceed the maximum contaminant level (MCL) defined by water quality standards. The major concern for water quality failure is the adverse effect on the health of humans.

Research on water quality reliability in water distribution systems has generally been addressed in relatively simplistic terms, such as the failure to maintain a certain level of disinfectant residual, and the total time of failure for which the contaminant concentration is above a threshold, both of which are characterizations on the basis of past monitoring. The characterization of water quality problems by these measures is insufficient (Todini, 2000).

The above weaknesses can be addressed by including different players which include local government authorities, private operators and water consumers to obtain the equilibrium point of the system as the outcome of interaction among them. For instance, when KUWASA are signing contracts with private operators, they can form agreements with mutual benefits while providing good services to the community.

Also, water consumer and management entity can agree on the price of water per bucket, the price that will be feasible for both sides. The theory was used in analysing the outcome of the research and in recommending the useful decision-making tool for both stakeholders and administrative authorities for optimal water resources supply to ensure operation and maintenance for service sustainability

2.5 Empirical Literature Review

2.5.1 Global Water Situation

The rural population of Latin America and the Caribbean exceeds 120 million of which, approximately 20 percent lack access to improved water services. Access to water and sanitation services remain insufficient, particularly in rural areas and for the poor.

It also differs substantially among and within countries. According to the Joint Monitoring Programme of the World Health Organization and UNICEF in 2004, the share of population which was connected to an improved water source varied from54 percent in Haiti to 100 percent in Uruguay (WHO and UNICEF, 2016).

The main challenges hindering the increasing access to water in Latin America includes poor financial health of service providers and fiscal constraints on behalf of central and local governments. For instance, the study conducted in Bolivia and Peru by the World Bank shows that, for the population that has access to the water supply, they are not financially sustainable in the medium term and therefore require additional capital to replace the current infrastructure to expand coverage (World Bank, 2012b).

For sustainable water services in Latin America, the community organizations are entrusted to provide water and sanitation services in rural areas, but are often underestimated and neglected. Responsibility can be assigned to a government Ministry and its regional branches, a Social Fund or municipalities. Often, NGOs also carry out this function, either on their own initiative and with their own resources, or under contract by the government. In Honduras for example support to community organizations (Juntas de Agua) is assigned to the Social Fund, in cooperation with the national agency for technical assistance in water and sanitation issues (RWSN, 2015).

In El Salvador it is done by the Social Funds and various NGOs as well. In Peru, it is carried out through NGOs and municipalities with the support of a national programme implemented by the Ministry of Housing. In Paraguay it is the responsibility of the national agency in charge of promoting specifically water supply and sanitation in rural areas and small towns. In Ecuador it is carried out under the national programme by consultants working for the Ministry of Housing. In Panama such support is provided by the Ministry of Health. In Haiti such support is provided by NGOs, some of which are under contract with the national urban water agency and its specialized unit for rural areas. There is a wide variety of institutional arrangements to support community organizations, so that one cannot speak of a uniform model for such support in Latin America (RWSN, 2015).

South Asia is another region experiencing challenges in providing access to safe, sustainable water supply and sanitation. Although, the situation pertaining to adequate supply of safe drinking water and improved sanitation has improved significantly over the period of 1990-2004, owing to changes in the policy and increased attention and

funding in the water supply and sanitation sector; however, still a substantial number of people remained un-served in this region. Over 1 billion people in South Asia still lack access to improved sanitation and over 250 million people lack access to improved water supplies.

This is due to population growth, excessive pressure on existing services, slow rate of introduction of new services and lack of proper operation and maintenance of existing services, (World Bank, 2012). Accordingly, the national governments in the South Asia region have responded to the challenges with policy reforms to increase the proportion of people having access to these fundamental requirements. Countries like Bangladesh, India, Nepal, Pakistan, and Sri Lanka, have formulated policies and programmes aiming at ensuring that all the people with access to safe water and sanitation services at an affordable cost.

For instance, in India, Policy reforms in drinking water sector in India were adopted during April 1999 through Sector Reform Project, based on a paradigm shift towards decentralization and people's participation in provision of drinking water services. To ensure people's participation, the Sector Reform Project (SRP) advocated three principles which are: 1) adoption of a demand responsive and adaptable approach based on empowerment of villagers to ensure their full participation indecision making, 2) shifting role of government from direct service delivery to that of planning, policy formulation, monitoring and evaluation and partial financial support, and 3) partial capital cost sharing and full responsibility of operation and maintenance by the users (Rout, 2010).

2.5.2   Water Supply Situation in Africa

In sub Saharan Africa, access to water supply and sanitation has been steadily improving over the past two decades, but the region still lags behind compared to the developing regions. Despite having a much lower population than Asia, Africa accounts for almost one-third of the global population without access to improved water supply, and has the lowest service coverage figures than the other continent. In Africa, access to improved water supply has increased from 49 percent in 1990 to 60 percent in2008 (WHO and UNESCO, 2010).

Water and sanitation services are highly needed in Africa; but the continent has many challenges facing the components of establishing sustainability of water service. Despite poor policy, management and institution problems, other problems include poor community facilitation process which is hindered by expansive physical distances and a lack of road and telecommunication infrastructure in rural areas; little funding for monitoring and supervision; poor or no systematic documentation of failed water projects, lack of financing for water services and cases of misappropriation of water user fees also pose considerable challenges to local financing and cost recovery(Montgomery *et al,* 2019).

For instance, Ethiopia achieved its Millennium Development Goal target of 57 percent access to safe drinking water, halving the number of people without access to safe water since 1990. The driving force behind the expansion of access to safe drinking water in Ethiopia was attributed to the incidence of drought and famine in the 1970s and the 1980s. In response to this devastating situation, and adverse effects associated with years of environmental crises, quite a lot of multi-lateral and bilateral

international NGOs, donor agencies and indigenous organizations have devoted significant proportion of their fund for the provision of rural safe drinking water supply and vigorously engaged in these endeavours (Tadesse *et al*, 2013).

Despite active mobilization of resources by international and local NGOs and the Ethiopian government, the national safe drinking water coverage of the country has not been improved since then especially in the rural areas. The main reasons for the low level of performance in the supply of safe drinking water is attributed to lack of articulate and holistic water policy and insufficient investment for safe drinking water supply. Also the communities lack capability in managing the water supply schemes (Tadesse *et al*, 2013).

For the case of Swaziland, the country has made significant progress towards meeting the national targets of providing water and sanitation to the entire rural population and was likely to achieve 100 percent coverage of both water supply and sanitation by the year 2022. UNICEF and WHO (2008) also noted that the coverage of improved drinking water has increased to 60 percent national wise and 51 percent for rural. The indicators from the studies showed that Swaziland was on the right track and pace to achieve the Millennium Development Goal (MDG) to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015. However, there was high percentage of unsustainable water projects and observed malfunctioned water projects nationally. That depicts the use of the traditional management system of top down by focusing on providing more water schemes rather than the sustainable use of the existing water sources (UNICEF and WHO, 2018).

2.5.3   Water Situation in Tanzania

According to 2002 National Water Policy (NAWAPO), the sustainability of water schemes can be achieved by instituting cost recovery and beneficiary participation in the operation and maintenance of the schemes by established water entities. The entities are water user association, trustees, user groups and companies. In 1998, United Republic of Tanzania through the Ministry of Water established Urban Water Supply and Sewerage Authority (UWSAs). This is among the water organization which operates and maintains the water infrastructure and providing the service in the Urban Area. Up to date, there are about 19 UWSAs in Tanzania which are categorized in A, B and C depending on the degree of ability to recover costs.

Demographic and Health Survey (DHS) of 2010 showed that access to clean and safe water in rural areas of Tanzania was only 47.9 percent and only 43.2 percent of the population had a safe water source in less than a kilometre (URT, 2010). Findings confirm that a core reason for the low rate of coverage increase, despite investment, is the growing number of non-functional water points (Water Aid, 2019).

There are many inter-related challenges facing the achievement of desired service level and overall sustainability of rural water supply services. A key one is inadequate attention to operation and maintenance right from the planning and design stages of the operation of projects. The second is inadequate community participation in project implementation, which leads to a low sense of ownership of the projects.

Other challenges include: the limited capacity of the communities to operate and maintain the water supply systems; a poor supply chain for operational and maintenance spare parts at the community level and deterioration of the quantity and

quality of water resources due to environmental degradation (URT, 2015). Likewise, the issues of environmental protection and conservation awareness campaigns have been so limited. Communities are not much aware on the relationship between forest management and water resources.

All these challenges have considerably affected the level of service provided by the rural water supply projects. This reality is depicted by the high number of non-functional Water Points in rural water supply projects. As at the end of September, 2014 out of 74,000 water points, 28,000 were non-functional (URT, 2015). To meet these challenges, the Ministry of Water and Irrigation has prepared the National Rural Water Sustainability Strategy (NRWSS) with the primary goal to offer a framework for sustainable rural water supply development. The strategy is a framework tool for five years from January 2015-January 2020. The framework is an outcome of Joint Water Sector Review Agreed Action and is intended to guide the sector towards fulfilment of various National goals, like the Vision 2025, National Strategy for Growth and Reduction of Poverty (NSGRP), Five Year Development Plan, Tanzania Long Term Perspective Plan – TLTPP and Water Sector Development Programme Phase I and II (2006-2025), through sustainable rural water supply services (URT, 2015).

The major purpose of the strategy is to provide a single source, overall framework for the water and sanitation sub sector in Tanzania that will guide the implementation of the Sustainability programmes in rural water supply Services. The framework provides a set of tools that can support water supply sustainability mechanisms includes technical Support Services, COWSO formation and registration,

popularization of policies and sustainable operation and maintenance (O&M) and appropriate governance and management regulations for sustainable service delivery (URT, 2015).

The application of this strategy is a collaborative effort that will stimulate dialogue and solution building among a range of sector stakeholders and external partners for enabling environment for sustainable rural water supply services. The Sustainability Strategy addresses the operation and maintenance challenges of the sector in a single, overall framework supported by a series of action plans. The strategy defines how, through effective operation and maintenance, the water sector will achieve its objectives aiming at ensuring sustainable water resources and services (URT, 2015).

The rationale of this Sustainability Strategy is to involve multiple stakeholders, particularly those at district and community level in formulating and implementing strategies that will contribute towards effective, efficient and equitable rural water supply services. The Strategy enables policy coordination, implementation and performance monitoring among different sector players. The Ministry, through the Big Results Now initiative and the recently launched Institutional Strengthening and Capacity Building Component of WSDP (phase II), is committed to continue to use the financial resources available to empower the implementation of agencies at all levels to meet its commitments for sustainable service delivery.

According to NRWSS, the Big Results Now initiative in rural water sector provides the framework for action where operation and maintenance issues are focused on four key areas which are: financial sustainability through effective tariff collection;

establishment of Community Owned Water Supply Organizations (COWSOs), technical capacity building and to improve the spare part supply chain (URT, 2015).

2.6 The Causes of Insufficient Household Domestic Water Supply

Both developed and developing countries are faced by water crisis, but the problem is more adverse in Third world countries compared to developed world (World Water Commission, 2000). Water scarcity refers to economic, social, or environmental problems caused by unmet water needs (Tatlock, 2006). Water scarcity occurs when demand exceeds supply due to mismanagement of water sources, disruption in distribution, contamination, natural causes, population growth or widespread practices that consume excessive amounts of water (UN, 2006).

Globally 1.1 billion people lack access to safe drinking water, 2.6 billion people are without improved sanitation and 1.8 million people die every year from water associated diseases, including 90 percent of fewer than five children (World Water Commission, 2000). Around 1.7 billion people live in countries that are water stressed (Soussan and Arriens, 2004).

The problem of water shortage is much bigger in developing countries than in the developed world due to inadequate income, rapid growth of the urban population, unplanned urban growth which leads to stressing existing services as well as infrastructure which are increasingly in breakdown or decay, furthermore records show that 27 percent of urban dwellers in developing world do not have access to piped water at home (IDA, 2012).

The major challenge facing developing countries is how to supply safe drinking water to their citizens. The demand for water is rising at an exponential rate due to increasing population in both urban and rural areas (Akpor and Muchie, 2011).

Following this crisis, several stakeholders around the World have joined efforts to address the problem. For example, the World Bank has engaged 142 countries in lending for water (IEG, 2009). The top 10 of those countries have accounted for 579 projects (31 percent), covering 56 percent of total Bank commitments for projects with water activities (IEG, 2009). Lending for water increased by over 50 percent from 1997 to 2007(IEG, 2009). United Nations launched another global initiative to tackle the ongoing failures of water supply projects in developing countries. In 2000, the UN established the Millennium Development Goals (MDGs) in which target 10 of Goal 7 - ensuring environmental sustainability -set a target to halve the proportion of people in the world who lack access to safe drinking water by 2015 (UNDP, 2011).

Like many other poor countries of the world, Tanzania suffers from insufficient water supply especially in rural areas (REPOA, 2007). In a country whose about one third of its population is living in arid to semi-arid areas, it is very difficult for people to find access to clean and sanitary water if they are living far from water sources such as lakes and rivers (REPOA, 2007). Even in areas with river basin shortage of water is an alarming problem. Water basins like Ruvu, Rufiji, Usangu and Wami; experiences this problem as well because of a number of reasons. To mention few are; degradation of water resources, socio-economic conflict, policy and law enforcement, and management and administration of these basins (IUCN 2010). As a response of this,

ground water has been a major source of water for the national people (Madulu, 2005).

However, it is not always clean. People have been suffering even in areas where few kilometres there are water sources. Dependency syndrome to donor countries and other development partners has been a chronic problem to the majority sectors including water sectors. Research survey done before 2009 shows that about 90 percent of all water projects in Tanzania are donor funded (IUCN 2010). Thus, in case these development partners fail to bring money, the implementation of project ceases (REPOA, 2007). The central regions of Tanzania like Dodoma, Singida, Tabora and Shinyanga to mention few, suffers from water shortage (Madulu 2005).

Unfortunately, Rural Water Supply Network (RWSN, 2010) indicates that regardless of various efforts and investment towards ensuring access to safe drinking water, many of water sources in developing countries have failed to promote reliable water supply services. For example, it has been estimated that the hand pump, which provides nearly half of the protected water supplies for Africa's rural population, has an estimated functionality rate of approximately 66 percent. Across rural Sub-Saharan Africa, an average of 36 percent of hand pumps is non-operational at any given time, and in some countries, it is estimated that more than 60 percent of hand pumps are non-operational (WHO, 2011).

Although water supply and management are a cross-sectoral issue in Tanzania, the Ministry of Water and Irrigation is responsible for water supply and management. It also provides technical assistance to regional and district levels. Ownership and

operation of water systems by government institutions have been blamed for poor water delivery systems mainly linked to lack of investment capabilities and incentives for maintaining efficiency and accountability in water resource use and management.

The 2002 National Water Policy aims at developing a comprehensive framework for promoting optimal sustainable and equitable development and use of water resource for the benefit of all Tanzanians (URT, 2002) but on the ground things are currently different. Water problems are increasing regardless of the promising policy goals. This is seen as the result of the poor implementation of the policies triggered by poor governance from the ministerial stage downwards (Rugemalila, 2009).

Chinyele (2008) observed that too low revenue collected by DAWASCO to enable it to run commercially in a competitive environment has promoted insufficient water supply to different water users. This tendency of poor collection of revenue has failed DAWASCO to maintain and service pipe leakages and to replace the worn-out infrastructure. If there were a good collection of revenue coming from bills the problem of water loss due to deteriorated water infrastructure would have been solved.

Besides, DAWASCO has not devised any definite strategies to minimize running costs such as savings on the renovation of offices and the financing of seminars, workshops and meetings. Saving from such expenditures and others not mentioned here could have contributed to extending the water network. According to Wangwe et al, (2003) urban water supply in Tanzania is poor due to ineffective fee collection and low tariffs as compared to operating costs.

Illegal water connection affects the capability of water authorities to provide services to the formally connected households as required. Throughout the study, it was observed that there was a lot of water loss through illegal connections. Water authorities loose more than 154,000 cubic litres of water per day due to illegal diversions and leakage (The Guardian, 2007-09-07). It was noted during the study that, illegal water connection contributed much on water loss in the city. This finding corresponds with that of (Chinyele, 2008) who observed high proportion of water lost through illegal connection along the transmission line. Illegal water connections have been involving some of the water authorities' staff. As a proof to this, since 2005 more than 70 of its workers have been dismissed after being implicated in illegal connections. Thus, unscrupulous workers are a major problem that hinders revenue collection. They collaborate with city residents to illegally connect them with water (Chinyele, 2008).

The African Water Vision for 2025 is designed to avoid the disastrous consequences of water scarcity and lead to a future where the full potential in Africa's water resources can be readily unleashed to stimulate and sustain growth in the region's economic development and social well-being (Donkor, 2003). The shared vision is for:

> "*An Africa where there is an equitable and sustainable use and management of water resources for poverty alleviation, socio-economic development, regional cooperation, and the environment*".

The study conducted in Kenya by Medina (2007) on availability and accessibility of water to Kisumu area reported that, the Government of Kenya must recognize the provision of clean and safe water as an integral part to economic growth. Based on

this recognition the government is implementing fundamental reforms to address the challenges in water sector. The purpose of the reforms is to improve the management of water resources, improve access to water and sanitation services, enhance accountability for water resource management through decentralized provision of service and improve utilization of water resources.

The study underscores the principle and recognition of the fact that the private sector offers invaluable potential, which has not been fully harnessed to contribute to sustainable development of the water sector. Also, the study sets out the framework that is intended to bring about the culture that promotes comprehensive water resources management and development with the private sector and community participation as the prime movers in the process to guarantee sustainability of the water projects in Kenya.

Another study was conducted by William, (2008) in Tanzania on assessment of community participation in water supply and sanitation services. This study linked participatory approach and sustainability of water services which was focused in rural areas. Two villages in Temeke district were used as a case study. The study examined the extent to which people participated in the initial project planning, capacity building, and strategies to achieve sustainability. The objective of the study was:

Firstly, to assess community participation and how beneficiaries of water and sanitation services in rural areas were involved in deciding on matters that affect water projects sustainability, how the approach helps in making the projects sustainable. After obtain findings he come out with several recommendations were given as

follows: Sufficient information should be used in formulating policies and also in measuring progress towards the achievements of set targets and objectives. Not only that but also, he insisted on transparency, as in his study he noted that there was no transparency on the expenditure of project funds which gave a sign of embezzlement. It is critical problem for many development projects, legal measures should be taken against project and grassroots local leaders who trick project funds.

Proper training and technical support at all levels and for all groups engaging in water project implementation and management should be given priority. Water attendants should be given basic technical training which serves a purpose for minor repairs in case of system breakdowns. Not only that but also, he insisted on mobilization from initial stage of project implementation so as to build interest in sustaining the initiated project services. Then he found cooperation among the key stakeholders is important especially among the LG leaders and WC, and between WC and the community, as well as technical experts at the municipal and institutional level.

Another study was conducted in Ethiopia on "Access to improved water source and satisfaction with services" The main objective of the study was to examine the sources of drinking water used by people in remote rural localities. Investigation on whether access to an improved water supply has increased users' satisfaction with quality and availability was also another objective. After the study the findings were as follows, improved water sources increased users' satisfaction with both quality and quantity of drinking water. However, household satisfaction with the availability is lower than satisfaction with quality.

In this access to improved water sources is limited and surface water obtained from rivers, lakes and ponds is the major source of drinking water for about 58 percent of the households. Likewise, they show that demographic, socio-economic, and location characteristics have strong influence on household access to an improved source of drinking water in the study area.

Also, in a study conducted in Malawi on Water Supply and Accessibility done by Water Aid in 2006 found that, only 2 percent of Malawians have access to piped water inside their dwelling, and 70 percent of these households are located in the urban areas. The Lilongwe Water Board (LWB) and Blantyre Water Board (BWB) provide urban water supply service. Despite their basic corporate structure, the Water Boards in Lilongwe and Blantyre have not been able to cover operating costs through user fees, much less service loans or reinvest. The situation in the other Water Boards (WBs) is slightly better as they do cover operating costs. All WBs require capacity building, restructuring, investment planning and capital, increased customer focus, efficiency improvements, and support in reaching low income consumers. In terms of low-income service, the Lilongwe Water Board has experimented with a new model of kiosk management, which has potential to be replicated in other urban areas (Nawema, 2003).

Ghana as medium ranked country in terms of population with access to improved sanitation and safe water resource for urban residents. As at 2002, overall sanitation coverage was 58 percent with 79 percent for safe water. In most cases, tap water is 20 used for drinking and cooking, whilst well and river water is used for washing. (UN, 2003).

In the Accra Metropolis for example, over 60 percent have access to potable water. However, whilst these overall statistics do indicate some differences within particular settlements, they also hide other differences between residential areas. In Greater Metropolis for instance, areas such as Adenta, Teshie, Nungua, Nima and other places use water from unprotected sources while others use water that is red in color, due to contamination, from an unreliable borehole, and some use both, for different purposes (UN, 2003).

2.7   Research Gap

According to Mugenda and Mugenda (2013), a conceptual framework refers to conceptualization of the relationship between variables in the study. For purposes of this study, the dependent variable is inadequate water supply; intervening variables are costs, illegal water connection, ineffective water policy, destruction of water infrastructures, poor maintenance of water infrastructures and stakeholders' involvement whereas the independent variables are water supply service which constituted effective management and managerial support.

The implication is that inadequate water supply is associated by the number of factors as refer to independent variables and this implies that when water management is not effective as well as poor managerial support it leads to unplanned cost of water supply, illegal connection of water, ineffective water policy, destruction of water infrastructures, poor maintenance of infrastructures which in turn leads to poor water supply service and therefore the social welfare will not be attained by the community of Bangwe ward.

Despite of many studies reviewed in theoretical and empirical reviewed such as the one conducted by William, (2008), Medina (2007), UNDP, (2001), Soussan and Arriens, (2004),Chinyele, (2008), and other authors focused much on water supply in urban areas but there are only less coverage on the focus of water supply especially in rural areas among Tanzania villages. Water is crucial for sustainable development however, limited access to clean and safe water associated with poor water supply, hygiene and sanitation at household level is widening the poverty gap, gender inequalities and the prevalence of water-borne diseases. Tanzania is among the few countries endowed with both surface and underground water resources to meet most of its present needs (URT, 2004) still the problem of water shortage in the village is too chronic as noted by Wangwe et al 2003 and Rugemalila 2009 in their studies. Again, despite of being endowed by many water sources like Lake Tanganyika and other water sources still some wards at Kigoma do not access safe and clean water. Therefore, little was known about water supply service in most Tanzania rural area especially at Kigoma municipality where this study intended to cover this gap by assessing factors affecting water supply service at Bangwe ward by determine some factors for insufficient water supply service.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents and describes the approaches and techniques that were used to carry out the study. They include the research design, study population, sample size and selection, sampling techniques and procedure, data collection methods, data collection instruments, data analysis and presentation as well as ethical consideration.

3.2 Research Design and Methodology

The study adopted a descriptive-explanatory research design. The design allowed a detailed description and analysis of the variables under study; describing and presenting their characteristics and explaining their relationships without manipulation as supported by Saunders *et al*. (2009). The design also allowed inductive and deductive reasoning to arrive at generalizations therefore requiring precise rules and procedures regarding collection and analysis of data. The design provided for proper formulation of the objectives of the study, designing methods of data collection, selecting the sample, processing and analysing the data and reporting the findings.

3.3 Study Area

This study was conducted at Kigoma Municipality specifically Bangwe ward. Geographically Kigoma region is located on the shore of Lake Tanganyika at the North West Corner of Tanzania.

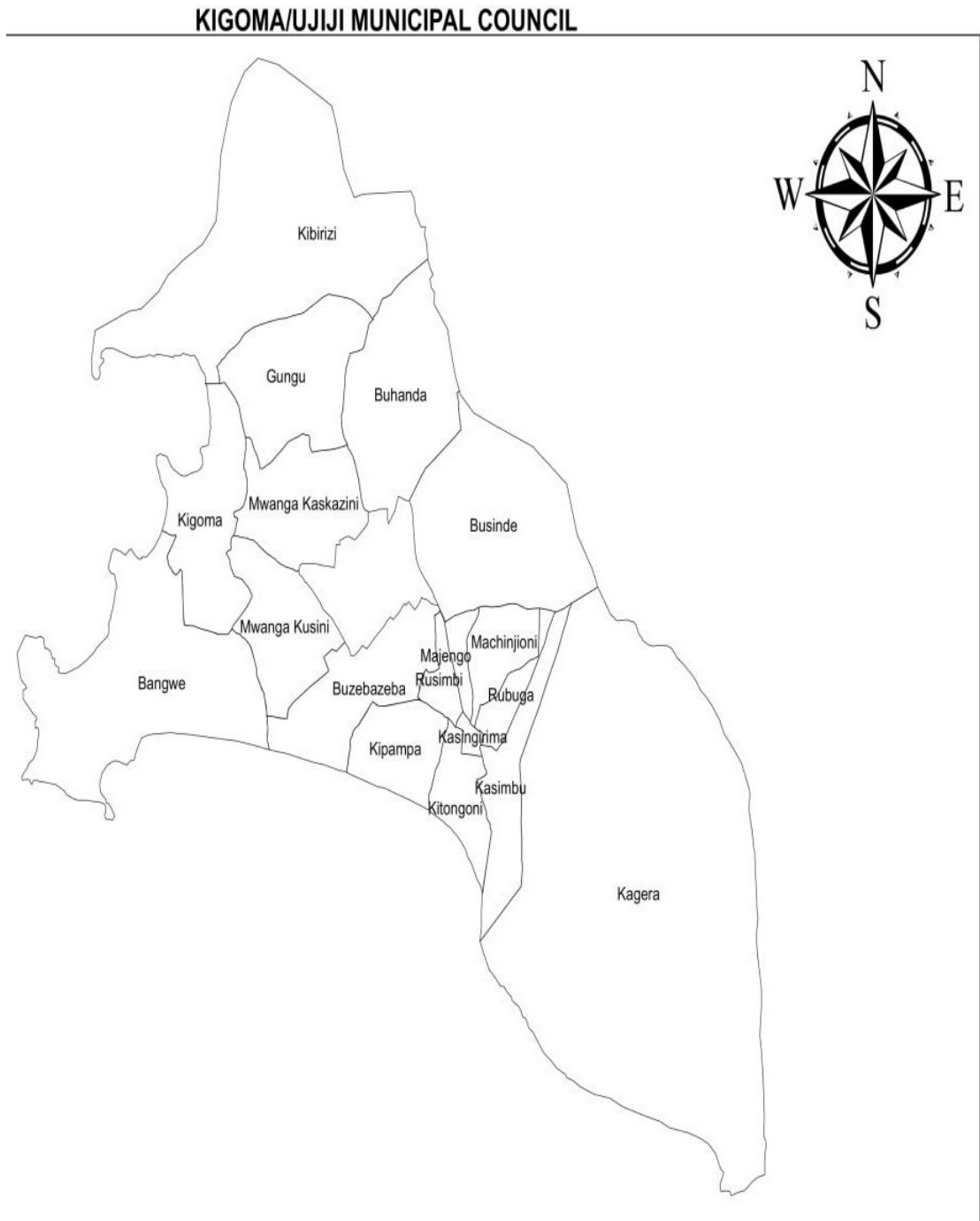**KIGOMA/UJIJI MUNICIPAL COUNCIL**

Figure 3.1: Map of Bangwe Ward

Source: Ujiji Municipality (2019)

The region is situated between Longitude 29.5^0 and 31.5^0 East and between Latitude of 3.5^0 and 6.5^0 South of the Equator. It shares boundaries with Burundi and Kagera region to the North, Shinyanga and Tabora region to the East, Lake Tanganyika and

Democratic Republic of Congo to the West and Rukwa region to the South. The town is along the shore of Lake Tanganyika (URT, 2002). Kigoma experiences a diversity of climatic conditions. Annual rainfall ranges between 600 mm and 1600 mm, mostly distributed along and around the Lake and in the highlands zone. Most rainfall (rainy season) is seen in November, December, January, February, March and April.

The pattern of rainfall is uni-modal with the rainy season lasting from October to May with short dry spell of 2-3 weeks in January or February followed by a prolonged dry season. Precipitation is reliable and allows a wide range of crops to be grown with some double planting of short season crops. Lowland areas are warm for most part of the year. Mean daily temperature ranges between 25ºC in December and January to 28ºC in September. Temperature varies inversely with altitude. Lowland zone tends to be warmer than the highlands zone (URT, 2011).

3.4   Justification of the Study Area

Research decided to select the area because of insufficient water supply service in the area of the study also research believed that valuable information could be obtained to enrich and answer research objective. Again, it is because of its accessibility and familiarity to the researcher; hence it is relatively convenient to the researcher in terms of time, money and energy to make data collection process.

3.5   Target Population

According to Ngechu (2004), a population is well expressed as a set of people, services, elements, and events, group of things or households that are being

investigated. The targeted population for this study included People served by KUWASA authority in of Bangwe and Ujiji respectively.

3.6   Sample Size and Sampling Technique

3.6.1   Sample Size

Kothari (2004) defined a sample as a small group of respondents drawn from the population about which a research is interested in getting information so as to arrive at conclusion. The sample represents the actual characteristics of the whole population and factors such as expense, time and accessibility frequently prevent the researcher from gaining information from the whole population (Cohen *et al.,* 2007). Therefore, the sample size for this study constituted 383 respondents. The sample size of the population was determined by using the following formula from Krejcie and Morgan (1970) determination framework.

Population Size Known

$$\text{Size} = \frac{X^2NP(1-P)}{d^2(N-1) + X^2P(1-P)}$$

Where

X= the table value of chi-square for one degree of freedom at the desired confidence level

N= Population size

P= the population proportion (assumed to be .50 since this would provide the maximum sample size)

d= the degree of accuracy expressed as a proportion (.05)

$$\text{Size} = \frac{3.841 \times 164268 \times 0.5 \times 0.5}{(0.05)^2(164268-1) + 3.841 \times (0.5)^2} = \frac{157738.34700}{411.62775} = 383.20$$

3.6.2   Sampling Techniques

The sampling plan describes the sampling procedures and the sample size for the study. The sampling frame describes the list of all population units from which the sample is selected (Kothari, 2010). This study employed simple random sampling and purposive sampling techniques. Simple random sampling is a probability sampling whereby all members in the population have equal chance of being selected to form a sample (Kamuzora, 2008). This technique is appropriate where the sampling frame is not too large and each unit is easily accessible (White, 2002).

For the case of community members of Bangwe pieces of papers were prepared and each was written a yes and no then the researcher randomly selected those respondents who chose a piece of paper written yes and those who pick pieces of paper written No were given chance to proceed with their responsibilities. Purposive sampling is a sampling method which involves purposive or deliberate selection of particular units of the universe for constituting the sample which represent the universe (Kothari, 2004). KUWASA staffs were purposefully selected in order to obtain rich information about the factors affecting insufficient water supply because they had the real information concern water supply services at the ward.

3.7   Methods of Data Collection

Methods of data collection refers to the process of gathering specific information aimed at providing or refuting some facts (Kombo and Tromp, 2006). In data collection the researcher must have a clear understanding of what they hope to obtain and how they hope to obtain it. The study used both primary data such as

questionnaires as well as secondary data collection methods such as documentary review to enrich this study. The primary data was collected using questionnaires and observation method, which were administered to both KUWASA staff as well as citizen residing at Bangwe. Each item in the questionnaire was developed to address a specific objective or research question of the study.

3.7.1 Questionnaire

This study used a questionnaire to obtain information on the appraisal of water services provided at Bangwe ward and the level of utilization of these services in their environments. According to Leedy (1989), a questionnaire consists of printed questions used to elicit information from the respondents based on their attitudes, feelings or reactions about the problem. A questionnaire is the most widely used tool for data collection in our society. It involves the use of written down items to which the respondent individually responds in writing (Creswell, 2009).

In this study, the researcher employed a questionnaire, which used both closed and open-ended questions to gather information from respondents. This technique has some advantages that it can be used to reduce bias that might result from the personal characteristics of the interviewer (Chireshe, 2005). It is more convenient for respondents because they can complete a questionnaire when they want and, in the speed, they want to do it. The use of a questionnaire helped the researcher to cover a wide area of information, which is being sought as it is advocated by Kombo& Tromp (2006). Questionnaires was used in order to obtain information on; age, education, attitude, experience of respondents as background information, institutional

arrangements, as well as domestic water supply service at the study area, causes of insufficient water supply as well as coping strategies toward water scarcity.

3.7.2 Observation

According to Kombo and Tromp (2006) observation is a tool that provides information about actual behaviour and draws first-hand information. It is structured and calls for careful definition of units to be observed, the style of recording the observed information, standardized conditions of observation and the section of pertinent data of observation (Kothari & Garg, 2014). This technique has two approaches which include participatory and non-participatory. In this study, however, direct participatory observation technique was used around Bangwe ward settings and Ujiji Municipality. Direct observation was useful because the researcher got an opportunity to visit the ward and observe physically the general situation of the provision of water services. Kothari (2004) has indicated that an observation increases the chance for the researcher to obtain the valid and credible picture of the phenomenon being studied. The observation checklist is found in Appendix 2. This tool collected information about water sources available, water bills as well as water infrastructure found at the study area.

3.7.3 Documentary Review

Documentary review is a way of collecting data by reviewing existing documents (Scott, 2006). Documents may be hard copies or electronic and may include reports, program logs, performance ratings, funding proposals, meeting minutes, newsletters, and marketing materials. Documentary review was conducted to obtain secondary data from documentations such as scholarly papers, research report publication and

relevant documents from library and from the municipal and village levels concern water supply services. This method was selected because it provided further detail which enriched the study, despite of its weakness such as some documents are more out-dated, and therefore the researcher to rescue this looked for the most updated information concern water supply. This tool collected further information about the causes of insufficient water supply as well as coping strategies so as to enrich the findings obtained from the study area.

3.8   Data Analysis and Presentation

Data analysis is the process of bringing order, structure and meaning to the mass of information collected in a research (Mugenda et al. 2012). On the hand, Blumberg, Cooper and Schindler (2014) define data analysis as a process of gathering, modelling and transforming data with an aim of retrieving useful information, suggesting conclusions and supporting decision making. The data that were collected using questionnaires were checked for uniformity, consistency and accuracy. A data entry interface was created in which software program known as IBM Statistical Package for Social Scientists (SPSS) version 22. SPSS was used to analyse information about demographic characteristics of respondents such as educational level and ages of respondents in terms of tables. This program was preferred because it is one of the most readily available statistical analysis software and is user friendly.

3.9   Ethical Issues

Respondents as the major stakeholders, the information they provide is one of the bases for coming up with findings and recommendations. Therefore, the research ensured that all the information that the respondents provided remained confidential.

Participants in the research were aware that their participation in the study was voluntary, that they have the freedom to withdraw from the study at any time without any unfavourable consequences, and they are not harmed as a result of their participation or non-participation in the project (Bhattacherjee, 2012).

Anonymity was observed by not disclosing the names of respondents, as at times there is usually intimidation, especially when confidential information was involved. Anonymity implies that the researcher or readers of the final research report or paper could not identify a given response with a specific respondent (Bhattacherjee, 2012). To protect subjects' interests and future well-being, their identity was protected in this study. This was done by using the dual principles of anonymity and confidentiality for all the people who took part in the study.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.1   Introduction

This chapter presents the findings gathered from the study area. The chapter begins with the analysis of social-demographic characteristics of the respondents. It goes further to discuss the major findings in line with the addressed specific objectives. A summary of the key findings of the study is provided at the end of the chapter.

4.2   Respondents Socio-demographic Profiles

4.2.1   Age of Respondents

Analysis of the respondents' age indicated that the majority of the respondents (42.6 percent) were above the age of 18 years for as shown, 42.6 percent of the respondents were aged between 25-29 years while those aged between 20 and 24years comprised 27.1 percent. Respondents in the age category of 30 and 34 years were 14.7 percent while those aged above 35 years were 15.5 percent.

Table 4.1: Distribution of Respondents by Age Category

Age Category of Respondents	Respondents	Percentage
20-24	103	27.1
25-29	162	42.6
30-34	56	147
35-39	36	9.5
40-44	11	2.9
45-49	7	1.8
50 and Above	5	1.3
Total	**380**	**100.0**

Source: Field Data, 2019

For that much one notes that the high percentage of respondents involved in this study were those in the age range of between 18 years and 34 years. Besides, Tanzania as a developing country is made up of the young population. Further clarification as far as the distribution of the data is concerned is as depicted in Table 4.1.

4.2.2   Sex of the Respondents

Sex refers to the biological difference between male and female (Encyclopaedia, 2019). This study was interested in determining the sex of respondents who participated in this study so as to identify respondent's sex ratio in relation to water supply service in the study area. As per data analyzed, it was observed that most of the respondents that participated in this study were females 339 (89.3 Percent) while male respondents comprised only 41(10.7 Percent). According to these findings, men were few due to the fact that most of them were the household heads hence during data collection were at their daily responsibility as the bread winner of most family. Also, the difference implies that females are the key actors in the question of water collection at the household level.

4.2.3   Education Level of the Respondents

Understanding the educational levels of the participants of the targeted population communities was an important factor in assessing their skills and knowledge for judging about different issues and challenges related to water supply. From the findings it was observed that 67.1percent of the respondents had attended and completed primary education while 29.4 percent attained other levels of education such secondary, education, college and university and 3.5 percent did not attend

school at all. These findings imply that the majority of respondents had primary education. The reasons behind the prevalence of high level of primary education leavers in the study area might be due to fact that literacy level in rural area is very low all over the country as the majority ends at standard seven because of universal primary education.

Table 4.2: Educational Level of Respondents

Educational Level	Respondents	Percentage
Primary	225	67.1
Secondary	80	20.7
College	24	6.3
University	0	2.4
Not attended	12	3.5
Total	**380**	**100.0**

Source: Field Data, 2019

4.2.4 Marital Status

Marital status refers to the state of being married, single or divorced. In this study major interest was to understand the nature of the study population whether was married, single or divorced. From the findings it was discovered that 283(74.5 percent) of all the respondents participated in this study were married while 97(25.5 percent). This implies that most respondents have families and therefore there is a high demand of water for different purposes to carter families multiple water needs.

4.3   Sources of Water at Bangwe Ward

In the sampled household of Bangwe ward, respondents were asked to comment on the question of water sources in their localities. An analysis of the findings indicates

that majority 243(64 percent) of respondents strongly agree that, the main sources of water supply at Bangwe ward were piped water connected from Lake Tanganyika from public pump situated at Amani beach area and 137(36 percent) stated that apart from water supplied from water tapes other source was sprig situated at Kiziwani Biteko but water accessed from this source was not clean and sometimes it was difficult to access it because of high number of inhabitants.

Further it was found that out of 100 percent water users at the study area only 57 percent households access water direct from water tape while 43 percent access water from spring and the rest household neither lacked access to neither water tapes nor springs available. This implies that the major sources of water depended by Bangwe household were only water tapes and springs only. From these findings, it can be established that Bangwe ward can be classified as water scarce ward due to insufficient water supply services to the area as water obtained from these sources is not enough to cater for the daily needs of all households.

With regards to whether available water sources were maintained by the water authority and/or citizen, it was learned that, 207(54.5 percent) of the respondents indicated that these water sources were not maintained and/or protected. They also commented that the amount of water supplied was not enough to cater for the needs of the households. While the 173(45.5 percent) were neutral which means that they were not aware about water information at their area just because of little understanding of either water supply service at their ward as it seems to be new phenomenon. This finding implies that water supply service to the household was not sufficient to match with the household needs.

Figure 4.1: A Spring Surrounded by a Group of Residents Striving to Fetch Water

Source: Field data, 2019

From the above Figure 4.1; it is clear that water supply to the study area is a critical issue as most households are looking for water from a spring which seem not to be safe for human use. Furthermore, it is clear that most natives walk for long time with their local transports (bicycles) to look for water for their daily domestic needs. In comparison to other part of the country the situation is not the same as for example currently due to establishment of different water project the problem of water has been solved contrary to the study area.

4.3.1 Water Household Connection

The main focus of the study was to look on water connection service among households from water authority. From KUWASA report of 2018, it was established that the total Municipal water household connection in 2018 was 10,955 customers.

Out of these active customers were 7,644 of which 6,465 customers were metered. The number of customers who were metered comprised 85 percent which mean that 14109 were the active customers while 85 percent were connected with water and 15 percent were not connected with water meters.

Currently customers which account to 7240 at Katonga, Kigoma Centre, Kibirizi, Mwanga, Majengo, Kilimahewa and Burega areas including 10 water kiosks/public standpipes at Katonga area are supplied with safe and clean water from the new project (Kigoma Water Supply and Sanitation Project) through temporary submersible pumps installed at Amani Beach intake site. Sludge disposal services provision from household is delivered to customers using vacuum truck and one completed anaerobic pond since May 2018. Furthermore, Municipal authorities have launched several water Kiosks at Bangwe ward in which the number of clients served by kiosk were 5270 out of 15453 in 2018.

This was due to fact that efforts done by the water authority to ensure many households were accessing water service was not enough due to the few numbers of clients who accessed water being 5270 out of 15453. There were five kiosks at Kamala Street, five kiosks at Katonga, and one kiosk at Buteko (Field Survey 2019). Water collected from a spring is mostly used for drinking because it is not salty. This spring is owned by the community and water is not sold. Sometimes the residents tend to buy water from private water pipes because these springs do not give safe and clean water as some of household tend to not conserve these sources as some household, they are not honest in conservation of few water sources available.

4.4 Causes of Insufficient Household Domestic Water Supply at Bangwe Ward

From the data collected in the study area, it was found that 106(28 percent) strongly agree that population growth, 91(24 percent) strongly agree on poor governance, 85(22 percent) strongly agree on high rate of water bills, 19(5 percent) on poor governance, 11(3 percent) on poor water management, 8(2 percent) on shortage of rainfall and 11(3 percent) on inadequate power supply while 30(8 percent) agree on the statement while (6 percent) disagree and none of them were either neutral or strongly disagree on statements provided. From this it can be established that rapid population growth in the study area was the critical factor for the shortage of water in the area despite of other factors prevailed.

4.4.1   Population Growth

Population growth refers to the increasing number of people in a given geographical locality in a given period of time (Msabila, 2010). Population growth was one of the causes of insufficient water supply to the study area as identified by respondents during data collection. With regards to this, 247(65 percent) of the respondents indicated that the problem of water shortage in their ward was associated with increasing number of people while the water sources available was not sufficient to meet the needs of all households living at Bangwe ward.

Therefore, the amount of water supply from water tapes and springs available was not sufficient enough to meet the demands of all household hence pose the problem of water shortage to the area as the area inhabited with 15453 but the one who accessed water services accounted 6465 while the rest had no access to water supply service

despite of government initiatives to ensure access to safe and clean water to each household in rural areas.

These findings are in line with the study done by Deen (2011) who showed that, rapid urban population is one of the governing features in most African countries, causing the breakdown in services such as water supplies and sanitation facilities. This problem is also common to the municipality like Kiowa whereby the number of birth rate to the area increase day after day but services like water supply remain constant which in turn it is only few people who accessed safe and clean water from the available water sources found in the area. From this it can be established that the concerned authorities regarding population is not active enough to check for an alternative for controlling water supply services to each household regarding the increasing number of water users especially the one who access it from water tapes available. Further the government initiatives to promote control population increase have not bear positive results as every day number of birth especially in rural areas tends to be high which in turn do not match with the water services provided as consumption of water tend to be high than what water authorities can supply to the households due to poor population policies that do not look on the capability of water resources available and increased trend of people.

Again the Tanzanian population has tripled from 12.3 million in 1967 to 44.9 million in 2012. In 2015, due to reduced mortality rates and persistently high fertility rate, the total population had grown to almost 50 million, with about 70% of this population living in rural areas (National Population Census, 2012). Despite massive

urbanization, rural population growth was three times higher than urban population growth during this period. However, access to drinking water coverage has only increased by one percentage point from 45 percent in 1990 to 46 percent in 2015. This clearly indicates that the investments made in the sub-sector have only managed to keep pace with population growth rather than expanding access to new population.

Population growth offers opportunities for investments and economic growth, but many agree that the increase in population is putting a huge strain on provision of basic services and resources, especially water. Recent data from the World Bank shows that the average volume of renewable freshwater per capita per year in Tanzania has declined by 80% since independence (from 7,862 m^3 in 1962 to 1,621 m^3 in 2014), putting the country in the water-stressed category especially in rural areas.

4.4.2 Poor Governance

Governance refer to the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions. In lay terms, it could be described as the political processes that exist in and between formal institutions. From the findings (5 percent) strongly agreed that insufficient water supply in their locality was associated with poor governance and the main reason associated with insufficient water supply were policy issues in which despite of initiating national water policy 2002 still there is a challenge on the implementation of water project as a result most of what is proposed remain as a paper plan and nothing is implemented especially in rural water

supply projects, Again even the maintenance of water supply infrastructures available especially in rural areas are not periodic all maintained to ensure water service is available all the time in ward like Bangle, Furthermore; poor governance of water sources at the grassroots level as well as distribution of water to reach each household contributed much to shortage of water in the study area. For the case of policy respondents shows that the policy formulated by the ministry of water did not take into consideration improving rural area life because of weak sound as they respond to this, that the 2002 water policy has remained as a paper plan at their ward and nothing is done by government to ensure 100 percent water is available for each household but only few access water.

Again, (5 percent) of respondents who responded on respondent's perception of maintenance of water infrastructures in their locality they indicated that no any initiative undertaken by KUWASA to maintain water on time, further respondents stated that despite of the available infrastructures water sources available are not well governed to ensure every house hold access water from the available sources. Furthermore, Tanzania has undergone impressive political and economic developments and improvements in social welfare in recent years. However, the country continues to face considerable development challenges, not least in essential areas such as water service distribution. At the same time, new opportunities are arising which have the potential to become decisive for the necessary changes and reforms. Thus, water management becomes a key issue, especially in developing countries, where the institutional and regulatory context is not always properly designed.

These findings concur with the study done by Rugemalila in Dar es Salaam (2009). His study revealed that water problems are increasing regardless of the promising policy goals; this is seen as poor implementation of the policies triggered by poor governance from the ministerial stage downwards. The same finding is in line with the study conducted in Kenya by Medina (2007) on availability and accessibility of water to Kisumu area. The author reported that, the Government of Kenya must recognize the provision of clean and safe water as an integral part to economic growth. Based on this recognition the government is implementing fundamental reforms to address the challenges in water sector. The purpose of the reforms is to improve the management of water resources, improve access to water and sanitation services, enhance accountability for water resource management through decentralized provision of service and improve utilization of water resources. The study underscores the principle and recognition of the fact that the private sector offers invaluable potential, which has not been fully harnessed to contribute to sustainable development of the water sector.

Furthermore, from 2018 KUWASA water report, it was discovered that, the Total length of water mains and distribution network (diameter>=50mm) for Kigoma/Ujiji water supply network was 218.9 km. Storage tanks stood at 14 with total operating storage capacity of 5,272m3, which is only 24percent of the demand. The number of people covered by water service although by rationing once or twice a week with 9 hours supply time is 171,120 which is 69 percent of the total population of Kigoma/Ujiji Municipality. The Municipal have estimated population of around 248,000 people, (KUWASA report, October 2018). This report serves to give rough

picture of the problem of water supply at Bangwe. Currently KUWASA serves only 387 (25.8percent) Bangwe households therefore leaving 1,113 Bangwe households not served by KUWASA. This implies that majority of households were not served by KUWASA a result most households fail to access water services from the established water authority.

4.4.3   Higher Rate of Water Bills

Analysis of the data indicates that causes of insufficient water supply in Bangwe ward was associated with the high rate of water bills in which most respondents (22 percent) strongly agreed that high rate of water bills discourage water user to access water services in the study area therefore most residents of Bangwe ward fail to get safe and clean water from the government managed tape water. They argued that, the cost of water was very high from the bills given therefore high rate of charges from monthly bills from KUWASA were very high therefore discourages even other household to access water in their area, this has resulted to the households spending more on water than they should. KUWASA pose high water bill of T/shilling 1400 per unit to its customers who accessed water service and this in turn discourage customers who are able and willing to get water service from the authority as most of respondents' (64 percent) complain that they fail to access water from KUWASA because of high rate of water bill which account about 1400 Tanzania shillings per unit. Again, it is not unusual to meet 5 to 10 customers in KUWASA office daily complaining on water bills whereby some customers are charged more than normal. Such comparisons are motivated by the quest for equity the premise that water should be accessible and affordable to all. This is also due to the economic reality that, when

the price of water tends to be high it discouraged customers to find better service of water supply as in turn lead to shortage of water among household because of high price of water which is not stable over time where most households lack access to piped water for their daily needs.

This finding is in line with that of Kjellén and McGranahan (2006) Wutich and Ragsdale, (2008) who showed that the number of poor households pay more than their counterpart rich households hence lead to insufficient of water supply to the rural household as they fail to access safe and clean water due to fearing of water bill at the end of month.

4.4.4 Shortage of Rainfall

Insufficient water supply was also associated with shortage of rainfall as 36 percent of respondents who responded to this strongly agreed that water shortage at the area sometimes was associated with little rainfall amount prevailing in their area due to drought condition which reduced the amount of water supply to meet the current needs of the people in the study area. Furthermore, (36 percent) of respondents out of 100 percent claimed that due to shortage of rainfall even those water sources they depended for water supply they were dried and led to shortage of water at their ward.

The Bangwe ward receives rain once in a year which account to about 750 mm per annum from 2009 to 2019. The rain months are October, November, December January, March and April. Months such as May, June, July, August and September are dry months where natives experience greater water shortage and the price of water

from street vendors rise up from about 200 Tanzanian shillings a bucket (10 litres bought from street vendors) to 700 Tanzanian shillings for every 10 litres of water).

Due to little amount of rainfall received in the area it caused shortage of water in most water sources depended by households despite the fact that Lake Tanganyika is the main source still there are some months an area gets no rain hence fluctuation of water due to climatic changes tend to affect water supply as the demand of water rises hence it affects water transmission by KUWASA.

In Bangwe ward water shortage is a big problem especially in the dry seasons. During this time women and children wake up 5.00am in the morning and walk for long distance to find water. This chronic water shortage in the area causes a serious concern to all household. Study shows in rural Tanzania people walk for 2 to 3 km daily in search of water from public taps where available or natural streams and carrying heavy containers on their heads of about 20 to 25 little per trip due to little rainfall received. This finding is in line with that of WHO/UNICEF report of 2004 which point out that water shortage in Tanzania has been a problem for years now; the problem is even bigger in rural villages that water shortage has been caused by climate change which has shrieked the resource of water.

4.4.5 Inadequate Power Supply

Analysis of the respondent's opinions indicates that shortage of electricity was to a large extent related with insufficient supply of water to the Bangwe households as the limited power supply frequently fail to drive most water ingines to supply water in different parts. From these responses it was observed that KUWASA complains on

power supply from TANESCO. TANESCO fails to supply electricity to KUWASA for 45 days per year. Electricity is on to KUWASA for approximately 16 hours. The rest of the remaining 8 hours KUWASA generators stand functionless due to disconnection of electricity by TANESCO. This acted as propelling factor for insufficient water supply to the study area (KUWASA, 2019).

Furthermore, despite of having many water sources which contribute to power generation still the amount of power generated to support water turbine in Kigoma is not sufficient to facilitate water supply and this in turn result into shortage of water in most areas Bangwe ward included. This finding concurs with Investment Climate Assessment (2004) which noted inadequate electricity supply was one of the major constraints confronting Tanzanian industry and a major obstacle to the start-up socio-economic development in the country especially in industries and water service supply. Further, A 2009 study that considered possible impacts on hydro power by 2030 under 'moderate climate change' and 'high climate change' scenarios projected losses of 0.7 percent and 1.7 percent of GDP due to decreased rainfall in the central region of Tanzania, where 95 percent of the country's hydro power installations are expected to be located by 2030 (ECA, 2009).

4.4.6   Coping Strategies to Water Shortage

In this section research interest was to identify whether due to limited water supply to the study area were there any coping strategies to address the problem of water shortage. I response to this question, it was noted that 86 percent of the respondents said **"Yes"** implied that there were some of coping strategies to the study area though the problem of water is too chronic while 14 percent of informants said **"No"**. The

major coping mechanisms included; use of water from wells and boreholes as mentioned by 42 percent respondents whereby respondents argued that the boreholes available to a greater extent helped them to cope with water shortage.

However, most of the wells and bore holes were not in a good condition and as such, they were unable to supply water throughout the year due to some faults and lack of maximum support from local government authorities for maintenance. This in turn lead to lack of safe and clean water because of the declining water tables during the dry period resulting into a longer waiting time for water to collect in the hole.

Another minor coping strategy identified was the use of rainwater. At least 14 percent of the respondents identified as one of them. They showed that, harvesting rainwater was important in supplementing water at the household level. It was unfortunate that the strategy was only limited to the rainy season. During the dry season the problem of water shortage remain the same.

Another raised mechanism for coping with water shortage was noted to be in the change in water consumption pattern. During the fieldwork time, 22 percent of respondents, argued that due to the current trend of water shortage in their locality households have changed water use and they only use water for only important use like drinking, washing as well as cooking but for the case of agriculture activities some families depended on rainfall instead of using the available scarce water sources. Furthermore, 25.7 percent of the respondents indicated to supplement water demand through purchasing water from vendors and neighbours who were connected to KUWASA tap.

Although 964 residents at Bangwe own deep wells, some households buy water or get it for free from their neighbours. Inability to afford drilling costs was frequently mentioned as the reason for choosing to get water from their neighbours as coping mechanism. Likewise, other residents have tried to drill wells within their plots but could not get water or the water was too salty. Some of the respondents who get water from neighbours reported to get it for free. All these strategies though viable, remained unable to satisfy the demand for water among many households in the study area.

These findings are in line with the study done by Rugemalila (2009) in Dar es Salaam who observed that the coping mechanisms differed from low income earners to high income earners and thus the pinch of the water shortages was quite different among these dichotomies. The major coping mechanisms included; use of water from wells and boreholes as mentioned by 71 (67.6 percent) respondents; rainwater harvesting as mentioned by 66 (62.9 percent) respondent; changes in water consumption pattern as mentioned by 42(40 percent) respondents and purchasing water from vendors and neighbours connected to DAWASCO tap as mentioned by 27 (25.7percent) respondents. All these mechanisms enabled households to cope with water shortages situation. Again, this finding is in line with that of Mujwahuzi (1993) in his study done in Dar es Salaam City who disclosed that rainwater collection is practiced by city's residents but due to inadequate storage facilities not much water is stored. Furthermore, such finding is similar to that of Messer (2001) who noted that when the water authorities do not provide water which meets the demands of the population, the locals look for alternative means of getting water. From these observations it is clear

that the study area can cope with the problem of insufficient water supply by improve much the existing strategies and get involve the water authority to promote the strategies in order to ensure each resident access water despite of the prevail condition of water shortage in the area.

4.5 Impacts of Water Shortage on People's Livelihood at Bangwe Ward

Analysis of the data with regard to the above caption indicated that the most impacts to the livelihoods of the respondents in Bangwe ward that were associated with water shortage included among others the outbreak of diseases and health problems, social conflicts, increased women and girls workload, increased household expenditures, loss of productive time in the course of water search and poor girls students' academic performance. The discussion that shortly follows discusses in details each of these consequences.

4.5.1 Outbreak of Diseases and Health Related Problems

One of the impacts which were identified as being associated with water shortage in the study area was the outbreak of diseases. In the multiple response questions set forward to seek for the respondent's opinions (37 percent) were of the opinion that water shortages were highly related with the increased incidences of different water related diseases outbreaks such cholera, bilharzias, typhoid and diarrhoea. Data collected from Bangwe health centre indicated that for the year 2017 there were 12 cases of cholera diseases reported. In 2018 the reported case for cholera diseases were 9 and for the year 2019 there were 6 cases. For the case of typhoid, it was reported that for the year 2017 the number of people who reported to the health centre and

identified to have been suffering from typhoid comprised 568. This number decreased to 382 in the year 2018 and 207 for the year 2019.

These findings imply that cholera and typhoid were the serious waterborne diseases that prevailed in the study area. As once commented by Sousan (2002), Water related diseases such as cholera and diarrhoea affect millions of poor especially those people who stay in rural areas where water supply service is inadequate to cater for the needs of rural dwellers to promote sanitation around their localities. Indicating in the same veins, Howard and Bartram (2003) went further to classify four categories of diseases that are related to water.

These are water-borne diseases which are caused by use of contaminated water such as diarrhoea, typhoid and dysentery; water-washed diseases caused by insufficient quantity of water for personal hygiene (faecal-oral transmission) such as diarrhoea, trachoma, typhoid and skin and water-based diseases transmitted through an aquatic host, like schistosomiasis and water-related diseases transmitted through insect vectors such as malaria. This finding therefore implies that most of water related diseases are related to shortage of water therefore there is a need for the appropriate authority for water supply in the area of study to look the situation by four eyes so as to reduce the risks associated with shortage of water supply to the area.

4.5.2 Social Conflicts, Women and Girls Workload

This was the second commonly responded effects related to water shortage in the study area and was responded by (34 percent) in the multiple response questions. Those ascribed to this point argued that shortage of water in their area resulted into various social conflict in the course of struggling to get access to water points.

It was also learned that, family conflicts in the study area happened frequently due to the time taken by wives to look for water and once they came late, they were in trouble to their husbands. Furthermore, girls experienced increased workload for looking water for their families which consequently resulted into poor concentration to their academic activities. This finding is supported by Panda (2007) who showed that women living in rural areas suffer severely when searching for water. Similarly, Rosen and Vincent (2013) discovered that majority of people especially women and girls in sub-Saharan Africa spent more time for domestic water searching instead for other economic activities.

The findings also imply that despite of some respondents being aware; water shortage took much of their working hours and they were struggling in order to secure access to water points. Each other at water sources in order to secure scarce water available in their community and in the course of time, some marriages have broken up as women spend more time for water fetching instead of being close to their husbands. In line to this Joshi and Fawcett (2011) commented that women being the main collectors of water experiences changes in their lives. Thus, the scarcity of water leading to erratic water availability implies that females spend more time in water collection activities.

Further analysis of the data suggests that, water shortage in the study area was associated with poor academic performance among girls. It was learned that most girls' students use a lot of time that could have been used for concentrating in their academic work for search for water for their family. When they arrive at school, they are already tired and fail to concentrate on their studies effectively.

4.5.3 Loss of Productive Time

Analysis of the data has revealed that water shortage impacts negatively productive time as many residents in Bangwe ward spend a lot of time to look for water. On top of that most of respondents arrange a long line from morning to noon waiting for water. Furthermore, this finding agrees with the study done by FAO, (1996) which noted that in most rural areas, the most time-consuming activities of women are fetching water and fuel wood. In some cases, women also pass of the burden of those activities to their children usually female children. Relieving women from such drudgery as fetching water would allow them to have more time for productive work and enable their children to attend school. Therefore; inadequate water supply is among the factors which contributed to poor academic performance of pupils particularly girls in the study area.

Figure 4.2: Women Fetching Water at a Water Pipe

Source: Field data (2019)

From the figure above it indicate how shortage of water at Bangwe ward makes people to spend much of their time waiting for water which seem to be scarce in supply.

4.5.4 Increased Household Expenditure

Charges demanded by the water service providers were among the factors which contributed in forcing respondent's majority to shy away from using piped water. An analysis of the data obtained from Kigoma Urban water and sanitation authority indicated that KUWASA charges 1,300 Tanzanian shillings per unit spending for a customer who uses up to 10 units of water and charges 1,400 Tanzanian shillings per unit as from the eleventh unit of spending. It was found out that Bangwe families spend a minimum of 7,800 Tanzanian shillings per month equals to 93,600 Tanzanian shillings annually to meet the household's water demands. This finding implies that most people (41 percent) in the study area used a lot of their income earned from various source for buying water which seemed to be a problem. This has an adverse impact on their monthly as well as annual expenditures. Furthermore, it was reported that majority of household lacked access to safe and clean water due to lack of income to access water supply in their living places hence affected their welfare.

4.6 Suggested Mitigation Measures

Respondents in this study were requested to give their opinions towards the problem of shortage of domestic water supply at their respective households. This part of questions was particularly directed to respondents drawn from Bangwe village which are characterized with water scarcity. Seventy five percent of responses indicated

installation of tap water (development of water supply systems) at the ward from reliable water sources (intakes) would reduce water problems for instance once KUWASA will manage to install water tape to each household the burden for looking water among household will be minimal compare to current time where there is water competition. Fifteen percent of responses indicated knowledge and skills on harvesting and storage techniques of rain water as respondents assets that once household will be knowledgeable they will apply for sustainable ways for harvesting rainwater and store it safe to meet their daily needs; 10percent acquisition of large quantity water storage containers at household level and improving the means of domestic water transportation from sources to homes will reduce water problem for various domestic purposes.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter gives a summary of the study findings, conclusions and recommendations in relation to the findings. At the end it provides suggestions for policy implementers and for further research.

5.2 Conclusion

The main objective of this study was to assess the factors which affect domestic pied water supply service in Bangwe ward in Kigoma municipality Tanzania. Specifically, the study intended to find out the sources of domestic water supply in Kigoma Municipality, to determine the causes of insufficient household domestic water supply in Kigoma Municipality and to find out the impact of water shortage on people's livelihood in Kigoma Municipality.

Findings from this study has indicated that KUWASA which is a water facility manager responsible in distribution of water service to the residents of Bangwe is operating with limitations as most of the residents lack clean and safe water for consumption. The households majority at Bangwe ward do not access enough safe and clean water for their domestic use including among others drinking. The main means of water access was water tape but due to poor supply, residents are forced to rely on other alternative means including among others intermittent streams, springs, bore holes and the lake itself.

Furthermore, findings have revealed that even water sources available are not adequately maintained and protected at the study area because the authority concerned (KUWASA) is not capable of providing adequate periodic maintenance of the water sources available in the area despite of many initiatives initiated by the Ministry of Water through the National Water Policy. Various factors are responsible for these shortfalls including among others the ever-growing population, poor governance, high rate of water bills, poor water management, shortage of rainfall and inadequate power supply. The overall results are the increased number socio-economic challenges including among others social conflicts; girls drop out at school, high households' expenditure, periodic outbreak of water borne diseases such as cholera and typhoid.

5.3   Recommendations

From the study findings the study recommend the following; 1. It is recommended that, since water supply is not satisfactory at Bangwe area there is a need for the government to intervene the situation by checking population growth rate at Kigoma Municipality so as to ensure that water services provided at the ward are in line with the number of households. 2. Again, the government through the Ministry of Health has to intervene the situation by introducing sanitation programs so as to enable the treatment of diseases associated with unsafe and clean water so as to reduce health risk such as water borne diseases such as typhoid, diarrhoea and cholera which seem to be among the problems associated with shortage of water at Bangwe ward. 3.Furthermore the study recommends that government in collaboration with other water stake holders should make efforts to encourage and sensitize the poor communities in the rural areas on the aims and importance of cost sharing in provision

of water supply services as well as preventive measures by increasing resources on water infrastructures maintenance programs also the government should make sure that the water bills correlate with the service provided to the residents to motivate many residents to install water taps in their households. 4.Again, to improve the quality of safe and clean water at the ward the ministry responsible for water distribution and management should ensure that all the money collected through cost sharing are fully utilized for the purpose of improving water services in rural areas.

5.3.1   Recommendation for Further Studies

This study has established that the majority of the households at Bangwe ward are not assured of enough safe and clean water for their daily activities including domestic uses such as washing, cooking and drinking. But during field survey households did not show their perception toward the situation. Therefore, there is a need for further research to be conducted on the perception of Bangwe residents toward shortage of water so as to reveal the situation and its magnitude to people livelihood.

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APPENDICES

Appendix 1: Questionnaires

Dear Respondent,

My Name is **William Manyama Mkama**, a student of Open University of Tanzania Pursuing Master of Natural Resource Management; I am undertaking a study on *"Assessment of the factors affecting Domestic Water Supply Service in Kigoma Municipality"-* a case of Bangwe Ward. You are kindly requested to answer the set of questions below by giving relevant details. This questionnaire is purely meant for academic purposes. Your contribution toward smooth realization of the intended purpose is highly appreciated and inconveniences that may arise are highly regretted too. Your identity as a respondent will remain anonymous and you are highly appreciated in advance for any information you will give. I also abide to confidentially and accuracy of information before and after being in my hands.

PART A: RESPONDENTS BIODATA

1. Sex of the respondents: 1= Male ( )   2= Female ( )

2. What is your age?

1= 18-22 ( )   2= 23-27 ( )   3= 28 and above ( )

3. Level of education:

1= Primary Education ( ) 2= Secondary Education ( ) 3= Ordinary Diploma ( ) 4= Bachelor Degree ( ) 5 = Postgraduate Degree ( ) 6= Master's Degree ( )

4. Marital Status 1= Single 2= Married 3= Divorced

5. Occupation 1= Employed 2= Self employed 3= Unemployed

6. Duration of stay

a) 1-3 Years ( )   b) 4-7 Years ( )   c) 8-10 Years ( ) d) Above 10 Years ( )

PART B: SOURCES OF WATER SUPPLY AVAILABLE

Please indicate your level of agreement or disagreement to the following statements on sources of water available at Bangwe ward by using the agreement legend provided. Agreement Legend Strongly agree=5, Agree=4, Somehow agree =3, Disagree=2, Disagree=1

SOURCES OF WATER SUPPLY AVAILABLE	1	2	3	4	5
1. To what extent do you agree with the statement that tap water is the main source of water supply at your ward?					
2. How do you agree with the view that shallow protected well and rivers are the only source of water at your ward?					
3. To what extent do you agree with the statement that sources of water available are public owned?					
4. How do you agree with the statement that sources of water are enough to cater for the needs of household at your ward?					
5. To what extent do you agree with the statement that there is enough water tanks at your locality?					
6. To what extent do you agree with the view that the available sources of water are safe and clean for human use?					
7. How do you agree with the view that sources of water available are maintained by the concerned authority?					
8. To what extent do you agree with the statement that community member at your ward contribute to destruction of the available water sources?					

5. Do you think the sources of water available are protected enough by the community? If Yes/ No briefly explain.

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6. Do you have a household connection?

    A. Yes [   ] B. No [   ]

7. If No, Where do you get water from?

A. Vendor [ ] B. Kiosk [ ] C. Borehole [ ] D. Shallow well [] E. Other, Specify [ ]

CAUSES OF INSUFFICIENT HOUSEHOLD DOMESTIC WATER SUPPLY

Please indicate your level of agreement or disagreement to the following statements on causes of insufficient household domestic water supply by using the agreement legend provided. Agreement Legend Strongly agree=5, Agree=4, Somehow agree =3, Disagree=2, Disagree=1

CAUSES OF INSUFFICIENT DOMESTIC WATER SUPPLY	1	2	3	4	5
1. To what extent do you agree with the view that shortage of water at your ward is associated with increasing number of people?					
2. How do you agree with the view that insufficient water supply is associated with poor government policy regarding water supply?					
3. To what extent do you agree with the statement that poor management of water sources contribute to insufficient water supply?					
4. How do you agree with the statement that shortage of rainfall attributes to insufficient domestic water supply at your ward?					

5. To what extent are the socio-economic activities at your ward contributes to insufficient water supply?

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6. Is the water authorities at your ward take any initiative to cope with insufficient water supply?

1= Yes   2 = No

7. If yes give at least three reasons

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8. If the answer is no, state at least three factors for not being able to cope with the situation

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IMPACT OF WATER SHORTAGE ON PEOPLE'S LIVEHOOD

Please indicate your level of agreement or disagreement to the following statements on impact of water shortage on people's livelihood by using the agreement legend provided. Agreement Legend Strongly agree=5, Agree=4, Somehow agree =3, Disagree=2, Disagree=1

IMPACT OF WATER SHORTAGE ON PEOPLE'S LIVELIHOOD	1	2	3	4	5
1.I believe that shortage of water affects much household income for buying water					
2.I believe that shortage of water makes people in terms of time for accessing water					
3.I believe that insufficient water supply service increase household expenditures for buying water					
4.I believe that shortage of water undermines student academic performance especially girls					
5. Shortage of water leads to the outbreak of diseases and health associated problems?					
6. I believe that shortage of water contributes to social conflicts and women and girls workload					

7. What do you suggest to be done so as to improve water supply service at your ward?

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8. How much does a household spend per week to purchase water at your family?

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9. How many hours do you spend looking for water and how does it affect other productive sectors at your locality?

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10. is there any water borne diseases happen at your ward due to water shortage problem?

a) Yes   b) No   c) I don't know ( )

11.Which among the following waterborne diseases are common at your ward for the atleast six months

a) Diarrhoea b) Dysentery c) Cholera d) Typhoid   ( )

12. is there any conflicts in this ward which are related to water supply issues?

a)Yes   b) No   c) I don't know   (   )

if Yes how frequently are they happen in three months

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…………………………………………………………………………………………

Appendix 2: Observation Checklist

Observation check list at the Bangwe ward

Please tick (√) in either present or absent

ITEM TO BE OBSERVED	PRESENT	ABSENT
1.Water plumbs		
2. Water supply office		
3. Water customers monthly bills		
4. Protected well		
5. Monthly water supply report		
6. Water supply budget		
7. Rivers		
8. Piped water		
9. Bore holes		
10. Unprotected dug well		
11. Hand pump		
12. Streams		
13.Ponds		
14. Lake		

Appendix 3: Table for determining sample size from a given population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377

170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note- N is population size and S is sample size

Appendix 5: Research Clearance Letter

THE OPEN UNIVERSITY OF TANZANIA

DIRECTORATE OF POSTGRADUATE STUDIES

P.O. Box 23409
Dar es Salaam, Tanzania
http://www.openuniversity.ac.tz

Tel: 255-22-2668992/2668445
ext.2101
Fax: 255-22-2668759
E-mail: dpgs@out.ac.tz

Our Ref: PG201702401

19th September 2019

Executive Director,
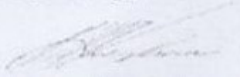Kigoma Water Supply and Sanitation Authority (KUWASA),
P.O.Box 812,
KIGOMA.

RE: RESEARCH CLEARANCE

The Open University of Tanzania was established by an Act of Parliament No. 17 of 1992, which became operational on the 1st March 1993 by public notice No.55 in the official Gazette. The Act was however replaced by the Open University of Tanzania Charter of 2005, which became operational on 1st January 2007.In line with the Charter, the Open University of Tanzania mission is to generate and apply knowledge through research.

To facilitate and to simplify research process therefore, the act empowers the Vice Chancellor of the Open University of Tanzania to issue research clearance, on behalf of the Government of Tanzania and Tanzania Commission for Science and Technology, to both its staff and students who are doing research in Tanzania. With this brief background, the purpose of this letter is to introduce to you **Mr. MKAMA, William Manyama Reg No: PG201702401** pursuing **Master of Arts in Natural Resource Assessment and Management (MANRAM).**We here by grant this clearance to conduct a research titled *"Assessment of the Factors Affecting Domestic Water Supply Service in Kigoma Municipality, A Case Study of Bangwe Ward".* He will collect his data at your area from 20th September 2019 to 20th October 2019.

In case you need any further information, kindly do not hesitate to contact the Deputy Vice Chancellor (Academic) of the Open University of Tanzania, P.O.Box 23409, Dar es Salaam.Tel: 022-2-2668820.We lastly thank you in advance for your assumed cooperation and facilitation of this research academic activity.
Yours Sincerely,

Prof.Hossea Rwegoshora
For:VICE CHANCELLOR
THE OPEN UNIVERSITY OF TANZANIA

Appendix 6: Request of Conducting Research for Mr. Mkama W. Manyama

URBAN WATER SUPPLY AND SANITATION AUTHORITY
KIGOMA

Telgrams "MTO"
Tel: No: 028 – 280 – 3621/3
Fax: No: 028 – 280 3621

P.O.Box812
Kigoma.

In reply please quate:
Re.No.P/KUWASA/171/VOL.I/212

02nd October, 2019.

OPEN UNIVERSITY OF TANZANIA,
P.O BOX 23409,
DAR-ES-SALAAM.
TANZANIA.

RE: REQUEST FOR CONDUCTING RESEARCH FOR MR. MKAMA, WILLIAM MANYAMA.

The reference is made to your letter received on 30th September, 2019 with Ref: PG201702401.

This is to confirm that there is a room for a mentioned student to conduct a research titled '**Assessment of the Factors Affecting Domestic Water Supply Service in Kigoma Municipality**' pursuing Master of Arts in Natural Resource Assessment and Management (MANRAM) from 20/09/2019 to 20/10/2019 in our Authority that will help acquainting the apprentice with practical experience in real work environment relevant to his occupation.

Regards.

KIGOMA / UJIJI URBAN WATER SUPPLY
AND SANITATION AUTHORITY

Paskazia S. Nyalaja   For Managing Director.

For: Managing Director