

**FACTORS INFLUENCING WATER SERVICE PROVISION IN GARISSA  
CENTRAL DIVISION, KENYA**

**BY  
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## **DECLARATION**

This project is my original work and has not been presented for a degree in any other University

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## **DEDICATION**

This project is dedicated to my loving wife, Mariah and my mother, Sally.

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Am indebted to acknowledge the sacrifices, contributions and support that I received from people throughout the project process. First, I acknowledge my supervisors, Dr. Ndunge Kyalo and Ms Mary Mbii for the grace, patience, time, and support on how to complete this project work. I would also like to thank all the other coursework lecturers for moderating my research work. I would also like to thank all my friends and colleagues for the encouragement and support while I immersed myself in the project process. Many thanks and appreciation for my wife Mariah and my family that provided encouragement long before this master's endeavour began. Much appreciation goes to my loving mother Sally, who has always believed in me, to God be the Glory.

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## ABSTRACT

The study investigated the factors influencing water service provision in Garissa Central District -Kenya. The purpose of this study was to carefully investigate the underlying factors that influence water service provision in Garissa Central District. The objectives of the study included: to establish whether demand for water influences water service provision in Garissa Central District, to determine how water source influence water service provision in Garissa Central District and lastly to investigate how water infrastructure influences water service provision in Garissa Central District. The research design used was descriptive analysis. There were different sampling techniques used for the study due to the nature of the population studied and they included; cluster, random and purposive sampling. The study targeted all the resident of Garissa Town but four Estates namely Winsor, Iftin, Township and Waberi were chosen by use of cluster sampling technique. Each Estate provided 21 household heads chosen randomly, to respondent to the study. To achieve the objectives, the study used primary data in the form of questionnaires, and secondary data from literatures, articles, books and internet sources. The data was primarily quantitative and therefore descriptive analysis was used.

The study found out that water demand exceeded the water which was supplied by the water service provider hence the residents had to look for alternative sources of water especially from boreholes which were managed by private providers. As for the sources the study established that there was enough water from Tana River which if well harnessed could meet the demand of water in the town. The water service providers were found to be doing a good job when it came to supplying water but the infrastructure was found to be wanting. The study recommended the following; that private companies should be encouraged to start providing water in the Garissa Town so that the demands of the resident could be met. The government needs to look into the water infrastructure in the town with an aim of improving it. There is also need for the government through the water service providers to look into ways in which water contamination can be prevented. The household waste as well as industrial ones need to be managed in such a way that it will not drain into Tana River. Where possible, fencing should be done on the banks of the river.

## ABBREVIATIONS AND ACRONYMS

<b>GAWASCO</b>	:	Garissa Water and Sewerage co Ltd
<b>GoK</b>	:	Government of Kenya
<b>IWM</b>	:	Integrated Water Management
<b>KIHBS</b>	:	Kenya Integrated Household Budget Survey
<b>MDGs</b>	:	Millennium Development Goals
<b>MWI</b>	:	Ministry of Water and Irrigation
<b>NRW</b>	:	Non Revenue Water
<b>NWSB</b>	:	Northern Water Services Boards
<b>UFW</b>	:	Unaccounted for water
<b>WASREB</b>	:	Water services and Regulatory Board
<b>WatSan</b>	:	Water and Sanitation
<b>WHO</b>	:	World Health Organization
<b>WSB</b>	:	Water Services Boards
<b>WSPs</b>	:	Water Services Providers
<b>NRW</b>	:	Non-revenue water
<b>EPA</b>	:	Environmental Protection Agent
<b>ASCE</b>	:	American Society of Civil Engineers
<b>DRA</b>	:	Demand driven approach

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Background of the study**

The United Nations has declared that access to safe water and sanitation is a human right that applies in times of peace and in emergencies but according to a report of USAID (2009) more than one billion people do not have access to safe drinking water and over 2.5 billion people have inadequate sanitation. In Africa around 300 million people do not have access of safe drinking water and 313 million have no access to sanitation. That means Africa has the lowest total water supply coverage of the other continents in the world (ADF, 2005).

Gordon, Hays, Pollack, Sanchez, and Walsh (2011) indicate that water is essential for all life. In addition to the water we drink, we use water to grow our food, to make concrete and steel, and to create nearly everything else we produce, consume, buy, and sell. Ecosystems require water in order to continue serving as the foundation of our economy and our way of life. Yet water scarcity is an increasingly critical challenge.

The world's population is increasing at a tremendous rate, the world's renewable water resources are reducing rapidly, the gap between supply and demand is widening with urbanisation and climate change making it even wider. Safe drinking water is a necessity for life (Environmental Protection Agent (EPA), 2009).

The achievement of Millennium Development Goals (MDGs) and elimination of poverty is hinged on improved access to water supply and appropriate sanitation. Kenya is a water scarce country with per capita availability of 647 m<sup>3</sup> of water per annum which is less than the recommended per capita availability of 1000m<sup>3</sup> of water per annum. This per capita availability is projected to fall to 235 m<sup>3</sup> by 2025 (WHO, 1998) as the

population increases and could be even less if resource base continues to be degraded. Comparatively, Uganda and Tanzania have 2,940 m<sup>3</sup> and 2,696 m<sup>3</sup> respectively (Nat. conference on IWM, 2002). This means that Kenya cannot afford the luxury that its neighbours have and must treat and manage water as a scarce resource with a social and economic value.

Regional water shortages and drought are discussed and featured regularly in the local media. Declining service levels can be linked with a rapidly growing and increasingly impoverished population, under-investment in water facilities and ineffective financial and commercial management of utilities. Inadequate water supplies have been blamed for hampering socio-economic growth in Kenya and compromising the integrity of national ecosystems. Provision of adequate water supply to a growing urban population is a daunting task worldwide (Schuringa, 2006, Nallathiga, 2006).

Kenya's new constitution (promulgated in August 4, 2010), recognizes the provision of basic water supply and sanitation services for all as a fundamental human right. Although the Government of Kenya (GoK) has affirmed its commitment to achievement of the UN Millennium Development Goals (MDGs) for water and sanitation as an essential investment in the country's long-term future, access to safe, adequate and affordable water and sanitation (WatSan) services remains an urgent and essential task. Kenya's WatSan coverage falls short of the required standards; where an estimated 53% of households use water from sources considered unsafe.

In Kenya, access to water and sanitation services for urban and rural poor remains very poor. This group has been deprived either because of lack of necessary infrastructure or through neglect. As a natural resource, water has a key role in development and

sustainable livelihoods, hence equitable, sustainable and efficient distribution of basic water and sanitation services is crucial.

Sustainable access to safe water is estimated at around 60% in urban and 40% in rural settings though missing baseline data and sustainable information systems hinder obtaining a clear nationwide picture and thus, coverage can only be estimated. The main reasons for the decline in sustainable access to safe water and basic sanitation are old infrastructure, inadequate management and maintenance of existing infrastructure, insufficient sustainability, investments not enough, concentrating on the options of fast tracking access and informal service provision operating outside a framework of basic standards and regulation. The National Water Master Plan Aftercare Study (1998) reported that there are close to 1800 water supply systems under the management of various providers. In addition, there are other privately owned boreholes, springs and other surface water schemes that are also part of service provision. It is estimated that only 53 per cent of the households in Kenya walk for less than 15 minutes to fetch water. In addition to the general national scarcity of water, there is a marked regional disparity in access to water in Kenya as documented by Odhiambo (2004) where 'only 0.6 per cent of households in both North Eastern (where the study area falls) and Nyanza Provinces have access to piped water compared to 11.8 per cent in Central Province and 33.2 per cent in Nairobi.

Government of Kenya (GOK) (2007) indicates that Garissa District is situated within Kenya's North-Eastern Province. The region is mainly arid, with average annual temperatures ranging from 25°C to 38°C, and mean annual rainfall ranging between 150mm and 300mm. The vegetation is characterized by grasslands, shrub land and thorny

thickets. The district is Located within the Arid and Semi-Arid (ASAL) region. It has historically been prone to repeated droughts that make the communities increasingly vulnerable to disasters. Water scarcity for both humans and livestock especially in the dry seasons is perhaps one of the top priority problems facing communities in ASAL areas, especially those in the pastoral livelihood zone.

Water and Sewerage Company (GAWASCO) serves Garissa town with water. The company has made significant strides in its efforts to connect every house hold in Garissa town and its environs with piped water (NWSB, 2007). The company had more than 6,000 metered consumers by 2007. However it had plans to connect over 10,000 consumers in the next two years.

## **1.2 Statement of the Problem**

Water service provision in Garissa Municipality suffers from a number of problems. Only 0.6 per cent of households in North Eastern province (where the study area falls) have access to piped water as documented by Odhiambo (2004). Garissa municipality is faced with excess demand over supply occasioned by population growth due to rural urban migration and economic development. The municipality also has a poor access to clean water due to dilapidated infrastructure and poor water quality. Coupled with that is a Report by WASREB (2009) which indicated that in 2006–2007 most Kenyan WSPs recorded good revenue collection efficiencies with an average collection rate of water bills of approximately 86%. But the worst performing utility was Garissa with 45% of the billed amount being collected by the WSP. It is due to the foregoing that this study intended to investigate the factors that influence water service provision in Garissa town.



### **1.3 Purpose of the Study**

The purpose of this study was to carefully investigate the underlying factors that influence water service provision in Garissa Municipality.

### **1.4 Objectives of the Study**

- i. To establish how demand for water influenced water service provision in Garissa Central Division.
- ii. To determine water source influence water service provision in Garissa Central Division.
- iii. To establish how GAWASCO water management facilities influence water service provision in Garissa Central Division.
- iv. To assess how water infrastructure influences water service provision in Garissa Central Division.

### **1.5 Research Questions**

- i. How does demand for water influence water service provision in Garissa Central Division?
- ii. Does water source influences water service provision in Garissa Central Division?
- iii. How does GAWASCO water management influence water service provision in Garissa Central Division?
- vi. How do water infrastructure influence water service provision in Garissa Central Division?

### **1.6 Significance of the Study**

This study proved invaluable in combating threats on water service provision and ensuring that the Garissa Municipality walk towards attaining Kenya Vision 2030 and

MDGs. This research shall be beneficial to the water actors in this area which includes the WSPs, WSBs and WRMA. Further, it will go a long way in ensuring customer satisfaction and a continuous improvement in their service delivery.

### **1.7 Limitation of the study**

The study was limited in that some project management staff in GAWASCO expressed discomfort in giving information for fear that the research was going to evaluate their leadership and service delivery, hence open up for debate their efficiency among the top management of the company. The researcher overcame this challenge by engaging the staff in a verbal discussion during one of the staff's sessions, in which he clarified the intention of the study to the respondents.

### **1.8 Delimitation of the Study**

Due to financial and time constraints the study only focused on Garissa town, Windsor estate. The study was also focussed on two institutions charged with water management and provisions in Garissa municipality that is GAWASCO and NWSB.

### **1.9 Assumptions of the Study**

One assumption of the study was that the household heads were best suited to give information concerning factors affecting the provision of water in Garissa town.

This study assumed that the respondents will cooperate and respond accurately and truthfully to the questionnaire administered to them.

### **1.10 Definition of significant terms used in the study**

**Water Service** – Any service of or incidental to the supply/provision of water or the provision of sewerage (Water Act, 2002, Kenya)

**Water quality**- is a measure of how good the water is, in terms of supporting beneficial uses or meeting its environmental values.

**Safe water** – This is water that meets the laid down quality standards such as by WHO's and KEBS

**Water demand** – This is the amount of water required to satisfy a population.

**Water supply** - This is the amount of water provided to meet the population's demands.

**Kenya Water act 2002** – This is a legal/institutional framework for the management and development of Kenya's water resources and the provision of water services.

**Water infrastructure** – This is the water circulatory system supplying water in Garissa Township area.

### **1.11 Organization of the study**

The chapter provided the general background of the study. It discussed the statement of the problem, the purpose and objectives of the study. The chapter also discussed the research questions, significance and limitations of the study. The chapter also provided the delimitations of the study before finally defining key terms used in the study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter contained reviewed literature related to factors influencing water service provision in Garissa Municipality. The factors investigated in this study included; demand for water, water source, water quality and lastly water infrastructure.

#### **2.2 Demand for water and water service provision.**

According to Water Partnership Program (2012) water demand deals with how much water is needed by the population. The water to be supplied should be sufficient to cover both the existing and future consumers. It must include provisions for domestic and other types of service connections. In addition to the projected consumptions, an allowance for non-revenue water (NRW) that may be caused by leakages and other losses should be included. The program Water Partnership Program (2012) shows that Water demands are influenced by the following factors: Service levels to be implemented; Size of the community; Standard of living of the populace; Quantity and quality of water available in the area; Water tariffs that need to be shouldered by the consumers; Climatological conditions; Habits and manners of water usage by the people.

Asingwire and Muhandi (2005) opine that one of the key policy requirements in the provision of safe water and sanitation services is the demand driven approach (DRA). However adherence to the principles of DRA means that communities that fail to express effective demand are left un-served. These are usually the low income groups. The approach requires that communities are mobilized en-masse hence political influence tends to interfere with the allocation process, some mobilization activities have focused

heavily on construction and less on operation and maintenance of water points hence obscure coverage figures and obscure the actual situation and complicate attempts ensuring equitable distribution of water supply services, the success of the DRA requires that communities receive Information and education, DRA is not practical with a private sector approach which is governed by the contract terms and is also sometimes hampered by late release of funds and the pressure to spend funds in time.

### **2. 3 Water source and water service provision.**

In the United States, freshwater resources are drawn from surface sources and groundwater sources. However, surface waters account for about three-quarters of withdrawals; in the arid West. Groundwater sources supply a larger percentage of withdrawals than in the East. In Kenya, the main water sources include; rain water, boreholes, wells, springs, rivers (mostly seasonal) and streams. Water can be abstracted from these sources after determining the safe yield (Water design Manual, 2005).

In the selection of a source or sources of water supply, adequacy and reliability of the available supply could be considered the overriding criteria. Without these, the water supply system cannot be considered viable. Adequacy of supply requires that the source be large enough to meet the water demand (Water Partnership Program, 2012). An adequate source is one that ensures supply of drinking water in sufficient quantity and quality, both from the viewpoint of the user community and the responsible water agency or government department (Lee and Bastemeijer, 1991).

Sphere Project (2000) recommends that the first priority is to provide an adequate quantity of water, even if its quality is poor, and to protect water sources from contamination. A minimum of 15 litres per person per day should be provided.

Frequently, total dependence on a single source is undesirable, and in some cases, diversification is essential for reliability (Water Partnership Program, 2012). Many people use multiple sources of water. Some will prefer certain sources for drinking water and others for laundry, bathing, watering animals and irrigation. There should be local contingency plans for rapidly ensuring the safety of such reserve sources of drinking-water. These will usually involve stockpiling a limited amount of chemicals to disinfect the source (taking into consideration the shelf-life of these chemicals), plus fencing to exclude animals. Depending on the economic base of the community or neighbourhood concerned, the discussion may go on to consider the provision of alternative or reserve water for livestock, small-scale industry, or irrigation; however, the first priority should always be water for drinking, cooking and personal hygiene (Meeks, 2012).

KIWASCO (2007) shows that sources, which require little or no treatment of the water, should be chosen in first instance provided the required quantity of water can be obtained. Hence springs and ground water resources should always be exploited in the first hand. For household and small-scale community supplies rainwater harvesting may serve well in most medium and high potential areas in Kenya. Surface water from river streams and lakes will almost always require some treatment to render it safe for human consumption. However, for large supplies surface water will often still be the most economical alternative. Rivers, which have the bulk of their catchment in forest areas, should be preferred. Sub-surface water drawn from a riverbed or riverbank can sometimes be a viable alternative in dry areas with only seasonal flow in the river, or in rivers with a high silt load.

It should be studied whether a combination of sources may give a more economical and reliable water supply than a system based on only one source. Mixing can also be used to reduce the content of certain constituents, e.g. Fluoride, to acceptable levels. Sources from which water can be supplied by a gravitational system are particularly favorable (KIWASCO, 2007).

Permanent water-supply arrangements will depend on the length of time that the settlement is to be in use and the size of the population to be served. When existing water sources have been destroyed, new sources may also need to be selected. In the longer term, it should be possible to improve and protect existing sources and to develop new ones, such as springs and borehole (KIWASCO, 2007).

The predominant sources of water in the pastoral livelihood where Garissa town lies, include boreholes/taps or underground tank, and hand/motor pumped well. In the Riverine, over half of the households' primary source of water is river. In Urban for the overwhelming majority of households is from piped tap water (Garissa Integrated Nutrition Survey, 2008).

Environmental factors affecting small water sources such as springs and local aquifers most seriously are pollution by source users, contamination from on-site sanitation, regular supply-site malfunctioning, competing demand for a limited water supply and the effects of local land-use changes. Larger water sources such as major rivers or regional aquifers are mainly affected by discharge of industrial pollutants, growing and widespread use of pesticides and fertilizers, discharge of sewage waste water, over-extraction of groundwater and effects of large-scale land-use change (Lee and Bastemeijer, 1991).

## **2.4 Water management facilities and water service provision**

Water supply policies and regulation are usually defined by one or several Ministries, in consultation with the legislative branch. In the United States the United States Environmental Protection Agency, whose administrator reports directly to the President, is responsible for water and sanitation policy and standard setting within the executive branch. In other countries responsibility for sector policy is entrusted to a Ministry of Environment (such as in Mexico and Colombia), to a Ministry of Health (such as in Panama, Honduras and Uruguay), a Ministry of Public Works (such as in Ecuador and Haiti), a Ministry of Economy (such as in German states) or a Ministry of Energy (such as in Iran). A few countries, such as Jordan and Bolivia, even have a Ministry of Water. Often several Ministries share responsibilities for water supply. Policy and regulatory functions include the setting of tariff rules and the approval of tariff increases; setting, monitoring and enforcing norms for quality of service and environmental protection; benchmarking the performance of service providers; and reforms in the structure of institutions responsible for service provision. The distinction between policy functions and regulatory functions is not always clear-cut. In some countries they are both entrusted to Ministries, but in others regulatory functions are entrusted to agencies that are separate from Ministries.

Water governance in Africa has been identified as the key issue in water resource management as well as water services delivery, especially in Sub-Saharan Africa (Krhoda, 2008). In Kenya, Moraa, Atieno and Salim (2012) show that all water resources in Kenya remain vested in the state. The Ministry of Water and Irrigation is tasked with the responsibility of creating institutions to manage water resources and provide water



services. Water use is subject to approval and a water permit, typically defining water use, the volumes authorized for abstraction, and the duration of the permit.

In 2002, the water sector reforms in Kenya culminated in the passing of the Water Act, gazetted in October 2002. The Water Act introduced new water management institutions to govern water and sanitation. The water reforms saw the introduction of the commercialization of water resources as part of the decentralization process and the participation of stakeholders in the management of national water resources. Policy and regulation responsibilities were separated. The devolution of responsibilities for water resources management and water services provision to local level functions has been the principal mechanism for improving accountability and transparency in the water and sanitation sector,

The Ministry of Water and Irrigation has set up several institutions such as Water Resources Management Authority, Water and Sewerage Services Policy among others to streamline its operations in the area of service delivery in the water sector. Some of the duties of the Water Resources Management Authority include: To ensure Rational and equitable allocation of water resources, water quality monitoring, testing and surveillance to ensure compliance with drinking water standards and other standards for various water uses and effluent discharges into public sewers and the environment and Mapping and publishing of key water catchment areas, groundwater resources and flood prone areas (Water Act, 2002).

Onjala (2002) continues to elaborate that during a workshop in 1995, the Ministry of Water and GTZ, decided to create Water and Sewerage Companies (WSCs) as a step towards commercialisation. These WSCs were set up along the normal lines of a private

company, with shareholders, a Board of Directors and a corporate management team (the latter consisting of a Managing Director, a Commercial Manager and a Technical Manager). The municipal council is the sole owner of the company because it owns all shares, thus exercising control over the company (officially through the annual general meeting). The ultimate authority, however, lies with the Board of Directors, as it “reviews the overall strategy, monitors and controls, considers significant issues and fulfils statutory duties”. It also appoints the Managing Director. The Board brings together representatives from the municipality, the state and stakeholders, thus giving it a ‘democratic’ outlook. Three municipalities were selected to start with: Eldoret, Nyeri and Nakuru.

Owuor, *et al.* (2006) attribute these efforts to the persistent failure and inability of most local authorities in the provision of water supply and sanitation services. Most local authorities faced, and continued to face, a number of persistent problems in water supply and management: frequent water shortages and wastage, high unaccounted-for-water, illegal connections, mismanagement of funds from water bills, non-reading of meters, and non-payment of water, among others

Despite that, there is lack of unified framework for the management of water resources, which limits the ministry’s capacity to fully play its leadership role in the sector. This also includes inadequate regional cooperative frameworks for the management of shared water resources (Moraa, Atieno and Salim, 2012).

In 1998, the government established the National Water Conservation and Pipeline Corporation (NWPC) to take over the management of government operated water supply systems that could be run on a commercial basis. In addition, large municipalities

were allowed to supply water within their areas. Also allowed to operate were a number of donor-funded or supported community self-help water supply projects (Mumma, 2005; Ngigi & Macharia, 2006). Although nominally autonomous with the opportunity for commercial orientation, NWCPC failed to attain financial viability or to improve provision of water supply as originally envisaged. Neither could the local authorities do any better.

KIWASCO (2007) acknowledges that in the past years prior to reforms, the water sector has experienced numerous challenges which include: Lack of a comprehensive sector policy or strategy to guide sector organization in the performance of their tasks, unclear roles and responsibilities for the sector leading either to duplication of efforts or gaps in some areas, deteriorating infrastructure as a result of poor maintenance and lack of new investments, erratic and insufficient funding by the government and local authorities, increasing pollution of water resources, non-existence of comprehensive legislative framework for managing water, lack of sector policy on water resources management and water supply and sanitation and lack of stakeholder involvement and ownership by consumers and users.

Asingwire and Muhangi (2005) say that although there is wide knowledge of the guidelines especially among the technical staff of local governments officials only partially apply these guidelines, or ignore them altogether. The interplay of political influence, lack of full knowledge by politicians, and inadequacy of resources undermines their application. The guidelines spell out the roles of different stakeholders, thus enhancing participation and avoiding role conflicts, the guidelines promote coordination and collaboration in the sector and promote a bottom-up participatory approach which

enhances participation, with high chances of meeting people's needs including equitable distribution. On the other hand the weaknesses include: allowing decision-making by politicians which provides room for ignoring or influencing the technical considerations, the politicians are not fully aware of the guidelines.

## **2.5 Water infrastructure and water service provision.**

Water infrastructure is the circulatory system of a country. Too much of the water infrastructure is outdated, overused and underserved. Water and wastewater infrastructure in the U.S. is in crisis. Much of the infrastructure is a relic of post-World War II investment (Gordon, Hays, Pollack, Sanchez, and Walsh, 2011). Deferred Maintenance & delayed pipe replacement are having a real impact. The decaying water infrastructure pollutes waters, sickens the children, and wastes natural resources. The U.S. Geologic Survey estimates that the U.S. wastes six billion gallons of clean drinking water each day or 14 percent of total use through leaky pipes in need of repairs. This is enough water to supply the ten largest cities with drinking water daily (Najjar, 2011).

Water is one of our most essential commodities, yet the infrastructure supporting its delivery is in serious need of repair (White Paper, 2013). In developing countries, households without water infrastructure spend billions of hours collecting water for domestic use every year (Meeks, 2012). Lack of water infrastructure can drive up the time intensity of home production, thereby diverting time from potentially income-generating activities, such as formal work, agricultural labor, and small businesses (Blackden and Wodon, 2006). When lacking water at their home, household members must bring water from other sources, either improved (wells, protected springs, shared

standpipes and taps) or unprotected (streams, rivers, unprotected springs, lakes, irrigation canals)

The average time required per round-trip to collect drinking water in rural areas is 36 minutes in Sub-Saharan Africa and 23 minutes in Asia (United Nations, 2010). Papers on the labor impacts of water infrastructure have found that access to water infrastructure results in less time spent collecting water; however, from there the results diverge. In urban Morocco, a randomized study found that shifting households from free public taps to individual household connections did result in time gains, however, such time was re-allocated towards leisure and social activities (Devoto, Duo, Dupas and Pariente, 2011). The benefits of any water intervention will depend on the location, technology, and circumstances of implementation (Whittington, Hanemann, Sado and Jeuland (2008). Meek (2012) indicate that households in a village that is allocated a water supply system are more likely to use shared piped water and less likely to use unprotected sources for their main water supply. Importantly, these households are also 12 to 15% more likely to have their water source less than 200 meters from the household. Results from Meeks (2012) study indicate that the infrastructure brought water supplies closer to households, decreasing the time required for water collection, increasing the time spent working on household small farms, and increasing farm production.

Both gravity flow and pumps are normally used for transmitting and distributing water.

Gravity flow is preferable as it avoids dependence on pumps and power supplies, so reducing costs, workload, and the risk of supply cuts as a result of breakdowns or fuel shortage.

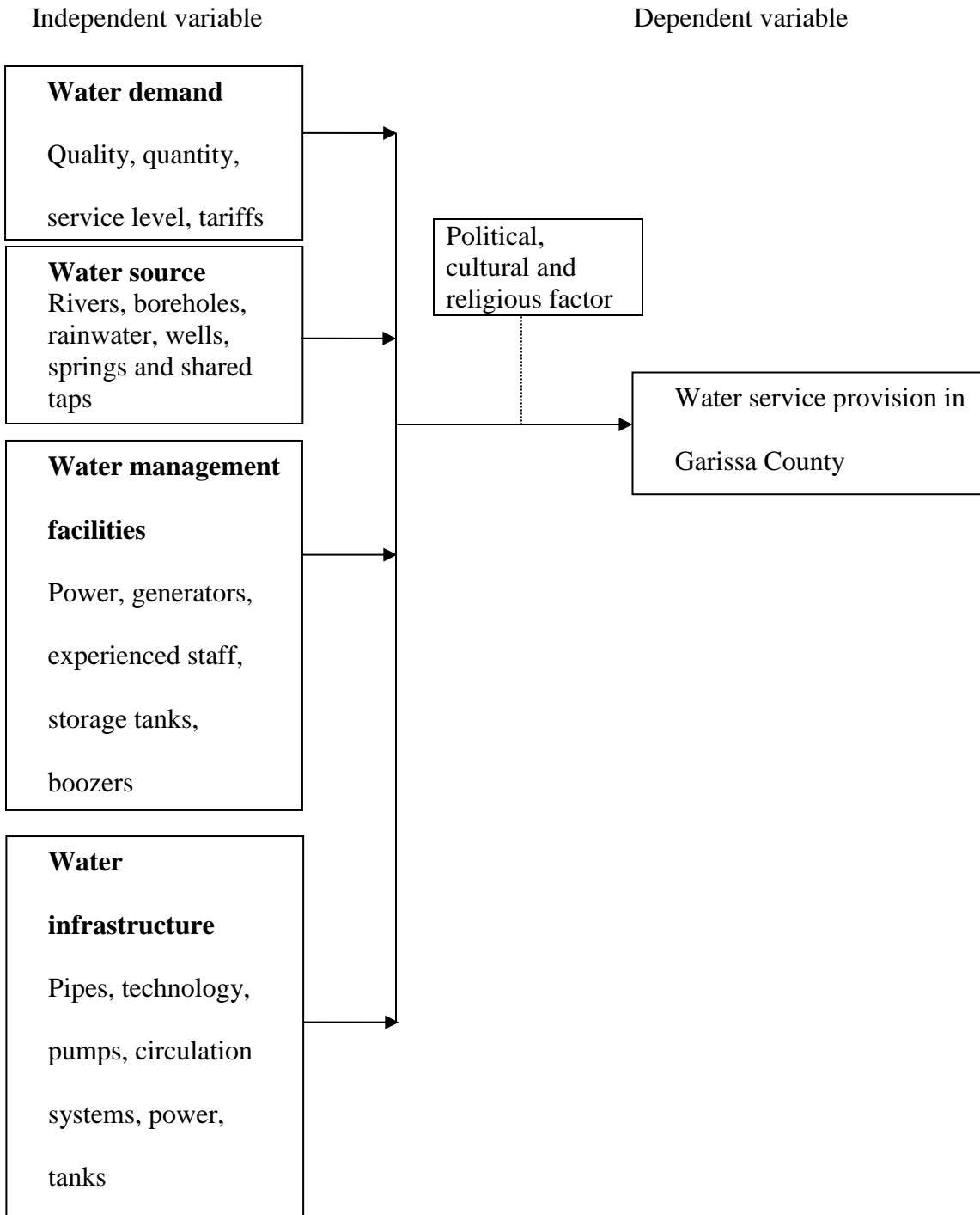
If natural slopes are not available, storage tanks can be built on raised mounds of compacted earth, an adequate margin of earth being provided around the tank to avoid collapse due to erosion. If pumps are used for distribution, a back-up pump should always be available together with a fuel reserve in case fuel supply to the settlement is cut off.

Polyethylene pipe and PVC pipe are usually used to distribute mains water. Care should be taken to protect plastic pipes from being crushed by vehicles before they are buried. Gullies and areas where the pipe could be washed away or broken by a landslide should be avoided if possible. If they are unavoidable, these obstacles should be crossed by sections of steel pipe, suitably supported by cables or structures to protect them (Meeks, 2012).

Failures in drinking water infrastructure can result in water disruptions, impediments to emergency response, and damage to other types of infrastructure (ASCE 2009). In extreme situations, water shortages, whether caused by failing infrastructure or by drought, may result in unsanitary conditions, leading to public health concerns. Broken water mains can damage roadways and structures and hinder fire-control efforts.

Unscheduled repair work to address emergency pipe failures may cause additional disruptions to transportation and commerce.

## 2. 6 Conceptual framework



**Fig 1. Conceptual Framework**

This diagram shows the relationship between the independent and dependent variable. Water demand, water source, water management facilities and water infrastructure influences water service provision positively or negatively. There are intervening factors that also influence the provision of water, chief among them are the political, cultural as well as the religious factor.



## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter deals with the specific methodology of the study. It starts by stating the design of the data and the target population. The chapter then describes the sampling procedure and the research instruments that were used in the study, including their validity and reliability. Finally, the chapter explains how data was analysed and presented.

#### **3.2 Research Design**

The study design used is descriptive analysis. Ng'ang'a, Kosgey and Gathuthi (2009) describe descriptive analysis as a method that involves measuring a variable or a set of variables as they exist naturally. It is suited for this study because it is not concerned with the relationship between variables but rather a description of individual variables. The aim is to describe a single variable or obtain a separate description for each variable when several are involved. The respondents will be asked questions about a particular issue. The study will employ descriptive analysis to establish opinions and knowledge about the factors influencing water service provision in Garissa Municipality.

#### **3.3 Target Population**

The target population for this study was the residence of Central Division in Garissa.

Four areas namely; Windsor, Iftin, Township and Waberi were selected to participate. A total population of 840 households (Kenya Census, 2009) were targeted for this study.

The household heads were the ones who participated in the study.

### **3.4 Sample size**

#### **3.4.1 Sampling size**

In order to get a proportional representation of the targeted respondents, the study used a combination of cluster, purposive and random sampling techniques. According to Orodho (2009) 10 to 20 percent sample of the population was representative enough to be used as a sample. Mugenda and Mugenda (1999) recommends that 10% of the population as enough samples. Garissa Central Division was divided into four areas namely, Windsor, Ifitin, Township and Waberi through cluster sampling. A sample of 84 households were chosen for this study

#### **3.4.2 Sampling procedure**

Purposive sampling which allows the researcher to use cases that have the required information with respect to the objectives of study was applied to choose Central Division because it is the one provided with water due to urbanization. After, cluster sampling, random sampling was used to select the 84 (21 households from each of the four areas) household heads who participated in this study. Proportionate technique could not be used due to lack of household statistics from each estate.

### **3.5 Research Instrument**

In this study the primary data was collected with the help of a questionnaire, which were administered to the sampled population of the residence of Garissa Central Division. The questionnaire was divided into sections, in line with the study objectives, and contained both open and closed ended question. The questions were both multiple-choice and open ended. Most questions in the questionnaire employed a Likert type -points scale. The

questionnaire contained four main sections. The first section dealt with the general information. Section two consisted of questions on demand for water supplied. The third section consisted of questions on the source of water supplied. The fourth section was about the water management facilities in Garissa, while the last was questions on the water infrastructure in the Municipality. In the development of the questionnaire two techniques were used; closed ended and open ended technique

- Closed ended items were developed for they allow easier and accurate analysis of the data. They also make numerical comparison relatively easy while allowing a high degree of respondents' objectivity. They also reduce the problem of falsification.
- Open ended questions were considered feasible in order to give the respondents a chance to deliver rich information and not to feel the constraints imposed by a fixed choice question

### **3.5.1 Pilot testing**

Piloting was conducted to assist in determining accuracy, clarity and suitability of the research instrument. According to Borg and Gall (1989), one can carry pilot study on two or three cases. The purpose of the piloting was to assist the researcher to identify the items which may be inappropriate so as to make necessary corrections, examine responses to determine the level of ambiguity of the questions and determine the percentage of responses.

### **3.5.2 Validity of instruments**

The questionnaires were given to three lecturers from the department of Extra Murals for validation. The responses were also checked to verify whether the questions answered

what they were intended to answer in order to ensure instruments validity. Based on the analysis of the lecturers, the researcher was able to make corrections, adjustments and additions to the research instruments.

### **3.5. 3 Reliability of instrument**

In the study, reliability was assessed through the results of piloting, which was done using test-retest technique. The research instrument was administered to the same group of subjects twice in the pilot study. A two week lapse between the first and the second test was allowed.

The scores from both tests were correlated to get the coefficient of reliability using Pearson's product moment formulae as follows: Pearson's coefficient of correlation

$$r_{xy} = \frac{N\sum xy - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X^2)][N\sum Y^2 - (\sum Y^2)]}}$$

Where

N      number of respondents

X      scores from the first test

Y      scores from the second test

The value of r lies between  $\pm 1$ , the closer the value will be to +1 the stronger the congruence.

### **3.6 Data collection procedures**

After approval of the research by the University supervisor, a research permit which authorized the researcher to carry out the study was obtained from the National Council

of Science and Research at Utalii House, Nairobi. The questionnaires were drop and pick type, so the respondents were given one week to fill them. After one week the questionnaires' were collected. Due to the vastness of the study area sampled the researcher was assisted by research assistants whose duty was mainly to follow up the questionnaires.

### **3.7 Methods of data analysis.**

The data collected from questionnaires was analyzed by the use of descriptive statistics (frequencies and percentages). The descriptive analysis was appropriate for this study because it involved the description, analysis and interpretation of circumstances prevailing at the time of study. Descriptive statistical techniques were used to analyze various items of the questionnaire. These included averages, percentages, frequencies and totals. This study used frequencies and percentages because they easily communicate the research findings to majority of readers (Gay, 1992). Frequencies easily show the number of subjects in a given category.

A number of Tables were used to present data findings. Coding was done where the response were transferred into summary sheets by tabulating. They were tallied to establish frequencies. The frequencies were determined by converting similar responses into percentages to illustrate related levels of opinion. The questionnaires were analysed separately in four categories; from household heads, government officers and from the NGO representatives.

### **3.8 Ethical consideration**

Consent of the participants was sought whereby they agreed to participate in the study through voluntary informed consent without threat or undue inducement. In addition the

respondents were assured that the information they gave was to be kept confidential and used only for the purpose of research. For anonymity the respondents were requested not to write their identities in the questionnaire section while the appropriate chain of command was followed before the commencement of the data collection process.

### 3.9 Operational definition of variables

**Table 1: Operationalization table**

<b>Objective</b>	<b>Variable</b>	<b>Indicators</b>	<b>Measurement scale</b>	<b>Types of analysis</b>
To establish how demand for water influenced water service provision in Garissa.	Demand	% of people with water  Litres of water used	Nominal  Ordinal	Descriptive
To determine whether water source influence water service provision in Garissa central Division.	Sources of water	Rivers,  Boreholes.  Taps,  Springs	Nominal  Ordinal	Descriptive
To explore how GAWASCO's water management facilities for water related emergencies influences water service provision in Garissa central Division.	Equipment	Backup Generators   Water Bowsers	Nominal  Ordinal	Descriptive
To investigate how water infrastructure influences water service provision in Garissa.	Infrastructure	Storage tanks  Pipes  Billing systems	Nominal  Ordinal	Descriptive

## **CHAPTER FOUR**

### **DATA ANALYSIS, PRESENTATION AND INTERPRETATION**

#### **4.1 Introduction**

This chapter provides the findings of the study, analyses the results and presents the results of the analysis. The findings are presented according to the specific objectives of the study. The analysis is done by considering each of the objective, analysing each of the questionnaire and interview schedule item relating to that objective and giving the findings on that particular objective and then discusses the results. A thematic analysis of the data is also performed i.e. the main themes found in the study objectives and questions are discussed, then the contents within the themes analyzed and presented. Finally, the various responses given by the various respondents on identical research objectives are compared to find if the respondents concur on various issues or not. The common responses are then considered to be representing the actual situation. An attempt is made to find possible reasons for the difference in the response from various respondents as they arise. Where possible, the results are presented in the form of Tables.

#### **4.2 Questionnaire Return Rate**

One questionnaire was used as an instrument for collection of data from household heads and it was administered to 84 household heads.

**Table 4.1: Questionnaire return-rate**

Area	Total	Returned (f)	%
Windsor	21	21	25.00
Iftin	21	18	21.42
Township	21	20	23.80
Waberi	21	16	19.04
Total	84	75	89.26

Out of the 84 questionnaires for the household 9 (11.91%) were not returned. Windsor Estate's 21 questionnaires were all returned forming 25% of the total number collected, followed by Garissa Township whose 20 questionnaire were returned forming 23.8%. In Iftin estate 18 questionnaires were collected (21.42%) and Waberi produced the least respondents 16, with a 19.04%. So the household heads who participated in the study were 75 (89.26 %).

#### **4.3 The demographic characteristics of the respondents**

The demographic information in this sub-section was obtained by use of 4 multiple choice questions for household heads in order to establish the respondents gender, age, academic qualifications and the their area of residence.

The results are shown on Table 4.2



**Table 4.2: Distribution of response by gender**

Gender of household heads	f	%
Male	60	80.0
Female	15	20.0
Total	75	100.0

From Table 4.2 majority of the household heads who responded to this study were men 80.0%. Garissa being an urban centre in an arid area does not attract women. The Al Shaabab threat which was rife at the time of the study was another threat that made the men to be more than women. Women feared to live and work in Garissa for fear of being attacked.

**Table 4.3: Distribution of household response by age**

Age of respondents (yrs)	f	%
21- 30	5	6.66
31 – 40	9	12.0
41 –50	45	60.0
51 – 60	16	21.33
<b>Total</b>	<b>75</b>	<b>100</b>

According to Table 4.3 most of the respondent 60% who participated in this study were in the age bracket of 41-50. This is the prime age whereby majority of the respondents have families. Age 21-30 recorded 6.66 % and this is because at that age majority of

people are still in colleges and very few have families of their own for them to be referred to as house hold heads. Those above 51 years of age were a mere 21.33%.

**Table 4.4: Distribution of response as per education level**

Level of education	f	%
Never went to school	4	5.3
Primary	9	12.0
Secondary	33	44.0
Diploma	18	24.0
Degree	11	14.67
<b>TOTAL</b>	<b>75</b>	<b>100</b>

From Table 4.4 shows that many of the household head respondent's educational level was secondary education 44.0%. Followed by those who had attained diploma 24% and degree level 14.7% and there are those who have never been to school at all 5.33%. This means that majority of the respondents can understand the national as well as the official languages of the nation hence easy to understand and answer questions related to factors influencing water service provision in Garissa.

#### **4.4 Analysis on item on water demand and its influence on water service provision**

The first question of this study sought to determine whether water demands influenced water service provision. This subsection was measured by use of 4 questions, 3 multiple choice and 1 open ended.

The first question sought to elicit answers on whether water demand affected its provision and the findings were presented in Table 4.5.

**Table 4.5. Responses as to where demand affected water service provision**

Responses	f	%
Yes	59	78.67
No	9	12.0
I don't know	7	9.33
Total	75	100.0

Table 4.5 shows that 78.67% of the respondents agreed that demand affected water service provision in Garissa Central division. 12% did not agree and there was 9.33% who did not know whether demand influences water service provision. That percentage could be attributed to be from the respondents who had no formal education who may be did not understand the question.

**Table 4.6 Responses as to whether water supplied was sufficient to cover the existing consumers**

Responses	f	%
Yes	4	5.33
No	71	94.67
Total	75	100.0

Almost all the respondents agreed that the water supplied was not sufficient to covers the existing consumers with 94.67% response. Only a mere 5.33% of the respondents agreed that the water supplied was sufficient. This means that Garissa town water demand was not met. This was attributed to the ever growing population in Garissaa. The unmet demand influenced provision of the water because though the source of water was available (Tana River), the existing water infrastructure was stressed beyond its capacity. As such some of the estates were not connected to tap water system. As concerns reasons as to why the demand was not met the respondents were given some statement to respond to and the results were presented on Table 4.7.

**Table 4.7 Reasons as to why the demand for water is not met.**

Responses	SA	A	NO	D	SD	Total
	%	%	%	%	%	
Service levels of water is low	9.0	13.0	13.6	28.3	36.0	100
Quantity of water available	0	0	0	0	100	100
Quality of water available	40	33.3	13.3	9.4	4.0	100
Climatic conditions	100	0	0	0	0	100
Habits and manners of water usage.	81.3	13.3	5.34	0	0	100
Size of the community	4.0	12	21.33	28.0	34.67	100
Water tariffs are high	53.34	33.3	9.33	4.0	0	100
Political influence	12.0	32.0	25.3	10.6	8.0	100
Lack of education among the people	81.3	2.67	5.33	10.6	0	100

It is clear from Table 4.7 that respondents in Garissa Central Division 100% strongly disagreed that quantity of water available caused water demand not to be met. This means that the quantity available is enough to supply water to the town. This could be attributed to the fact that Tana river, the largest river in Kenya, passes through the town and has big volumes of water. However another 100% of the respondent strongly agree that climatic conditions could be a reason for the unmet demand. Coupled with that is 81.3% who also strongly agree that habits and manners of water usage by the people and lack of education among the people also form part of the reasons for the unmet demands. As concerns quality of the water, many of the respondents (40%) strongly agreed and (33.3%) agreed that the quality was wanting and as such leads to the unmet demands for water. Other reasons given include the water tariffs being high 53.3% (strongly agreed) and size of community 34.67% (strongly disagreeing). This means that the tariffs are high hence residents can not afford but to the resident the community was not so large to be a reason for their water demands not to be met. Political interference was also found to be a reason for water demands not to be met.

#### **4.5 Analysis on items on sources of water and its influence on water service provision**

The researcher sought to determine the water sources and whether the identified water sources were sufficient and reliable for the populace of the Town.

**Table 4.8. Responses as to the sources of water**

Responses	f	%
Rain water	75	100
Boreholes	21	28
Wells	11	14.7
Indoor tap water	54	72.0
Shared tap	60	80
Springs	0	0

It should be noted that Table 4.8 indicates that the respondents had multiple source of their water. All of them (100%) had access to water from rivers and this as said earlier could be attributed to the proximity of Tana River to the town.80% indicated that they used shared taps meaning that even though there was 72% who indicated that they had indoor tapped a water, at times they were forced to use the shared taps. Boreholes were another source of water in the town with 28% of the respondents indicating that. Wells formed a mere 14.7% of all the respondents. None of the respondents indicated that springs were a source of water in the regions.

**Table 4.9 Sufficiency and reliability of water in Garissa Town**

Responses	f	%
Sufficient	36	48%
Not reliable	28	37.3
No response	11	14.6
Total	75	100.0

From Table 4.9 48% of the responded said that the available water sources were sufficient, but not reliable, 37.3% said that the water sources were neither sufficient nor reliable. 14.7% did not respond to the question. It can be inferred therefore that one of the major factor influencing water service provision is the unreliable water sources though available.

**Table 4.10 Responses as to whether the water was treated**

Response	f	%
Yes	63	84
No	4	5.33
I don't know	8	10.67
Total	75	100

Majority 84% of the respondents are aware that the water was treated a factor that contributes much to water service provision. This means that that the residents trust the water they are provided with.

**Table 4.11 Responses as to whether the source of water was protected from contamination**

Response	f	%
Yes	0	0
No	75	100
Total	75	100

In Table 4.11 all the respondents 100% showed that the sources of their water were not protected from contamination. This may be the reason why in Table 4.10 majority of them indicated that the water is treated before it is used by households.

The researcher wanted to establish the water pollutants at the source and the results are presented in Table 4.12.



**Table 4.12: Water pollutants at the source**

Response	f	%
Industrial pollutant	23	30.67
Use of pesticides and fertilizers	7	9.33
Discharge of sewage waste water	68	90.67
Land use changes	13	16.0

Majority 90.67% of the respondent indicated that discharge of sewage waste water was the main pollutant of water in Garissa Town. It was followed by industrial pollutant with 30.67%. Use of pesticides and fertilizers scored 9.33% may be because, though livestock was a major livelihood of the people, agricultural activities were minimal.

#### **4.6 Analysis on items on water management facilities and water service provision**

The respondents were asked to indicate whether GAWASCO had the necessary water management facilities to manage and handle water related emergencies and the respondent were presented in Table 4.13

**Table 4.13: Respondents' opinion on whether GAWASCO have the necessary water management facilities to manage and handle water related emergencies**

Response	f	%
Yes	48	64
No	27	36
Total	75	100

From Table 4.13 it is clear that 64% of the respondents agreed while 36% disagreed to GAWASCO having the necessary water management facilities to manage and handle water related emergencies. Among the explanations given by those who agreed were that GAWASCO has back up power generators in case normal power went off, GAWASCO has adequate experienced staff who offer 24 hour response to leakages and burst pipes, GAWASCO has big storage tanks and water boozer from the NWSB used to supply water in the town in case of emergency shortage, motorbikes for rapid response and improved technical department which handles emergencies adequately. Those who disagreed cited the many instances where there are pipe bursts which take more than 24 hrs to be repaired.

**4.7 Analysis on items on water infrastructure and its influence on water service provision.**

The fourth research question for this study was to establish whether water infrastructure had influence on water service provision and the findings are shown in Table 4.14.

**Table 4.14: Responses as to whether infrastructure development influences water service provision**

Response	f	%
Very highly	75	100
Highly	0	0
Averagely	0	0
Very little	0	0
Total	75	100

All the respondent 100% were in agreement that infrastructure development influenced water service provision. Among the reasons given for this are that this would translate to more consumers hence increased revenue leading to better services, planning will be enhanced, few customer complaints hence enhanced service delivery, reduced cost of operations, provision of reliable supply and services to customers, it would translate to reduction in costs through leakages and pipe bursts and improved infrastructure brings forth effectiveness among company employees to the public.

The researcher sought to find out which aspects of water supply needed improvement in the future and the results are indicated on Table 4.15.

**Table 4.15 Aspects of water supply that needs improvement in the future**

Response	f	%
Quality	75	100
Pressure	61	81.3
Rate Reliability	75	100
Billing system	57	76
Maintenance	43	57.3

This Table communicates the fact that all the above given areas needed to be improved especially the quality 100% and the water reliability with also 100% response. The pressure of the water needed to be improved also as shown by the 81.3% response, followed by billing systems with 76%.

## **CHAPTER FIVE**

### **SUMMARY OF THE FINDING, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter provides the summary of the research findings. The study was an analysis into the factors influencing water service provision in Garissa Central Division. This chapter aims at analyzing, presenting and discussing the results.

#### **5.2 Summary of the findings**

The questionnaire return rate was 89.26 % of all the household heads who participated in the study. This means that only 10.74 of the questionnaires were not returned. Windsor Estate had all its 25 distributed questionnaires returned. Majority of the household heads who responded to this study were men forming 80.0%. This could be attributed to Garissa being in the ASAL area a climatic condition that does not favour women coupled with the Al Shaabab terror group which has affected the security situation in the region. Most of the respondents (60%) were in the age bracket of 41-50. This is the middle class age where majority of people have families. Many of the household heads educational level was secondary with 44.0% score, followed by those who had attained diploma with a 24% score. However, a few of them had no formal education (5.33%).

As to whether demand has any influence on water service provision, 78.67% of the respondents agreed that demand affected water service provision in Garissa Central division. 12% did not agree and there was 9.33% who did not know whether demand

influences water service provision. That percentage could be attributed to be from the respondents who had no formal education who may be did not understand the question. The water supplied IN Garissa was not sufficient to covers the existing consumers with 94.67% response. Only a mere 5.33% of the respondents agreed that the water supplied was sufficient. The study established that 100% of the respondents strongly disagreed that quantity of water available caused water demand not to be met. This means that the quantity available is enough to supply water to the town. This could be attributed to the fact that Tana river, the largest river in Kenya, passes through the town and has big volumes of water. However another 100% of the respondent strongly agree that climatic conditions could be a reason for the unmet demand. Coupled with that is 81.3% who also strongly agree that habits and manners of water usage by the people and lack of education among the people also form part of the reasons for the unmet demands. As concerns quality of the water, many of the respondents (40%) strongly agreed and (33.3%) agreed that the quality was wanting and as such leads to the unmet demands for water. Other reasons given include the water tariffs being high 53.3% (strongly agreed) and size of community 34.67% (strongly disagreeing). This means that the tariffs are high hence residents can not afford but to the resident the community was not so large to be a reason for their water demands not to be met. Political interference was given as another reason as to why water demands was met.

The study established that the respondents had multiple source of their water. All of them (100%) had access to water from rivers and this as said earlier could be attributed to the proximity of Tana River to the town. 80% indicated that they used shared taps meaning that even though there was 72% who indicated that they had indoor tapped water, at times

they were forced to use the shared taps. Boreholes were another source of water in the town with 28% of the respondents indicating that. Wells formed a mere 14.7% of all the respondents. None of the respondents indicated that springs were a source of water in the regions. This influenced water service provision in that the residents could get water from alternative source some of which were private like the boreholes.

48% of the respondents said that the available water sources were sufficient, but not reliable, 37.3% were of contrary opinion that the water sources were neither sufficient nor reliable. 14.7% did not respond to the question. It can be inferred therefore that one of the major factor influencing water service provision is the unreliable water sources though available. The unreliability of the water could be attributed to the fact that 100% showed that the sources of their water were not protected from contamination

Majority 84% of the respondents are aware that the water was treated a factor that contributes much to water service provision. This means that that the residents trust the water they were provided with translating to more people using the water. It can also be translated to mean that the water service provider spent more on water treatment, money which would have otherwise been used to expand the infrastructure for provision of more water to the growing demand as seen earlier.

Majority 90.67% of the respondent indicated that discharge of sewage waste was the main pollutant of water in Garissa Town. It was followed by industrial pollutant with 30.67%. Use of pesticides and fertilizers scored 9.33% may be because, though livestock was a major livelihood of the people, agricultural activities were minimal.

As for the water policies 64% of the respondents agreed that GAWASCO had the necessary water management facilities to manage and handle water related emergencies only while 36% disagreed to that. Among the explanations given by those who agreed were that GAWASCO has back up power generators in case normal power went off, GAWASCO has adequate experienced staff who offer 24 hour response to leakages and burst pipes, GAWASCO has big storage tanks and water boozer from the NWSB used to supply water in the town in case of emergency shortage, motorbikes for rapid response and improved technical department which handles emergencies adequately. Those who disagreed cited the many instances where there are pipe bursts which take more than 24 hrs to be repaired.

All the respondent 100% were in agreement that infrastructure development influenced water service provision. Among the reasons given for this are that this would translate to more consumers hence increased revenue leading to better services, planning will be enhanced, few customer complaints hence enhanced service delivery, reduced cost of operations, provision of reliable supply and services to customers, it would translate to reduction in costs through leakages and pipe bursts and improved infrastructure brings forth effectiveness among company employees to the public.

Lastly the study inquired on the areas which needed to be improved .The major areas were the quality 100% and the water reliability with also 100% response. The pressure of the water needed to be improved also as shown by the 81.3% response, followed by billing systems with 76%.

### **5.3 Discussions of the study**

This subsection discusses the findings of the study in comparison to the literature reviewed. It is arranged as per the objectives of the study

Demand for water was found to have influence on water service provision. The water supplied in Garissa was not sufficient to cover the existing consumers. Though the study found that the water was insufficient, respondents strongly disagreed that quantity of water available caused water demand not to be met. This means that the quantity available is enough to supply water to the town. This could be attributed to the fact that Tana river, the largest river in Kenya, passes through the town and has big volumes of water. Climatic conditions of Garissa area was also given as another reason for the unmet demand. Coupled with that are the habits and manners of water usage by the people and lack of education among the people which formed part of the reasons for the unmet water demands. This agrees, though not fully with Water Partnership Program (2012) which gave some of the reasons as to why water provided may not meet the demands to include; service levels to be implemented; size of the community; standard of living of the populace; quantity and quality of water available in the area; water tariffs that need to be shouldered by the consumers; climatical conditions and habits and manners of water usage by the people.

The study established that the respondents in Garissa had multiple source of their water. All of them had access to water from rivers and this as said earlier could be attributed to the proximity of Tana River to the town. Majority indicated that they used shared taps meaning that even though there was many who indicated that they had indoor tapped water, at times they were forced to use the shared taps. Boreholes and wells were other



source of water in the town, though only few respondents were using them. None of the respondents indicated that springs were a source of water in the regions. This influenced water service provision in that the residents could get water from alternative source some of which were owned privately like the boreholes. In terms of water service provision having multiple sources is seen to be positive as Water Partnership Program (2012) indicates that total dependence on a single source is undesirable, and in some cases, diversification is essential for reliability.

This study also established that though water sources were sufficient, they were not reliable, while others were of contrary opinion that the water sources were neither sufficient nor reliable. It can be inferred therefore that one of the major factor influencing water service provision in Garissa is the availability of the water though considered by many to be unreliable because the sources were not protected from contamination. This influenced water service provision in that the water service provider spent more on water treatment, money which would have otherwise been used to expand the infrastructure for provision of more water to the growing demand as seen earlier. KIWASCO (2007) which supplies Garissa town with water shows that sources, which require little or no treatment of the water, should be chosen in first instance provided the required quantity of water can be obtained hence it needs to prevent it source of water from contamination.

According to the respondents GAWASCO which provides water in Garissa had the necessary water management facilities to manage and handle water related emergencies only. Among the explanations given by those who agreed were that GAWASCO has back up power generators in case normal power went off, it has adequate experienced staff who offer 24 hour response to leakages and burst pipes, it has big storage tanks and water

boozer from the NWSB used to supply water in the town in case of emergency shortage, motorbikes for rapid response and improved technical department which handles emergencies adequately. There were however a few who disagreed and cited the many instances where there are pipe bursts which take more than 24 hrs to be repaired.

Respondent were in agreement that infrastructure development influenced water service provision because it would translate to more consumers hence increased revenue leading to better services, enhanced planning, few customer complaints hence enhanced service delivery, reduced cost of operations, provision of reliable supply and services to customers, it would translate to reduction in costs through leakages and pipe bursts and improved infrastructure brings forth effectiveness among company employees to the public.

Devoto, Duo, Dupas and Pariente, (2011) Papers on the labor impacts of water infrastructure have found that access to water infrastructure results in less time spent collecting water an aspect that was not noted by the respondents to this study. In urban Morocco, a randomized study found that shifting households from free public taps to individual household connections did result in time gains. Such time was re-allocated towards leisure and social activities.

Lastly the study inquired on the areas which needed to be improved .The major areas were the quality 100% and the water reliability with also 100% response. The pressure of the water needed to be improved also as shown by the 81.3% response, followed by billing systems with 76%.

## **5.4 Conclusion**

From the finding discussed in the previous sub section of this study, it is clear that the water provided to the residents of Garissa was not sufficient for use by all the residents. The sources of water were found to be available especially Tana River but as a result of undeveloped water infrastructure, coupled with the high demand due to the expanding population it was hard for the water to be sufficient. The water source was also not protected from contamination hence the water service providers were forced to treat the water before supplying it to the residents. This was considered to be inefficient due to the large amount of finances involved. However the water service providers were appraised by the respondent as being able to provide water in the town. It was therefore important for the water service providers to look into the water service provision and come up with solutions that can assist the local people demand for water to be met.

## **5.4 Recommendations**

Private companies should be encouraged to start providing water in the Garissa Town so that the demands of the resident could be met. The government needs to look into the water infrastructure in the town with an aim of improving it. There is also need for the government through the water service providers to look into ways in which water contamination can be prevented. The household waste as well as industrial ones need to be managed in such a way that it will not drain into Tana River. Where possible, fencing should done on the banks of the river.

## **5.6 Recommendations for further study**

The study covered only the Central Division area in Garissa town. A study needs to be done in the outskirts of Garissa town to establish whether the same factors affecting water service provision in the Central Division applied to the outskirts.

A study also needs to be done to establish the effects of the water to human healthy bearing in mind that this study has found out that the source is contaminated.

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## **APPENDICES**

### **APPENDIX A: LETTER TO RESPONDENTS**

Dear Respondent,

I am a graduate student of the University of Nairobi. I am conducting a study the factors that influence provision of water in Grrissa Municipality. This is in fulfilment of the degree in Masters of Arts in Project Planning and Management. You have been selected to participate in this study. I would very much appreciate if you would kindly assist me by responding to all the items attached in the questionnaire. Your name and that of your organization need not to appear anywhere in the questionnaire unless you wish. The information you provide is anonymous and will be used for academic research purposes only.

Your cooperation will be greatly appreciated.

The completed questionnaire will be picked from you two weeks after delivery.

Thank you in advance.

Yours faithfully,

**KIPRONO ROP.**

**POST GRADUATE STUDENT**

**Appendix B: QUESTIONNAIRE FOR HOUSEHOLD HEADS**

**Section A: Demographics**

1. Indicate your Gender.

Male ( ) Female ( )

2. Age -----(years)

3. Indicate your age (in years) in the appropriately box

(a) 21- 30 ( ) (b) 31 – 40 ( )

(c) 41 –50 ( ) (d) 51 – 60 ( )

4. What is your highest Academic qualification?

(a) Primary ( ) (b) Diploma ( )

(c) Degree ( )

(d) Others (specify)-----

5. Respondents area of residence

**Section B: Items on water demand**

6. Does demand for water influence water service provision in your area?

Yes ( ) No ( )

7. If Yes in question 6 please explain -----

-----

-----

8. Is the water supplied sufficient to covers the existing consumers

Yes ( ) No ( )

9. Below are reasons as to why the demand for water is not met. Please tick to show the most common factor in Garissa town.

Using the scale in given:

Strongly Agree (SA)

Disagree (A)

No Response (NO)

Disagree (D)

Strongly Disagree (SD)

Please indicate by ticking the statements that you agree or disagree are applicable in your area

<b>Reasons as to why demand for water is not met</b>					
Service levels is low					
Quantity of water available					
Quality of water available					
Climatic conditions					
Habits and manners of water usage by the people					
Size of the community					
Water tariffs are high					
Political influence					
Lack of education among the people					

**Section C: Items on water sources**

10. Please tick all relevant.

a).Rain water            ( )            b) Boreholes            ( )            c) Wells  
( )

d) Indoor tap water    ( )            e) Shared tap            ( )            f) Springs  
( )

g) Rivers and streams. ( )

11. Is the source you have mentioned in question (7) sufficient and reliability?

No            ( )            Yes            ( )

12. Is the water you use treated?

a) Yes            ( )            b) No            ( )

13. How severe are problems with water service in your community?

a) low    ( )    b) fair    ( )    c) strong    ( )    d) very strong    ( )    e) No problem    ( )

14. Is the source of your water protected from contamination?

Yes            ( )            Now            ( )

15. Which of the following pollutes the water sources in Garissa?

a. Industrial pollutant            ( )

b. Use of pesticides and fertilizers    ( )

- c. Discharge of sewage waste water ( )
- d. Land use changes ( )

**Section D: Water management facilities**

16. Does GAWASCO have the necessary water management facilities to manage and handle water related emergencies?

Yes ( ) No ( )

17. Please explain your answer-----  
-----  
-----  
-----

**Section E: Items on infrastructure**

18. Does water infrastructure development influence water service provision?

Very highly ( ) highly ( ) averagely ( ) Very little ( )

19. The water distribution network for water in your area is mainly operated as;

Continuous (24hrs) ( ) Intermittent ( )

20. How would you rate the existing water supply infrastructure in Garissa?

a) Excellent ( ) b) Very good ( ) c) Good ( ) d) Bad ( )

**21.** Below are obstacles to fighting water losses. Which one applies in your area? Please tick

a) Political situation ( )

- b) Lack of financial means ( )
- c) Lack of appropriate technologies ( )
- d) Maintenance system ( )
- e) Personnel capacities ( )
- f) Personnel awareness ( )
- g) Public acceptance / awareness ( )

22. What do you consider to be the best solution to improve your water infrastructure supply situation?

- a) Development & exploitation of new resources ( )
- b) Water loss reduction ( )
- c) Rehabilitation ( )
- d) Reducing wastage of water ( customer awareness) ( )

23. Which of the following aspects of your water supply needs improvement in the future?

- Quality ( )      Pressure ( )      Rate Reliability ( )
- Billing system Service quality ( )      Maintenance Others ( )