UNIVERSITY OF EDUCATION, WINNEBA

EXAMINING THE CAUSES OF ILLEGAL WATER CONNECTION AND ITS IMPACT ON A UTILITY COMPANY: A CASE STUDY OF GHANA WATER COMPANY LIMITED, KUMASI.

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A Project Report in the Department of Management Studies, Faculty of Business Education, submitted to the School of Graduate Studies, University of Education Winneba in Partial Fulfilment of The Requirements Award of Master of Business Administration (Marketing) degree.

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DECLARATION

STUDENT'S DECLARATION

I Ayamba Joseph Afuubilla equivocally declare that the work was done by myself and that the composition there in is my own work and where other materials were used, the Arthurs who produce these materials were acknowledged.

I also declare that this piece of work has not been submitted for any other master or graduate or professional qualification except as specified

Signature:……..

Date:…….

SUPERVISOR'S DECLARATION

I solemnly declare that this piece of work has been thoroughly read and approved as having met the standard requirement for the award of Masters of Business Management (Marketing) in the faculty of Business Management in the University of Education, Winneba.

NAME OF SUPERVISOR: MR. ANTHONY FREEMAN MENSAH

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Date……..

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I would also like to show gratitude to all those who help me in diverse ways to get to the stage in life especially in the academic pedestal. Though I cannot mention all those who help me through this hectic time. I would like to also show gratitude to the following personalities.

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DEDICATION

I dedicate this piece of work to my parents who gave me the foundation in the academic, professional and brought me up to this stage in life. I also dedicate this work to my beautiful hardworking wife; Diana Minkan Biiyeen, my four strong boys; Masiah Ayamba Righteous, Ayamba Prosper Awinbe, Ayamba Joseph Awinpiini and Ayamba Wisdom Azortwini who were solidly behind me physically, emotionally, antenatally, spiritually and psychologically. They gave me strength, support, advice and encouragement throughout the program.

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ABSTRACT

The main purpose of this study was to assess the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region. The researcher used descriptive research design for the study. Quantitative and qualitative research approaches were used. The population was made up of the staff and customers of Ghana Water Company in the Ashanti Region. The total population for the study was Nine Thousand Seven Hundred and Eighty-Three (9783). Purposive and convenience sampling techniques were used to select three hundred and forty-six (346) respondents for the study. Questionnaires were the main instrument used for data collection. The main statistical techniques such as frequencies, percentages, tables and charts were used to explain certain findings. The study results concluded that the factors that motivate customers to connect water illegally to their premises were expensive new service connection fee, when pipe connection network is not available in their area, when they do not want to be billed on monthly basis, when the landlord is not willing to pay for the connection fee, and ignorance and inadequate knowledge on illegal connections can result in illegal water connections. The impact of illegal water connection on Ghana Water Company in Ashanti North Region were that illegal water connection increases water leakages and loss of water resources, illegal water connection can decrease company revenue and profitability, illegal water connection leads to decrease in water pumping capacity and decrease in productivity. The prevalence of illegal water connection in the study area was high. The study recommended that; the Ghana Water Company limited need adequate human, financial, technical and administrative resources to fulfill their mandate, including a professional and qualified workforce to monitor illegal connections.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Water occupies about two thirds of the earth surface but still scares in its availability in terms of wholesomeness for human consumption. Water is a basic need and next to air followed by food in God's chronology of creation and its importance. Water is said to be life and indeed perfect and reasonable as far as human consumption and survival are concern. We have different sources of water such as rivers, streams, lakes and underground water, scientifically known as water aquifers. Water has so many uses such as row water for irrigation, for drinking, for sanitation but cannot be said to be wholesome or hygienic for consumption.

According to Ghana national water policy document 2007 page 27, government must ensure availability of water in sufficient quantity and quality for cultivation of food crops, watering of livestock and sustainable freshwater fisheries to achieve sustainable food security for the country.

It must also ensure availability of water in sufficient quantity and quality to support the functions of the eco-systems in providing alternative livelihoods. Secondly, ensuring that there is adequate water, both quantity and quality, to restore. Increasing and improving existing water sources, tapping new sources and managing catchments to eliminate or abate

depletion and degradation of water resources and meeting increasing demand within finite supplies and increasing degradation of water quality resulting in high treatment costs.

Lately, expansion of roads, human settlements, agricultural use, mining and pollution are all ways that threaten our sources of water hence depleting it exponentially. This however prompted world leaders to scientifically device a way of solving this phenomenon hence the artificial way of treating water to make it wholesome for human consumption. To get pure water for human consumption, companies all over the world invest heavily in the water industry in order to get quality water for the indigenes. The quantity of treated water produced depends on the level of demand and yet a lot of companies are unable to meet the population demand due to financial constraints. Getting quality treated water is very expensive in terms of cost, capital, labor and infrastructure.

The effects of illegal water connection in the water industry and quality treated water are very expensive and therefore, using it illegally has adverse effect on the performance of the organization in terms of billing and revenue generation. Some people who are into construction, agriculture, mining, fishing, irrigation, in physical and chemical industry do steal or connect water illegally with the intension of playing smart on the utility providers.

These organizations also pollute our water bodies making treatment very costly. Generally, the illegal use of water in some parts of Ghana is becoming rampant. It is very costly to produce quality water for consumption. This illegal use of water affects the operations of the utility companies negatively in terms of production billing and revenue generation.

Water experts, water focused nongovernmental organizations (NGOs), governments, and communities do not agree whether there is any such a thing as water theft (VANDA FELBAB-BROWN). Violations of existing regulations and water allocations or accessing water through means that jeopardize water quality should not be allowed under the premise of exercising a basic human right(A Destructive Partnership," in Global Corruption Report 2008: Corruption in the Water Sector, Transparency International (Cambridge: Cambridge University Press, 2008), page 3).

Production of quality water depends on how liquid the company is and illegal use of water hampers meeting the demands of the public. Impact of illegal water connection on the performance of Ghana Water Company in Ashanti Region:

It is an undisputed fact that some people in Ashanti Region connect water illegally to their houses, farms and construction sites. This phenomenon is affecting the operations of the company negatively as it is very costly to treat heavily polluted water to make it pure for consumption. According to the World Bank, some 48.6 million cubic meters of drinkable water escape daily from official supply networks, enough to provide water for 200 million people. In developing countries, such water loss amounts to some 30 to 50 percent of all treated water (Washington, DC: World Bank, December 2006, The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries). Impact of illegal water connection of Ghana Water Company Limited in Ashanti Region:

The operations of Ghana Water Company Limited are geared towards production of quality water for the urban cities and towns and its environs. Water treatment needs a lot of

investments such as land acquisition, plant acquisition, financial capital, human capital, infrastructural development and acquisition of chemicals which are normally imported to make the this operation of water treatment very smooth. Water treatment goes through a lot of processes such as intake is the point in which water enters plant through large pipes located on the bottom of the river. The coarse metal screens captures weeds, sticks and alike. Coagulation, flocculation and sedimentation: chemicals are added to the water so that small particles merge to form bigger ones that look like snowflakes. These so called particles also trap most of the colony dissolved organic matter bacteria and viruses. The water then flows into a large basin when the flows gradually settle to the bottom.

- The process removes over 5 percent of all particles.
- Filtration: The water taken at the top of the large basins then flows down through 18 filters made of sand and arbitrates a form of seal. Here 99.99% of the fine particles are removed. After filtration, the water is sparkling clean.
- Primary disinfection: filtered water enters the clear well, a disinfecting tank where chlorine is added. It then flows through a maze of channels so that the disinfectant has time to work.
- PH Correction: The water's PH is raised to 9.2 Ph. This protects water mains, household plumbing and tap fixtures from corrosion.
- Secondary disinfection: Chlorine and ammonia are added. These two substances react to form chloramine, a long lasting but mild disinfectant that keeps the water purified whiles in the distribution system.
- Fluoridation is a process of adding fluoride to the water to prevent cavities.

- Distribution: The water is pumped to homes and businesses through water main in several kilometers.
- Quality tasting: The water quality is tested at the plants and several vantage points throughout the distribution system.

It is after these hectic processes that people tap or connect it illegally to their homes, farms, companies, construction sites and selling points. This phenomenon is becoming alarming hence the need to find out why people get involved in this act.

1.2 Statement of the problem

Purification of water is very expensive and hard to come by. Water polluted by human activities causes a lot of diseases in our part of the world such as: cholera, typhoid fever, dysentery, diarrhea as water borne diseases and malaria, bilharzia as water related diseases. In turn, poor water quality and high pollution levels can pose a variety of serious and potentially deadly diseases, whether cholera or typhoid or other longer-term illnesses. Water scarcity and the lack of access to clean water also greatly increase infant mortality and are linked to poverty in multiple complex ways (Water and Human Survival (New Haven: Yale University Press, 2016).

To avoid the above phenomenon call for proactive program and punitive policies on water purification. It has become a public concern about the rate at which illegal connection of water is rising. A limited number of empirical researches have been conducted on this phenomenon hence the need to find out how serious illegal connection has on the performance of the water industry. According to the World Bank, some 48.6 million cubic

meters of drinkable water escape daily from official supply networks, enough to provide water for 200 million people. In developing countries, such water loss amounts to some 30 to 50 percent of all treated water (The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries," (Washington, DC: World Bank, December 2006).

This has necessitated the researcher to deal deep into the statement assessing the impact of illegal water connection on the performance of Ghana Water Company Limited in billing and collection. The statement when properly dealt with will help Ghana Water Company to set out policy guidelines, measures and strategies to stop the menace. The main problem of this research is to assess the impact of illegal water connection on the operations of Ghana Water Company Limited on production, billing and revenue mobilization.

1.3 Purpose of the Study

The main purpose of this study is to assess the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region.

1.4 Objectives of the Study

This study is:

a. To examine the factors that motivate customers to connect water illegally to their premises.
b. To examine the impact of illegal water connection on Ghana Water Company in Ashanti North Region.
c. To determine the prevalence of illegal water connection in the study area.

d. To determine the measures that can be put in place to stop illegal water connection.

1.5 Research Question

With regards to the above problem and purpose, the study seeks to answer the following research questions.

a. What are the factors that motivate customers to connect water illegally to their premises?
b. What is the impact of illegal water connection on Ghana Water Company In Ashanti North Region?
c. How prevalent is illegal water connection in the study area?
d. What are the measures that can put in place to stop illegal water connection?

1.6 Significance of the Study

The study will be very relevant to businesses, marketers, policy makers and stakeholders. To management of Ghana Water Company Limited, the study will be very important regarding the findings and results reported. It would give the company reliable, authentic and credible scientific measure, solutions and recommendations. It would also help describe and evaluate the extent to which this phenomenon is affecting the operations of the company. It is an avenue for management to know the demographics involved in illegal water connection. It would essentially provide imperial support for management strategic decisions in crucial areas like production, distribution, billing and collection.

The future sustainability of the company will depend on how the company will use this study profitability to gain synergy.

To stakeholders like investors, pressure groups, employees, consumer associations, shareholders, policy formulators, strategists and among others, the empirical research document would help them to contribute their suggestions and help to improve the water sector in Ghana.

1.7 Limitations of the Study

Financial constraints were the major limitation that affected the study erroneously. It was very difficult, expensive and time consuming during the administration of the questionnaire. It was also difficult and tiring combining work and the research study.

Due to time limitation, twenty workers of Ghana Water Company Limited and three hundred and seventy customers were interviewed. Ten potential customers who had come for water connection were also interviewed. Some people felt reluctant giving out information with regards to illegal connection of water.

1.8 Organization of the Study

The study is organized into five chapters. Chapter one is the introductory chapter that presents the background to the study, statement of the problem, purpose and objectives of the study, research questions, significance of the study, limitations, delimitations and structure of the study.

Chapter two contains the literature review on theories and other related history about the water industry. It also provides in-depth analysis of the company under assessment, reasons given by customers, potential customers and some affected customers. It also contains the background of Ghana Water Company Limited mission and vision statements and other related works done by some other scientific researchers. Chapter three talks about the methodology used in conducting the study. The study was basically both qualitative and quantitative. It also explains the data collection, strategies, and administration of data instruments, population size, sample size and credibility of the study. Chapter four is the presentation of empirical data and results analysis and findings that will help solve the phenomenon that led to the conduction of the research. It also contains a detailed analysis of the study.

Chapter five presents the summary, solutions, recommendations and conclusions that will help management make informed decisions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter covers the literature review. The chapter reviewed comprehensive literature to cover areas such as the History of water supply and sanitation in Ghana, Decline in efficiency of GWCL, Components and Definitions of illegal water connections or Non-Revenue Water (NRW), Strategy for Dealing with Water Losses, Physical (real) Losses, Economics of Water Loss Management, The Principles of Law of Diminishing Return,

Interventions to improve efficiency, Sustainable Water Supply in the GWCL, Access to water, Urban water supply and sanitation in Ghana, Water as a development issue, Billing and revenue-collection systems, Good water governance, and Institutional efficiency.

2.6 Conceptual framework of the study

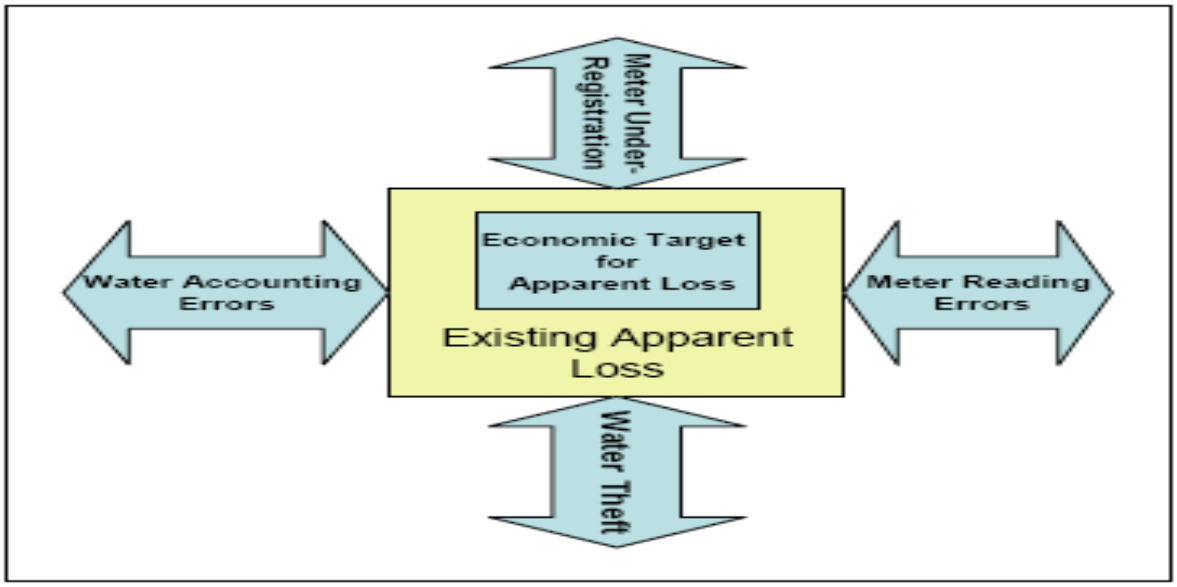

Figure 2.3: The four components of apparent losses.

Source: Rizzo Alex

Meter Under-Registration

According to Alex, the following account for meter under-registration in water utility:

- Meter wear and tear;
- Incorrect installation practice;
- Lack of maintenance or calibration; and
- Incorrect meter sizing.

Under-Registration means that, the meter will only read portion of the water that passes

through it and therefore, the consumer is only billed for that portion.

Meter Reading Errors

This relates to inaccuracies of the manual reading of the meters of the water utility by the meter reader. Usually this happens when meter readers under read the meters but according to Rizzo, meter readers can also condone with customers to under read their meters as a way of getting 'something' from the customers. To Rizzo, the solution to this is automatic meter reading (AMR).

But Thornton (2002), is of the view that AMR has hardly been justified only on the basis of improving apparent losses in a system besides other benefits that come with it, 'such as the block use analysis and pressure monitoring for real losses control'.

Water Theft

Water theft (illegal connection) 'is probably the easiest to conceptualize although sometimes may be very difficult to eliminate' (Rizzo). According to Butler and Memon (2016), apart from loss of water to the water supply system, illegal connection (water theft) also play a major role in limiting the water system's ability to increase its level of service. Illegal connection or water theft is where some deliberately bypasses the water meter to get water for a period of time. Some of the causes for water theft are; water scarcity, poor management, lack of awareness, inappropriate tariff system and refusal to allow individuals the do house connection (Butler and Memon, 2016). Several factors account for the difficulties for water utility staff to try to stamp out illegal connections in a water system. Some of these factors are (Butler and Memon, 2016), The assumption that water is a basic human need and therefore should not be charge for; and The involvement of politicians who try to win public support at the expense of sustainability.

The following measures are some of the ways adopted by some utilities of late to regularize illegal connections with aim of stamping out the practice (Butler and Memon, 2016)

Providing an amnesty for those already having illegal connections for them to use the amnesty period to regularize their connections;

Awareness creation through appeals and advertisement to enable those with illegal connections to regularize them;

Giving 'on the spot powers' to local managers and operators to regularize illegal connections when detected; and Punitive measures taken against those with illegal connections to deter others from doing so. But according to Butler and Memon (2016) this should be the last resort and that regularization should be preferred instead to enable consumers to still get the water they need.

2.1 History of water supply and sanitation in Ghana

The first public water supply system in Ghana, then Gold Coast, was established in Accra just before World War I. Other systems were built exclusively for other urban areas among them were the colonial capital of Cape Coast, Winneba and Kumasi in the1920s. During this period, the water supply systems were managed by the Hydraulic Division of the Public Works Department. With time the responsibilities of the Hydraulic Division were widened to include the planning and development of water supply systems in other parts of the country. In 1948, the Department of Rural Water Development was established to engage in the development and management of rural water supply through the drilling of bore holes

and construction of wells for rural communities. After Ghana's independence in 1957, a Water Supply Division, with headquarters in Kumasi, was set up under the Ministry of Works and Housing with responsibilities for both urban and rural water supplies.

During the dry season of 1959, there was severe water shortage in the country. Following this crisis, an agreement was signed between the Government of Ghana and the World Health Organisation for a study to be conducted into water sector development of the country. The study focused on technical engineering, establishment of a national water and sewerage authority and its financing methods. Furthermore the study recommended the preparation of a Master Plan for water supply and sewerage services in Accra-Tema covering the twenty-year period 1960 to 1980. In line with the recommendations of the WHO, the Ghana Water and Sewerage Corporation (GWSC), was established in 1965 under an Act of Parliament (Act 310) as a legal public utility entity. GWSC was to be responsible for:

Water supply and sanitation in rural as well as urban areas. The conduct of research on water and sewerage as well as the making of engineering surveys and plans. The construction and operation of water and sewerage works, The setting of standards and prices as well as collection of revenues.

2.1.2 Decline in efficiency of GWCL

By the late 1970s and early 1980s, the operational efficiency of GWCL had declined to very low levels mainly as a result of deteriorating pipe connections, illegal water connections and pumping systems. A World Bank report in 1998 stated that: "The water

supply systems in Ghana deteriorated rapidly during the economic crises of the 1970s and early 1980s when Government's ability to adequately operate and maintain essential services was severely constrained." GWCL experienced operational difficulties because of inadequate funding. From its inception, GWCL depended solely on government subvention to meet both operational and development costs. However, the annual government subvention was inadequate to meet operational and development needs of the Corporation over the period. In addition, the annual subvention was, often, either not released on time or in most cases not released at all before the end of the budgetary year. GWCL therefore met its operating costs at a level constrained by unavailability or inadequacy of funds. The lack of funds to meet operational costs resulted in the poor state of the existing infrastructure at the time, especially the distribution system.

Before 1957, there were 35 pipe-borne water supply systems in the country. In a bid to promote rapid national development after Ghana's Independence, the government launched a crash programme for urban water expansion and accelerated rural development. As a result, by 1979 there were 194 pipe-borne and 2,500 hand pumped borehole systems in the country. By 1984, additional 3000 boreholes had been drilled and fitted with hand pumps. However, by the late 1980's and early 1990, 33% of the water supply systems had either deteriorated greatly or completely broken down due to inadequate funding to carry out maintenance and rehabilitation works.

2.2 Theoretical framework of the study

2.2.1 Causes and Definitions of illegal water connections or Non-Revenue Water (NRW)

There are cases in Ghana and many other places of people illegally tapping into a water main in order to obtain water without paying for it. The cost of the water they use is borne by others who do pay for the water produced by the utility. Apart from committing a crime (theft of water, thus depriving the water utility of revenue), people who make illegal connections to the water supply system also endanger the safety of the mains water through possible contamination. This can be caused simply by making a break in the pipe without taking the necessary precautions to prevent contamination. The same can also happen if the illegal connection consists of a hose or pipe that, at one end, is connected to the water main and, at the other end, is left immersed below the water level of a storage tank, bucket or other container. If there is a reduction in water pressure in the water main (say, due to a pipe burst), water from the container could be drawn into the mains supply. This phenomenon is referred to as **back-siphonage.** If the water in the bucket is contaminated in any way, this will result in contamination of the mains water too. Illegal connections mainly occur in newly established residential areas where some of the newly built households are supplied with water from the mains, while others do not have a piped supply. They get water from their neighbours through illegal connections using water hoses or plastic and metal pipes, without the knowledge and authorisation of the water utility. Illegal water connections can also be termed as non-revenue water (NRW) because the water tapped illegally cannot be accounted for. In order to come to better understanding and set the framework for in-depth research into the current topic, it was necessary to find out the various components and their definitions as they relate to the topic. Various literatures were identified. But the one which seemed to have dealt with the issue of non-revenue water to a greater extent in recent times and to which most writers and researchers kept referring to

was the document which has been developed by the International Water Association (IWA) Water Loss Task Forces for concepts and methodologies for quantifying and definitions of the components of non-revenue water. Most of the following definitions are therefore quoted from this document.

According to the International Water Association (IWA) Task Force on Water Loss, (IWA, 2013), Non-Revenue Water (NRW), is "the difference between System Input Volume and Billed Authorised Consumption". According to the task force, system input is "the annual input to a defined part of the water supply system" and billed authorised consumption, according to the task force is "billed metered consumption including water exported and billed unmetered consmption".

These definitions and others are shown in figure 2.1 below.

<table>
<tr><td rowspan="8">System Input Volume</td><td rowspan="4">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Non-metered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td></tr>
<tr><td>Unbilled Non-metered Consumption</td></tr>
<tr><td rowspan="4">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorized Consumption</td><td rowspan="6">Non-Revenue Water</td></tr>
<tr><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and/or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to Customers' Meters</td></tr>
</table>

Figure 2.1: The IWA best practice standard water balance.

Source: McIntosh (2013).

The World Bank Group (2016) and its affiliate partners (Water and Sanitation Sector Board and Public Private Infrastructure Advisory Facility -PPIAF) discussing the issue of non-revenue water in Developing countries, defined NRW and its components as follows:" non-revenue water is the difference between the volume of water put into a water distribution system and the volume that is billed to customers". NRW has three components:

 Physical (or real) losses: this comprises leakage from all parts of the system and overflows at the utility's storage tanks. These occur as a result of poor operations maintenance, the lack of active leakage control, and poor quality of underground assets.

It is "any leakage downstream of a production source and upstream of the consumer revenue meter" (UNEP/IETC 2009).

Commercial/Apparent Losses; these are caused by customer meter under registration, data-handling errors, and theft of water in various forms;

Unbilled authorised consumption; these include water used by the utility for operational purposes, water used fire fighting, and water provided for free to certain consumer groups. The first two of these components constitute **Water Loss** (IWA 2013). Normally it is the water loss indicators that reflect the level of efficiency of management of the water supply system (Butler and Mamon (eds.), 2016:192). To be able to effect effective reduction in water loss, issues of technical, operational, institutional, planning, financial and administrative need to be coherently addressed (WHO, 2010 as cited in Butler and Mamon (eds.), 2016).

Figure 2.2: illegal water connector connecting water illegally from the main source

2.2.2 Strategy for Dealing with Water Losses

Perhaps the two most important components of NRW are the **real losses** and the **apparent losses**. In the view of this author these components are the ones which need much resource in terms of logistics, staffing and finance in order to control water losses. The third component, **unbilled authorised consumption** can be controlled fairly well without much resource. It is therefore important to develop the appropriate strategies for controlling water losses especially through real and apparent losses if meaningful achievements are to be made and the outcome would justify the efforts put in. The starting point to deal with water losses in any water utility, according Butler and Mamon (2016), is to understand the network system of the utility.

Butler and Mamon (2016), suggest that certain questions should be posed about the water utility with regard to the characteristics, the production process, and the operating practices, and using the available tools and mechanisms within the water utility to answer these questions form the first step in the right direction to deal with the prevailing situation. In the process of trying to answer these questions, better understanding of the network system of the water utility would now be obtained, which would then form the basis for the formulation of strategies for dealing with water losses.

Butler and Mamon (2016) suggest the following questions:

- How much water is being lost?
- Where is it being lost from?
- Why is it being lost?

The first two questions, "how much" and "where from", according Butler and Mamon (2016) can be answered by conducting water balance. Referring to figure 2.1, which shows the components of water losses from a network, "which is the difference between system input volume and authorised consumption" (Butler and Mamon, 2016), water balance can be conducted.

The third question "why is it being lost" can be answered according to Butler and Mamon (2016), by reviewing the management practices of the water system. The reviewing processes should identify the policies and procedures that need reviewing and those which are being done well. Having addressed the first three questions, the "how? where? And why?" of the losses in the system, it then becomes possible to address the last two questions which have to do with issues of strategies, policies and methodologies that need to be formulated and adopted to address the system's losses and improve performance and how

these strategies be maintained or sustained? According to Butler and Mamon (2016), the strategies, methodologies and policies referred to above do not only entail "introducing equipment for measurement and monitoring flows, leakage control equipment and leak repair policies, but also education and awareness programmes and a fully operational O&M policy".

The two tools; water balance and network review, would enable priority areas to be identified and tackled. According to Thornton (2012), the above tools would enable the utility to identify the priority areas and this would mean tackling apparent losses first or vice versa depending upon the outcome of the processes so far described.

2.2.3 Physical (real) Losses

Physical losses according to IWA (2014), is "the annual volumes lost from transmission and distribution systems through all types of leaks, bursts and overflows on mains, service reservoirs and service connections, up to the point of customer metering". The major part of real losses, according to Butler and Mamon (eds.), (2016), is due to system leakages which also stems from lack of maintenance or "failure to renew and replace ageing systems" (Assets Management). It is of importance to note that the way and manner leakages in water utility are managed has great influence on the success or otherwise on any utility systems. Successful management of leakages has both financial and social benefits to the water utility.

Butler and Mamon (eds.), (2016), assert that the successful management of system leakages leads to systems' sustainability as well as "foster public support by providing affordable water to consumers. Assessing physical (real) loss can be carried out by any of the

following three methods; 'top-down' annual water balance; 'bottom-up' analysis of night flows; and 'component analysis' (IWA 2014). A combination of two or all three can be used at a time. Real losses can be calculated using the above methods as follows (IWA 2014):

Top- down annual water balance: using the IWA "best practice" standard water balance, real loss is the difference of volume when the volumes of authorised consumption and apparent losses are taken from the system input volume. To cater for errors and uncertainties in the calculated values, 95% confidence limits are usually used in the calculations. This method has the limitation of not providing the components of the real losses, e.g. "detectable bursts (can be potentially be managed through speed and quality of repairs, and active leakage control), or real losses due to background losses (that can only be reduced by pressure management or infrastructure management strategies" (IWA 2014). It is therefore best to conduct this method with the other two methods;

Bottom-up real losses assessment: in this method the real loss volume obtained from the top-down water balance is checked by bottom-up calculations of independently individual small sectors or zones of the distribution network through analysis of night flows into these zones. This approach rely on what is known as the minimum night flow (MNF) which according to IWA (2014), is usually in the early mornings between around 2.00am and 4.00am in the urban set up but would vary from zone to zone. During these periods, real losses are at their maximum of the total flow. The real loss value is obtained by the difference between the legitimate night consumption by customers of the zones under consideration and the minimum night flow to these areas. There is some degree of

uncertainty in these estimations since the legitimate night consumptions vary from night to night.

The Bottom-up real loss, according to IWA (2014), has the benefits that, "it provides independent determination of the volume of real losses," which if carried out across the whole distribution network, enables areas of high real losses to be identified and mapped for active leakage control work, and as said earlier, provides a cross check on the water balance calculation. According to IWA (2014), these two values should balance but are often not "because of the cumulative errors in each method's calculation". The bottom-up method, through the field work "also facilitates collecting of data required for determining the pressure/leakage relationship (NI) and the infrastructure condition factor (ICF).

Components analysis of real loss: annual real losses are assessed using components analysis (IWA 2014). It "uses numbers, average flow rates and average run- times of different types of leaks and bursts (background, reported and unreported) on different parts of the distribution infrastructure (mains, service reservoirs, and different sections of the service connections)".Other data such as "basic infrastructure data (mains length, number of service connections, length of the privately owned service line from property boundary to the meter); infrastructure condition factor (ICF) for background leakage; numbers of reported and unreported bursts, and their average run-times based on utility policies; average system pressure and pressure/leakage relationships (using appropriate NI values)". This model allows the overall volume of real losses to be broken down into its constituent components for each aspect of the system's infrastructure and this in turn allows evaluative alternative options for the management of real losses. According to Butler and Mamon (eds., 2016), real losses can be severe, it can go on for a long time (months and even years)

without been detected. The severity and the volume lost would largely depend on the following characteristics of the pipe network and the leak detection and repair policy of the water utility (Butler and Mamon, Eds. 2016):

 The pressure in the network;

 The frequency and typical flow rates of new leaks and bursts;

 The proportions of new leaks which are 'reported';

 The 'awareness' time (how quickly the loss is noticed;

 The location time (how quickly each leak is located);

 The repair time (how quickly it is repaired or shut down); The level of "background leakage" (undetectable small leaks).

2.3 Economics of Water Loss Management.

2.3.1 The Principles of Law of Diminishing Return

In as much as every water supply system wants to eliminates leakage and for that matter all forms of water losses, there is a limit to which this can be carried up to, after which it would no more be economical to apply resources to reduce leakage. According to Farley and Trow (2013), for majorities of water utilities, leakage cannot be completely eliminated and that "there will always be a level of leakage which has to be tolerated and which has to be managed". The reason for this is the law of diminishing returns, where returns on investment begin to diminish in relation to the cost of production or investment. Two major options in bridging the gap between future demand for water and the current level of supply, Farley and Trow, (2013) are;

Supply augmentation- addition of reservoir, increase in pumping capacity, treatment plant expansion, and exportation of water from other area; and Reducing the future need for water by leakage reduction and demand management. The economic implications of the two methods are different and should be appreciated. Whereas system augmentation has the advantages of economies of scale, leakage reduction has the disadvantages of the law of diminishing returns (Farley and Trow, 2013). "The more effort that is put in leakage reduction programme, the less would be the returns in terms of water saved". Each of the four "pillars" of leakage management follows the law of diminishing returns (Pearson and Trow 2013).

These pillars are:

Active leakage control; the effort of starting active leakage control programme would be relatively lower. It would take less effort and probably logistics to locate illegal water connections and repair leaks on the mains and the distribution networks. But after the more obvious leaks and bursts have been identified and repaired, it would then take more effort to locate and repair any leaks and bursts of the same volume.

Pressure management; schemes such as installation of pressure reducing valves (PRV), are more cost effective in that an action covers a large area and make 'a significant impact on average pressure'. However, if more PRVs are installed in a particular district area, the benefits derived would be less than the cost incurred (Farley and Trow 2013). Again in a district meter areas (DMAs), a point would reach where the addition of further properties to the district meter area would incur more cost. This according to Farley and Trow (2013) may due to; the need to install additional valves, the need to provide two or more meters in the area, and the need to lay new lengths to link mains.

Infrastructural Management; For instance if mains replacement is being used as a water leakage reduction strategy, then it would be more beneficial to carry out targeting studies to determine which areas of the water system are more prone to frequent bursts and leaks and even which mains within these areas have the highest frequency (number per kilometre per year) and the highest background leakage. If this exercise is carried out effectively, according to Farley and Trow (2013), the initial schemes would be more cost effective than the later ones and therefore, mains replacement also follow the law of diminishing returns.

Speed of repair; the volume of leakage would definitely be reduced if the time taken to carry out repair works is reduced. However, after certain threshold of reduction in repair time has been reached, any further reduction in repair time would not be cost effective and the cost of further reducing the repair time beyond this threshold would be higher than the benefit that would be gained in terms of water saved.

Beyond this threshold, the cost of repair begin to rise due to "standby, call out and overtime payments to staff, or supplementary payments to contractors to make additional repair teams available" (Farley and Trow 2013). The law of diminishing returns is again seen here.

2.3.2 Interventions to improve efficiency

To reverse the decline in water supply services, various sector reforms and improvement projects were undertaken in 1970, 1981 and 1988 by the World Bank, IDA, donor countries and other external support agencies including the Austrian Government, Italian Government, Nordic Development Fund, the African Development Bank, CIDA, DFID, KfW, GTZ, OECF, ECGD and CFD/ADF. Though some gains were derived from these

interventions, their general impact on service delivery was very disappointing. Due to the failure of these interventions to achieve the needed results, several efforts were made to improve efficiency within the water supply sector in Ghana especially during the era of the Economic Recovery Programme from 1983 to 1993.

During that period, loans and grants were sought from the World Bank and other donors for rehabilitation and expansion programmes, training of personnel and procurement of transport and maintenance equipment. In 1986, subvention for operations and maintenance was withdrawn although funding for development programmes continued. User fees for water supply were increased and subsidies on water tariffs were gradually removed for GWSC to achieve self-financing. The government at that time approved a formula for annual tariff adjustments to enable the Corporation generate sufficient funds to cover all annual recurrent costs as well as attain some capacity to undertake development projects. For political reasons, this tariff formula was not applied. Although there were intermittent tariff increases during the period, they were always below cost recovery levels. This resulted in heavy corporate deficit financing and ineffective service delivery (Water Aid, 2007).

2.3.3 Sustainable Water Supply in the GWSL

The concept of sustainability has been defined in various ways by different people and organizations. The World Commission on Environment and Development (WCED, 2007) landmark publication entitled Our Common Future‘ defines sustainable development as development that meets the needs of the present without compromising the ability of future generation to meet their own needs‘ (WCED, 2007). The United Nations Agenda 21 Report

(UN, 2013) defines sustainability as the integration of environmental and development concerns for the fulfillment of basic needs and improved living standards for all. According to the World Business Council for Sustainable Development (2013 cited in Lockwood et al., 2013) Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line‖. It can be inferred from the above definitions that resource limitations, generational interdependence of human activities, and social equity are common features in the definition of sustainability.

Sustainability is a concept that takes its root from the attempts to protect or maintain the limited natural resources from over exploitation and shocks or stress. The concept has however been extended to encompass social, economic and institutional dimensions, among others (Lockwood et al., 2013). The concept of sustainability is widely used in the water sector. However, due to conceptual differences various studies have used different definitions of sustainability in the context of water supply projects. A study by Carter *et al.,* (2009), for example, states that sustainability is constancy in water and sanitation services which may be realized through evolving and adaptive mechanisms. On their part, Dayal et al., (2010 cited in Parry-Jones et al., 2011) argue that a sustained water supply is _a service that regularly and reliably provides enough water of an acceptable standard for at least domestic use. Breakdowns are rare and repairs rapid (within 48 hour) and local financing covers at least the regular cost of operation, maintenance (O&M) and repairs‘.

Abrams (2008) also defines sustainability as whether or not something continues to work over time. For a water service, this would mean that water continues to be available for the period for which it was designed in the same quantity and at the same quality as it was designed‘. Abrams (2008) outlined six dimensions of water sustainability namely, technical, social, financial, natural environment, gender, and institutional sustainability. He explained further that if the water flows then all of the many elements which are required for sustainability must have been in place.

There must have been money for recurring expenses and for the occasional repair, there must have been acceptance from the consumers of the service, the source supplying the service must have been adequate, the design must have been properly done and there must have been sound construction ‘. For the purpose of this study, the definition of sustainable water supply offered by Abrams (2008) has been adapted for its practical implications. This study however focused on technical, financial, institutional, and social sustainability. Technical sustainability is defined as carefully designed water supply system that responds to the needs of the poor. It also relates to functionality of water systems and mechanisms of monitoring the entire system. Financial sustainability refers to the availability of funds for meeting recurrent maintenance, occasional repairs requiring replacement of parts and rehabilitation or overhauling of water distribution infrastructure. Institutional sustainability on the other hand connotes a mechanism for regulating the water sector to ensure the delivery of reliable, safe and affordable water to the urban poor. It entails good customer service and means of ensuring transparency and accountability of water sector stakeholders. Social sustainability denotes community participation in project decision making. It also stands for availability of, and implementation of pro-poor water policies.

2.3.4 Access to water

Access to safe drinking water is a fundamental precondition for the enjoyment of several human rights, including the right to education, housing, health, life, work and protection against cruel, inhuman or degrading treatment or punishment. It is to eradicate discrimination. For example with regard to the right to education, where no toilet block is set aside for girls in education, parents will often not allow their daughters to attend school especially once they have started menstruating (UN-Water, 2009).

A household is considered to have access to improved water source if it gets drinking water primarily from a pipe borne water supply system, a public standpipe, borehole and dug well with pump, a protected spring, a well-developed rain water harvesting system, a reliable water vendor or water tank truck. Sources such as direct from surface waters –i.e. rivers, lakes, ponds, etc. and unprotected wells and springs are regarded as unimproved water sources. (UNICEF and WHO, 2008). Worldwide, the percentage of people without access to treated water and sanitation has been virtually constant at about 17%, despite the increase of infrastructure during the 1990's (UNFPA, 2013a). Bremner and Bilsborrow (2015) pointed out that, given the population increase that will occur until 2015, the additional number of people to be served is in the order of 1.6-2.2 billion. What makes matters worse is that. if per capita consumption continues its current upward trend, about two thirds of the world population will face moderate or severe water scarcity. The Latin, American and Caribbean (LAC) countries are undergoing an intensive process of expansion of coverage for drinking water, according to WHO/UNICEF (2015). In 1990 coverage for drinking water was 83% and 89% in 2002. There is an important differential

in terms of rural and urban distribution of access to water. According to Lenton (2013), in 2000 the urban population of the LAC region not served by improved water was only 6 million, compared to 34 million in rural areas.

For sanitation, these numbers were 14 and 48 million, respectively. However, these numbers change dramatically once population change is taken into account. Due to the fact that all population growth in coming years will be urban, the need for providing water and basic sanitation in the cities actually exceeds that of rural areas. In urban areas, 121 million people will require improved water supply and 132 million improved sanitation, compared to 20 and 29 million, respectively, in the rural areas (UNFPA, 2013). These projections are based on aggregate trends that do not take into account population growth in under-served urban areas that may be higher than in areas that already have adequate infrastructure. If this difference is factored in, then the urban requirements may even be higher, but to our knowledge, no such scenarios have been carried out so far (UNFPA, 2013).

According to International Water Association (IWA, 2014), "access to good, safe and reliable drinking water is one of the most basic needs of human society and as such requires integrated approach, close cooperation and partnership between all stake holders". Again, research has shown that access to good, reliable and sufficient water supply increases the health status of people. However, many people in the world today lack this basic need. In 2000 Global Water Partnership observed that most countries give first priority to satisfaction of basic needs for water, one fifth of the world's population is without access to safe drinking water and the service deficiencies primarily affect the poorest segments of the population in developing countries.

It goes on to say that: 'water supply and sanitation for both urban and rural areas in these countries represents one of the most serious challenges in the years ahead". As the amount of water accessed every day is largely determined by the distance to the water source and the collection time, a reasonable distance is one that allows everyone to collect sufficient water to cover personal domestic uses. According to WHO, in order to have a basic access to 20liters per day, the water source has to be within 1,000 metres of the home and collection time should not exceed 30 minutes. When water is piped into the home, access is optimal and at least 100 litres per person per day is likely to be ensured. In this respect, UNDP confirms in its human development report 2006 that having a regular supply of clean water piped to the household is the optimal type of provision for human development. Access to a regular supply of water within the home also eliminates the need for women and children to spend time and physically exert themselves to collect water from distant sources.

2.4 Urban water supply and sanitation in Ghana

The main sources of water supply to urban areas of Ghana are conventional treatment plants where surface water is taken from rivers. Generally, ground water sources are limited to only a few areas in the forest zone. Historically, major feature of these treatment plants has been their inability to produce enough water to meet growing urban demand. The Ghana Water Sewerage Corporation was not able to provide efficient and effective services to urban population and the public became frustrated, some even losing faith in the company. The corporation faced a number of challenges.

These included high rates of water loss through leakages (about 40 percent), the inability of the supply to meet rising demand, non and low revenue returns as well as vandalizing of water pipes and other facilities by people who were tapping water illegally (Osumanu, 2008). Over the past decade, attempts have been made to address the constraints to the sustainable development and management of Ghana's urban water supply and sanitation services. These interventions have mainly been targeted at streamlining the role, functions, and decisions –making processes within the water and sanitation sectors. The first of these initiatives was the urban water reform, which transformed the Ghana Water and Sewerage Corporation in 1999 into limited liability company –Ghana Water Company Limited (GWCL), as an initial step towards the introduction of private sector operation and management of urban supply system.

As part of the reform the regulation of urban water has been shifted away from government to independent body, the Public Utilities Regulatory Commission is responsible for the protection of investment, operation and maintenance costs of the water supply to encourage private sector involvement. This policy also shifted responsibility for sanitation and wastewater management to impoverished local government. Metropolitan/Municipal/District Assemblies which are responsible for sanitation were required to promote aggressively the construction and use of domestic latrines and enforce by -laws on the provision of sanitation facilities by landlords. The construction of public latrines was to be restricted to public places. Simplified sewerage systems were to be introduced for poor areas with high population densities as well as technological options

for the installation of KVIPs (Kumasi Ventilated Improved Pits) in the poor areas with unfavourable terrain.

As part of the reform, a water sector rehabilitation project was put in place. Its purpose was to revamp the country's major urban water supply, to deal with illegal water connections and restore broken down smaller urban systems and to provide spare parts, plant and equipment to ensure sustainable operations. Subsequent to this project, a Water Sector Retracting Programme (2003- 2009) was implemented to increase urban water availability. Current attempts by the government to reform the water sector focuses on public –private partnerships in the form of management contract arrangements. The Ghana Water Company Limited (GWCL) entered into a management contract arrangement with Aqua Vitens Rand Limited (AVRL), a private company formed by a merger between Vintex of Holland and Rand Water Company of South Africa (contract now terminated), to operate urban water systems. These contracts were required that tariffs be structured so that cost recovery and therefore financial sustainability was ensured. Even though reform of the urban water system is still underway, it has not yet had much of the desired results, and it is anticipated to have a negative impact on the poor by restricting their access to clean water supplies as a result of high tariffs (Amenga, 2013).

2.4.1 Water as a development issue

There exists a strong relationship between access to safe water and the level of development of a country. A look at recent researches undertaken on water reveals the correlation between water and development. According to the United Nations World Water

Assessment Program (UN-WWAP) (2006 and 2009) the world's poorest nations also experience the most cases of poor or limited access to safe water. While the importance of water to national development cannot be over emphasized the negative effects of poor access to safe water is also easily recognizable. It translates into long hours spent in search of safe water. Women and children are often the first and visibly impacted by this situation. Education is also affected as children are kept from school because they have to spend long hours in search of water. In sum human capital value and returns eventually gets diminished. The United Nations (UN) Organisation reports a high incidence of malaria, cholera, intestinal worms, schistosomiasis and diarrhea; and a high evidence of avoidable deaths as a result of the use of unsafe drinking water, poor hygiene and sanitation in sub-Saharan Africa. The indubitable links between water and other sectors in the national development process suggest that a poor state of access to safe water creates a poor human development environment which constrains the economic development of the nation. It is a recognised fact that all countries that have achieved a high level of development have done so having disencumbered themselves of such basic human development challenges as morbidity and low life expectancy (World Bank, 2014).

While Africa in general faces the water challenge the case of sub-Saharan Africa is particularly egregious. In order to build and maintain a healthy and productive workforce and achieve high returns on its human capital, sub-Saharan African countries need to seek and device means to tackle the key challenges to its human resources. Access to safe drinking water is one such key challenge to sub-Saharan Africa's human resource. Lee Jong-wook, former director or the World Health Organisation (WHO) notes that „wherever

people achieve reliable access to safe drinking water and adequate sanitation they have won a major battle against a wide range of diseases (AFP, 2014), and the WHO identifies water as one of the determinants of a nation‟s public health status – a major factor in determining a nation's human development index.

The World Water Development Report (UN-WWAP, 2009 and 2006) for its part describes as inextricably linked, the state of human health and water related conditions; and underscores the need for urgent improvements in access and management of water as well as sanitation because of their implications for human health and development. However for most sub-Saharan African countries, tackling water as a development issue poses enormous challenges stemming from the complex nature of the needs of developing economies which are characterised by low incomes, poor balance of payments, high birth rates, urbanisation and migration, and low level of education and literacy among others. Added to these are the following significant factors influencing access to safe water throughout the world: population growth and urbanisation, industrialisation, changing climate and governance (UN-WWAP, 2016).

Africa as a continent is generally considered to be blessed with an adequate amount of natural water resources. The issue facing Africa is the need to convert its abundant natural water resources into forms suitable for human consumption. Thus, in the midst of the seeming adequacy of natural water, safe drinking water is still out of reach for millions of people on the African continent. Governance has the solution to many of the water problems in the world today (UN-WWAP, 2016).

2.5 Billing and revenue-collection systems

Although, the utility agency meets "most" of its operating costs through internally generated revenue, while capital projects are financed by the federal government through loans, and international donors (FCTWB, n.d.), improved water billing and revenue collection could enhance the utility's financial sustainability and capacity to improve service quality. In Cote d'Ivoire, for instance, more than 3 million households have gained access to piped water since 1990, entirely financed through tariff revenues and without any public funding (Marin, 2009). Based on the author's experience, residents of Abuja are like those of many cities in developing countries and would rather pay higher tariffs than have to access water from more expensive sources (like vendors and distant areas) or store water in tanks and containers. Indeed, one survey found that 21% of respondents in Abuja are willing to pay more for improved water quality (Ojo, 2011). However, an important caveat is that any tariff increase must translate into better services as people resent paying for poor services.

On the issue of tariffs, the agency should shift from flat rates to more equitable water pricing. Installing meters is a way to improve revenue collection and provide households with incentives to conserve water. Pre-paid meters not only prevent the problem of bill-payment default, but they also save the agency from meter reading and disconnection costs. Bill payment could also be improved by using an electronic system.

2.5.1 Good water governance

Water governance is about political, administrative, and socioeconomic decisions-making processes through which societies manage and govern their water resources and systems

(Teisman and Herman, 2011) and at the core of the World Health Organization's agenda for the sector (WHO/UNICEF, 2014). For more effective provision of water services in developing countries, the following aspects of water governance should be strengthened.

2.5.2 Institutional efficiency

Institutional efficiency in water governance could be greatly improved by restructuring the agency from the traditional civil service style to become more commercially oriented. This could be achieved through strategic planning that asks, 'where are we now, where do we want to be, how might we get there and how do we ensure success' (Mugabi *et al.,* 2007). Recommendations for promoting institutional efficiency include:

Providing staff with required maintenance equipment and parts, operational vehicles, and protective gears (uniforms, boots, and helmets) would improve operational efficacy. Strengthening transparency and holding the staff and decision makers accountable would lead to more efficient management of public resources and dealing with illegal water connections;

The agency should set and work toward achieving performance targets, including revenue generation targets for agency staff.

Incentives mechanisms for staff include promotions when due, allowances for hazardous work and overtime, and bonuses for meeting performance targets.

Building the capacity of the utility staff through on-the-job training would enable them to better maintain the water infrastructure and provide customer services. This is preferable and less costly than paying foreign engineers for maintenance and repair works.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

In carrying out any desirable activity, it requires that an individual follow certain procedures or methods in order to achieve favorable results. This chapter intends to examine the methods used for the study, given a vivid description of how the research was carried out. This chapter will cover the research methods that will be adopted by the researcher in arriving at the findings. It will describe the research design, research approach, the population, sampling and sample procedures, data gathering instruments, data collection measures, data analysis and ethical consideration will also be dealt with in this chapter.

3.1 Research Design

The purpose of research design was to provide a framework for the collection and analysis of data. A choice of research design reflects decisions about the priority given to set of dimensions of the research process. The researcher used descriptive research design for the study. This refers to a research which specified the nature of a given phenomenon. It determined and reported the way things were done. Descriptive research thus involved the collecting of data in order to test hypotheses or answer research questions concerning the current status of the subject of the study (Bryman, 2004).

There are basically two research philosophies within which social research are located: interpretivist and positivist paradigms. While the interpretivist paradigm is grounded in the qualitative approach to research, the positivist paradigm is placed within the quantitative approach to research. In this study the researcher used the qualitative approach. This type of research approach was used because it will enable the researcher to make fair judgment about the effectiveness, relevance or desirability of the study. Research designs can be classified into three main types. These are qualitative research method, quantitative research method and the mixed method which is the combination of qualitative and quantitative research methods. This research required the use of the mixed method.

3.2 Population

The population was made up of the staff and customers of Ghana Water Company in the Ashanti Region. The total population for the study was Nine Thousand Seven Hundred and Eighty-Three (9783).

3.3 Sampling Technique and Sample size

Purposive and convenience sampling techniques were used for selecting participants for the study. The Managers and some staffs were purposively selected for the study. According to Creswell (2012), in purposive sampling, researchers intentionally select individuals and sites to learn or understand a phenomenon. In this way, the researcher built up a sample that was satisfactory to specific needs. Three Managers (3), and 10 selected staffs were purposively sampled for the study. However, the convenience sampling

technique which provided participants who were readily available to be selected were used to select the Customers. A total of three hundred and forty-six (346) respondents were selected.

The total estimated sample size for the study according to Krejcie and Morgan (1970), if the population is nine thousand seven hundred and eighty-three (9783) the sample size should be three hundred and forty-six (346) participants. The researcher based on this determinant to achieve the sample size for the study. The sample size was three hundred and forty-six (346).

3.4 Research instrument used

Data was collected using a structured questionnaire and an interview guide. Closed and open-ended questionnaire items were designed to collect primary data; this was because it had proven to be consistent and popular method of data collection. This questionnaire and interview guide were designed for the Managers, some selected staff and customers of the Ghana Water Company. The questionnaire assisted the researcher to assess the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region.

3.4.1 Interview Guide

The researcher also use structured interview guide for the data collection during the study. A special interview guide consisting of four (4) items was prepared. The interview investigated the causes of illegal water connection and the impact of the performance of

Ghana Water Company in production, billing and revenue generation in Ashanti North Region. Also, the interview guide solicited for views on remedial measures which can be put in place by the Ghana Water Company to remedy the situation.

3.5 Data Collection Procedure

Before the data collection, I sought permission from the authorities in charge of operations at Ghana Water Company, to conduct the study in that setup. After permission was granted to conduct the study, the researcher sent a letter to each of the participants to seek their consent to take part in the study and to inform them of the impending questionnaire and interview guide. A written questionnaire was hand delivered to all the selected participants. A 5-point Likert scale was used ranging from strongly disagree, disagree, neutral, agree and strongly agree.

An interview guide also used to solicit data from some Managers and selected staff in the maintenance department. Primary data was collected through a field survey from the Managers, staff and customers of the Ghana Water Company. Data was collected through the use of a questionnaire hand-delivered to participants in their office and homes. Questionnaires were filled out by participants and the researcher had to go for the questionnaires on the same day of distribution. Also, an interview was granted to those Managers and staff who ticked on the questionnaire that they would like to be interviewed using the interview guide prepared by the researcher to gather data.

3.6 Data analysis

The data collected was analysed statistically using Statistical Package for Social Sciences (SPSS) version 18 was used to analyze data. The main statistical techniques such as frequencies, percentages, tables and charts were used to explain certain findings. This enabled the researcher to discuss the collected data holistically.

3.7 Ethical Considerations

Ethical considerations in the study such as confidentiality, anonymity, access, betrayal, informed content was critically addressed. During the study, high ethical standards were maintained to ensure that no harm was caused to any of the participants. Steps were taken to keep information provided confidentially and anonymous, seeking the participants consent was also adhered to.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

The main purpose of this study is to assess the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region. This study specifically examined the factors that motivate customers to connect water illegally to their premises, b) examined the impact of illegal water connection on Ghana Water Company in Ashanti North Region, c) determined the prevalence of illegal water connection in the study area and assessed the measures that can be put in place to stop illegal water connection.

Table 4.1 Access to water supply

The main type of water source used by household	**Frequency**	**Percent (%)**
Piped	234	67.6
Borehole installed with pump	87	25.1
Protected Hand-dug well	25	7.3
Total	**346**	**100**
Location of water point		
Private	309	89.3
Public	37	10.7
Total	**346**	**100**
Where is the location of the water point used by your household?		
In own house	309	89.3
In neighbours' house/yard	19	5.5
At an institution (mosque, church, school, etc.)	7	2
Water vendor	11	3.2
Total	**346**	**100**
Does your main water source last throughout the year?		

Yes	342	98.8
No	4	1.2
Total	**346**	**100**
<u>On average, how many buckets of water do your house-hold use every day?</u>		
1-5 buckets	7	2
5-10 buckets	83	24
More than 10 buckets	256	74
Total	**346**	**100**
<u>Do you think there are problems with water supply and delivery in your areas?</u>		
Yes	332	96
No	5	1.4
don't know	9	2.6
Total	**346**	**100**

Source: Field survey, 2019, N= 346

Table 4.1 reveals that 234 customers representing 67.6% said that their main type of water source used by the household was pipe borne water, 87 customers representing 25.1% indicated that they used mechanize boreholes, while 25 customers representing 7.3% used protected hand dug well. Furthermore, 309 customers representing 89.3% indicated that their location of water point was private while 37 customers representing 10.7% said that their location of water point was public. Also, 309 customers representing 89.3% revealed that the location of water point used by their household was in their own house, 19 customers representing 5.5% said that their water point was in their neighbours house/ yard, 7 customers representing 2% indicated that they fetch water from an institution like mosque, church and schools, while 11 customers representing 3.2% also bought water from commercial water vendors. Moreover, 342 customers representing 98.8% affirmed that their main source of water last throughout the year, while 4 customers representing 1.2% said their main source of water does not last throughout the year.

The study results held that 256 customers representing 74% said that on average their household use more than 10 buckets every day, 83 customers representing 24% revealed that they used 5-10 buckets every day, while 7 customers representing 2% indicated that they used 1-5 buckets of water every day. The study results revealed that 332 customers representing 96% affirmed that they are problems with water supply and delivery in their area, 5 customers representing 1.4% said that they do not have problems with their water supply and delivery, while 9 customers representing 2.6% said that they do not know.

Access to safe drinking water is a fundamental precondition for the enjoyment of several human rights, including the right to education, housing, health, life, work and protection against cruel, inhuman or degrading treatment or punishment. It is to eradicate discrimination. For example with regard to the right to education, where no toilet block is set aside for girls in education, parents will often not allow their daughters to attend school especially once they have started menstruating (UN-Water, 2009). A household is considered to have access to improved water source if it gets drinking water primarily from a pipe borne water supply system, a public standpipe, borehole and hand dug well with pump, a protected spring, a well-developed rain water harvesting system, a reliable water vendor or water tank trucks. Water Sources such as direct from surface waters –i.e. rivers, lakes, ponds, etc. and unprotected wells and springs are regarded as unimproved water sources (UNICEF and WHO, 2008).

There exists a strong relationship between access to safe water and the level of development of a country. A look at recent researches undertaken on water reveals the correlation between water and development. According to the United Nations World Water Assessment Program (UN-WWAP) (2006 and 2009) the world's poorest nations also

experience the most cases of poor or limited access to safe water. While the importance of water to national development cannot be over emphasized the negative effects of poor access to safe water is also easily recognizable. It translates into long hours spent in search of safe water.

4.1 The factors that motivate customers to connect water illegally to their premises

The first objective of the study was to examine the factors that motivate customers to connect water illegally to their premises. Table 4.2 evaluated the factors that motivate customers to connect water illegally to their premises.

Table 4.2 The factors that motivate customers to connect water illegally to their premises

S/N	Statement	1 N(%)	2 N(%)	3 N(%)	4 N(%)	5 N(%)	Mean X	Ranking
1	Expensive connection fee can influence customers to connect water illegally to their premises	16 (4.6)	28 (8.1)	9 (2.6)	263 (76)	30 (8.7)	3.76	5th
2	Pipe connection network is not available in their area	14 (4)	9 (2.6)	11 (3.2)	167 (48.3)	145 (41.9)	4.21	1st
3	Don‘t want to be billed on monthly basis	17 (4.9)	19 (5.5)	13 (3.8)	134 (38.7)	163 (47.1)	4.18	2nd
4	Landlord will not pay the connections	14	28	11	175	118	4.03	3rd

	fee	(4)	(8.1)	(3.2)	(50.6)	(34.1)		
5	Ignorance and inadequate knowledge	18	38	18	131	141	3.98	4th
	on illegal connections	(5.2)	(11)	(5.2)	(37.9)	(40.8)		

(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).

Source: Field survey, 2019, N= 346

Table 4.2 shows that 263 customers representing 76% agreed that expensive connection fee can influence customers to connect water illegally to their premises, 30 customers representing 8.7% strongly agreed, 28 customers representing 8.1% disagreed, 16 customers representing 4.6% strongly disagreed, while 9 customers representing 2.6% were neutral. Moreover, 167 customers representing 48.3% agreed that customers can connect illegally when pipe connection network is not available in their area, 167 customers representing 48.3% strongly agreed, 14 customers representing 4% strongly disagreed, 11 customers representing 3.2% were neutral, while 9 customers representing 2.6% disagreed. Furthermore, 163 customers representing 47.1% strongly agreed customers connect water illegally when they do not want to be billed on monthly basis, 134 customers representing 38.7% agreed, 19 customers representing 5.5% disagreed, 17 customers representing 4.9% strongly disagreed, while 13 customers representing 3.8% were neutral.

The study results revealed that 175 customers representing 50.6% agreed that customers connect water illegally when the landlord is not willing to pay for the connection fee, 118 customers representing 34.1% strongly agreed, 28 customers representing 8.1% disagreed, 14 customers representing 4% strongly disagreed, while 11 customers representing 3.2% were neutral. The study revealed that 141 customers representing 40.8% strongly agreed

that ignorance and inadequate knowledge on illegal connections can result in illegal water connections, 131 customers representing 37.9% agreed, 38 customers representing 11% disagreed, while 18 customers representing 5.2 % were neutral. Illegal connections mainly occur in newly established residential areas where some of the newly built households are supplied with water from the mains, while others do not have a piped supply. They get water from their neighbours through illegal connections using water hoses or plastic and metal pipes, without the knowledge and authorisation of the water utility. Illegal water connections can also be termed as non-revenue water (NRW) because the water tapped illegally cannot be accounted for.

4.2 The impact of illegal water connection on Ghana Water Company in Ashanti North Region

The second objective of the study was to examine the impact of illegal water connection on Ghana Water Company in Ashanti North Region. Table 4.3 assessed the impact of illegal water connection on Ghana Water Company in Ashanti North Region.

Table 4.3: The impact of illegal water connection on Ghana Water Company in Ashanti North Region

S/N	Statement	1	2	3	4	5	Mean	Ranking
				N(%)	N(%)	N(%)	X	
1	Illegal water connection increases water leakages and loss of water resources	0	0	11 (3.2)	166 (48)	169 (48.8)	4.46	1st
2	Majorities of water utilities, leakage cannot be completely eliminated and that "there will always be a level of leakage which has to be tolerated and which has to be managed".	0	0	13 (3.8)	209 (60.4)	124 (35.8)	4.32	2nd
3	Illegal water connection can decrease company revenue and profitability	0	0	10 (2.9)	237 (68.5)	99 (28.6)	4.26	3rd
4	Illegal water connection leads to decrease in water pumping capacity and decreases in productivity	0	0	12 (3.5)	285 (82.4)	49 (14.2)	4.11	4th

(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).

Source: Field survey, 2019, N= 346

Table 4.3 reveals that 169 customers representing 48.8% strongly agreed that illegal water connection increases water leakages and loss of water resources, 166 customers

representing 48% agreed, while 11 customers representing 3.2% were neutral. Furthermore, 209 customers representing 60.4% agreed that majorities of water utilities, leakage cannot be completely eliminated and that "there will always be a level of leakage which has to be tolerated and which has to be managed", 124 customers representing 35.8% strongly agreed, while 13 customers representing 3.8% were neutral. Moreover, 237 customers representing 68.5% agreed that illegal water connection can decrease public revenue and profitability, 99 customers representing 28.6% strongly agreed, while 10 customers representing 2.9% were neutral. To add more, 285 customers representing 82.4% agreed that illegal water connection leads to decrease in water pumping capacity and decreases productivity, 49 customers representing 14.2% strongly agreed, while 12 customers representing 3.5% were neutral.

Illegal connections mainly occur in newly established residential areas where some of the newly built households are supplied with water from the mains, while others do not have a piped supply. They get water from their neighbours through illegal connections using water hoses or plastic and metal pipes, without the knowledge and authorisation of the water utility. Illegal water connections can also be termed as non-revenue water (NRW) because the water tapped illegally cannot be accounted for. In order to come to better understanding and set the framework for in-depth research into the current topic, it was necessary to find out the various components and their definitions as they relate to the topic. Various literatures were identified. But the one which seemed to have dealt with the issue of non-revenue water to a greater extent in recent times and to which most writers and researchers kept referring to was the document which has been developed by the International Water Association (IWA) Water Loss Task Forces for concepts and methodologies for

quantifying and definitions of the components of non-revenue water. Most of the following definitions are therefore quoted from this document.

4.3 The prevalence of illegal water connection in the study area

The third objective of the study was to determine the prevalence of illegal water connection in the study area. Table 4.4 shows the prevalence of illegal water connection in the study area.

Table 4.4: The prevalence of illegal water connection in the study area

How prevalent is illegal water connection in the study area?	Frequency	Percent (%)
High	326	94.2
Low	8	2.3
I do not know	12	3.5
Total	346	100

Source: Field survey, 2019, N= 346

Table 4.4 shows that 326 customers representing 94.2% indicated that the prevalence of illegal water connection in the study area is high, 8 customers representing 2.3% revealed that illegal water connection practices in the study area is low, while 12 customers representing 3.5% said that they do not know. There are cases in Ghana and many other places of people illegally tapping into a water main in order to obtain water without paying for it. The cost of the water they use is borne by others who do pay for the water produced by the utility. Apart from committing a crime (theft of water, thus depriving the water utility of revenue), people who make illegal connections to the water supply system also

endanger the safety of the mains water through possible contamination. This can be caused simply by making a break in the pipe without taking the necessary precautions to prevent contamination. The same can also happen if the illegal connection consists of a hose or pipe that, at one end, is connected to the water main and, at the other end, is left immersed below the water level of a storage tank, bucket or other container. If there is a reduction in water pressure in the water main (say, due to a pipe burst), water from the container could be drawn into the mains supply. This phenomenon is referred to as **back-siphonage.** If the water in the bucket is contaminated in any way, this will result in contamination of the mains water too.

4.4 The measures that can be put in place to stop illegal water connection

The fourth objective of the study was to determine the measures that can be put in place to stop illegal water connection. Table 4.5 determined the measures that can be put in place to stop illegal water connection.

Table 4.5: The measures that can be put in place to stop illegal water connection

S/	Statement	1	2	3	4	5

N				N(%)	N(%)	N(%)
1	Water management institutions need adequate human, financial, technical and administrative resources to fulfil their mandate, including a professional and qualified workforce to monitor illegal connections	0	0	10 (2.9)	253 (73.1)	83 (24)
2	Pro-poor anti-corruption efforts need to focus on the types of service provision most relevant to those living in poverty, such as public standpipes or wells.			13 (3.8)	220 (63.6)	113 (32.7)
3	It is important that anti-corruption measures are designed in such a way that they do not undercut people's livelihoods; part of this will likely involve recognising that a crackdown on unofficial water vendors without concomitant efforts to provide clean, affordable water to the poor will simply restrict their access to water.	0	0	12 (3.5)	164 (47.4)	170 (49.1)
4	Attempts to bring informal providers into the legal sphere through the use of licences, formal recognition and "light touch" regulation is considered to be a more fruitful approach to reducing corruption and improving access to water.	0	0	15 (4.3)	225 (65)	106 (30.6)
5	Authorities have to issue licences to inform vendors	0	0	18	238	90

	and laid down guidelines for independent providers.			(5.2)	(68.8)	(26)
6	Strengthen the role of regulators and law enforcement agencies	0	0	12 (3.5)	244 (70.5)	90 (26)
7	Speak out against corruption and build platforms to discuss integrity	0	0	14 (4)	242 (69.9)	90 (26)
8	Measures aimed at curbing regulatory capture can include capacity building and training for regulatory staff	0	0	10 (2.9)	211 (61)	125 (36.1)
9	Management should provide adequate resources (human, financial, technical and administrative), and create a clear institutional mandate.	0	0	18 (5.2)	141 (40.8)	187 (54)
10	There is the need to start active leakage control programme to repair leaks on the mains and the distribution networks.	0	0	11 (3.2)	166 (48)	169 (48.8)
11	The volume of leakage would definitely be reduced if the time taken to carry out repair works is reduced.	0	0	15 (4.3)	111 (32.1)	220 (63.6)

(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).

Source: Field survey, 2019, N= 346

Table 4.5 reveals that 253 customers representing 73.1% agreed that water management institutions need adequate human, financial, technical and administrative resources to fulfil their mandate, including a professional and qualified workforce to monitor illegal connections, 83 customers representing 24% strongly agreed, while 10 customers representing 2.9% were neutral. Furthermore, 220 customers representing 63.6% agreed

that pro-poor anti-corruption efforts need to focus on the types of service provision most relevant to those living in poverty, such as public standpipes or wells, 113 customers representing 32.7% strongly agreed, while 13 customers representing 3.8% were neutral. The study results held that 244 customers representing 70.5% agreed that the Ghana Water Company should strengthen the role of regulators and law enforcement agencies to deal with illegal connectors, 90 customers representing 26% strongly agreed, while 12 customers representing 3.5% were neutral. Moreover, 242 customers representing 69.9% agreed that there is the need to speak out against corruption and build platforms to discuss integrity, 90 customers representing 26% strongly agreed, while 14 customers representing 4% were neutral. Furthermore, 211 customers representing 61% agreed that measures aimed at curbing regulatory capture can include capacity building and training for regulatory staff, 125 customers representing 36.1% strongly agreed, while 10 customers representing 2.9% were neutral. To add more, 187 customers representing 54% strongly agreed that management should provide adequate resources (human, financial, technical and administrative), and create a clear institutional mandate, 141 customers representing 40.8% agreed, while 18 customers representing 5.2% were neutral.

Also, 169 customers representing 48.8% strongly agreed that there is the need to start active leakage control programme to repair leaks on the mains and the distribution networks, 166 customers representing 48% agreed while 11 customers representing 3.2% were neutral. Moreover, 220 customers representing 63.6% strongly agreed that the volume of leakage would definitely be reduced if the time taken to carry out repair works is reduced, 111 customers representing 32.1% agreed while 15 customers representing 4.3% were neutral.

These results are in agreement with Mugabi *et al.,* (2007), they indicated that institutional efficiency in water governance could be greatly improved by restructuring the agency from the traditional civil service style to become more commercially oriented. This could be achieved through strategic planning that asks, 'where are we now, where do we want to be, how might we get there and how do we ensure success'. Recommendations for promoting institutional efficiency include:

Providing staff with required maintenance equipment and parts, operational vehicles, and protective gears (uniforms, boots, and helmets) would improve operational efficacy. Strengthening transparency and holding the staff and decision makers accountable would lead to more efficient management of public resources and dealing with illegal water connections;

The agency should set and work toward achieving performance targets, including revenue generation targets for agency staff.

Incentives mechanisms for staff include promotions when due, allowances for hazardous work and overtime, and bonuses for meeting performance targets.

Building the capacity of the utility staff through on-the-job training would enable them to better maintain the water infrastructure and provide customer services. This is preferable and less costly than paying foreign engineers for maintenance and repair works.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The main purpose of this study was to assess the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region. The researcher used descriptive research design for the study. Quantitative and qualitative research approaches were used. The population was made up of the staff and customers of Ghana Water Company in the Ashanti Region. The total population for the study was Nine Thousand Seven Hundred and Eighty-Three (9783). Purposive and convenience sampling techniques were used to select three hundred and forty six (346) respondents for the study. Questionnaires were the main instrument used for data collection. The main statistical techniques such as frequencies, percentages, tables and charts were used to explain certain findings.

Response from Managers

Generally, the responses were almost the same.

The managers expressed their displeasure about the growing trend of illegal water connection in the region. They alluded to the fact that some staff and outside plumbers aid the customers and potential customers to do the illegality.

They also stated that the operations of these people are affecting the company negatively.

The managers though admitted that the new service connection fee is very high, that does not give them the right to do illegal connection.

Response from Some Selected Staffs

1. Though the staff expressed their concerned about the situation, they gave the following reasons as the causes of illegal water connection:
2. High cost of new service connection fees

3. High tariffs
4. Delay in new service connections after payment have been made
5. No mains or pipe lines connected to the various new sites
6. Deceit from outside plumbers
7. Some unscrupulous staff among the work force.
8. Lack of education about the operations of the company.

5.2 Key Findings of the Study

The first objective of the study was to examine the factors that motivate customers to connect water illegally to their premises. The study shows that 76% agreed that expensive connection fee can influence customers to connect water illegally to their premises. Moreover, 48.3% agreed that customers can connect illegally when pipe connection network is not available in their area. Furthermore, 47.1% strongly agreed customers connect water illegally when they do not want to be billed on monthly basis. The study results revealed that 50.6% agreed that customers connect water illegally when the landlord is not willing to pay for the connection fee. The study revealed that 40.8% strongly agreed that ignorance and inadequate knowledge on illegal connections can result in illegal water connections.

The second objective of the study was to examine the impact of illegal water connection on Ghana Water Company in Ashanti North Region. The study reveals that 169 customers representing 48.8% strongly agreed that illegal water connection increases water leakages and loss of water resources. Furthermore, 60.4% agreed that majorities of water utilities,

leakage cannot be completely eliminated and that "there will always be a level of leakage which has to be tolerated and which has to be managed". Moreover, 68.5% agreed that illegal water connection can decrease public revenue and profitability. To add more, 82.4% agreed that illegal water connection leads to decrease in water pumping capacity and decreases productivity.

The third objective of the study was to determine the prevalence of illegal water connection in the study area. The study shows that 94.2% indicated that the prevalence of illegal water connection in the study area is high.

The fourth objective of the study was to determine the measures that can be put in place to stop illegal water connection. The study reveals that 73.1% agreed that water management institutions need adequate human, financial, technical and administrative resources to fulfil their mandate, including a professional and qualified workforce to monitor illegal connections. Furthermore, 63.6% agreed that pro-poor anti-corruption efforts need to focus on the types of service provision most relevant to those living in poverty, such as public standpipes or wells. The study results held that 70.5% agreed that the Ghana Water Company should strengthen the role of regulators and law enforcement agencies to deal with illegal connectors. Moreover, 69.9% agreed that there is the need to speak out against corruption and build platforms to discuss integrity. Furthermore, 61% agreed that measures aimed at curbing regulatory capture can include capacity building and training for regulatory staff. To add more, 54% strongly agreed that management should provide adequate resources (human, financial, technical and administrative), and create a clear

institutional mandate. Also, 48.8% strongly agreed that there is the need to start active leakage control programme to repair leaks on the mains and the distribution networks. Moreover, 63.6% strongly agreed that the volume of leakage would definitely be reduced if the time taken to carry out repair works is reduced.

5.3 Conclusion

The study concluded that the factors that motivate customers to connect water illegally to their premises were expensive connection fee, when pipe connection network is not available in their area, when they do not want to be billed on monthly basis, when the landlord is not willing to pay for the connection fee, and ignorance and inadequate knowledge on illegal connections can result in illegal water connections. The impact of illegal water connection on Ghana Water Company in Ashanti North Region were that illegal water connection increases water leakages and loss of water resources, illegal water connection can decrease public revenue and profitability, illegal water connection leads to decrease in water pumping capacity and decreases productivity. The prevalence of illegal water connection in the study area is high.

5.4 Recommendations

Based on the conclusions of the study, the study recommended that;

1. The Ghana Water Company need adequate human, financial, technical and administrative resources to fulfil their mandate, including a professional and qualified

workforce to monitor illegal connections and to reduce illegal consumption through proactive, effective and comprehensive identification & investigation of illegal water consumers in the water supply area(s).

2. The pro-poor anti-corruption efforts need to focus on the types of service provision most relevant to those living in poverty, such as public standpipes or wells.

3. The Ghana Water Company should liaise with the utility regulators and law enforcement agencies to deal with illegal water connectors, in order to maximize collection of fines that has been levied on the identified illegal consumers.

4. The Ghana water company should devise and establish mechanisms that will compel the identified illegal consumers to desist from reverting to the bad practices of illegal consumption and speak out against corruption and build platforms to discuss integrity.

5. The management of the Ghana Water Company should provide adequate resources (human, financial, technical and administrative), and create a clear institutional mandate.

6. The Ghana Water Company should start active leakage control programme to repair leaks on the mains and the distribution networks.

7. The Ghana water company should embark on mains extension program to all new sites to prevent illegal water connections in those areas and to review their new service fees downwards for the less privilege to have access to portable water.

5.5 Suggestions for Further Research

According to the recommendations of the study, the researcher recommended that there is the need to investigate the impact providing adequate human, financial, technical and

administrative resources to fulfil the GWCL mandate, including a professional and qualified workforce to monitor illegal connections.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION

QUESTIONNAIRES FOR THE RESPONDENTS

I wish to introduce myself to you as a Master of Business Administration at the University of Education, Winneba. As part of the programme, I am required to write a thesis which is entitled **"assessing the causes of illegal water connection and the impact on the performance of Ghana Water Company in production, billing and revenue generation in Ashanti North Region".** Your prestigious organisation has granted me permission to use it as my case study organisation. I respectively request you to be part of this research by completing the attached questionnaire. I would be most grateful if you could please spare some few minutes of your precious time to answer all the questions before you. Anonymity and non-traceability is assured. I thank you in advance for your valuable co-operation.

Section A: Demographic Information of the Respondents

1. What is your gender?

Male [ ] Female [ ]

2. Age category of respondent

A. 18-26 [ ] B. 27-35 [ ] C. 36-44 [ ] D. 45-53[ ] E. 54 and above [ ]

3. Marital status

A. Single [ ] B. Married [ ] C. Separated [ ] D. Divorced [ ] E. Widowed [ ]

4. Level of education of the respondent A. Primary [ ] B. Secondary [ ] C. Tertiary [ ]

D. University [ ] E. Others, specify [ ]

5. How long in years have you been in this area?

A. Less than 1 year [ ] B. 1- 5 [ ] C. 6-10 [ ] D. 11-15 [ ] E. 16-20 [ ] F. Over 21 [ ]

6. How many people live in this household?

A. 1-5 [ ] B. 6-10 [ ] C. 11 and above [ ]

Access to water supply

What is the main type of water source used by household?

(A) Piped (b) Borehole installed with pump (c) Protected Hand-dug well (d) Unprotected well (e) Surface water (f) Covered rainwater tank (g) Uncovered rainwater tank

(h) Other (specify)……

Is the water point (A) Private [ ] (B) Public [ ]

Where is the location of the water point used by your household?

(A) In own house (B) In neighbours' house/yard (C) Public place (D) At an institution (mosque, church, school, etc.) (E) Water vendor (f) Other (specify)……

Does your main water source last throughout the year? (A) Yes (B) No

If No, how often does it run out? ……

(i) Do you pay for water used? (1) Yes [ ] (2) No [ ]

(ii) If yes, what is the cost of a 20 liter bucket of water?……

How much do spend on water? Per day…… GH₵

Per month …….. GH₵

On average, how many buckets of water do your house-hold use every day? …….

What is the maximum time spending for collecting water? ……hr(s)……min(s)

How far does it take you to walk to where you draw or fetch water?

(A) Less 50m (B) 50 – 100m (C) 101 – 200m (D) over 201m

Do you think there are problems with water supply and delivery in your areas?

(A) (B) No (C) Don't know

Section B: The factors that motivate customers to connect water illegally to their premises?

On a scale of 1 to 5, rate each of the items below by assigning the appropriate number **(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).**

S/N	Statement	1	2	3	4	5
	Expensive connection fee can influence customers to connect water illegally to their premises					
	Pipe connection network is not available in their area					
	Don‘t want to be billed on monthly basis					
	Landlord will not pay the connections fee					
	Ignorance and inadequate knowledge on illegal connections					

Section C: The impact of illegal water connection on Ghana Water Company in Ashanti North Region?

On a scale of 1 to 5, rate each of the items below by assigning the appropriate number

(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).

S/N	Statement	1	2	3	4	5
	Illegal water connection increases water leakages and loss of water resources					
	Majorities of water utilities, leakage cannot be completely eliminated and that "there will always be a level of leakage which has to be tolerated and which has to be managed".					
	Illegal water connection can decrease public revenue and profitability					
	Illegal water connection leads to decrease in water pumping capacity and decreases productivity					

Section D: The prevalence of illegal water connection in the study area?

How prevalent is illegal water connection in the study area?

……

……

……

……

Section E: The measures that can be put in place to stop illegal water connection?

On a scale of 1 to 5, rate each of the items below by assigning the appropriate number **(1=strongly disagree, 2=disagree, 3= Neutral, 4=agree, 5=strongly agree).**

S/N	Statement	1	2	3	4	5
	Water management institutions need adequate human, financial, technical and administrative resources to fulfil their mandate, including a professional and qualified workforce to monitor illegal connections					
	Pro-poor anti-corruption efforts need to focus on the types of service provision most relevant to those living in poverty, such as public standpipes or wells.					
	It is important that anti-corruption measures are designed in such a way that they do not undercut people's livelihoods; part of this will likely involve recognising that a crackdown on unofficial water vendors without concomitant efforts to provide clean, affordable water to the poor will simply restrict their access to water.					
	Attempts to bring informal providers into the legal sphere through the use of licences, formal recognition and "light touch" regulation is considered to be a more fruitful approach to reducing corruption and improving access to water.					
	Authorities have to issue licences to inform vendors and laid down guidelines for independent providers.					

	Strengthen the role of regulators and law enforcement agencies					
	Speak out against corruption and build platforms to discuss integrity					
	Measures aimed at curbing regulatory capture can include capacity building and training for regulatory staff					
	Management should provide adequate resources (human, financial, technical and administrative), and create a clear institutional mandate.					
	There is the need to start active leakage control programme to repair leaks on the mains and the distribution networks.					
	The volume of leakage would definitely be reduced if the time taken to carry out repair works is reduced.					

APPENDIX B

INTERVIEW GUIDE FOR THE RESPONDENTS (OPTIONAL)

What are the factors that motivate customers to connect water illegally to their premises?

……

……

……

……

What is the impact of illegal water connection on Ghana Water Company In Ashanti North Region?

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……

……

How prevalent is illegal water connection in the study area?

……

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……

……

What are the measures that can put in place to stop illegal water connection?

……

……