FACTORS INFLUENCING EQUITABLE DISTRIBUTION OF WATER SUPPLY IN EMBU COUNTY KENYA: A CASE OF EMBU WATER AND SANITATION COMPANY LIMITED

BY

EUNICE MBANDI IRERI

A Project Report Submitted in Partial Fulfilment of the Requirements for the Award of Degree of Master of Arts in Project Planning and Management of the University of Nairobi

2018

DECLARATION

I declare that this research project report is my original work and has not been presented for academic award in any other University.

Signature:_____ Date _____

Eunice Mbandi Ireri

L50/84394/2016

This research project report has been submitted for examination with my approval as the university supervisor.

Signature:_____ Date_____

Dr. Ndunge Kyalo
Senior Lecturer
School of Open and Distance Learning
University of Nairobi

DEDICATION

I dedicate this project report with deep respect and great love to my son Michael Wanyiri whose support and love I treasure. To my 185 foster children at Gatumbiri Primary School in Embu County who give me great pleasure and to my brother Job Mbogo whose support remains my source of inspiration.

ACKNOWLEDGEMENT

I wish to appreciate the following for their encouragement and assistance during the period of coming up with this project report. First, my University Supervisor Dr. Ndunge Kyalo, for her patience, constructive suggestions, motivation and guidance and to my Mentor George Njari for putting in me the desire to further my studies in Project Management.

Special gratitude goes to the University of Nairobi Librarians at Jomo Kenyatta Memorial Library who through their advice, facilitated access to valuable information that made this report possible. Last but not least, my sincere thanks to the Department of Extra-Mural Studies staff members for their support and guidance in the entire period.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AMCOW : African Ministers' Council on Water

DCA : Development Credit Authority

EWASCO : Embu Water and Sanitation Company Limited

GDP : Gross Domestic Product

KNBS : Kenya National Bureau of Statistics

MDG : Millennium Development Goals

NWSS : National Water Services Strategy

SDG : Sustainable Development Goal

TOC : Theory of Constraints

UNESCO : United Nations Educational, Scientific and Cultural Organization

UNICEF : United Nations Children's Fund

USAID : United States Agency for International Development

WASREB : Water Service Regulatory Board

WWDR : World Water Development Report

WHO : World Health Organization

WSP : Water and Sanitation Program

WWAP : World Water Assessment Program

WSPs : Water Service Providers

WWDR : World Water Development Report

WSTF : Water Sector Trust Fund

WRA : Water Resource Authority

NWSA : National Water Storage Authority

BWRC : Basin Water Resource Committee

WRUAS : Water Resource User Association

WWDA : Water Works Development Agencies

WSB : Water Service Board

ABSTRACT

Embu County according to Kenya National Bureau of Statistics (2010), the 2009 Kenya national census shows water coverage level at 50% with 68% of the population in Mbeere districts not having access to improved water sources and 42% of the population in Embu Districts not having access to improved water sources. The purpose of the study was to assess the factors influencing equitable distribution of water supply in Embu County. The study objectives were; to assess how water resource infrastructure influence equitable distribution of water supply in Embu County, to establish how financial resource allocation influence equitable distribution of water supply in Embu County, to identify how government interventions influence equitable distribution of water supply in Embu County and to examine how household economic characteristics influence equitable distribution of water supply in Embu County. The study employed the descriptive survey design using permanent employees in the Departments of Finance and Commercial Services, Technical and Administration. A sample size of 82 was drawn from a target population of 103 employees of Embu Water and Sanitation Company Limited. The data was collected through a structured and unstructured questionnaire and analysis done using Statistical Package for the Social Sciences (SPSS). Inferential analysis correlation and regression was done to examine the strength and relationship on the factors influencing equitable distribution of water supply. The results established that there was a significant variation of 71.95% between the factors influencing equitable distribution of water supply and the equitable distribution of water in Embu County. The study concluded that equitable distribution of water in Embu County has been achieved to a moderate extent. There is increased rate in water supply in the county and adequate supply of water to some households as well as increased equitable water distribution to a moderate extent in Embu County. The study recommends that the management of Embu Water and Sanitation Company Limited enhance equitable distribution of water by increasing the rate in adequate water supply for all regions and households in the county.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Drinking water is a basic human right and the state has the responsibility to provide safe drinking water (Panickar, 2007). Rising urbanization does not guarantee the reliable access to safe and sustainable drinking water supply. It often causes inequality of drinking water supply. The existence of inequitable distribution of water and sanitation services is not in doubt. The problem has already received concerns from government and other stakeholders. Water scarcity remains a major concern as it affects more than 40% of the world population with an estimation of 783 million people not having access to improved source of water (UNDP 2016). According to IIED (2017), in many parts of the world water resources are increasingly under pressure and not just in developing or semi-arid countries, water extraction for industries, municipal supplies and agricultural irrigation is growing, and many catchments are now facing occasional or regular water stress.

Sub-Saharan Africa accounts for over a third of the population not using improved sources of drinking water with only 60% of the population using improved sources of drinking-water despite an increase of 11 percentage points since 1990 (WHO/UNESCO 2010). UNESCO (2010) in their analysis on access to improved drinking water source indicated that in sub-Saharan Africa rural population without access to an improved drinking water source is over five times greater than that in urban areas. World Bank (2013) noted that rapid urbanization in Africa is a major challenge for the increase of

improved water supply sources. Dos Santos et al.'s(2017), postulates that Sub-Saharan Africa accounts for more global population without access to clean water than other major regions in the world and they attribute this to population growth, increasing pollution, accelerating urbanization and changing lifestyles. In their study, they indicate that these attributes will continue to broaden the gap between the demand for water and the available supply.

According to 2030 water resources group (2015), in Kenya the annual renewable fresh water supply is only 650 m3 per capita, well below the threshold for "chronic water scarcity". AMCOW (2015) suggests that in Kenya water supply is characterized by low levels of access especially in rural areas and urban slums. WHO/UNICEF (2016), In a joint monitoring program for water supply show that in 2015 at least 58% of Kenyans had access to basic drinking water source of which 22% were reported as having access to piped water connection. Although there being an increase in access to improved water source, results suggest that access to improved water sources in urban areas decreased from 92% in 1990 to 82% while in rural areas access increased from 33% to 57% in the year 2015 (WHO/UNICEF 2016). Water Aid (2008), found out that water in Kenya is not distributed equitably and priority is given to planned urban areas and wealthy rural communities that can pay for services whereas those in slums and remote villages often go without. It is estimated that Kenya could face a 31% gap between water demand and practically available water supply by 2030 (2030 WRG 2015).

To mitigate these water challenges and ensure equity in water supply, the Kenyan government over the years has made reforms and policies to better improve efficiency in

the water sector. Moraa, Otieno and Salim (2012) indicated that the legal framework on water supply influence creation of water institutions and limits the Ministry's role to policy formulation; overseeing policy implementation and resource mobilization. According to Muteithia (2003) noted that market based regulation has also displaced direct government management systems. Demand management is prioritized over dam building (Tarrasset, 2012). Spaling. Geoffrey and Njoka (2014) examined sustainability factors that are water supply, regulatory policy, and local management affecting the sustainability of a community water supply project in Kenya. The creation of the water agencies such as Water Resource Management Authority (WRMA) aimed at managing and regulating water resources, Water Services Regulatory Board (WASREB) mandated to oversee implementation of lied down policies and strategies relating to water and Sanitation Company Limited services, Water Services Boards (WSBs), aimed at developing infrastructure, and finally the water service providers (WSPs), who are utility companies that purchase water from Water Service Boards and sell to consumers. These reforms and changes are geared towards achieving the human right to clean and safe water in adequate quantities as it's founded in the Kenyan constitution 2010.

With the creation of devolved system of governance in Kenya, the water resources management and water services roles have been shared among the national government and the 47 county governments. Firstly, the water resources are bestowed in the national government; secondly, water and sanitation services are vested in the county governments while water storage and irrigation have not explicitly been identified as functions of either level. Kibugi and saltiel (2013), highlights the important role of

cooperation between county governments and the national government in order to fulfill the constitutional right to clean and safe water in adequate quantities to all citizens.

The role of counties in water provision is critical and requires scrutiny in order to meet the constitutional right to water. Embu County according to KNBS (2010), the 2009 Kenya national census shows water coverage level at 50%. The data, however, shows disparities across the four sub counties which are made up of the former Embu district and Mbeere districts. The rural improved water coverage is estimated at 46% and the urban coverage is estimated at 67%. The data showed that in Embu County urban coverage is relatively similar, while there is a remarkable difference in the rural coverage with Embu district rural coverage standing at 58% and Mbeere district at 32%. Tana water services board (2013), indicated that (54%) of rural households in Embu County use unimproved water sources of which most are found in Mbeere district (Mbeere south and Mbeere North sub-counties), where 68% of rural households rely on unimproved water sources while in Embu district about 42% of the rural households rely on unimproved water sources. According to USAID (2014), Mbeere South sub-county is the most affected in the four sub-counties in Embu County, with only 25% of residents using improved water sources, the lowest percentage in the Embu County. EWASCO (2016), however, put the water supply at 771km2 or approximately 64%, of the Company's areas of jurisdiction which include 1200 km2. There is a clear indication that equitable distribution of water supply is a major challenge in Embu County and therefore the proposed study seeks to assess the factors influencing equitable distribution of water in the county.

1.2 Statement of the Problem

Equitable water supplies to all communities in Kenya continue to remain a critical need for both donors and the government with the value for investment involved being difficult to achieve (GOK, 2016). The existence of inequitable distribution of water provision is not in doubt in Embu County. The increasing population growth and accelerating urbanization has continued to broaden the gap between the demand for water and available supply by the Embu Water and Sanitation Company Limited (EWASCO) to equitably distribute and supply water to the residents. The constitution of Kenya safeguards adequate access to clean water for all citizens as a basic human right. The reality, however, is far from the aspirations and entitlements of many Embu County residents more so the rural residents who according to 2009 Kenya national census were 83.8% of the total population. According to Tana Water Services Board (2013), 68% of rural households in Mbeere districts (Mbeere South and Mbeere North) rely on unimproved water sources while in Embu district (Manyatta and Runyenjes sub-county) about 42% of the rural households rely on unimproved water sources. It is on the basis of these inequalities observed in the water distribution and supply that this study seeks to assess factors that influence equitable distribution of water supply and offer some recommendations for action.

1.3 Purpose of the study

The purpose of this study is to assess the factors influencing equitable distribution of water supply in Embu County.

1.4 Objectives of the study

The objectives of this study were:

i. To assess how water resource infrastructure influence equitable distribution of water supply in Embu County.
ii. To establish how financial resource allocation influence equitable distribution of water supply in Embu County.
iii. To identify how government intervention influence equitable distribution of water supply in Embu County.
iv. To examine how household economic characteristics influence equitable distribution of water supply in Embu County.

1.5 Research Questions

This study sought to answer the following research questions:

i. How does water resource infrastructure influence equitable distribution of water supply in Embu County?
ii. How does financial resource allocation influence equitable distribution of water supply in Embu County?
iii. How does government intervention influence equitable distribution of water supply in Embu County?
iv. How does a household economic characteristic influence equitable distribution of water supply in Embu County?

1.6 Significance of the Study

The study would be significant to various parties. To water service providers, the findings of this study may be important in guiding them implement equitable distribution of water supply with minimal challenges and in effect reduce residents using unimproved water sources in the counties. It is hoped that the water service providers will use the findings of the study to save resources and time which are used in conducting field surveys on water supply.

The study is hoped to be of value to the scholars and researchers. The study forms a foundation in which further research can be carried out. To the scholars, the study provide valuable information as there are no prior researches conducted on factors influencing equitable distribution of water supply in Embu County.

The study is hoped to be of value to policy makers. The policy makers are hoped to gain insight and formulate policies that would enhance equitable distribution of water in the county government level. This is hoped to foster equitable distribution of water and eliminate inequality in water resource distribution in the country.

The study is hoped to be of significant to the community in Embu County. The data will make them aware of the factors influencing equitable distribution of water supply in their community and offer them a cause of action to deal with these factors. It will further build capacity in individuals, households and community not only to demand for services from providers but to know and progressively realize their right to clean water supply.

1.7 Assumptions of the Study

The basic assumption of the study was that the participants at EWASCO would be willing to participate freely and give out their honest responses. The researcher also assumes that the respondents would be cooperative, truthful and trustworthy in their responses to the questionnaire and would be available to respond on time.

1.8 Limitations of the Study

The key limitation of this study was that it depends on cooperation and honesty of the EWASCO respondents which in turn affects the return rate. To ensure cooperation,

honesty and trustworthiness, the importance of the study was explained. Due to the nature of qualitative research, the data obtained in this study could be subject to different interpretations by different readers. The researcher did not manipulate the independent variables whilst the dependent variable was controlled with the aim to establishing the effect of the independent variable on the dependent variable.

1.9 Delimitation of the Study

The sample was taken from Embu Water and Sanitation Company Limited with a permanent employee population of 103. The study was delimited with respect to method, sampling, tools, variables and techniques proposed for the study. The study was restricted to Embu County. Different researchers may have different interpretations of the same data; thus, adding research bias to the interpretations. Due to the time factor and lack of comprehensive data base, the study was not able to get responses from a wide range of respondents. The study was delimited to the following variables: Equitable Distribution of Water, Financial Resource Allocation, Government Intervention, Household Economic Characteristic and Water Resource Infrastructure.

1.10 Definitions of Significant Terms

Equitable Refers to the fair or solution that is ethically or legally just and reasonable under the circumstances, but may or may not be wholly satisfactory to any or all the involved parties.

Government Intervention This is defined as regulatory actions taken by a government in order to affect or interfere with decisions made by individuals, groups, or organizations regarding social and economic matters.

Household Income Means a measure of the combined incomes of all people sharing a particular household.

Resource Allocation Means a process and strategy involving a company deciding where scarce resources should be used in the production of goods or services.

Water Infrastructure Means systems of water supply, treatment, storage and water resource management.

Water Supply Means the provision of water by public utilities commercial organizations, community endeavours or by individuals, usually via a system of pumps and pipes.

1.11 Organization of the Study

The study was organized into five chapters; Chapter one consisted of an introduction, background to the study which provides an overview of the components of study. This included development of context by providing background information on existing research on the factors influencing equitable distribution of water supply. Statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions of the study, limitations of the study, delimitation of the study, definition of significant terms and the structure of the study.

Chapter Two, the literature review was organized in two broad categories which included an analysis of published information related to the objectives of the study on factors influencing equitable distribution of water. For the theoretical framework the following theories were reviewed; Theory of Constraint, Innovation Diffusion Theory and Resource Dependence Theory. The conceptual framework to the study was reviewed. A review of the relevant literature in each of the themes is critically analyzed to select the information which is directly related to the study.

Chapter Three, presented the steps which were followed to meet the study objectives which consisted of introduction, research design, target population from which data was collected, sample size and sampling technique, research instrument, Piloting of the research instrument, validity and reliability of the instrument. The steps were followed by data collection procedures, data analysis and presentations, ethical consideration and operationalization of variables.

Chapter Four, provided data analysis, presentation, interpretation, discussions and findings. The chapter was organized in sub-sections: first, is the instrument return response rate, the trends are explained using tables, and descriptions of data. The findings are presented as per the objectives and research questions.

Chapter Five, presented the Summary of Findings, Discussions, Conclusions and Recommendations as well as discussions of the study findings on factors influencing equitable distribution of water supply. Finance resource allocation, government intervention, water resource infrastructure and household economic characteristics were discussed.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter present review of literature related to the study guided by the research objectives. The chapter also presents the conceptual framework, theoretical framework and summary of the literature and knowledge gaps.

2.1 Equitable Distribution of Water Supply

Equity in water supply is a noteworthy facilitator towards financial improvement. As per Sustainable Development Goal 6 on Clean Water and Sanitation, Clean, available water for all is a basic part of the world we need to live in. There is adequate new water on the planet to accomplish this. However, because of awful financial matters or poor framework, consistently a huge number of individuals, the vast majority of them kids, kick the bucket from sicknesses related with deficient water supply, sanitation and cleanliness. Water shortage, poor water quality and lacking sanitation contrarily affect sustenance security, job decisions and instructive open doors for poor families over the world. Dry season burdens a portion of the world's poorest nations, declining appetite and ailing health. As per World Bank (2017), this objective mirrors the developing significance of water as a human right and absence of access to enhanced water supply force enormous expenses on society. Facts and Figures by the UN indicates that; 2.6 billion people have gained access to improved drinking water sources since 1990, but 663 million people are still without; At least 1.8 billion people globally use a source of

drinking water that is fecally contaminated; Over 1.7 billion people are currently living in river basins where water use exceeds recharge; 2.4 billion people lack access to basic sanitation services, such as toilets or latrines; More than 80 per cent of wastewater resulting from human activities is discharged into rivers or sea without any pollution removal; Each day, nearly 1,000 children die due to preventable water and sanitation-related diarrheal diseases and floods and other water-related disasters account for 70 per cent of all deaths related to natural disasters. World water development report (2016), demonstrates that water is related to several other SDGs, including Goal 8, which addresses the promotion of full and productive employment and decent work for all and the development of sustained, inclusive sustainable economic growth. Sustainable Development Goals on Water proposes a broader agenda by 2030 to; achieve universal and equitable access to safe and affordable drinking water for all; achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations; improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally; substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity; implement integrated water resources management at all levels, including through transboundary cooperation as appropriate; protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes; expand international cooperation and capacity-building support to developing

countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies and Support and strengthen the participation of local communities in improving water and sanitation management.

UNDP (2017) Access to safe water and sound management of freshwater ecosystems are essential to human health, environmental sustainability and economic prosperity. The benefits of equitable water supply improve access to improved drinking water and improving water management to reduce risks of water-borne infectious diseases (Tertiary, 2012). Hunter, MacDonald and carter (2010) observed that water supply is essential for good health and that safe reliable water, affordable and easily accessible water is key to this achievement. Improvements in various ways of water supply provide an opportunity to improve public health

Equitable distribution of clean water and water management creates tremendous opportunity for the poor and is a progressive strategy for economic growth. Opare (2011), equitable distribution of water is core and critical for socio-economic development, healthy ecosystems and for human survival itself. HSBC (2012), Uncertain water availability is a challenge for many countries, which can impact economic growth. Moreso Lundquist and Gleick, (1997), found that Lack of water is a barrier to sustainable socio-economic development. Water has a crucial role in all dimensions of sustainable development which are connected to various key global problems, and all human and economic activities (UNESCO 2012). Kenya has not been left behind in the water supply initiative and aims to achieve universal access by 2030. The benefits of equitable water

supply have shown to outweigh the costs. The study aims to assess factors that influence equitable distribution of water supply more so in Embu County.

2.2 Water Resource Infrastructure and Equitable Distribution of Water Supply

The daily supply of water in developing countries is very low compared to the industrial world. (Kirkpatrick, Parker, & Zhang, 2006). Despite higher economic growth, the equitable access of drinking water to population is a major challenge in developing countries such as Kenya (Jimenez & Perez-Foguet, 2011). On a study on Sustainability factors affecting local infrastructure project by Fedderke (2006), he found that infrastructure projects play a major role in community development and that they significantly contribute to sustainable development and economic growth. Lee and Chan (2008) highlight the need for holistic management of the infrastructure projects in order to meet project requirements and participants' satisfaction.

Water infrastructure in developing countries such as Kenya is outdated and largely dilapidated as majority of it was constructed during the colonial time and that the functionality for the rural water systems is an issue due to poor management and lack of technical know-how (Bonaya 2017). This view is supported by Moore and Finch (2004) who opined that most of the key authorities of local government are incompetent, lack technical ability and have poor management skills which sometimes lead to poor water supply. Bonaya (2017), also highlights other infrastructural issues affecting water supply in Kenya such as adoption of the use of innovative technologies including remotely read meters, e-billing and e-payment platforms, customer interface programs, hydraulic water

system monitoring and pump system monitoring software which if adopted would reduce utility inefficiencies and reduce the levels of non-revenue water.

Failures in drinking water supply infrastructure result in water disruptions, impediments to emergency response, and damage to other types of infrastructure (ASCE 2009). In extreme situations, water shortages, whether caused by failing infrastructure or by drought, may result in unsanitary conditions, leading to public health concerns. Broken water mains can damage roadways and structures and hinder fire-control efforts. According to Kiprono (2013), he investigated the factors influencing water service provision in Garissa Central District Kenya. The purpose of his study was to carefully investigate the underlying factors that influence water service provision in Garissa Central District using descriptive analysis. Cluster sampling technique was adopted to select respondent from the population. The findings revealed that water sourcing, water service providers, inadequate infrastructure affected water provision in Garissa Central Sub County.

Natural infrastructure solutions are also key in the effective planning and implementation roles in order to effectively address the myriad challenges in water supply (Dini, 2013). EPA (2014), highlights the need for long term natural infrastructure solutions that utilize water-related ecosystem services in strengthening the performance of built infrastructure to provide a wide array of benefits. Cashman and Ashley (2008), globally the sustainable provision and financing of water distribution infrastructure continue to present a major challenge. This is attributable to rapid urbanization and increasing population across developing countries, Rouse (2014), attributes it to the scarcity of water supply. (Perard,

2012) attributes it to the increased demand for investment in water services. This study aims to investigate how water resource infrastructure influence equitable distribution of water in Embu County.

2.3 Financial Resource Allocation and Equitable Distribution of Water Supply

Financial resources allocation that contribute to sustainability of a water supply system include efficient revenue collection, the ability to meet the cost of operation and maintenance and the willingness to pay for the services. Globally, the sustainable provision and funding of water sector infrastructure will continue to present a major challenge (Cashman & Ashley, 2008). This is attributable to rapid urbanization and increasing population across developing countries Rouse (2014), the scarcity of water supply (Perard, 2012; KPMG, 2011) and the increased demand for investment in water services (Foster and Briceño-Garmendia, 2010; OECD, 2012). Public–private partnerships (PPPs) are viewed as a reform tool for resolving inefficiency and absence of dynamism in water supply delivery in developing countries (Ameyaw and Chan 2014).

According to World Bank (2007) evaluation report, sustainability of water supply projects can only be ensured if tariffs generate enough resources to operate the system and replace the infrastructure after its useful life. Nanjowe (2016) assessed factors influencing sustainability of piped water supply systems in Likuyani Sub County, Kakamega County. His study sought to examine how management approaches, community participation, finances and technology influenced sustainability of community piped rural water supply projects. The study found that inadequate sensitization and mobilization of the community before the project implementation,

inadequate community and poor adoption of technologies as well as adequate funding affected sustainability of the piped water supply schemes.

Aid environment (2016) indicated that the Water Service Providers in Kenya face several investment needs including abstracting water from sources, replacing aging water pipeline network, reducing non-revenue water losses, expanding current networks to meet the growing need for water in cities, reaching the un-served and under-served consumers, introducing cost efficient technologies especially on energy savings . The Water Service Regulatory Board (WASREB) emphasizes the need to bridge the gap by attracting private sector funding and improving the self-financing capacities of Water Service Providers (WSPs). According to Kleemeier (2010) water service providers through the approval of the county governments are allowed to attract commercial funding for commercially viable investment on water services through the Public Private Partnership (PPP) policy that allows private sector involvement. As reviewed water services funding poses a major threat to equitable distribution in many developing countries like Kenya.

Asset management of the water systems is crucial to ensure functionality of the improved water source. As it has been noted the lack of government financing on water supply due to deficit budget causes non-functionality of some of this improved water sources. However, PPP has come as an alternative to bridge the gap. Li *et al*. (2005) Public–private partnership (PPP) has attracted the attention of governments across the world as a preferred means to procure public infrastructure assets and services. In the water sector of developing countries, PPP is on one hand due to governments not having sufficient

financial resources to undertake the large-scale investments that are required for water supply projects (Kayaga, 2008).

European Union evaluation report (2012), states that out of 23 water supply and sanitation projects reviewed in Sub-Saharan Africa, fewer than half of the project results met the needs of the beneficiaries. The study found that if the equipment were generally installed as planned. Their results and benefits did not continue to flow in the medium and long term unless non-tariff revenue is ensured or because of institutional ineffectiveness to regulate, monitor, collect service fees, manage procurement processes, and collect and disseminate information, or deficiencies in the capacities of operators to run the installed equipment (Siwi (2005). This study examines how the financial resource allocation influences equitable distribution of water supply in Embu County.

2.4 Government Intervention and Equitable Distribution of Water Supply

Water is no longer perceived to be universally abundant, areas of water scarcity have disappeared and regional cross-subsidies have dwindled. This has motivated the government involvement in supply of water to its population. The implementation of the water reforms have been carried out in various sub-sectors in an effort to achieve equitable distribution of water. The study by Mommen and Nekesa (2010) adopted descriptive research survey design and used questionnaires in data collection. The results revealed that lack of community support; inadequate regulatory framework and inadequate external support hinder sustainability of water supply project in Kenya.

According to Owuor (2013), the Government's long-term objective is to ensure all Kenyans have access to clean potable water, and that water is available for key economic activities. In addition, it recognizes that for the country to meet its poverty-eradication strategies water has to be made available, accessible and affordable especially to the poor. Asingwire, Muhangi, and Odolon (2005) examined factors influencing equitable distribution of water supply and sanitation services in Uganda. The objective of the study was to determine factors influencing equitable distribution of water supply and sanitation services. The study revealed that natural occurrence of water, hydro-geological factors availability of funds, technology adoption for water service delivery, political factors, and actual allocation of water points influence equitable distribution of water in Uganda. Further Sanjay (2009) assessed factors that affected equitable distribution of drinking water supply in municipal corporations in Thane District in India. The finding revealed that growth of the population, increase in industries, health, educational institutions, commercial units, policies of rainwater harvesting, reducing leakages and wastage, more provision of funds for water supply projects, revision of tariff structure and private sector participation in distribution of drinking water supply affected equitable distribution of water to meet the demand of water supply. The current study sought to determine factors influencing equitable water distribution in Embu County, Kenya.

2.5 Household Economic Characteristic and Equitable Distribution of Water Supply

Households having access to piped water in their homes for domestic use has increased over the years. Rahut, Behera and Ali (2015), in their study on household access to water and choice of treatment method found that household income is a strong determinant of

the choice of safe and secure water access. According to argument by Kalbermatten (2009) sources of revenue ensure service even to the absolute poor and ensure facility maintenance and expansion. As a part of the push to promote private participation in the water sector in Africa and other developing regions, cost recovery became an increasingly common practice. Mommen and Nekesa, (2010) argue that most users of rural water supplies are relatively poor and not able to pay for water service without external support. External support available to communities can be from NGOs, national and local government institutions, as well as the private sector (Carter, 2009). In recognizing that communities cannot autonomously manage services, Gine & Perez-Foguet (2008) call for appropriate institutional support where governments don't neglect their responsibilities to train technicians, encourage and motivate communities, as well as monitor service performance.

Inequities in access to and use of drinking water services in Latin America and the Caribbean found that access to drinking water as well as total and per capita household expenditures on drinking water show an association with household income, economic conditions and the location (Soares, Griesinger Dachs, Bittner and Tavares, 2002). Access of the rural population to drinking water services is much more restricted than that of the urban population for groups having similar income while the proportion of families having a household water supply system is comparable in the higher-income rural population and the lower-income urban population.

Rahut *et. al* (2015) found that the pattern of distribution of water sources and access to them across income groups shows that wealthier households in both rural and urban areas

have access to safer water sources than the poorer rural and urban households. Totouom and Fondo (2012) in their study found that as households become better-off in terms of income, they are much more likely to choose improved quality water. These findings are confirmed by those of Fotue (2013) which found that a households' wealth index has a statistically significant role in demand for drinking water quality in that, households' that are wealthier are more likely to consume safe and reliable water. Koskei *et al.* (2013) established that the occupation of the household head significantly influenced the type of water source used by the household. Their study reviewed that the household expenditure is the fundamental factor which compels households to rely on unimproved sources hence the conclusion that authorities should grant special attention to poorer households when implementing strategies for population access to safe and reliable water.

Mahama (2013), in a study to establish factors which influenced householders access to improved water and sanitation facilities in five selected low-income communities in Accra found out that income statistically influenced the likelihood of access and use of improved drinking water. Yang, Bartram, Gundry, Pedley, and Wright (2013) in their study water safety and inequality in access to drinking-water between rich and poor households found majority of poor households access non-piped improved sources, which may provide unsafe water, resulting in greater inequality of access to safe water compared to improved water sources. Nastiti, Sudradjat, Geerling, Smits, Roosmini and Muntalif (2017), found that higher-income households are more likely to use piped water, bottled water, or combinations thereof and have higher water expenditures than their lower-income counterparts. WWDR (2015) highlights that Weak governance, low

incomes and costs of services as factors that make it harder for poor people to acquire sustainable access to improved water source and that even in situations where investments are made, and sustainability remains a serious challenge. This study aims to investigate how household economic characteristics influences equitable distribution of water supply in Embu county.

2.6 Theoretical Framework

The theoretical background used in this study is based on the theory of constraints, diffusion of innovation theory and resource dependence theory.

2.6.1 Theory of constraints

The theory of constraints (TOC) by Goldratt (1984) informs organizations in achieving their goals. It is a management theory that views any manageable system as being constrained in achieving more of its goals by a very small number of limitations. According to TOC, there is always at least one limitation and that processes or organizations are vulnerable because the weakest person or part can always damage or break them or at least adversely affect a process or an organization from achieving its goal. The underlying assumptions of constraint theory are that organizations can be measured and controlled by three variations: inventory, operational expense and throughput. According to the theory, inventory is defined as all the money that the organization has invested in purchasing things which are intended to be sold. The operational expense is defined as all the money spent in the conversion of inventory into

throughput and throughput is defined as the rate at which the organization generates revenue through sales.

According to goldratt, process in addressing the internal constraint which may include identifying the system's constraints, deciding how to exploit the system's constraints, subordinating everything else to the above decisions, Elevation of the system's constraints and monitoring of the process to potentially remove the constraint. This theory is relevant to this study in that the reviewed literature has shown that access to improved water sources still faces many constraints in order to ensure universal access to all. This study addresses factors that influence equitable distribution of water supply in Embu County which only has 50% access level to improved water source. With the Constitutional mandate for water as a human right the constraints that hinder equitable distribution and supply of water need to be addressed. Kenya failed to achieve millennium development goal target of attaining water services in urban areas of 80% in 2015 and according to sustainable development goals 2030 on water the government of Kenya aim is to ensure universal access to water and sanitation services in the whole country, whereas according to WASREB (2016), Water coverage in Kenya stands at 55% in urban and urbanizing which is a clear indication that universal access has been constrained. According to the theory of constraint any manageable system is limited in achieving more of its goals by a very small number of constraints which are either internal or external to the system. The failure to achieve MDG goal 2015 on water and the low coverage levels in Embu County is a clear indication that the theory of constraint can be applied in the Kenyan context to explain the constraints in the water distribution

and supply. This study, therefore, wants to address the internal and external factors or constraints to the equitable distribution of water supply.

2.6.2 Diffusion of Innovation Theory

Diffusion of Innovation (DOI) Theory developed by Rogers (1962), explains the concept that an innovation over time gains momentum in its adoption and diffuses through a specific group and the population adopts that new idea, behavior or the new product. This results to an individual doing something different due to the adoption of the innovation. According to Rogers for an innovation to be deemed to have been adopted, the individual must perceive the idea, behavior, or product as new. According to Rogers, adoption of an innovation does not happen simultaneously in a social system. He highlights that in some social systems people are more reluctant to adopt the innovation than others. The theory identifies different strategies for promoting innovation called the adopter categories which include; Innovators who are the first to try the innovation, Innovators who are willing to take risks and are often the first to develop the new innovation or idea.

This theory is relevant to the study in that Water management and development projects have seen some emerging innovations relative to financing and infrastructural development to enable effectiveness and sustainability. In many developed countries equity in water distribution and supply is evident while in many developing countries equity in water distribution and supply is a major challenge. The literature reviewed has highlighted the need to adopt emerging innovations to mention a few the need for the use

of innovative ways such as Public private partnership to bridge the financing gap and use of innovative technologies including remotely read meters, e-billing and e-payment platforms, customer interface programs, hydraulic water system monitoring and pump system monitoring software which if adopted would reduce utility inefficiencies and reduce the levels of Non-Revenue Water. These innovative ways of bridging the gap in the water supply are left to the utility companies to adopt and improve efficiency by adopting different strategies used to appeal to the different adopter categories.

2.6.3 Resource Dependence Theory (RDT)

Resource Dependence Theory (RDT) by Jeffrey Pfeffer and Gerald R. Salancik (1970) is concerned with how organizational behavior is affected by external resources. The theory highlights that organizations depend on many resources such as labor, capital, raw material (Akhtar, Akmal, Shah, Niazi, & Tahir, 2013). The theory is important because an organization's ability to gather, alter and exploit resources faster than competitors can be fundamental to success. Resource Dependency Theory is underpinned by the idea that resources are important to organizational success and that access and control over resources is a basis of power. According to Resource Dependency Theory strategies must be carefully considered in order to maintain open access to resources (Kongmanila & Takahashi, 2009). The theory has implications regarding the organizational structure which include recruitment of employees and board members, production strategies, external organizational links, contract structure and many other aspects of organizational strategy (Tertiary, 2012). According to this theory of resource dependence organization should move through the principle of criticality and principle of scarcity. Critical

resources are those the organization must have to run its day to day operations. For example, a firm cannot expand without finances or without necessary infrastructure.

Resource dependency theory focuses on the external organizational resources that provide, distribute, finance, and compete with an organization. Firms depend on their customers to whom they sell products and services to making these customers the ultimate resource on which companies depend (Kleemeier & Narkevic, 2010). Resource Dependency Theory is one of the many theories of organizational studies that characterize organizational behavior, and not organizations performance. This theory is relevant to the study in that water distribution and supply are assigned to organizations that depend on external resources to alter and exploit them for the organization's success. The organizations such as water service providers are expected to formulate strategies that result to the firm having open access to resources in order to overcome dependencies and improve an organizational autonomy and legitimacy.

2.7 Conceptual Framework

The study was guided by a conceptual framework where Water Resource Infrastructure, Financial Resource Allocation, Government Intervention and Household Characteristics are independent variable while Equitable Distribution of Water Supply is the dependent variable.

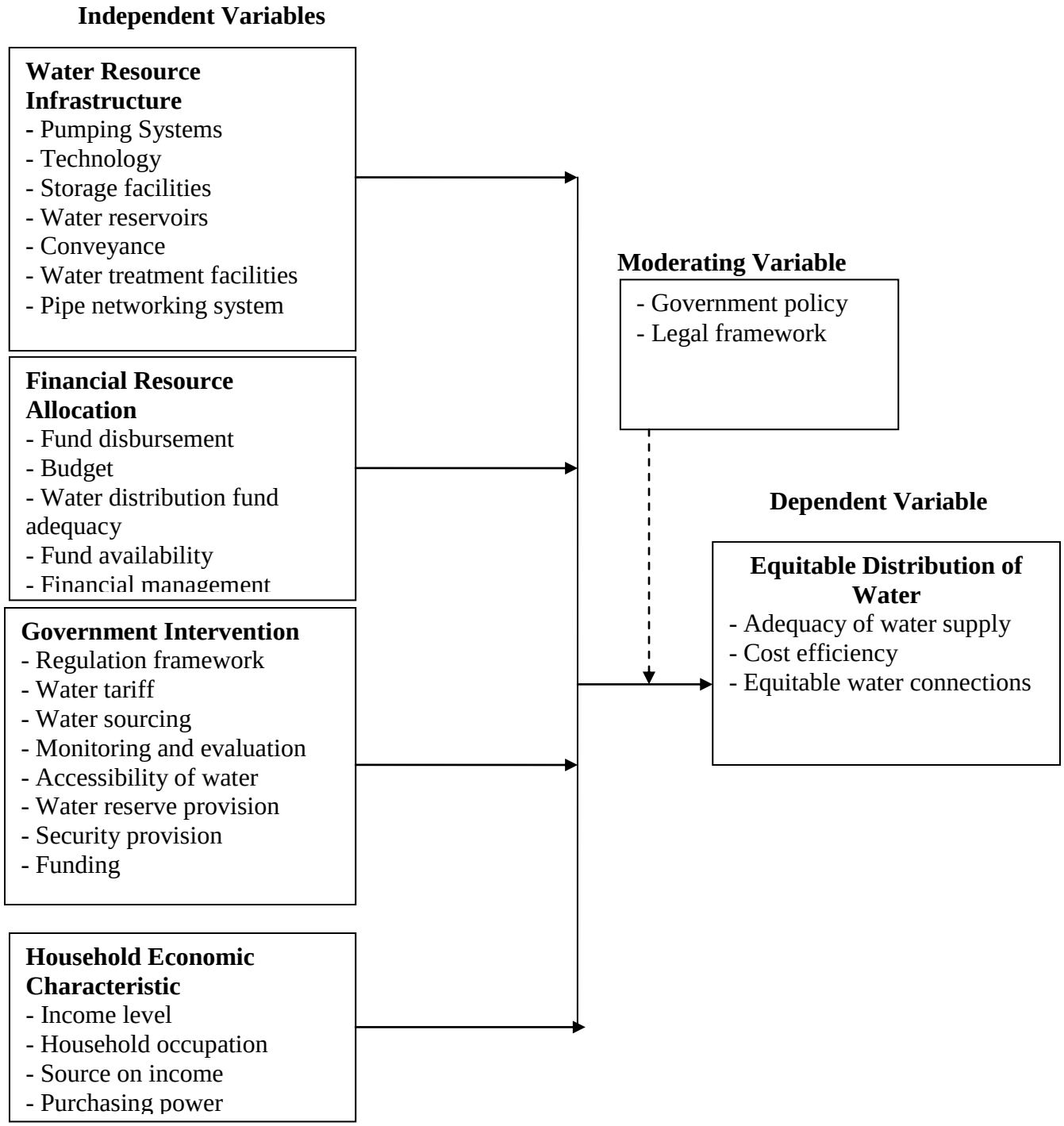

Figure 1: Conceptual Framework that illustrates variable relationships

2.8 Explanation of relationships of variables in the Conceptual Framework

Government intervention has been operationalized as government policies and guidelines on water. There are different policies, strategies and guidelines developed for the different sub-sectors, which potentially have implications on equitable distribution of water services. With the role of government being to oversee the implementation of the policies and resource mobilization such as financial resources, both county government and national government play a critical role in water supply since they are the mandated bodies to ensure universal access to all citizens. The government mobilizes financial resource from either internal sources or external sources and these financial resources are expected to be invested in water infrastructural development. Financial resource allocation has been operationalized as financial budgeting and the financial planning the literature reviewed clearly indicates deficit in funding of water projects from government. Funds are required for investment in infrastructure operations and maintenance. Therefore if there is a deficit in funding this would result negatively leading to ineffective infrastructure that barely meets equity in water distribution and supply. Water infrastructure has been operationalized as water supply system, water treatment, storage and water resource management. The literature reviewed has shown that the state of water infrastructure influences distribution and supply of water affecting equity in supply according to Bonaya (2017), Water infrastructure in Kenya remains outdated and largely dilapidated.

2.9 Gaps in Literature Reviewed

The foregoing review of literature indicates that equitable distribution of water remains a great challenge especially in developing countries such as Kenya. Studies such as Sanjay (2009) revealed that growth of the population, increase in industries, health and educational institutions, commercial units, policies of rainwater harvesting, reducing leakages and wastage, more provision of funds for water supply projects, revision of tariff structure and stakeholder participation hinder equitable distribution of water Thane, India. In Uganda, Asingwire, Muhangi, and Odolon, (2005) established that existing policy prescriptions, natural occurrence of water, hydro-geological factors and availability of funds, technology adoption for water service delivery, political factors, and actual allocation of water points influence equitable distribution of water.

Previous local studies such as Kiprono (2013) focus on water provision and sustainability of water supply in Kenya. Kiprono (2013) revealed that water sourcing, water service providers, inadequate infrastructure affected water provision in Garissa Central Sub County while Nanjowe (2016) revealed that inadequate sensitization and mobilization of the community before the project implementation , inadequate community and poor adoption of technologies as well as adequate funding affected sustainability of the piped water supply schemes. Despite inequality in water distribution problems existing in various counties in Kenya, factors that influence equitable distribution of water remain unexplored. This study sought to determine factors influencing equitable distribution of water supply in Embu County.

2.10 Summary of Literature Review

A summary of the literature review showing research findings of various studies and gaps in knowledge is presented in Table 2.1

Table 2.1 Summary of the Literature Review on Empirical Studies: Findings and Gaps

Researchers	Focus	Findings	Comments and gaps
Asingwire, Muhangi, and Odolon (2005)	Examining factors influencing equitable distribution of water supply and sanitation services in Uganda	Existing policy prescriptions, natural occurrence of water, hydro-geological factors and availability of funds, technology adoption for water service delivery, political factors and actual allocation of water points influence equitable distribution of water in Uganda of equity	The study was done in Uganda while the current study focus on Kenya focusing on Embu County
Spaling. Geoffrey and Njoka (2014)	To examine sustainability factors that are water supply, regulatory policy, local management affecting the sustainability of a community water supply project in Kenya	The results revealed that lack of community support; inadequate regulatory framework and inadequate external support hinder sustainability of water supply	The study focused on factors affecting sustainability of water supply and failed to identify factors that affect equitable distribution of water in Embu County

Sanjay (2009)	Examine factors that affected equitable distribution of drinking water supply in municipal corporations in Thane District in India	The finding revealed that growth of the population, increase in industries, health and educational institutions, commercial units, policies of rainwater harvesting, reducing leakages and wastage, more provision of funds for water supply projects, revision of tariff structure and stakeholder participation	The study focus on examining of equitable distribution of water in Thane in India. Its failed to focus on Kenya case and especially on factor affecting equitable water distribution in Embu County , Kenya
Kiprono (2013)	Examined the factors influencing water service provision in Garissa Central District - Kenya	The findings revealed that water sourcing, water service providers, inadequate infrastructure affected water provision in Garissa Central Sub County	The study focus on factors affecting water provision and failed to identify factors that affect equitable distribution of water
Muteithia (2012)	Focused on investigation of the factors that affect the provision of water by Nanyuki Water and Sewerage Company (NAWASCO)	study found that the loss of water through conveyance and storage affected, illegal connection, efficiency in revenue collection	The study focused on water provision while the current study focus on factors affecting equitable water distribution in Embu County

Nanjowe, W. F (2016)	Focused on assessing factors influencing sustainability of Piped water supply systems in Likuyani Sub County, Kakamega County	The study found that inadequate sensitization and mobilization of the community before the project implementation, inadequate community and poor adoption of technologies as well as inadequate funding affected sustainability of the piped water supply schemes	The study failed to identify factors that influence equitable distribution of water and more specifically in Embu County

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives a detailed outline of how the study was carried out. It describes the research design, the target population, and the sample size, sampling procedure, research instruments, data collection procedure and data analysis procedure.

3.2 Research Design

The study employed a descriptive survey design. This design is used to answer questions that have been raised, solve problems that have been posed or observed, assess needs, set goals, determine whether or not specific objectives have been met, to analyze trends across time and generally to describe what exists, in what amount, and in what context (Stevenson & St-Onge, 2005). The approach is considered appropriate because the study involved fact finding and inquiries to assess the factors influencing equitable distribution of water supply in Embu County. A set of questions to assess the opinions of respondents about each variable of the study was used. The research design helped in collection of quantitative data that helped in answering the research questions on what factors influence equitable distribution of water supply in Embu County.

3.3 Target Population

The target population of the study was 103 permanent employees in 2018 in the Departments of finance and commercial services, technical and administration in Embu water and Sanitation Company Limited. All the respondents covering the entire population were contacted. The respondents were considered on a random list of employees for inclusion in the sample. The departments were essential for the research because it consists of employees with considerable experience in factors influencing equitable distribution of water supply in Embu County. The employees per department in the year 2018 are indicated in Table 3.1

Table 3. 1: Target Population

Department	**Number of Employees**
Finance and Commercial Services	35
Technical	60
Administration	8
TOTAL	103

EWASCO (2018)

3.4 Sample Size and Sampling Technique

A sample size based on the target population was calculated using the methods provided by Cooper and Emory (1995) and Sekaran (2006) as indicated.

Sample size,

$$n = \frac{N}{1 + (N (e) 2)}$$

Where;

n =sample size

N= Target population

e = acceptable margin of error at 5% (STD value of 0.05)

n = 103/ 1+(103*0.00025) = 81.91

Therefore to calculate sample size for population per strata the following formula was used:

Sample size per strata;

nh = (Nh/N*) n

Where:

nh= Sample of the stratum

Nh= Population of the stratum

n = Total Sample size (82)

N= Total Population (103)

The analysis presented in Table 3.2 shows Sample size estimates for the number of employees in each department.

The sample size for each department was calculated based on its respective employee numbers taking into account the margin of error of five percent.

3.5 Research Instruments

The study used structured questionnaires for data collection from the 82 respondents of EWASCO. A structured questionnaire has questions that are accompanied by a list of all possible alternatives from which respondents select the answer that best describes their situation. The questionnaire is appropriate for this study because it is time-saving in addition to ensuring uniformity in the way questions are asked, Brink (2009).

3.5.1 Piloting of Research Instruments

In order to reduce the shortcoming and to ensure the effectiveness of the questionnaire, a pre-test was conducted on a different sample of similar characteristics to the actual sample. According to Baker (1994) a sample size of 10-20% of the sample size for actual study is a reasonable number of participants to consider in a pilot study. Thabane, Ma, Chu, Cheng, Ismaila, Rios, Robson, Giangregorio and Goldsmith (2010) are of the opinion that sample size calculations may not be required for some pilot studies however it is important that the sample for a pilot be representative of the target study population. This enhances reliability and validity of the collected instruments. A sample of 11 employees used for pilot testing was not considered in the final study.

3.5.2 Validity of the Instrument

Validity is the extent to which a tool measures the items for which it is intended to. This term has different connotations for various types of tools and thus, a different type of validity evidence is appropriate for each. For validating the present tool, face and content validities was ensured which involved pre-testing the sample of permanent employees from a different population with similar characteristics as the target population. The employees in the pilot test were included in the final research. Piloting was carried out in order to identify items that were ambiguous. The items were modified appropriately in order to capture the required data, some items were restructured back.

3.5.3 Reliability of the Instruments

Reliability is the consistency and dependability of a research instrument to measure a variable (Brink, 2009). In this study, the reliability of the research instrument was ensured by pre-testing the questionnaire with a selected sample during the piloting. In order to test the reliability of the instruments, internal consistency techniques was applied using Cronbach's Alpha. The alpha value ranges between 0 and 0.9 with reliability increasing with the increase in value. The coefficient of 0.6 - 0.7 is a commonly accepted rule of thumb that indicates acceptable reliability and 0.8 or higher indicates good reliability. A high value of alpha (> 0.90) may suggest redundancies and show that the test length should be shortened (Tavakol & Dennick, 2011).

3.6 Data Collection Procedures

The researcher visited EWASCO headquarters in Embu County where the data was collected on factors influencing equitable distribution of water. A rapport was created prior to the collection of the data. The data was collected using a self-administered questionnaire with a checklist. Each item on the questionnaire was developed to address the specific objective of the study. The items on the questionnaire were structured and unstructured. The researcher was present to clarify any unclear questions to the respondents.

3.7 Data Analysis and Presentation

After collecting data, the researcher organized it according to its type as used in the study ensuring that the raw data was edited to free them from inconsistencies and incompleteness. This involved the scrutiny of the completed questionnaires in order to detect and reduce as much as possible, errors, incompleteness, misclassification and gaps in the information obtained from the respondents. The data was coded before running the analysis using Statistical Package for the Social Sciences (SPSS) analysis. Techniques such as means, standard deviations and inferential statistics, regression and correlation was used to determine whether there existed a relationship between factors and equitable distribution of water in Embu County.

3.8 Ethical Considerations

In this study, ethical consideration was made by identification of the researcher to the respondents, giving reasons why the research was being carried out and the consequences of the respondents' participation in the study. The respondents were informed that the research was purely for academic purposes. A copy of the authorization letter from the University of Nairobi was used for student identification while gathering data from the sampled individuals at EWASCO. They were assured that the information obtained would be confidential, and they were required to provide information truthfully and honestly. In addition, permission to undertake the study was sought from the administration of EWASCO.

3.9 Operational definition of the variables

Table 3.2 present the operationalization of the variables. This is done by presenting the research objectives, the research variables, indicators, measurements, the instruments of data collection and data analysis techniques.

Table 3. 2: Operationalization of Variables

Objectives	**Variables**	**Indicators**	**Measurement**	**Scale**	**Type of Analysis**
To assess how Water Resource Infrastructure influence equitable distribution of water supply in Embu County	Water Resource Infrastructure	-Pipe availability -Storage facilities -Water reservoirs - Conveyance -Water treatment facilities -Pipe networking system	Extent to which Water Resource Infrastructure influence equitable distribution of water supply in Embu County	Ordinal	Descriptive
To establish how Financial Resource Allocation influence equitable distribution of water supply in Embu County	Financial Resource Allocation	-Fund disbursement -Water distribution Adequacy -Fund availability -Financial management	How does Financial Resource Allocation influence equitable distribution of water supply in Embu County	Ordinal	Descriptive

To identify how Government Intervention influence equitable distribution of water supply in Embu County	Government Intervention	-Regulation framework - Water tariff -Water sourcing -Monitoring and Evaluation -Accessibility of water -Water reserve Provision -Security provision	How does Government Intervention influence equitable distribution of water supply in Embu County	Ordinal	Descriptive
To examine how Household Economic Characteristics influence equitable distribution of water supply in Embu County	Household Economic Characteristic	- Income level -Household occupation -Source on Income -Purchasing power -Economic activities	How does a Household Economic Characteristic influence equitable distribution of water supply in Embu County	Ordinal	Descriptive
The purpose of the study will be to assess the factors influencing equitable distribution of water supply in Embu County	Equitable Distribution of Water Supply	- Adequacy of water supply -Cost Efficiency -Equitable water connections	Level of Project success/ equitable distribution of water supply in Embu County	Ordinal	Descriptive

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRATATION OF FINDINGS

4.1 Introduction

This chapter is a presentation of the data analysis, presentation, interpretation of findings and discussion. The first section looks at the demographic information and the other sections the results are presented according to the research objective. The data has been presented in tables. The responses were analyzed using descriptive statistics. Inferential statistics have been employed specifically using regression and ANOVA to establish the significance /fitness of the model and also to establish the link between the factors influencing equitable distribution of water supply in Embu County.

4.1.1 Questionnaire Response Rate

The response rate for the questionnaire was worked out and results were as displayed in the Table 4.1

Table 4. 1: Questionnaire Response Rate

Questionnaires	No. of respondents
Issued	82
Returned	76
Not returned	6

A total of 82 questionnaires were sent to the respondents out of which 76 were successfully returned. This study shows that the response rate was 93% from the total questionnaires sent to respondents. According to Mugenda and Mugenda (2003) assert

that a response rate of 50% is considered adequate for a descriptive study. Babbie (2004) collaborates with this assertion that a response rates of 50% and above is considered acceptable for an analysis. This means that the response rate of 93% is adequate for analysis.

4.2 Demographic Characteristics of the Respondents

This section displays the analysis of the respondents' demographic information. During the data collection, the demographic characteristics considered during the study were period of time working in EWASCO, age, education and period of time they had been working in water department.

4.2.1 Respondents Period of Time Working in EWASCO

Respondents were requested to indicate the period of time in which they had been working in EWASCO and results were displayed in the Table 4.2

Table 4. 2: Respondents period of time working in EWASCO

Questionnaires	No. of respondents
0 -1 Years	2
1- 5 Years	47
Over 5 Years	27
Total	76

Findings revealed that, 62% of the respondents had been working at EWASCO for 1-5 years, 35% of the respondents said over 5 years while 3% of the respondents had been working at EWASCO for 0 -1 year. This study indicated that majority of the respondents had worked at EWASCO for more than one year and this shows that the respondents had

the knowledge of the subject matter and would contribute relevant information to the study.

4.2.2 Age of The Respondents

The respondents were required to indicate their age and the results were as follows in Table 4.3

Table 4. 3: Age of the Respondents

Questionnaires	No. of respondents
30 - 40	27
40 - 50	22
20 - 30	14
Over 50	13
Total	76

From the findings majority 35% of the respondents indicated that they were aged 30 – 40 years, 30% of the respondents were aged from 40 to 50 years, 18% of the respondents were aged from 20 to 30 years while 17% of the respondents indicated that they have 50 years and above. The findings show that the respondents were of age and mature enough to give information required by the study.

4.2.3 Highest Education Level

The respondents were required to give their education attainment and the results were as shown in Table 4.4.

Table 4. 4: Highest Education Level

Questionnaires	No. of respondents
Secondary Education	5
Diploma/professional certificate	38
Under-graduate degree	29
Post-graduate degree	4
Total	76

Majority of the respondents at 51% had obtained diploma/professional certificate level of education. 38% of the respondents had under-graduate degree, 6% of the respondents showed had secondary education while 5% of the respondents indicated that they had post graduate degree. The findings showed that the respondents possess the necessary qualification to give information required by the study.

4.2.4 Respondents Period of Time Working in the Water Department

Respondents were requested to indicate the period of time in which they have been working in water department and results were as displayed in Table 4.5

Table 4. 5: Respondents period of time working in the water department

Questionnaires	No. of respondents
1 - 2 Years	19
3 - 4 Years	25
5 - 6 Years	21
More than 6 Years	11
Total	76

33% of the respondents indicated that they had worked in the water department for 3 to 4 years, 27% of the respondents indicated 5 to 6 years. 25% of the respondents indicated

that they had worked in the water department for 1 to 2 years while 15% of the respondents said more than 6 years. This implies that respondents had the knowledge of the subject matter as they had worked for more than one year in the water department and therefore would offer required information to the study.

4.3 Water Resource Infrastructure influence on Equitable Distribution of Water

On a five likert scale of 1-5, respondents' responses were interpreted on the extent to which water resource infrastructure influence equitable distribution of water. The results are presented in the Table 4.6

Table 4. 6: Water Resource Infrastructure and Equitable Distribution of Water

Statement on Water Resource Infrastructure	Mean	Std dev
There is adequate water storage facility in the county	3.45	0.57
There is well lain pipe network system across the county	2.54	0.63
The pipe connection system is well distributed in all regions	3.41	0.54
The capacity of the pumping system(s) and distribution system is adequate	3.61	0.52
The capacity of the water treatment system is appropriate to meet water demands through the next 5 years	3.56	0.68
The water system has a master meter upon entry to the distribution system	2.17	0.31
There is sufficient water treatment facilities in the county	3.46	0.44
There adequate conveyance in the county	2.44	0.73
The water system performs water audit regularly	2.50	0.53
The water system has a leak detection program in place	3.17	0.68
There is implementation of technology in water distribution	2.76	0.74

Respondents indicated that capacity of the pumping system(s) and distribution system is adequate to a great extent as indicated by a mean of 3.61 with a standard deviation of

0.52. That the capacity of the water treatment system is appropriate to meet water demands through the next 5 years to a great extent as indicated by a mean of 3.56 with a standard deviation of 0.68. Respondents also indicated that there are sufficient water treatment facilities in the county to a moderate extent as indicated by a mean 3.46 with a standard deviation of 0.44. They indicated that there is adequate storage facility and that the pipe connection system is well distributed to a moderate extent as indicated by a mean of 3.45 and 3.41 and a standard deviation of 0.57 and 0.54 respectively. The findings were consistent with those of Nanjowe (2016) that piped water supply systems, poor adoption of technologies as well as funding affected sustainability of the piped water supply schemes in Likuyani Sub County, Kakamega County.

The results indicated that the water system has a leak detection program in place to a moderate extent as indicated by a mean of 3.17 with a standard deviation of 0.68 and that there exist implementation of technology in water distribution and that there is well lain pipe network system across the county to a moderate extent as indicated by a mean of 2.76 and 2.54 with a standard deviation of 0.74 and 0.63 respectively. The findings also indicated that the water system performs water audit regularly to a moderate extent as indicated by a mean of 2.50 with a standard deviation of 0.53. Further results indicated that there is adequate conveyance in the county to a less extent as indicated by a mean of 2.44 and a standard deviation of 0.73 and that the water system has a master meter upon entry to the distribution system to a less extent as indicated by a mean of 2.17 with a standard deviation of 0.31. This implies that water resource infrastructure influences equitable distribution of water in Embu County. This is in line with Jimenez and Perez-

Foguet (2011) that local infrastructure projects play a major role in equitable distribution of water in community level in developing countries.

4.4 Financial Resource Allocation influence on Equitable Distribution of Water

The respondents were requested to indicate the extent to which the given aspects of financial resource allocation influence equitable distribution of water supply in Embu County. The findings are tabulated in the Table 4.7

Table 4. 7: Financial Resource Allocation influence on Equitable Distribution of Water

Statement on Financial Resource Allocation	Mean	Standard deviation
The county has adequate fund for water distribution	4.47	0.82
The county maintain cost management for distribution of water	4.07	0.75
EWASCO formally approves the annual budget	3.40	0.46
Water distribution fund disbursement is done for all the region in the 4 Districts	3.42	0.48
There is access to sufficient fund for water distribution in the county	2.44	0.24
The Water fund is available to finance distribution of water in the county	4.41	0.72
There is effective utilization of water distribution fund in the county	4.08	0.62
The water distribution fund is availed timely	4.03	0.45

The results indicated that the county had adequate fund for water distribution, fund for water distribution is available to finance distribution of water in the county and that the county maintains a cost management for distribution of water thus influencing equitable distribution of water to a great extent as indicated by a mean of 4.47, 4.41 and 4.37 with standard deviation of 0.82, 0.72 and 0.75.

Further results indicated that there is effective utilization of water distribution fund in the county and the water distribution fund is availed timely thus influencing equitable distribution of water to a great extent as indicated by a mean of 4.08 and 4.03 with standard deviation of 0.62 and 0.45.

Most of the respondents indicated that the water distribution fund disbursement is done for the entire region in the county and the governing body formally approves the annual budget thus influencing equitable distribution of water to a moderate extent as indicated by a mean of 3.42 and 3.40 with standard deviation of 0.48 and 0.46. Most of the respondents indicated that the county has access to sufficient funds for water distribution influencing equitable distribution of water to a less extent as indicated by a mean of 2.44 with standard deviation of 0.24. This implies that financial resource allocation influences equitable distribution of water in Embu County. This is consistent with the finding by Nanjowe (2016) that inadequate funding affected sustainability of the piped water supply schemes in Likuyani Sub County, Kakamega County.

4.5 Government Intervention influence on Equitable Distribution of Water

The respondents were requested to indicate the extent to which the given aspects of government intervention influence equitable distribution of water in Embu County. The findings are tabulated in the Table 4.8

Table 4. 8: Government Interventions influence on Equitable Distribution of Water Supply

Statement on Government Interventions	Mean	Standard deviation
The county government has institutional regulatory framework that foster equitable water distribution	4.76	0.77
There is decrease in water tariff to promote equitable water distribution to all households	4.72	0.70
The government increases water sourcing in the county for expansion	4.57	0.50
There is adequate auditing systems by the government for equitable distribution of water	4.67	0.58
Government provides funding for distribution of water fund	4.68	0.64
Government provide security for water distribution system	4.83	0.72
The Government improves accessibility of water in the county	4.86	0.77
The Government Institutes water distribution policies to achieve equitable distribution of water	4.79	0.70
The Government increases water reservoirs	4.63	0.50
The long-term supply and demand projections are updated regularly, and upcoming capacity issues addressed	4.63	0.62
Increase water sourcing for the county	4.59	0.58
The Government lowers water taxes for EWASCO and other water service providers	4.48	0.53

Respondents indicated that there is improved accessibility of water in the county, provision of security for water distribution system and institution of water distribution policies to achieve equitable distribution of water influencing equitable distribution of water in Embu County to a very great extent as indicated by mean of 4.86, 4.83, 4.81 and 4.79 with standard deviation of 0.77, 0.72, 0.72 and 0.70. Most of the respondents indicated that the Embu county government had institutional regulatory frameworks that foster equitable water distribution, there is also a decrease in water tariffs to promote equitable water distribution, the government provide funding for distribution of water fund and there is adequate auditing systems for equitable distribution of water influencing

equitable distribution of water in the County to a very great extent as indicated by mean of 4.76, 4.72, 4.68 and 4.67 with standard deviation of 0.77, 0.70, 0.64 and 0.58. Most of the respondents indicated that long-term supply and demand projections are updated regularly and upcoming capacity issues are being addressed influencing equitable distribution of water to a very great extent as indicated by mean of 4.63 with standard deviation of 0.62.

The study further found that most of the respondents indicated that increase in water reservoirs, increase in water sourcing for the county influence equitable distribution of water in Embu County to a very great extent as indicated by a mean of 4.63, 4.59 and 4.57 with standard deviation of 0.50, 0.58 and 0.50.

Results further indicated that lower water taxes for distributing companies influenced equitable distribution of water supply in Embu County to a very great extent as indicated by mean of 4.48 with standard deviation of 0.53. This clearly demonstrated that the government interventions contribute to equitable distribution of water in Embu County. The results are consistent with those of Owuor (2013) findings that the Government's long-term objective is to ensure all Kenyans have access to clean potable water, and that water is available for key economic activities. These findings are similar to those of Sanjay (2009) who assessed factors that affected equitable distribution of drinking water supply in municipal corporations in Thane District in India. The findings revealed that growth of the population, increase in industries, health and educational institutions, commercial units, policies of rainwater harvesting, reducing leakages and wastage, more provision of funds for water supply projects, revision of tariff structure and private sector

participation in distribution of drinking water supply affected equitable distribution of water to meet the demand of water supply.

4.6 Household Economic Characteristics influence in Equitable Distribution of Water

The study went further to determine the extent to which the given aspects of household economic characteristics influence equitable distribution of water in Embu County. The results are presented in the Table 4.9

Table 4. 9: Household Economic Characteristics influence on Equitable Distribution of Water

Statement on Household Economic Characteristics	Mean	Standard deviation
The income level of household	4.87	0.82
The occupation of members in a household	4.67	0.61
The source of income for the household	4.76	0.66
The purchasing power for each household	4.82	0.78
The economic activities the household engage	4.69	0.75
The provision of labor in water distribution operations in the county	4.38	0.27
People resource mobilization to enhance water distribution in the county	4.52	0.58
Participation in water distribution activities	4.50	0.56
Household members contribution to water funds	4.59	0.61
Payment of water supply due to increase in income level	4.85	0.79

The results indicated that the income level of households, payment of water supply, the purchasing power for each household and the source of income for the household

influence equitable distribution of water in Embu County to a very great extent as indicated by mean of 4.87, 4.85, 4.82 and 4.76 with standard deviation of 0.82, 0.79, 0.78 and 0.66. Respondents also indicated that the economic activities a household engages in and the occupation of members influence equitable distribution of water supply in Embu County to a very great extent as indicated by mean of 4.69 and 4.67 with standard deviation of 0.75 and 0.61. The findings in Table 4.9 indicated that contribution of water funds, people resource mobilization to enhance water distribution in the county and participation in water distribution activities influence equitable distribution of water in Embu County to a very great extent as indicated by mean of 4.59, 4.52 and 4.50 with standard deviation of 0.61, 0.58 and 0.56.

Further results revealed that provision of labor in water distribution operation influence equitable distribution of water in Embu County to a great extent as indicated by mean of 4.38 with standard deviation of 0.27. The results demonstrated that household economic characteristics influence equitable distribution of water in Embu County. This concur with Nastiti, Sudradjat, Geerling, Smits , Roosmini and Muntalif (2017), who found that higher-income households are more likely to use piped water, bottled water or combinations thereof and have higher water expenditures than their lower-income counterparts.

4.7 Equitable Distribution of Water

The study investigated the extent to which the given aspects of equitable distribution of water have been achieved in Embu County. The results presented in Table 4.10

Table 4. 10: Equitable Distribution of Water

Statement on Equitable Distribution of Water	Mean	Standard deviation
There is adequate supply of water to house hold in the county	4.75	0.68
There is an increase in equitable water distribution rate in the county	4.68	0.64
There is an increase rate in water supply in all region of the county	4.88	0.72
There is equitable supply of water to households	3.67	0.22

From the findings, majority of the respondents indicated that there is increased rate in water supply in all region of the county and adequate supply of water to households in the county has been achieved to a very great extent as indicated by mean of 4.88 and 4.75 with standard deviation of 0.72 and 0.68. Most of the respondents indicated that increase in equitable water distribution rate in the county has been achieved to a very great extent as indicated by a mean of 4.68 with a standard deviation of 0.64. Most of the respondents indicated that equitable supply of water to household has been achieved in Embu County to a moderate extent as indicated by mean of 3.67 with standard deviation of 0.22. This implies that equitable distribution of water in Embu County have been achieved to a moderate extent. This is in line with Opare (2011) who stated that equitable distribution

of water is core and critical for socio-economic development, healthy ecosystems and for human survival itself.

4.8 Inferential Analysis

The study carried out correlation and regression to establish the relationship between the factors influencing equitable distribution and water supply in Embu County. The correlation coefficient was also used to test whether there existed correlation amongst the study variables. A correlation coefficient of more than 0.9 ($r>0.9$) denotes high multi-collinearity of which may lead to an unreliable regression model (Dancey & Reidy, 2011). A regression analysis was carried out to determine the factors influencing equitable distribution of water supply in Embu County. The results are presented in the Table 4.11

4.8.1 Correlation Analysis

Table 4. 11: Correlation between the factors influencing Equitable Distribution of Water Supply and Equitable Distribution of Water

		Equitable Distribution of Water	Water Resource Infrastructure	Financial Resource Allocation	Government Intervention	Household Economic characteristic
Water Resource Infrastructure	Pearson Correlation	0.809*	1			
	Sig. (2-tailed)	0.01	0.001			
Financial Resource Allocation	Pearson Correlation	0.703*	0.572	1		
	Sig. (2-tailed)	0.02	0.013	0.0231		
Government Intervention	Pearson Correlation	0.743*	0.659	0.324	1	
	Sig (2-tailed)	0.04	0.0580	0.00709	0.0180	
Household Economic Characteristic	Pearson Correlation	0.722*	0.5231	0.4841	0.4211	1
	Sig. (2-tailed)	0.01	0.0135	0.02137	0.0053	0.0017

**-Correlation is significant at the 0.01 (2 tailed)

*- Correlation is significant at the 0.05 (2 tailed)

The correlation between factors influencing equitable distribution of water supply and the equitable distribution of water were determined using Pearson Product Moment correlation coefficient. The criterion employed was that Correlation Coefficient of 0.7 and above denoted existence of a strong association, that of 0.4 and less than 0.7 signified presence of a moderate association and a correlation coefficient of less than 0.4 signified

existence of a weak association between independent and dependent variables (Mirie, 2014).

The results in Table 4.11 shows that there exists a strong, significant and positive correlation between resource infrastructure and equitable distribution of water where r=0.809, P V=0.01<0.05). There also exists a strong, significant and positive correlation between financial resource allocation and equitable distribution of water where r=0.703, PV=0.02. Similarly, government intervention has a strong significant and positive correlation with equitable distribution of water, r=0.743, PV=0.04<0.05 while there exist a strong, significant positive relationship between household economic characteristic and equitable distribution of water as r= 0.722, PV=0.01<0.01.

4.8.2 Regression Analysis

The coefficient of determination (R^2) established the extent of the relationship between factors influencing equitable distribution and water supply in Embu County. The results are presented in the Table 4.12

Model Summary

Table 4. 12: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.8592a	0.7382	0.7195	0.0381

In the model summary, R2 is 0.7382 and adjusted to 0.7195. This implied that there exist

a 71.95% variation between factors and equitable distribution of water.

Analysis of Variance

The results are presented in the Table 4.13 are the Analysis of variance (Anova) establishing the significance of a regression model.

Table 4. 13: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	18.684	4	4.671	5.40915986	.00112a
Residual	61.311	71	0.86353521		
Total	79.995	75			

a. Water Resource Infrastructure, Financial Resource Allocation, Government Intervention and Household Economic Characteristic
b. Equitable Distribution of Water

Analysis of variance (Anova) test goodness of fit of the model. The study also established that there existed a significant goodness of fit of the model $Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + ę$ (1) as F_{Cal} =5.40916 far exceeds F_{Cri} = 3.2815, P=0.01<0.05 implying the model has goodness of fit to explain the existing variation.

Beta Coefficients Analysis

From the results on Table 4.14, $\beta_{0=}$ 2.6744 represented the constant which predicted value of Equitable distribution of water supply while Water Resource Infrastructure, Financial Resource Allocation, Government Intervention and Household Economic Characteristic were constant at zero (0).

Table 4. 14: Beta Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Significant
	B	Std. Error	Beta		
(Constant)	2.674364	0.308		8.683	0.0011
Water Resource Infrastructure	0.589508	0.0679	0.486	8.682	0.0103
Financial Resource Allocation	0.326278	0.0342	0.269	9.5403	0.0027
Government Intervention	0.468876	0.0615	0.542	7.624	0.0038
Household Economic Characteristic	0.643924	0.0583	0.365	11.045	0.015

a. Water Resource Infrastructure, Financial Resource Allocation, Government Intervention and Household Economic Characteristic
b. Equitable Distribution of Water

The resultant regression model took the form:

$Y=2.6744 +0.589X_{1+}0.326X_2+ 0.469X_3+0.644X_4+ẹ.$

From the regression analysis, holding all the factors influencing equitable distribution of water at zero, the distribution of water would be at = 2.6744, with PV= 0.0011< 0.05.

The regression results indicated that there existed a significant and positive relationship between Water Resource Infrastructure and equitable distribution of water in Embu County as $\beta1=0.589$, PV=.0103<0.05, t=8.682. This demonstrated that a unit change in

Water Resource Infrastructure would result to 0.589 increases in equitable distribution of water in Embu County holding all other factors constant. These findings concurred with those of Bonaya (2017) that infrastructural issues affecting water supply in Kenya such as adoption of the use of innovative technologies including remotely read meters, e-billing and e-payment platforms, customer interface programs, hydraulic water system monitoring and pump system monitoring software which if adopted would reduce utility inefficiencies and reduce the levels of Non-Revenue Water.

Regression results revealed that Financial Resource Allocation has a significant and positive influence on equitable distribution of water in Embu County as β2=.326, PV=.0027, t=9.5403. This implies that a unit increase in application of financial resource allocation would lead to an increase in equitable distribution of water in Embu County by factor 0.326278. These findings are supported by those of World Bank (2007) that evaluation report, sustainability of water supply projects can only be ensured if tariffs generate enough resources to operate the system and replace the infrastructure after its useful life.

Regression results indicated that there existed a significant and positive relationship between government intervention and equitable distribution of water in Embu County as $\beta_{3=}$.469, P=.0038 and t=7.624. This implied an increase in government intervention would result into an increase in equitable distribution of water by factor 0.469 in Embu County. Hence government intervention facilitates the implementation of the water reforms to be carried out in various sub-sectors, in an effort to achieve equitable distribution of water. The results were consistent with Mommen and Nekesa (2010) that

inadequate regulatory framework and inadequate external support hinder sustainability of water supply project in Kenya.

Further regression results indicated that there existed a significant and positive relationship between Household Economic Characteristic and equitable distribution of water as indicated by β_4 =.644, PV=.015, t=11.045. This implied that a unit increase in household economic characteristic would lead to an increase in equitable distribution of water in Embu County by factor 0.644. These results were supported by Rahut, Behera and Ali (2015) in their study on household access to water and choice of treatment method found that household income is a strong determinant of the choice of safe and secure water access.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides the summary of the findings from chapter four. The data analysis, presentations and interpretation of findings presented in the previous chapter were guided by the issues identified in the problem statement. The literature review identified the research gap, the research design and the subsequent analysis. A summary and concluding remark on the discourse, recommendations and suggestions for further research are laid out in the synopsis below based on the objectives of the study. The response rate was appropriate to derive the inferences regarding the objectives of the research, the instruments for data collection were reliable and validity of data collected was ensured. Respondents were characterized in different categories like working period, age, educational status or working period in the water department.

5.2 Summary of Findings

The study sought to investigate the factors influencing equitable distribution of water supply in Embu County. The study established a significant variation of 71.95% between factors influencing equitable distribution of water supply and the equitable distribution of water in Embu County.

5.2.1 Water Resource infrastructure performance on Equitable Distribution of Water

The first objective of the study was to assess how water resource infrastructure influence equitable distribution of water supply in Embu County. The results revealed that resource infrastructure had a significant and positive influence on equitable distribution of water (β_1=0.589, PV=.0103<0.05, t=8.682). The results showed that there is implementation of technology in water distribution to a less extent, non-revenue water accurately tracked monthly and is below reasonable minimal levels and the water system has a leak detection program in place therefore influencing equitable distribution of water to a moderate extent.

The findings revealed that capacity of the water treatment system was appropriate to meet water demands through the next 5 years to a moderate extent, there is well lain pipe network system across the county and the pipe connection system is well distributed influencing equitable distribution of water to a less extent. There was to a moderate extent water system that performs water audit regularly influencing equitable distribution of water to a moderate extent. The study established that there are sufficient water treatments facilities in the county to a moderate extent, that water system track non-revenue water monthly and that the capacity of the pumping system(s) and distribution system is adequate influencing equitable distribution of water to a moderate extent. The study further found that water system has a master meter upon entry to the distribution system, there being adequate conveyance in the county and adequate storage facility influencing equitable distribution of water to a moderate extent.

5.2.2 Financial Resource Allocation performance on Equitable Distribution of Water

The second objective of the study was to establish how financial resource allocation influence equitable distribution of water supply in Embu County. Regression results revealed that there exists a strong, significant positive relationship between financial resource allocation and equitable distribution of water (β_2=.326, PV=.0027, t=9.5403).The study established that the county had adequate fund for water distribution to moderate extent, fund is available to finance distribution of water in the county to a moderate extent and the county maintain cost management for distribution of water thus influencing equitable distribution of water to a moderate extent..

The study established that there is effective utilization of water distribution fund in the county and water distribution fund is availed timely, water distribution fund disbursement is done for the entire region in the county and the governing body formally approves the annual budget and the county access to sufficient fund for water distribution influencing equitable distribution of water.

5.2.3 Government Interventions performance on Equitable Distribution of Water

The third objective of the study was to identify how government interventions influence equitable distribution of water supply in Embu County. The study revealed that improving accessibility of water in the county, provision of security for water distribution system, water supply and demand are regularly monitored and institute water distribution

policies to achieve equitable distribution of water influence equitable distribution of water in Embu County.

From the findings, the county government had institution regulatory framework that foster equitable water distribution, there is decrease in water tariff to promote equitable water distribution, provide funding for distribution of water fund and there is adequate auditing systems for equitable distribution of water influencing equitable distribution of water. Long-term supply and demand projections are updated regularly and upcoming capacity issues are being addressed, increase water reservoirs, increase water sourcing for the county and the government increase water sourcing in the county influence equitable distribution of water. Finally the study established that lower water taxes for distributing companies and system having a complete, up-to-date operations and maintenance plan that another certified operator could follow if the operator leaves or is unavailable influencing equitable distribution of water in Embu County to a less extent. The government interventions have a strong significant and positive association with equitable distribution of water ($r=0.743$, $PV=0.04<0.05$) and from the regression analysis $\beta_{3=}.469$, $P=.0038$ and $t=7.624$.

5.2.4 Household Economic Characteristic's performance on Equitable Distribution of Water

The fourth objective of the study was to examine how household economic characteristics influence equitable distribution of water supply in Embu County. The study established that income level of household, payment of water supply, the

purchasing power for each household and the source of income for the household influence equitable distribution of water in Embu County

Most of the respondents indicated that the economic activities household engages and the occupation of members in a household, contribution of water funds, resource mobilization to enhance water distribution in the county, participation in water distribution activities and provision of labor in water distribution operation influence equitable distribution of water in Embu County. Regression results revealed a strong, significant and positive correlation between household economic characteristics and equitable distribution of water supply (β_4 =.644, PV=.015, t=11.045).

5.3 Discussion

Availability of financial resources and adequate allocation of water distribution fund contributes to sustainability of a water supply system. Fund for equitable distribution of water is mobilized through efficient revenue collection, the ability to meet the cost of operation and maintenance and the willingness to pay for the services. Financial resource significantly contribute to equitable distribution of water (β_1=0.589, PV=.0103<0.05, t=8.682).

Improvement in accessibility of water in the county is achieved through provision of security for water distribution system, water supply and demand are regularly monitored and institute water distribution policies to achieve equitable distribution of water influence equitable distribution of water in Embu County. From the findings, county government had institution regulatory framework that foster equitable water distribution,

there is a decrease in water tariff to promote equitable water distribution, provide funding for distribution of water fund and there is adequate auditing systems for equitable distribution of water influencing equitable distribution of water. Government interventions have a strong significant and positive association with equitable distribution of water ($r=0.743$, $PV=0.04<0.05$) and from the regression analysis $\beta_{3=}.469$, $P=.0038$ and $t=7.624$. This is supported by Kleemeier (2010) that water service providers through the approval of the county governments are allowed to attract commercial funding for commercially viable investment on water services through the Public Private Partnership (PPP) policy that allows private sector involvement.

The study established that income level of household, payment of water supply, the purchasing power for each household and the source of income for the household influence equitable distribution of water in Embu County. Most of the respondents indicated that the economic activities household engages and the occupation of members in a household, contribution of water funds, resource mobilization to enhance water distribution in the county, participation in water distribution activities and provision of labor in water distribution operation influence equitable distribution of water in Embu County. Regression results revealed a strong, significant and positive correlation between household economic characteristics and equitable distribution of water supply ($\beta_4 =.644$, $PV=.015$, $t=11.045$).

The results revealed that resource infrastructure had a significant and positive influence on equitable distribution of water ($\beta_1=0.589$, $PV=.0103<0.05$, $t=8.682$). The results show that there is implementation of technology in water distribution to a less extent, non-

revenue water accurately tracked monthly and is below reasonable minimal levels and the water system has a leak detection program in place therefore influencing equitable distribution of water to a moderate extent. The study established that there are sufficient water treatments facilities in the county to a moderate extent, that water system track non revenue water monthly and that the capacity of the pumping system(s) and distribution system is adequate influencing equitable distribution of water to a moderate extent.

Regression results revealed that there exists a strong, significant positive relationship between financial resource allocation and equitable distribution of water (β_2=.326, PV=.0027, t=9.5403).The study established that the county had adequate fund for water distribution to moderate extent, fund is available to finance distribution of water in the county to a moderate extent and the county maintain cost management for distribution of water thus influencing equitable distribution of water to a moderate extent. The study established that there is effective utilization of water distribution fund in the county and water distribution fund is availed timely, water distribution fund disbursement is done for the entire region in the county and the governing body formally approves the annual budget and the county access to sufficient fund for water distribution influencing equitable distribution of water. This views is supported by Mommen and Nekesa (2010) that lack of community support; inadequate regulatory framework and inadequate external support hinder sustainability of water supply project.

Government intervention is critical in achieving objective of achieving equitable distribution of water among the people. The implementation of the water reforms have been carried out in various sub-sectors, in an effort to achieve equitable distribution of

water. Improvement of accessibility of water in the county is influence by government provision of security for water distribution system, water supply and demand are regularly monitored and institute water distribution policies and availing fund for water distribution.

Economic features of households such as income level of household, ability to pay for water supply, the purchasing power for each household play a significant role in achieving equitable distribution of equitable water in Embu County. Economic activities household denote occupation of members in a household and earn income that empower household to acquire water supply, foster resource mobilization to enhance water distribution in the county, There exist therefore correlation between household economic characteristics and equitable distribution of water supply (β_4 =.644, PV=.015, t=11.045). This view is supported by Mommen and Nekesa, (2010) that most users of rural water supplies are relatively poor and not able to pay for water service without external support.

5.4 Conclusion

The study concludes that water resource infrastructure influence equitable distribution of water in Embu County. When the county embraces the sustainable local infrastructure there is sustainable development and economic growth. Infrastructure projects play a major role in community development.

The study concludes that Financial Resource Allocation influence equitable distribution of water in Embu County. Sustainable piped water supply systems will be enhanced by adequate sensitization and mobilization of the community before the project

implementation, adequate community and adoption of technologies as well as adequate funding and resource allocation.

The study concludes that Government Interventions influence equitable distribution of water in Embu County. Government's long-term objective is to ensure all Kenyans have access to clean potable water and that water is available for key economic activities.

The study concludes that growth of the population, increase in industries, health and educational institutions, commercial units, policies of rainwater harvesting, reducing leakages and wastage, more provision of funds for water supply projects, revision of tariff structure and private sector participation in distribution of drinking water supply affects equitable distribution of water to meet the demand of water supply

The study concludes that Household Economic Characteristics influence equitable distribution of water in Embu County. Higher-income households are more likely to use piped water, bottled water or combinations thereof and have higher water expenditures than their lower-income counterparts.

The study concludes that equitable distribution of water supply in Embu County has been achieved to a moderate extent. There is increased rate in water supply in all regions of the county and adequate supply of water to households as well as increased equitable water distribution rate in Embu County.

5.4 Recommendations of the Study

Based on the findings and conclusions of the study, the following policy recommendations were proposed to improve the overall management of equitable distribution of water in Embu County;

The management of EWASCO should enhance equitable distribution of water and aim to continue increasing the rate in adequate water supply in all regions of the county and households.

The water resource infrastructure should be aligned towards maximizing and improving the equitable distribution of water in the county due to the high level it has on equitable distribution of water in the county.

The EWASCO management and the County government of Embu as well as the national government ensure sustainable provision and funding allocation of the water sector infrastructure development so as to improve equitable distribution of water.

The government should continue having a long-term objective of ensuring all Kenyans have access to clean potable water and that water is available for key economic activities. Due to growth of the population, increased industries, health and educational institutions, commercial units more provision government interventions would improve equitable distribution of water in the county.

The authorities grant special attention to poorer households when implementing strategies for the population access to safe and reliable water. This is because access to drinking

water and per capita household expenditures on drinking water show an association with household income, economic conditions and the location.

5.5 Recommendation for Further Studies

This study examined the factors influencing equitable distribution of water supply in Embu County. The study revealed that factors influencing equitable distribution, contributes greatly to equitable distribution of water supply in Embu County. This is evidenced by the R-Square which is the coefficient of determination that showed that the four independent variables in the model explain a big percentage of equitable distribution of water supply. The study recommends further research to be carried focusing on other factors not studied in the current study for instance; influence of community involvement, resource mobilization, county government support and public private partnerships on equitable distribution of water supply in Embu County.

REFERENCES

African Development Bank's (2006). Getting Africa on track to meet the MDGs on water and sanitation: *A status review of sixteen African countries*.

Akintoye, H. Edwards, K. & Hardcastle, D. (2005). Critical success factors for PPP/PFI projects in the UK construction industry, *Journal of Construction Management Economics,* 23 (5).

AMCOW (2011). Water Supply and Sanitation in Kenya Turning Finance into Services for 2015 and Beyond, *Country Status Overview*.

Ameyaw, D. & Chan, K. (2013). Private sector's involvement in the water industry of Ghana", *Journal of Engineering, Design and Technology*, 11 (3) pp. 251-275.

Ameyaw, E.E. & Chan, A.P.C. (2015). Evaluation and ranking of risk factors in public–private partnership water supply projects in developing countries using fuzzy synthetic evaluation approach, *Expert Systems with Applications*, 42 (12).

Augenblick, S. C.(1990). The Build, Operate, and Transfer("BOT") Approach to Infrastructure Projects in Developing Countries, World Bank, Washington, DC.

Bonaya (2017). *Rethinking water services in Kenya*. Retrieved from www.kenyamarkets.org /2017/05/10

Cashman and Ashley, (2008). Costing the long-term demand for water sector infrastructure. *Foresight*, 10 (3), pp.9-26,

Drazin, R & Howard, P. (2004). Strategy implementation: a technique for organizational design. *Journal of Management Studies,* urban and rural challenge of the decade 34 (3) 465-85.

Eisenbeiss, et al. (2008). Transformational leadership and team innovation: Integrating team climate principles. *Journal of Applied Psychology*, Vol93.

EvisGjebrea, J. (2006). Monitoring and Evaluation of the Water and Sanitation Sector Performance: *Case of Albania PhD Candidate*,

FAO (2007), Coping with water scarcity. *Challenge of the twenty-first century*. Retrieved from: http://www.unwater.org. Accessed on 21 January 2018

Fitzgerald, M., Posner, J. & Workman. A. (2009). A Guide to Monitoring and Evaluation of NGO Capacity Building Interventions in Conflict Affected Settings. *JSI Research and Training Institute,* Inc.

Foster, V. & Briceño-Garmendia, C. (2010). Africa's Infrastructure: A Time for Transformation, *World Bank Report*, Washington, DC.

Fotso, J. E., Ezeh, A. C., Madise, N. J. and Ciera, J. (2008). *Progress towards the child mortality millennium development goal in urban sub-Saharan Africa,* UN/POP/EGM-URB/2008/12, New York.

Fuest, V. & Haffner, S.A. (2007). PPP – policies, practices and problems in Ghana's urban water supply, *Water Policy*, 9 No. 2.

Gaitano, S. (2011). The Design of M&E Systems. A Case of East Africa Dairy Development Project. *A paper presented at INTRAC 7th Monitoring and evaluation conference.*

Gorgens, M. &Kusek, J. Z. (2009). *Making Monitoring and Evaluation Systems Work.* World Bank.

Government of the Republic of Kenya (2001). National Disaster Management Policy (Nairobi, Kenya: Government of the Republic of Kenya).

Greene, W. H. (2003). *Econometric Analysis*, fifth edition, Pearson Education Private, Ltd, Indian Branch, Delhi, India

Guijt, I. (1999). Participatory monitoring and evaluation for natural resource management and research. *Socio-economic Methodologies for Natural Resources Research*.

Gujja, B.& Shaik, H. (2005). A Decade for action: water for life, when India will cover the uncovered?, *Economic and political weekly*, pp. 1086-1089.

Haarmeyer, D. & Mody, A. (1998). Tapping the Private Sector: Approaches to Managing Risk in Water and Sanitation, the World Bank, Washington, DC.

Iimi, A. (2005). Urbanization and development of infrastructure in the East Asian region, *JBICIReview*, Vol. 10 No. 1.

International institute for environment and development (2017). Ensuring water is equitably allocated and governed. Retrieved from: https://www.iied.org/ensuring-water-equitably-allocated-governed.

Jimenez, A., & Perez-Foguet, A. (2011). Water point mapping for the analysis of rural water supply plans: Case study from Tanzania. *Journal of Water Resources Planning and Management*, 137(5), 439-447.

Kayaga, S. (2008). Public-private delivery of urban water services in Africa", Proceedings of Civil Engineers: *Management, Procurement and Law*, 160 No. MP4, pp. 147-155.

Khatri, K. B. & Vairavamorthy, K. (2007). Challenges for urban water supply and sanitation in the developing countries, UNESCO IHE, Institute for water. *Education discussion draft paper*, Deift. Netherlands.

Kibugi (2013). Water Cooperation at the National Level: *The Case of Kenya*. Retrieved from: http://blogs.worldbank.org/

Kirkpatrick, C., Parker, D., & Zhang, Y. F. (2006). An empirical analysis of state and private-sector provision of water services in Africa. *World Bank Economic Review*, 20(1), 143-163.

Kleemeier, E. (2000). The impact of participation on sustainability: an analysis of the Malawi rural piped scheme program. *World Development*, 929-944.

Kleemeier, E. (2010). Private Operators and Rural Water Supplies, A desk review of experience.

Kleemeier, E., & Narkevic, J. (2010). A global review of private operator experiences in rural areas. *Private Operator Models for Community Water Supply.*

KNBS (2010). Kenya National Bureau of Statistics. Retrieved from: *www.knbs.or.ke/index.php?*. Accessed on 21th December 2017.

Kongmanila, X. & Yoshi T. (2009). Innovation, Performance and Firm performance of Lao Garment. International. *Journal of Economics and Management* 3(2):225 – 236

Koskei, E.C., Koskei, R.C., Koske, M.C. & Koech, H.K. (2013). Effect of Socio-economic Factors on Access to Improved Water Sources and Basic Sanitation in Bomet Municipality, Kenya. *Research Journal of Environmental and Earth Sciences* 5(12): 714-719.

KPMG (2011). Delivering water infrastructure using private finance", *Report*, pp. 1-19, retrieved from: *www.kpmg.com/infrastructure*.

Lobina, E., & Hall, D. (2008). The comparative advantage of the public sector in the development of urban water supply. *Progress in Development Studies*, 8(1), 85.

Lockwood, H., Bakalian, A., & Wakeman, W. (2003). Assessing sustainability in rural water supply: the role of follow-up support to communities. NY: *World Bank*, New York.

Mackey, A. (2008). The effect of CEOs on firm performance. *Strategic Management Journal*, 29(12), 1357-1367.

Mahama, A. M. (2013). Determinants of Factors Influencing Householders' Access to Improved Water and Sanitation Facilities in Selected Low-Income Urban Areas of Accra, *PhD Thesis*. University Of Ghana, Legon, Ghana.

Mehta, L., Marshall, F., Movik, S., Stirling, A., Shah, E., Smith, A.& Thomson, J. (2007). Liquid dynamics challenges for sustainability in water and sanitation, *STEPS working paper*, 6, Institute of Development Studies; University of Sussex Brighton BN1 GRE U.K.

Nanjowe, W. F. (2016). Assessment of factors influencing sustainability of Piped water supply systems in Likuyani Sub County, Kakamega County. *MA Report,* UON , Kenya.

Nastitiet. A. (2017). The effect of physical accessibility and service level of water supply on economic accessibility: a case study of Bandung City, Indonesia, *Journal of Water International* . 42, No 7.

NIUB (2008). *Appraisal of city development plan Kalyan- Dombivali*, New Delhi.

NMMC (2006). *New Mumbai Municipal Corporation City Development Plan*, New Mumbai, Maharashtra.

OECD (2007). Kenya Annual Economic Outlook Report. A Rapid Assessment of Kenya's Water, Sanitation and Framework. Institute of Economic Affairs.

OECD (2010). Dedicated Public-Private Partnership Units: A Survey of Institutional and Governance Structures, OECD Publishing, Paris.

Opare, S. (2011). Sustaining water supply through a phased community management approach: Lessons from Ghana's "oats water supply scheme. *Environment, Development and sustainability* , 13(6), 1021-1042

Pakistani horticultural products', *Pakistan Journal of Agricultural Research,* 26(2): 87–96.

Panickar, M. (2007). State responsibility in the drinking water sector: An overview of the Indian

Perard (2012). Private sector participation in water infrastructure: a review of the last 20 years and the way forward, Public Private Infrastructure Advisory Facility, World Bank, Washington, DC.

Rahutet, F. (2015). Household access to water and choice of treatment methods: Empirical evidence from Bhutan, *journal of Water Resources and Rural Development*vol 5: 1-16**.**

Reddy, V. R. (2006). Declining social consumption in India, *Economic and political weekly*, 2001 pp. 2750-51.

Rivera, D. (1996). Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries, Directions in Development Series, *the World Bank Report.* Washington, DC.

Rode, S. (2008). Public private partnership in drinking water supply of Greater Mumbai, *Urban studies*, Working Paper.

Rode, S. (2009). Sustainable drinking water supply in Pune Metropolitan Region: Alternative Policies, *Theoretical and Empirical Researches in Urban Management*, Number 1S, pp. 48-59.

Rosemarinet. E.(2008). Pathways for Sustainable Sanitation – Achieving the Millennium Development Goals. Stockholm: EcoSanRes Programme.

Rouse, M. (2014). The worldwide urban water and wastewater infrastructure challenge. *International Journal of Water Resources Development*, 30 No. 1.

Santos, G. (2017). Urban growth and water access in sub-Saharan Africa: Progress, challenges, and emerging research directions.

Scenario, *International Environmental Law Research Center* (IELRC), Working paper Geneva, Switzerland.

Shaw, A. (2007). Basic Amenities in Urban India: Analysis at state and town level, *Working Paper Series*, WPS No. 616/ December 2007, Indian Institute of Management Calcutta.

Siwi (2005). Making Water a Part of Economic Development: *The Economic Benefits of Improved Water Management and Services*.

Tana water services board (2013). Water point mapping report Embu County. Retrieved from http://maps.virtualkenya.org. Accessed on 23rd December 2017

Tarrasset, G. (2012). Mortality Water shortages Water supply Public health Drinking water *journal of Perspectives in Public Health*. 132, No. 5

Tertiary, I. (2012). Commercial viability analysis of water systems in LVNWSB& LVSWSB. Nairobi: SNV Netherlands Development Organization

Thomas, W. (2007). Crisis, what crisis? Challenging the urban water challenge of the twenty first century, *Development Planning Unit: Working Papers*, working paper no.133, University College London.

TMC (2006). *Thane Municipal Corporation City Development Plan*, Thane.

UMC (2006). *Ulhas nagar Municipal Corporation City Development Plan*, Ulhasnagar.

UNDP (2006). *Human Development Report 2006*.

UNICEF (2015). Use of improved drinking water sources and MDG target in 2015, and percentage point change from 1990 to 2015.

UNICEF (2016). Maintaining Africa's water infrastructure: findings from a Water Audit in Kitui County, Kenya. Policy Brief.

UNICEF and WHO **(**2016**).** Joint Monitoring Programme for Water Supply and Sanitation. Geneva: WHO and UNICEF.

Usaid (2007), *Kenya Water and Sanitation Profile*.

Water and Sanitation Program (2013). Supporting Poor-Inclusive WSS Sector Reform Devolution in Kenya: Opportunities and Challenges for the Water Sector.

Water Services Regulatory Board (2016). A Performance Review of Kenya's Water Services Sector2014 – 2015.

WHO/UNESCO (2010). Progress on Sanitation and Drinking-water: 2010 Update. Geneva: WHO press.

World Bank (2005). World Development Indicators 2005, World Bank, Washington, DC.

World Bank (2010).World Development Indicators. Washington, DC

World Bank (2013). The Future of Water in African Cities Why Waste Water? Retrieved from https://openknowledge.worldbank.org/handle/10986/11964.

World Bank Group (2015). World Bank Group Support to Public-Private Partnerships: *Lessons from Experience in Client Countries, FY02-12*, The World Bank, Washington, DC.

World Bank Group (2017). Reducing Inequalities in Water Supply, Sanitation, and Hygiene in the Era of the Sustainable Development Goals: *Synthesis Report of the WASH Poverty Diagnostic Initiative*.

World Water Development Report (2015). water for the sustainable world, United Nations Educational, Scientific and Cultural Organization.

Yang et. al (2013). Water Safety and Inequality in Access to Drinking-water between Rich and Poor Households, *journal Environ. Sci. Technol.*, 47 (3): 1222–1230.

APPENDICES

Appendix 1: Letter of Introduction

Eunice Mbandi Ireri

University of Nairobi

P.O Box 10737-00400

Nairobi

Dear Respondent,

RE: ACADEMIC RESEARCH

I am a post graduate student at the University of Nairobi. The research is partial requirement for the completion of a degree of Masters of Arts in Project Planning and Management. This is part of an exploratory study that will assess factors influencing equitable water supply in Embu County.

Enclosed here is a copy of my research questionnaire which I kindly request you to take a little of your time to fill in. The purpose of this questionnaire is to collect data on factors influencing equitable water supply in Embu County. Rest assured that all responses to this questionnaire will be treated with utmost confidentiality. Responses will only be reported in grouped figures and percentages; no individual will be identified once all interviews are completed and the data have been processed.

Thank you very much for your participation and enormous effort in helping in this study.

Yours sincerely,

Eunice Mbandi Ireri

L50/84394/2016

Appendix II: Questionnaire

The information you provide will be confidential and will only be used for the purposes of this research. Tick (√) your answer where necessary.

Section A. DEMOGRAPHIC DATA OF THE RESPONDENTS

1. For how long have you worked at EWASCO?
   - i. 0-1 year [ ]
   - ii. 1-5 years [ ]
   - iii. Over 5 years [ ]
2. What is your age bracket?
   - iv. 20-30 [ ]
   - v. 30-40 [ ]
   - vi. 40-50 [ ]
   - vii. Over 50 [ ]
3. What is your highest education level?
   - i. Secondary Education [ ]
   - ii. Diploma/professional certificate [ ]
   - iii. Under-graduate degree [ ]
   - iv. Post-graduate degree [ ]
4. Indicate how long you have work in the water department in your county
   - i. 1-2 [ ]
   - ii. 3-4 [ ]
   - iii. 5-6 [ ]
   - iv. More than 6 years [ ]

Section B: Water Resource Infrastructure and Equitable Distribution of Water

5. On a scale of 1-5 indicate the extent to which water resource infrastructure influence equitable distribution of water? (Where 1-Not at all, 2-Less extent, 3-Moderate Extent, 4 –Great extent and 5 -Very Great extent)

Statement on Water Resource Infrastructure	1	2	3	4	5
There is adequate water storage facility in the county					
There is well lain pipe network system across the county					
The pipe connection system is well distributed in all regions					
The capacity of the pumping system(s) and distribution system is adequate					
The capacity of the water treatment system is appropriate to meet water demands through the next 5 years					
The water system has a master meter upon entry to the distribution system					
There is sufficient water treatment facilities in the county					
There adequate conveyance in the county					
The water system performs water audit regularly					
The water system has a leak detection program in place					
There is implementation of technology in water distribution					

Section C: Financial Resource and Equitable Distribution of Water

6. To what extent do the following financial resources influence equitable distribution of water in Embu County? (Where 1-Not at all, 2-Less extent, 3-Moderate Extent, 4 –Great extent and 5 -Very Great extent)

Statement on Financial Resource Allocation	1	2	3	4	5
The county has adequate fund for water distribution					
The county maintain cost management for distribution of water					
EWASCO formally approves the annual budget					
Water distribution fund disbursement is done for all the region in the 4 Districts					
There is access to sufficient fund for water distribution in the county					
The Water fund is available to finance distribution of water in the county					
There is effective utilization of water distribution fund in the county					
The water distribution fund is availed timely					

Section D: Government Interventions and Equitable Distribution of Water

7. To what extent does the following government intervention influence equitable distribution of water in Embu County? (Where 1-Not at all, 2-Less extent, 3-Moderate Extent, 4 –Great extent and 5 -Very Great extent)

Statement on Government Interventions	1	2	3	4	5
The county government has institutional regulatory framework that foster equitable water distribution					
There is decrease in water tariff to promote equitable water distribution to all households					
The government increases water sourcing in the county for expansion					
There is adequate auditing systems by the government for equitable distribution of water					
Government provides funding for distribution of water fund					
Government provide security for water distribution system					
The Government improves accessibility of water in the county					
The Government Institutes water distribution policies to achieve equitable distribution of water					
The Government increases water reservoirs					
The long-term supply and demand projections are updated regularly, and upcoming capacity issues addressed					
Increase water sourcing for the county					
The Government lowers water taxes for EWASCO and other water service providers					

Section E: Household Economic Characteristics and Equitable Distribution of Water

8. To what extent do the following household Economic characteristics **influence** equitable distribution of water in Embu County? (Where 1-Not at all, 2-Less extent, 3-Moderate Extent, 4 –Great extent and 5 -Very Great extent)

Statement on Household Economic Characteristics	1	2	3	4	5
The income level of household					
The occupation of members in a household					
The source of income for the household					
The purchasing power for each household					
The economic activities the household engage					
The provision of labor in water distribution operations in the county					
People resource mobilization to enhance water distribution in the county					
Participation in water distribution activities					

Household members contribution to water funds					
Payment of water supply due to increase in income level					

Section F: Equitable Distribution of Water

9. To what extent does the following aspect of equitable distribution of water have been achieved in Embu County? (Where 1-Not at all, 2-Less extent, 3-Moderate Extent, 4 – Great extent and 5 -Very Great extent)

Statement Equitable Distribution of Water	1	2	3	4	5
There is adequate supply of water to house hold in the county					
There is an increase in equitable water distribution rate in the county					
There is an increase rate in water supply in all region of the county					
There is equitable supply of water to households					

Appendix III; Plagiarism Report