DETERMINANTS OF SUSTAINABILITY OF COMMUNITY WATER PROJECTS IN WEBUYE EAST SUB-COUNTY, BUNGOMA, KENYA

BY

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DECLARATION

This is my original work and has not been presented for award of a degree in the University of Nairobi or any other university.

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

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DEDICATION

I dedicate this study to my husband Michael Situma for his encouragement, financial support and motivation during the study.

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ACRONYMS AND ABBREVIATIONS

CIDA	Canadian International Development Agency
DANIDA	Danish International Development Agency
EU	European Union
EUWI- FWG	European Union Water Initiative-Finance Working Group
GWP	Global Water Partnership
IFAD	International Fund for Agricultural Development
IISD	International Institute for Sustainable Development
IWRM	Intergrated Water Resource Management
JPM	Joint Progress Monitoring
MDG	Millennium Development Goals
NACOSTI	National Commission for Science, Technology and Innovation
NGO	Non- governmental Organization
O& M	Operation and Maintenance
OECD	Organization for Economic Co-operation and Development
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UN-HABITAT	United Nations Habitat
UNICEF	United Nations Children's Fund
VLOM	Village level Operation and Maintenance
WB	World Bank
WCED	World Commission on Environment and Development
WHO	World Health Organization
WSSD	World Summit on Sustainable Development

ABSTRACT

Water is the most important natural resource and a basic human need. In many developing countries as a result of achieving the United Nations Millennium Goal 7c which targeted to reduce the proportion of people without sustainable access to safe water by 50% by year 2015, many Governments in partnership with the communities have invested money in construction and maintenance of the water projects. Despite the numerous water projects initiated, many have failed after a short time leading to unsustainable access to clean safe water. In order to make the investment in water projects more effective, failure rates of the water systems should be reduced. This study purposed to investigate determinants of sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya. The study was guided by the following objectives; to assess the extent to which water resources conservation practices, training, choice of technology and levels of funding influences sustainability of community water projects. The study employed descriptive survey design. The study targeted population size of 10,000 household users, 300 community water management committee executives and key informant from the Ministry of Water and Irrigation. The sample size of this study was calculated using simplified Yamane formula (1967:886). The study employed both probability and non-probability sampling techniques. The researcher used questionnaires and interview schedule to collect data. Pilot study results were used to test reliability and validity of the instruments. Data was analysed using descriptive statistics and correlation analysis by use of Statistical Package for Social Sciences (SPSS) version 20 and presented using frequency distribution, percentages, tables and Pearson product moment coefficients. With regards to water resources conservation practices, the study established a low community participation level of 36.2%. Findings revealed that afforestation was at 43.1%, pollution management and hygiene practices at 38.2% and management at 18.7%. The study established low level of training at 42.1% of which 38.5% were trained on conservation, 23.8% on management and 37.8% on Operation and Maintenance. The study also found out there are only two technologies used; use of hand pump (3.5%) and use of gravity fed pipes (96.5%). Community participation in choosing the technology was high at 90.3%. 97.1% of the community are conversant with the technology used while 2.9% are not conversant with hand pump technology introduced by the County Government. Findings show that spare parts are readily available but not affordable. It was also established that there is low level of funding, with the community contribution towards construction of the water projects highest at 96.5% while the County Government contribution was at 3.5%, only 16.8% contribute towards operation and maintenance of the water systems. Insufficient financing is a major factor in poor maintenance which leads to project failure. The study established that there is a positive correlation between sustainability of community water projects and water resources conservation practices, training, choice of technology and level of funding (r=0.959, 0.821, 0.879 and 0.689 respectively)by using Pearson's Product Moment Correlation (PPMC) analysis. It is recommended that awareness creation on importance of water resources conservation and sensitization on water catchment areas should be done to enhance reliability of the water sources. Stakeholders should raise the level of awareness on available training opportunities regarding conservation, O & M and management to ensure the community is impacted with proper skills and knowledge that enhance water project sustainability. The community and the County Government should explore other modern technologies to pump water to households and train community on how to use the technologies. Prices for spare parts should be subsidized to be affordable. Lastly the County Government should increase level of funding for construction and maintenance of community water projects. The study findings will benefit the County Government, water project financiers and the community in achieving sustainable community water projects.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Water is the most important natural resource, indispensable for life and the backbone of growth and prosperity for mankind (Hutton, Haller & Bartram, 2007). Water is the most basic need for human health and survival and many refer to water as life. United Nations General Assembly in 2010 recognized the human right to water and acknowledged that water is essential to the realization of all human rights. The resolution called upon international organizations and states to provide financial support, technology and capacity building for developing countries to access safe clean water. United Nations Department of Economic and Social Affairs (UNDESA) states that water as a resource is important for sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival.

Acknowledging water as a basic human right has lead to international communities and nations to enhance their efforts to meet the need. The United Nations had formulated Millennium Development Goals (MDG's) towards reducing poverty and ensuring sustainable development. UN MDG 7c targeted to reduce the proportion of people without sustainable access to safe water by 50% by year 2015, (WHO, 2010).According to progress update and MDG assessment, (1990 to 2015), access to improved drinking water increased from 76% to 91% of population. Target for water was 90% which was achieved globally. The report also states that, 147 countries have met the MDG target on safe water, about 2.6 billion people access safe drinking water since 1990. About 96% of global urban population access safe

drinking water compared with 84% of the rural population in 2015. The target of safe drinking water was met in 2010, ahead of 2015 deadline. Over 90% of the world's population have access to improved sources of drinking water. However, the least developed countries did not meet the target; 663 million people still lack access to improved or safe water.

United Nations World Water Vision 2050, states that by 2050 humanity could have achieved a water secure world, where every person will have access to adequate quantities of water of an acceptable quality and from sustainable sources in order to meet their basic needs and sustain their well-being and development. In 2010, Kenya adopted a new constitution that enshrines the human right to water and sanitation in Article 43(1d). It states that, 'every person has a right to clean and safe water in adequate quantities".

According to Joint Progress Monitoring (JPM) report for water supply 63% of Kenyans (82% in urban areas and 57% in rural areas) had access to improved drinking water by 2015. 22% of Kenyans (45% of urban and 14% of rural dwellers) have access to piped water through house connection. It estimates that there is a decrease of access to improved water in urban areas from 92% in 1990 to 82% in 2015 while in rural areas it increased from 33% in 1990 to 57% in 2015.

Water demand has been projected to increase in demand by 55% globally between 2000-2050 (OECD, 2011). According to Kenya National Water Master Plan 2030, the demand for water in Kenya was at 14% in 2010 and by 2050 it is projected to be at 81%. This is as a result increase in competition for the scarce resource for Agriculture, electricity generation, industrial use and domestic use. Climate change also seen to affect the balance between water demand and water availability. This calls for efforts to ensure sustainable water supplies.

Abrams (2000) defines sustainability of water resources as water that continues to be available for the period for which it was designed. Water availability at the same rate and quality as the day the project was commissioned, then it is said to be sustainable. He argues that for water to be sustainable, there must be money spent for repairs, that consumers should accept the service, source of supplying service must be adequate and the design must be properly done or constructed. Sustainability of water projects ensures adequate water quantity and appropriate water quality without compromising the present and future ability to provide capacity and quality.

Asumani & Danny (2014) recommended seven factors for sustainability of water projects including; the quantity of water available, quality of water available, capacity of the infrastructure to produce and supply adequate water continually, capacity of the infrastructure to produce safe water continually, capacity of infrastructure to function as required at the design stage, capacity to operate the infrastructure and the realization of service provider expectation. Well (1998) adopted a criteria of measuring sustainability; effectiveness, efficiency, equity and replicability.

Haysom (2006) states that improving sustainability of community water supplies ensures ongoing provision of service which is important in improving people's health, reducing burden of carrying water long distances by women and girls and ensures communities live a life of dignity. Achieving sustainable water supply remains a critical issue globally as indicated in the recent Sustainable Development Goals. Goal 6 targets to ensure availability and sustainable management of water and sanitation for all. Sustainability of the water projects is related to factors such as water resources conservation practices, training, choice of technology and levels of funding as cited by Carter, Harvey & Casey (2010).

1.2 Statement of the Problem

In most of the African countries, water supply systems in rural areas are not operational due to breakdown and are eventually abandoned. According to World Health Organization (WHO), it is estimated that 30% to 60 % of existing water supply systems are not operational. The operation and maintenance of community water projects have been given little attention in developing countries. International Institute for Environment and Development estimates that in Africa, 50,000 water supply points have effectively died as a result of failure to plan for maintenance of infrastructure. Carter et al. (2010) observes that many rural water supply projects in Sub-Saharan Africa, have not been sustainable as a result of; community participation levels, poor or lack of freshwater management, community having not owned the projects, financial costs which the community is not in a position to raise for O&M, lack of skills to operate and maintain the systems, construction quality been compromised in terms of technology used, lack of spare parts for repairs and changes in ground water levels affecting the reliability of water supplies.

In Webuye East Sub-County, the County Government in partnership with the community has invested money in construction water projects. Despite the numerous water projects initiated, many have failed after a short time leading to unsustainable access to clean safe water. It has been observed that increasing coverage of the water projects in the region does not equate to increased access due to high failure rate of the water systems. Unsustainability of the water systems poses a challenge to women and children as they have to walk long distances to access the nearest water points to draw water and at times they are forced to use water from unsafe sources which has a health risk. In order to make the investment in water projects more effective, failure rates of the water systems should be reduced. There is therefore a need

to find out why there are numerous water projects while the problem of water shortage exists. Therefore, this study intended to investigate the determinants of sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.

1.3 Purpose of the Study

The purpose of this study was to carry out an in depth study of determinants of sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives:

1. To assess the extent to which water resources conservation practices affects sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.
2. To assess the impact of training on sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.
3. To determine how choice of technology affects sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.
4. To assess the extent to which levels of funding influences sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya.

1.5 Research Questions

The study intended to answer the following questions:

1. To what extent does water resources conservation practices affects sustainability of community water projects in Webuye East Sub-County?

2. What is the impact of training on sustainability of community water projects in Webuye East Sub-County?
3. How does choice of technology affect sustainability of community water projects in Webuye East Sub-County?
4. To what extent does the level of funding influence sustainability of community water projects in Webuye East Sub-County?

1.6 Significance of the Study

The findings of this study will provide stakeholders with possible indicators of sustainable water systems and associated factors that need to be given due emphasis in future planning. This will enable them make informed decisions in the establishment of water projects and adopt suitable strategies and measures, the community will gain knowledge on the important role they play in ensuring sustainable water projects, Lastly it will be of great benefit to the future researchers as it will be a platform for their research and it will add to the existing body of knowledge in the field area.

1.7 Basic Assumptions of the study

The study assumed that the participants will be available, cooperate and give required information willingly and honestly.

1.8 Delimitations of the Study

The study was conducted in Webuye East Sub-County, involving Sub-County official in the Ministry of Water and Irrigation, community water committee executives and household users. The study was confined on how water resources conservation practices, training, choice of technology and levels of funding determine sustainability of community water

projects in Webuye East Sub-County, Kenya. The study relied on the use questionnaire and interview schedule as instruments for collection of data.

1.9 Limitations of the Study

The remoteness of the study area and the heavy rains during this period were the major limitations of the study. The issue of remoteness was countered by engaging a research assistant from the study area who assisted in data collection. Due to heavy rains and flooding paths leading to the water springs, the researcher was forced to collect data from homesteads.

1.10 Definitions of Significant terms used in the study

Water resources conservation practices; Refers to strategies and activities to manage fresh water as a sustainable resource to protect the water environment and to meet current and future human demand for water.

Training; refers to a process of enhancing stakeholder's knowledge and skills, changing their attitudes, values and practices.

Technology in community water projects; refers to the techniques, knowledge, tools machines, systems used in a water project to achieve a given goal or solve a problem arising in the construction, operation and maintenance of the water system.

Sustainability of water projects; sustainability of community water projects refers to management of water resources in the manner that it ensures both the current and future generations benefit, that acceptable levels of service are available for the current and future generations.

Water quantity; refers to the mass of water or the discharge in terms of the timing, frequency and duration.

Functionality; refers to a condition whereby the system provides water to the users.

1.11 Organization of the study

The research report is organised into five chapters. Chapter one provides the background information of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, basic assumptions, delimitations of the study, limitations and definition of significant terms used in the study. Chapter two covers past or previous studies in the same field, the theoretical framework and conceptual framework of the study and the knowledge gap identified. Chapter three covers the following under research methodology; research design, target population, sample size and sampling procedure, research instruments, piloting of the instruments, validity and reliability of the research instruments, data collection procedures, data analysis and ethical considerations in the study. Chapter four covers data analysis, interpretation and presentation according to the variables of the study. Chapter five provides a summary of the findings, discussion, conclusions of the study, recommendations of the study and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter critically reviews relevant literature review related to the study. The literature reviewed in this chapter is in connection with the research objectives of the study. The chapter also presents a conceptual framework and theoretical framework on which the study is based.

2.2 The Concept of Sustainable Development

The concept of sustainable development evolved between 1972 and 1992 through a series of international conferences and initiatives. The UN conference on the Human Environment held in Stockholm in 1972 being the first international conference to discuss sustainability at a global scale. In 1983, UN convened a Commission which was created to address the deterioration of the human environment and natural resources and its consequences on economic and social development (International Institute for Sustainable Development, 2010).

In 1987, the World Commission on Environment and Development published ‘Our Common Future’ (or Brundland report). The report popularized the most commonly used definition of sustainable development; development that meets the needs of current generations without compromising the ability of the future generations to meet their own needs (WCED, 1987). Brundland report provided foundation for 1992 Rio Summit, Rio Declaration contained 27 principles of sustainable development including; developed countries acknowledge to have

the responsibility to bear the international pursuit of sustainable development. Important conferences were also held in 1997 (Earth summit) in New York and in 2002 (World Summit) in Johannesburg to review the progress.

In 2002, WSSD (World Summit on Sustainable Development) demonstrated a major shift in the perception of the concept sustainable development away from environmental issues to social and economic development. The shift was accelerated by the needs of the least developed countries, the Millennium Development Goals and the recent Sustainable Development goals. According to IFAD Strategic Framework (2007-2010) the concept sustainability of a project is the ability to ensure benefits of a project are realized and maintained after the external funding has stopped. Sustainability measures the growth or expansion, maintenance or degradation of a resource.

Over year the concept has gained wider acceptance by many institutions, NGOS, governments, private sector and in businesses. Sustainable development worldwide has been achieved in integrating environmental considerations in economic decision-making. Critics of sustainable development argue that there has been a problem to measure whether sustainability has been achieved or not and its level of achievement (strong or weak).

2.3 Water Resources Conservation Practices and Sustainability of Community Water Projects

Availability and quality of freshwater in many regions around the world is threatened by overuse, misuse and pollution. As a result of growing imbalance between supply and demand of water, there is an increasing need for ensuring adequate water quality and quantity. Water catchment areas include lakes, rivers, underground water, wetlands, forests and mountains.

Sustainable forest management is important to ensure supply of good quality freshwater. Forest ecosystem is the largest renewable freshwater supply source at 57 %. Forests play a role in ensuring quality, quantity and regularity of water flow. The loss of forest cover can adversely affect freshwater supplies as they act as water reservoirs. Protection of groundwater and surface water catchments is important in maintaining quantity and quality of water. Protection activities include well use of agricultural products such as herbicides, pesticides and fertilizers. Washing of the chemicals downstream results in water pollution affecting the quality of water. Change of land use patterns example clearing of forest areas to use for cultivation purposes can lead to rainfall runoff affecting water quality.

McLyor (2000) urged that the main reason why the water resources are being destroyed is because majority of people in the communities are passive observers of environmental degradation but currently communities around the world are beginning to realize the economic, social, and environmental benefits of water conservation. Planners and water managers are increasingly moving away from supply-side solutions to meet water demand (e.g. expanding physical infrastructure, such as pipes, pumps, dams, and reservoirs) Instead, they are looking toward long-term, comprehensive water management approaches that will ensure adequate quantities of water for the future.

Brikke & Davis (1995) states that conditions in the environment can have adverse effects on the quality and quantity of water source. Maintenance of a water supply includes the protection and conservation of the water source environment. Demand for water is on the increase while the resource is getting more and more limited globally. World Bank (2010) estimates that 40% percent increase is expected in water demand over the period of next two decades. The increase in water demand is as a result of growing population, agriculture,

industrialization and for energy production. Therefore to ensure quantity of water is available to meet the demands, protection and conservation of the sources is very important.

Global Water Partnership (2000) states that Integrated water resource management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems The concept of IWRM as advanced by the UN encourages coordinated sustainable management of water resources among all water users. However, according to Victor (2013) the optimism about IWRM must be tempered by realities about how integration across different industries and political systems might be achieved. Further, IWRM is a repetitive process of managing water resources. It needs coordinated efforts and engaging relevant stakeholders.

The World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002 put IWRM at the top of the international agenda. The IWRM was included as one of the key components for achieving sustainable development. Since 2002, IWRM has marked a fundamental shift away from the traditional top-down, supply-led solutions to water problems dominated by technology (McDonnell, 2008). This where the issue of paying water use fees and maintenance costs is significant in sustaining IWRM. The 2012 United Nations survey revealed that over 50% of African countries are implementing national plans for IWRM while 75% are on course in the implementation of water laws in line with African Water Vision for 2025. The report shows that 18 of the 40 countries that responded have IWRM plans under implementation compared to 2008 when 5 countries, out of the 16 that responded had IWRM plans (UN Water report, 2012).

Mwangi (2014) In the study of determinants of sustainability of community water projects in Kieni East District, Nyeri County, found out that in communities which practiced adequate water conservation interventions including storage reservoirs, roof water harvesting and fencing around water sources had more reliable water sources in quality and quantity than those who sparingly practiced.

2.4 Training and Sustainability of Community Water Projects

Training of community members and water committee members play a critical role in ensuring sustainability of water projects. Training provides knowledge and skills on how to operate and maintain the water systems. Komives, Akanbang, Thorsten, Tuffuor, Wakeman, Larbi, Bakalian & Whittington (2008) states that training of community water caretakers by water agencies and technical experts has always resulted in proper Operation and Maintenance (O & M) leading to sustainable water systems. Many community members always need guidance and support on managing the water systems. Training provides knowledge and skills on how to operate and maintain the water systems and also increase awareness of the community members about willingness to sustain the water systems. If a water system is to operate efficiently, properly and continuously, skilled personnel are needed. Availability of trained personnel in charge of operations, inspection, monitoring and maintenance is important to ensure sustainable water. Ong'wen (2014) recommended that trainings need to be frequent and education level of the community members should be considered to choose the best mode of training and the language to be used to ensure effective learning.

Beyene (2012) in the study of factors affecting the sustainability of rural water supply systems in Ethiopia, shows that where the household users and the water committee members

were trained most of the water systems were functional and where no training was conducted the water projects were not functioning. This shows that training play a great role in ensuring sustainability.

Sarah & Katz (1997) in their study on Making Rural Water Sustainable established that household training plays a key role in ensuring sustainability of water systems. Communities lack capacity to operate and maintain the water projects. Projects that received training on O& M and hygiene had higher sustainability compared to projects that did not receive training. He states that training impacts knowledge and skills on how to operate the systems and do repairs, training on O &M informs communities of what expectations they should have for their system, how to identify and address minor problems on the system and educates the users that the responsibility for maintaining the system rests with them. Training on hygiene issues informs people on health benefits of protecting the water source and this may affect how people value the water sources and increases their satisfaction and willingness to sustain the water system.

Karanja (2014) carried out a study on the influence of management practices on sustainability of youth income generating projects in Kangema District, Murang'a County, Kenya. The study revealed that appropriate training influence the sustainability of the youth projects. The study recommends that, the youths should be provided with comprehensive, quality and convenient training on project planning, implementation and post- implementation of income generating projects.

Mimrose, Gunawardena & Nayakakorala (2011) carried out an assessment of sustainability of community water supply projects in Kandy District. 20 community managed water schemes

in eight Divisional Secretariat divisions in Kandy district were assessed to determine the sustainability of community based rural water supply projects. The results show that the community water supply projects to provide water to rural areas of Kandy district has been a success since 14 out of 20 schemes were found to be sustainable indicating that the strategies followed during the project implementation have succeeded. However, the study has also highlighted areas which require further attention to ensure that these systems would continue to provide the expected services and improve the functioning of other potentially sustainable schemes in the long run. A capacity building program along with an institutional arrangement to provide the support services by the authorities, at least in the short term, is considered vital to help improve the Community Based Organizations and to make them capable and mature entities

Tifow (2013) carried out a study on factors influencing sustainability of rural water supplies in Kenya: (Case of UNICEF supported rural water projects in Lake Victoria south and Lake Victoria north water). The study findings indicate lack of training on the management of the projects contributed majorly to the failure of sustainability. The study recommends the water sector to develop training packages and models for training communities and middle level trainers of trainers to improve sustainability of rural water supplies.

2.5 Choice of Technology and Sustainability Community Water Projects.

Brikke & Bredero (2003) points out that the choice of technology to be used in water projects can have far-reaching consequences on the sustainability of the water services .They suggest an affordable, simple, appropriate, alternative, village technology, self-help and low-cost technology should be used in O &M of community water projects .Effective O&M is of great benefit as it contributes towards sustainable access of water supplies in adequate quantity and

quality; by reducing the time and effort spent on water collection. When choosing a technology to be used factors to be considered should include its complexity, the technical capacity of the system to respond to demand and provide the desired service level, the technical skills needed to operate and maintain the system, the availability, accessibility and cost of spare parts, the overall costs of O&M.

Taylor & Mudege (1996) states that technology choice is very important in ensuring sustainable rural water supply because the type of technology affects O &M. Proper operation and maintenance of community water supply systems is important for sustainability of the water project. Musonga (2004) states that technology should be socially acceptable, economically sustainable, environmentally sound and technically effective. Haysom (2006) points out that the use of appropriate technologies which are of low cost, easy to maintain, easy to use and readily available ensures water project sustainability. He also argues that appropriate technologies are intergral concept of village level O &M (VLOM) which emerged in Water Decade (1981-1990). VLOM ensures beneficiary participation in selection of technologies to be used creating a sense of ownership. Webster, Dejachew, Tseion, Mehari, & Tesfaye (1999) does not support the VLOM concept by arguing that it does not recognise contribution of external support from the Government and other agencies in achieving sustainability.

Roark, Yacoob & Roark (1989) categorises water technologies in two; Water provision methods which includes; spring, dug well, drilled well, dam and catchment. The other category is water lifting or conveyance methods which include; gravity fed pipeline, hand pump, diesel engine, solar pump and windmill. They suggest that when choosing a technology to be used in water projects one should consider water quality(conditions of water

source), reliability(frequency of breakdowns), construction techniques(degree of complexity), construction costs(installing the system),maintenance techniques(expertise and spare parts required),maintenance cost(cost of operating and maintaining a system)and operations management (management, organization and financial management).

Brikke & Davis (1995) noted that lack of spare parts has been a major constraint in the sustainability of water supplies. In some community water projects, it has resulted to the complete abandonment of water systems. Spare parts are all those materials and tools (lubricants, chemicals, electrical and mechanical parts) that are very important in ensuring efficient and sustainable operation of the technical components of a water supply. Spare parts affordability and availability should be considered when selecting the technology to be used.

Donnelly (1987) argues that there is no community that is self-sufficient, it must interact with other agencies to meet their needs. Community's need for spare parts to repair water systems which are usually imported or purchased from businessmen. For example a water project using a pump, the community needs to be trained on the technology used to ensure sustainability. He states that ongoing operations and maintenance of a given water system is an indicator of sustainability. O & M requires technical skills to repair the water systems and he observes that on projects where successfully O & M has been done, it has resulted into sustainable projects.

Brikke & Bredero (2003) came up with factors that influence the selection of community water-supply technology. Technical factors include dependence on fuel or power, quality and durability of materials, availability of spare parts, O &M requirements, compatibility with user's expectations and preferences, availability of trained personnel within the community,

availability of mechanics, carpenters and masons, potential local manufacturing and potential for standardization. Environmental factors including availability accessibility and reliability of water sources (springs, ground water, rainwater, surface water, streams, lakes and ponds), seasonal variations, water quality and treatment, water source protection and negative environmental impact. Institutional factors includes; roles of different stakeholders, availability of local artisans, training and follow-up, availability and capacity of training, skills requirement and monitoring. Community and managerial factors including; local economy, managerial capacity, availability of technical skills and ownership. Lastly, financial factors includes; capital costs, budget allocations, financial participation of users, local economy, financial management, tariff design, cost of spare parts, recurrent costs.

Tafara (2013) in the study of factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi Sub-county, found out that factors affecting continued water supply included breakdown of generator pumps, breakage of pipes, vandalism and blockages of pipes. Local people lacked adequate skills to maintain the water systems. He points out that ensuring that local people have adequate skills and capacity to maintain water projects is important in ensuring sustainability of water projects.

Beyene (2012) in his study found out wrong choice of technology led to failure of Kuyu-Rim water supply system. The pipes did not fit well with the water pump, as the pressure of water pumped is greater than the size of the pipe and this led to breakages.

Musonga (2004) in the study of Issues Regarding Sustainability of Rural Water Supply in Zambia noted that Africare was involved in rehabilitating of water supply facilities and water system in Munjili community was not functioning as the system had not been repaired for 2

weeks. This was as a result of the inability of the community to finance repairs and get technical capacity from the community and even the trained members were not in a position to do repairs and they needed external support.

2.6 Levels of funding and Sustainability of Community Water Projects

Raising of adequate funds for maintaining water systems and activities is important to achieving sustainability. Insufficient financing is a major factor in poor maintenance which leads to project failure. The commitment of financial resources by beneficiary communities is a clear indicator of the expected value of the project to the community members. Capital costs are necessary for purchasing equipment, materials and paying labour services for construction of the projects while recurrent costs cover operations, maintenance, repair, and replacement of system components and community extension activities.

European Union Water Initiative-Finance Working Group (2012) states that public financing for water could take different forms including; including allocations from annual budgets, loans for infrastructure development from governments, external finance like EU and WB, subsidies targeted at water users or service providers including self-initiatives and public guarantees for loans. Water services tend to recover part of their costs from consumers. For developing countries, external finance is always the largest source of capital for investment in water projects.

In Africa, according to Africa Water Vision 2025, financial investment required per year is about USD 20 billion in the water sector. Most water financing systems are based on political, bureaucratic and legal pressures. EUWI 2012 states that in Zambia, financing of water resources is through; recovering costs from users for direct services, use of public

finance for public good, use of external grants and loans, from commercial sources, revenues such as polluters, penalties which are returned the government .In Ghana the constraint to water development is lack of adequate financial resources. The budget falls far below the required levels. The main donors to water sector in Ghana have been CIDA, DANIDA, EU, UN-HABITAT and UNICEF. South Africa gains revenue through licensing fees and license application fees, it also has polluter pay principle, state budgetary allocations have been a source of capital for investment for water projects.

Charity Water as a non-profit organization funds water programs in 24 countries around the world- in Asia, Africa, Central and South America. The organization has funded 13,641 projects, benefiting over 4.6 million people. Over $155 million as at the end of 2014 was raised. The organization funds construction of new wells and fund existing ones to ensure that water projects continue to provide clean water to communities long after they are installed. Up to 30% of the funds go to training and educating the community about how to maintain the wells on their own. This promotes sense of ownership of the projects. They are trained on how to make minor repairs and the organization ensures funding for maintenance is adequate. Charity water has ensured sustainable water supply in Central African Republic by partnering with the communities, communities are asked to pay $8 to help support repair costs but for those who cannot afford pay in kind. In India, Charity water has tried a new approach of investing in local entrepreneurs to repair broken wells as a business for them and this has led to sustainability of the projects.

According to the Annual Water review 2013-2014, Investment in Kenyan urban water and sanitation was 12 billion compared to and investment need of around 75billion. The main sources of funds in Kenya for water sector is the government budget, donor funding and

voluntary contribution from the communities. In 2013/14, Kenya depended on external donors for over 94% of the total investment. World Bank is the largest external source of financing for water projects in the world totalling to US$7.5 billion in FY 11, comprising 53% for water supply and sanitation 12.5% for irrigation and drainage, 23.5% for hydropower and 9.9% for flood protection.Water.org has been providing financial support to Ethiopia, Ghana, Kenya (Kisumu), In Uganda (Kampala) Water.org also supports water projects in India, Bangladesh, Indonesia, Philippines.

Brikke & Rojas (2001) points out sources finance for community water projects. Voluntary funds by voluntary contributions from the members of the community through public meeting and social activities, these funds could be used construction and repairs on the water systems. The communities in some regions also fund their water projects through community revenue from other productive activities, some households contribute to construction and repairs in kind, by providing voluntary labour for trench digging, transport and providing materials such as sand.

Musonga (2004) is his study found out that Munjili community was unable to meet the cost of spare parts as poverty levels were high. They could only meet costs of less expensive spare parts as valves and lubricants but they could not afford pipes, rods and cylinder heads leading to non functional systems. Munyui (2014) carried out a study on factors influencing sustainability of community water projects: a case of Kitui West Sub County, Kitui County. The study indicated that the national governments and Non-governmental Organization had invested large sums of money over years developing community water projects to address the problem of accessibility of water, but the aspect of sustainability of the water projects is left in the hands of the community resulting to high failure rates of these projects. The study

established that sustainability of community water projects in Kitui West Sub County was being influenced though differently by community participation, technology, management and financial factors. The research also established that failure by communities and other stakeholders to take up ownership of projects have plunged community projects into immense financial huddles threatening the sustainability and hence threatening them to seize operations daily. Managerial training of management committees, managerial capacity of management committees, technical training of management committees and financial support for payments of operations and maintenance services significantly influenced sustainability of community water projects in Kitui West Sub County. The study recommends that policy makers should formulate policies aimed at addressing capacity building of management committees in terms of managerial and technical aspects. Policy makers should also formulate policies to address sustainable financing of operations and maintenance of community water projects (Munyui, 2014).

Okemwa & Wanyoike (2015) in the study on Influence of Integrated Water Resources Management approach on Sustainability of water projects in Lake Naivasha Basin concluded that treating water as an economic and social good, contributes towards continuous water supply ensuring project sustainability. They argue that paying water use fees is very important in water project ownership and promotes its sustainability.

2.7 Theoretical Framework

A theoretical framework is a collection of interrelated ideas based on theories. It accounts for or explains phenomena. The study was based on Resource Dependency theory and citizen participation theory.

2.7.1 Resource Dependence Theory

The study was based on Resource Dependence Theory developed by Pfeffer and Salancik (1978).The theory is based upon how organizations depend on resources; it argues that resources originate from an organization's external environment which affects the behaviour of the organization that dependent on resources. According to the theory, organizations depend on resources for their survival or maintenance which is sustainability.
(Davis & Cobb,2010). For any project to achieve its sustainability resources are very important and these resources include financial and human resources.

The theory relates to this study in that in establishment, operation, maintenance and management of community water projects, resources are needed in order for the water projects to be sustainable. Resources include human resource, finances, spare parts for repairs and experts to offer training to the community. There is no community that is self-sufficient and therefore there is need to involve other stakeholders to ensure project sustainability.

2.7.2 Citizen Participation Theory

The history of citizen participation was institutionalized in the mid 1960's with President Lydon Johnson's Great Society Programs. It is traced in ancient Greece and colonial England when government procedures were designed to accelerate external participation. The theory states that participation is necessary in community development activities. Citizen participation is a process where individuals are given opportunities to take part in decision making process in a democratic way. This is based on the assumption that those who are affected by a given decision have a right to participate in the making of the decision. Citizen participation approach has widely been used in management of forests.
(Cogan & Sharpe, 1986).

In the study, communities were involved in choice of technology to be used especially in projects initiated by the community but they were not involved in choosing the technology in projects initiated by the County Government. Communities were involved in financing of the water projects and water resources conservation practices that contributed towards sustainability.

2.8 Conceptual Framework

According to Mugenda & Mugenda (2003) a conceptual framework is a hypothesized model that identifies the concepts under study and their relationships. It presents in a diagrammatic form the way the researcher has conceptualized the relationship between the independent and dependent variables. The independent variables are arranged on the left while the dependent variable is on the right of the diagram in Figure 2.1

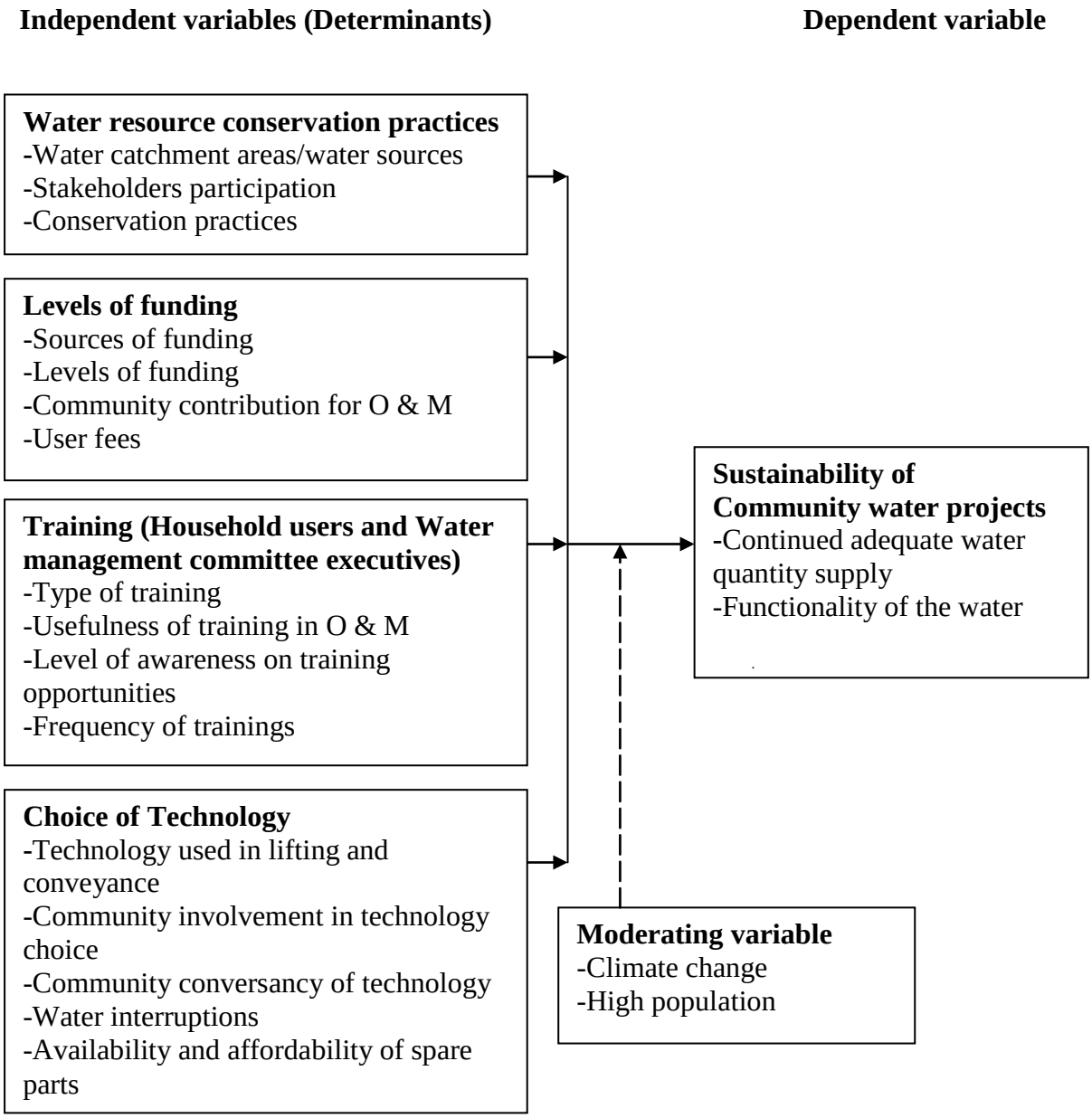

Figure 2. 1: Conceptual framework

As indicated in the figure 2.1 above, Independent variables are Water resource conservation practices, training, choice of technology and levels of funding. The dependent variable is sustainability of water projects and the moderating variables are climate change and high population. The relationship between the independent and dependent variables could be affected by the moderating variables which will not be measured in the study.

2.9 Research Gap

Literature reviewed provided an analysis of determinants of sustainability of community water projects including; water resources conservation practices, training, choice of technology and level of funding. Literature reviewed from previous studies indicate that there is a knowledge gap, little has been done on variables such as water resources conservation practices, training, choice of technology, and levels of funding on sustainability of community water projects. Therefore the study was conducted to fill pertinent knowledge gaps in literature as it covered additional variables.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the Research design and methodology that was employed to the study. The chapter covers research design, target population, sample size and sampling procedure, research instruments, piloting of the instruments, validity and reliability of the instruments, data collection procedure, data analysis techniques and ethical considerations in the study.

3.2 Research Design

This study adopted descriptive survey design. It attempts to describe characteristics of a particular phenomenon, situation, of an individual or a group (Kothari, 2004). It involves studying a situation as it is, in an attempt to explain why the situation is the way it is. (Wierman, 1999).The researcher considered it most the appropriate in examining determinants of sustainability of community water projects since it permits gathering of information on a large population and allows generalization of results from the sample to the larger target population, it is also an approach that allows to collect both qualitative and quantitative data. It is relatively quick and inexpensive considering the researcher's limited resources.

3.3 Target Population

Target population is a complete set of individuals, cases or objects with some common observable characteristics (Mugenda & Mugenda, 1999). This study targeted the water management committee executives, the household water users and an official in the Ministry of

Water and Irrigation in Webuye East Sub-county. The Sub-County has approximately 100 community water management committees and each is made up of three executive officials including the chairman, secretary and treasurer. An estimated population of 10,000 household users are served by the community water projects. Therefore the target population units for the study consisted of; 10,000 household users, 300 community water management committee executives and 1 official in the Ministry of water and Irrigation. Consequently the target population for this study was 10,301 respondents as represented in the table 3.1

Table 3.1: Target Population

Strata	**Target Population**
Community water management committee executives	300
Household users	10000
Ministry of water official	1
Total	**10,301**

3.4 Sampling Size and Sampling Technique

Sampling is the process of systematically selecting representative elements of a population (Kothari, 2014). The sample size of this study was calculated using simplified Yamane formula (1967:886) below. 95% confidence level and 5% error is assumed

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

Where;

n = Sample size

N = Population size (10,301)

e = Sampling error

Sample size for the respondents

$$n = \frac{10301}{1+10301\,(0.05)^2}$$

The sample size of respondents was 382.

Table 3. 2: Proportionate Sampling of Respondents

Strata	Target	Sampling procedure	Sample
Community water committee executives	300	300/10301*382	11
Household users	10000	10000/10301*382	370
Ministry of water official	1	1/10301*382	1
Total	10301	10301/10301*382	382

Using simplified Yamane formula (1967:886) above, the sample size for the community water projects was 80. The researcher employed Simple Random Sampling in selecting the community water projects. The researcher selected 370 household users by convenience sampling, which involves selection of cases as they become available. The advantage of this method is that subjects are easily and conveniently available and accessible as they come to collect water. Purposive sampling was used to select 11 executive committee members and an official from the Ministry of Water and Irrigation. Purposive sampling is a technique that allows a researcher to use cases that have required information with respect to the objectives in the study (Mugenda & Mugenda, 2003).

3.5 Research Instruments

The researcher used questionnaires to collect quantitative data from water management committee executives and the household users. A questionnaire is a research instrument that gathers data over a large sample and therefore can enable generalizations. (Mugenda & Mugenda,2003). The researcher used two types of questionnaires, one for the water management committee executives and the other for household users. The questionnaires consisted of both open and closed form of questions. Qualitative data was collected using interview guide from the key informant from the Ministry of Water and Irrigation at the Sub-County level. According Ong'ondo & Jwan (2011) interviews are intended to get to what the participant in the study thinks, the attitudes of that person or explore person's reasons for thinking in a certain way. Interviews are flexible, take care of sensitive remarks and have high rate of response. The interview guide was developed by the researcher in accordance with the set objectives.

3.6 Pilot Study

Orodho (2004) states that pilot testing is a smaller version of a large study that is conducted in order to prepare for the study and to provide a basis for the design. According to Mugenda & Mugenda (2003) pilot study enables the researcher to incorporate suggestions made by the respondents to improve the questionnaire and also evaluate the methods of analysis, if they are appropriate or not. He states that a pilot size of between 1% and 10% is considered appropriate. Before the research instruments were finally administered to the targeted sampled respondents, pre-testing was carried out to assess their validity and reliability. It was conducted among selected community water projects in the neighbouring Webuye West Sub-County. The researcher employed a sample size of 5% of the required sample size in pretesting (4 water management committee executives and 16 household users). Questions

were checked to ensure they were relevant, understandable and the wording, structure and sequence were also checked. Piloting assisted the researcher in reviewing and adjusting the research instruments appropriately.

3.7 Validation of Research Instruments

Validity is the measure of accuracy of data obtained from the instruments used in the study (Mugenda & Mugenda, 1999). In this study piloting was used to determine accuracy, clarity and suitability of the instruments. Based on pilot study results, rectifications and modifications were made to the research instruments. The instruments were assessed for content validity. Content validity was done to ensure the instruments cover exhaustively the study objectives, content logically get at the intended variable and have an appropriate format. The instruments were given to the supervisor and lecturers in the department to assess their validity. Final instruments to be used for data collection put into consideration the contribution of made.

3.8 Reliability of Research Instruments

The researcher used the split half method to test reliability of the research instruments. It involves scoring two-halves of a test separately for each item and then calculating a correlation coefficient for the two sets of the scores. The split-half method was preferred because it was a simple to use, time and cost effective. The researcher used SPSS to compute Pearson's product moment correlation coefficient (0.84).According to Orodho (2004) a correlation coefficient of about 0.84 should be considered strong enough to judge the instrument as reliable for a study.

3.9 Data Collection Procedures

The researcher obtained a research permit from NACOSTI and a letter from the University An introductory letter was attached to the questionnaire to inform the participants on the purpose and significance of the information that they provided and assuring them confidentiality. The researcher then contacted the various water management committee executives and set up appointments. The researcher first trained the research assistant on how to use the instruments, then administered the questionnaires together with the research assistant to the household users and the committee executives. The researcher personally conducted the interview to an official from the Ministry of Water and Irrigation at the Sub-County level.

3.10 Data Analysis Techniques

Data analysis is the process of creating order, structure and meaning to the mass of information collected (Mugenda, 2003). Data collected was first cleaned to identify missing data, identify errors and corrections were made. Then data coding was done to translate other types of data into numeric codes. Descriptive statistics and correlations analysis was used to analyse raw data by using Statistical Package for Social Sciences version 20.0 and data was presented using frequency distribution, tables, percentages and Pearson product moment coefficients. Pearson's correlation was used to determine the degree of relationship between the independent and dependent variables.

3.11 Ethical Considerations

The researcher upheld ethical issues in the study and this included; obtaining consent from National Commission for Science, Technology and Innovation and sought permission from the University of Nairobi and was granted a letter to allow the researcher carry out the

research. The researcher obtained informed consent from the participants and assured them of anonymity and confidentiality.

Table 3. 3: Operationalization of Variables Table

Objective	Variable	Measuring Indicators	Data collection methods	Scale	Method of data analysis
To assess the extent to which water resources conservation practices affects sustainability of community water projects	Water resources conservation practices	-Sources of water/ catchment areas -Stakeholders participation -Conservation/ protection practices	Questionnaire and interview guide	Nominal Ordinal	-Descriptive analysis -Correlation analysis
To assess the impact of training on sustainability of community water projects	Training of Household users and water management committee executives	-Types of training -Usefulness of training in O & M -Level of awareness on training opportunities - Frequency of trainings	Questionnaire and interview guide	Nominal Ordinal	-Descriptive analysis -Correlation analysis
To determine how choice of technology affects sustainability of community water	Choice of Technology	-Technology used(lifting or conveyance) -Community involvement in choice of technology -Community conversancy -Water interruptions -Availability and affordability of spare parts	Questionnaire and interview guide	Nominal Ordinal	-Descriptive analysis -Correlation analysis
To assess the extent to which levels of funding affects sustainability of community water projects	Levels of funding	-Sources of funding -Levels of funding - Community contribution for O & M -User fees	Questionnaire and interview guide	Nominal Ordinal	-Descriptive analysis -Correlation analysis

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter provides data analysis, presentation and interpretation. Raw data was organized and analyzed using descriptive statistics and correlations using Computer Software Statistical Package for Social Sciences version 20 according to the objectives of the study. The analyzed data is presented using frequency distribution, percentages, cross tabulations, narratives, interpretation and explanations of the findings on the Determinants of Sustainability of Community Water Projects in Webuye East Sub-County.

4.2 Questionnaire Return Rate

Bobbie (2002) defines questionnaire return rate as the proportion of the questionnaires returned after they are issued and filled by the respondents. He states that a questionnaire return rate of 50% and above is sufficient for analysis. Questionnaires were administered to a sample of 11 management committee executives and 370 household user respondents. Response rate for management committee executives was 100% while response rate for household user respondents is given in the Table 4.1 below.

Table 4.1: Questionnaire Return Rate

Questionnaire Return Rate	Frequency	Percent	Cumulative Percent
Returned Questionnaires	340	91.9	91.9
Unreturned Questionnaires	30	8.1	100.0
Total	**370**	**100.0**	

Household user respondents' response rate was at 91.9%. High response rate can be attributed to the data collection procedure, where the researcher personally administered questionnaires with the help of a research assistant .It is also as a result of willingness of the respondents to participate in the survey. 30 (8.1 %) of the questionnaires that were not returned were due to unavailability of respondents at that time of collection and the heavy rains that resulted in impassable roads.

4.3 Demographic Characteristics of the Respondents

The study sought to establish information on the respondents' background information including gender, age distribution, education level and period of residence. This information is presented in Tables 4.2 to 4.7. This information was important in establishing appropriateness of the respondents in answering questions regarding determinants of sustainability of community water projects in Webuye East Sub-County.

4.3.1 Gender Distribution of Respondent's

The study sought to establish the gender of the respondent's. Table 4.2 shows the gender distribution of the household user respondents.

Table 4.2: Gender of the Household User Respondents

Gender	Frequency	Percent	Cumulative Percent
Male	80	23.5	23.5
Female	260	76.5	100.0
Total	**340**	**100.0**	

From the findings as shown in table 4.2, majority of the household user respondents were female 260 (76.5 %) and the minority were male (23.5 %). The findings show that female are more involved in water issues than men because of their gender roles that confine women to

household chores such as fetching water. This made it possible to involve more women in the survey as they were easily found at water points. Few men are involved as the roles are changing. Fetching water as a responsibility continues to be shared between women and men. This could have a significant role in operation and management of the water projects affecting the sustainability of the projects.

The study also sought to find out gender distribution in water management executive positions in the 11 water management committees.

Table 4.3: Gender of the Water Committee Executives

Gender Distribution	Frequency	Percent	Cumulative Percent
Equal distribution	4	36.4	36.4
Male dominance	1	9.1	45.5
Female dominance	6	54.5	100.0
Total	**11**	**100.0**	

From the findings as shown in Table 4.3.2, female dominance was at 54.5 % which is the highest and male dominance the lowest at 9.1 %. This indicates that female have been given chance in leadership on water committees as women are the most affected by water scarcity issues.

4.3.2 Age of the Respondents

The study sought to find out the age group of the household user respondents. Table 4.4 presents the Age groups.

Table 4.4: Age Group of the Household User Respondents

Age	Frequency	Percent	Cumulative Percent
20-30 years	133	39.1	39.1
31-40 years	100	29.4	68.5
41-50 years	41	12.1	80.6
51-60 years	36	10.6	91.2
over 60 years	30	8.8	100.0
Total	**340**	**100.0**	

Among the household user respondents 133(39.1 %) was aged between 20- 30 years, 100 (29.4 %) were aged between 31-40 years, 41(12.1 %) were aged between 41- 50 years, 36(10.6 %) were aged between 51-60 years and 30(8.8 %) were over 60 years. The findings indicates that the most dominant age group in this community was between the ages 20 - 40 years and it is the age that is actively involved in fetching water as a responsibility. This dominant group was very vital in the survey as it was more informed on current issues concerning water projects in this community than the age between 41 and above.

4.3.3 Level of Education of the Household User Respondents

The study sought to find out the level of education of the respondents. The findings are shown in Table 4.5 below.

Table 4.5 : Level of Education of the Household User Respondents

Level of Education	Frequency	Percent	Cumulative Percent
Never attended school	5	1.5	1.5
Primary level	107	31.5	32.9
Secondary level	195	57.4	90.3
College/ University level	33	9.7	100.0
Total	**340**	**100.0**	

Among the household user respondents, 5 (1.5%) had never attended school, 107(31.5 %) had attained primary education, 195 (57.4%) had achieved secondary level of education and 33 (9.7 %) had at least attained a diploma or a degree. The findings indicate that literacy level is high as only 5(1.5%) had never attended school. This demonstrates the ability of the community to provide valid and consistent information on the determinants of sustainability of water projects in the community. The study also sought to find out level of education of the 11 Management water committee executives. The Table 4.6 shows the findings.

Table 4.6: Level of Education of the Management Water Committee Executives

Level of Education	Frequency	Percent	Cumulative Percent
Primary level	1	9.1	9.1
Secondary level	5	45.5	54.5
College/University	5	45.5	100.0
Total	**11**	**100.0**	

Among the Management water executives 1 (9.1%) had attained primary level of education, secondary and college/university level had both 5(45.5 %) These indicates the high literacy level among management water committee executives, this demonstrates valid and consistent information provided in this survey as well as them being in a position to make informed decisions concerning the water projects. High literacy level also has an implication for improving future sustainability of community water projects as more people with higher education retire and go back to their communities and get actively involved in management of community projects.

4.3.4 Period of Residence of the Household User Respondents

The study sought to find out for how long the household user respondents had lived in Webuye East Sub-County. Table 4.6.1 below shows the findings;

Table 4.7 : Period of Residence of the Household User Respondents

Period of Residence	Frequency	Percent	Cumulative Percent
Less than 6 months	13	3.8	3.8
6 months - 1 year	17	5.0	8.8
1-5 years	106	31.2	40.0
over 5 years	204	60.0	100.0
Total	**340**	**100.0**	

From the findings, 13 (3.8%) of the respondents had stayed in the community for less than 6 months, 17 (5 %) between 6 months to 1 year, 106 (31.2 %) had been resident for a period of 1-5 years and 204 (60%) for over 5 years. This indicates that most of the respondents had been residents long enough to give credible information about the community water projects.

4.4 Sustainability and Water Supplies

The study sought to find out the operational status and the sustainability of the community water projects. The household user respondents were asked concerning the type of the water project, when it was developed, if it is functioning or not and opinions on whether the water supply is sustainable or not.

4.4.1 Type of Water Project

The study aimed at finding out the types of community water projects in the region. The table below shows the findings;

Table 4.8: Type of Water Project

Type	Frequency	Percent	Cumulative Percent
Borehole	12	3.5	3.5
Spring	328	96.5	100.0
Total	**340**	**100.0**	

From the household user respondents, 12(3.5%) collect water from the community boreholes and 328(96.5%) from community water springs. According to an official from the Ministry of water and irrigation at the sub-county level, most of the boreholes have been drilled by the county government. The researcher sought to find out types of the water projects as this could contribute towards the sustainability depending on how the water is extracted.

4.4.2 Age of the Community Water Projects

The household user respondents were asked to indicate when their respective water supplies facilities were developed. Their responses were as shown in Table 4.9 below

Table 4.9: Age of the Community Water Projects

Age of Community Water Projects	Frequency	Percent	Cumulative Percent
Under 2 years	105	30.9	30.9
Between 2-4 years	113	33.2	64.1
Between 4-6 years	93	27.4	91.5
6 years and above	29	8.5	100.0
Total	**340**	**100.0**	

105(30.9%) of the household respondents indicated that their respective water projects had been developed in less than 2years, 113(33.2%) said that their facilities had been operational between 2-4 years, 93(27.4%) indicated their facilities having been operational between 4-6 years and 29(8.5%) indicated that they had lasted for over 6 years. The researcher found it important to know the period the facilities have been in existence in order to know the

sustainability of the facilities. From the findings most of the facilities were developed 4 years and below while 6 years above had few facilities still existing showing the level of sustainability being low.

4.4.3 Functionality of the Community Water Projects

The study sought to find out the operational status of the water projects and the household user respondents were asked to indicate whether water facilities were functional or not. Below are their responses.

Table 4.10: Functionality of the Water Facilities

Response	Frequency	Percent	Cumulative Percent
Yes	284	83.5	83.5
No	56	16.5	100.0
Total	**340**	**100.0**	

Majority of the household user respondents 284 (80.9%) reported that their water facilities were functional compared to 56 (16.5%) who reported otherwise. Most of the water facilities were functional taking into account rainy season during which the study was done. The main reasons given by those who said their facilities were not functioning included breakdown of the water systems, water sources/catchment for the water supply drying up and others said it is as a result of having no one to operate the facility as they are not familiar with the technology used to extract water.

4.4.4 Extent of Sustainability of the Water Supplies

Household user respondents and the management water committee executives were asked if the water supply was sustainable. The findings are presented in Table 4.11 below.

Table 4.11: Sustainability of the Water Facilities

Response	Frequency	Percent	Cumulative Percent
Yes	208	61.2	61.2
No	132	38.8	100.0
Total	**340**	**100.0**	

The findings in the table 4.11 indicate responses by the household user respondents. 208(61.2%) reported that their water supplies are sustainable while 132(38.8%) reported that their water supplies are not sustainable. Among the 11 water management water executives, 6(54.5%) reported that water supplies are sustainable and 5(45.5%) reported that they were not sustainable. Household user respondents and the water management water committee executives who reported that their water supply was not sustainable attributed it to lack of funds to maintain the facilities, water drying up during dry seasons and breakdowns due to non-repairs. The household user respondents were asked to indicate the extent to which the water supplies were sustainable and the responses are presented below.

Table 4.12: Extent of Sustainability

Response	Frequency	Percent	Cumulative Percent
To a very low extent	56	26.9	26.9
To a low extent	41	19.7	46.6
Sometimes good and sometimes bad	65	31.3	77.9
Great extent	27	13.0	90.9
A very great extent	19	9.1	100.0
Total	**208**	**100.0**	

From the 208 household user respondents who had indicated that water supply was sustainable, 56(26.9%) said the water supply was sustainable to a very low extent, 41(19.7%) reported the water supply to be sustainable to a low extent, 65(31.3%) indicated that water supply was sometime good and sometimes bad, 27(13%) indicated that the water supply is sustainable to a great extent and 19(9.1%) reported the water supply to be sustainable at a very great extent.

When the water management committee executives and household users were asked of what influences sustainability of the community water projects, they gave reasons including financial constraints that the community faces in construction and maintenance of the facilities, complex technology used especially for those getting water from the boreholes using a hand pump, lack of community participation in county initiated projects and low efforts in conservation of catchment areas.

4.5 Water Resource Conservation Practices and Sustainability of Community Water Projects

The first objective of the study was to assess the extent to which water resources conservation practices affects sustainability of community water projects.

4.5.1 Source /Catchment Area for the Water Projects

The researcher sought to know the sources/catchment areas for the water projects. The response was as shown in the table 4.13 below.

Table 4.13: Source/Catchment Area for the Water Projects

Source	Frequency	Percent	Cumulative Percent
Groundwater	217	63.8	63.8
Wetland	33	9.7	73.5
Forest	29	8.5	82.1
Mountain/Hill	8	2.4	84.4
River	53	15.6	100.0
Total	**340**	**100.0**	

From the Table, 217(63.8%) of the household user respondents say the source of the water for projects is from underground, 33 (9.7 %) from wetland, 29 (8.5%) from forests, 8(2.4 %) from mountain/hill and 53 (15.6 %) from rivers. The researcher found it of great importance to know the sources of water for the projects as it can have adverse impact on the sustainability of the water projects.

4.5.2 Community Involvement in Conservation and Protection of Water Catchment Areas

The study aimed at establishing community involvement in conservation of catchment areas and the findings are shown in Table 4.14

Table 4.14: Community Involvement in Conservation and Protection of Water Catchment Areas

Response	Frequency	Percent	Cumulative Percent
Yes	123	36.2	36.2
No	217	63.8	100.0
Total	**340**	**100.0**	

In responding to the level of community involvement, 123 (36.2 %) household user respondents indicated that they were involved in the conservation and protection activities that were initiated in order to ensure continued water supply, 217 (63.8 %) of the

respondents indicated that they have never been involved in water conservation practices. A high level of non-participation indicates how it contributes to unsustainable water projects.

4.5.3 Conservation and Protection of Water Catchment Areas of the Water Projects

The study established some of the conservation practices by the household users and the findings are shown in the Table 4.15

Table 4.15: Conservation and Protection Practices

Conservation and Protection Practices	Frequency	Percent	Cumulative Percent
Afforestation	53	43.1	43.1
Pollution management and Hygiene practices	47	38.2	81.3
Management of catchment areas	23	18.7	100.0
Total	**123**	**100.0**	

With regards to the types of water catchment conservation interventions, 53 (43.1%) household user respondents indicated afforestation which involves planting trees in the catchment area and according to the Ministry of Water and Irrigation official, the County Government have been initiating programmes towards afforestation in the area. 47 (38.2 %) been involved in pollution management and hygiene practices including; avoiding dumping in the rivers, not bathing in the rivers and avoiding grazing in the areas, careful use of fertilizers in farms upstream to avoid pollution of water as fertilizers are swept into the rivers. 23 (18.7 %) of the respondents indicated that they have been involved in management practices such as fencing the catchment areas and the water systems. Respondents said that most of the conservation activities were initiated by the community itself as the county government plays a minimal role. This has resulted into little effort as the community is not

in a position to ensure effective conservation and management of water resources affecting water sustainability.

4.5.4 Water Resource Conservation Practices and Continued Water Supply

The researcher sought to find out from household user respondents if water conservation practices contribute towards continued water supply. Table 4.16 presents their responses.

Table 4.16: Water Resource Conservation Practices Contribute to Continued Water Supply

Response	Frequency	Percent	Cumulative Percent
Strongly Agree	156	45.9	45.9
Agree	123	36.2	82.1
Undecided	44	12.9	95.0
Disagree	12	3.5	98.5
Strongly disagree	5	1.5	100.0
Total	**340**	**100.0**	

Of the 340 household user respondents interviewed on whether water conservation practices contribute to continued water supply, 156 (45.9 %) strongly agree with the statement, 123 (36.2%) agree, 44 (12.9 %) were undecided, 12 (3.5 %) disagreed with the statement and (1.5 %) strongly disagreed with the statement. Majority of the respondents attributed that the conservation of the water resources such as afforestation and general management of the water sources or catchment areas influence water supply. While the minority did not see how conservation activities would lead to a continued water supply in the community water projects because of other factors that could influence continued supply such as climatic change. Climate change is a phenomenon we can no longer deny as its effects have become increasingly evident worldwide.

4.5.5 Relationship between Water Resource Conservation Practices and Sustainability of the Water Supplies

The respondents' responses on the question related to the extent to which they thought water supplies were sustainable was scored on a 5-point scale, ranging from "a very low extent "to a very great extent" These scores were used to compute the Pearson's Product Moment Correlation (PPMC) between water resource conservation practices and sustainability of the water supplies. The results of correlation analysis were as shown in Table 4.17

Table 4.17: Relationship Between Water Resource Conservation Practices and Sustainability of the Water Supplies

		Conservation practices	**Extent of sustainability**
Conservation practices	Pearson Correlation	1	.959**
	Sig. (2-tailed)		.000
	N	123	123
Extent of sustainability	Pearson Correlation	.959**	1
	Sig. (2-tailed)	.000	
	N	123	208

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

The PPMC analysis indicated that there was a strong positive correlation between water resources conservation practices and sustainability of water supplies (r=0.959).The correlation was significant at the 0.01 level. An official from the ministry of water and irrigation pointed out that conservation and protection of water resources and catchment areas is very important in ensuring sustainable community water projects and it calls upon efforts from the community and the county government. The researcher cross tabulated conservation practices and sustainability of water facilities to know how much each intervention has contributed to sustainability.

Table 4.17: Conservation practices * Sustainability of the Water Facilities Cross Tabulation

Conservation practices		Sustainability of the water facilities
Afforestation	Count	53
	% within Sustainability of the water facilities	43.1%
Pollution management and Hygiene practices	Count	47
	% within Sustainability of the water facilities	38.2%
Management of catchment areas	Count	23
	% within Sustainability of the water facilities	18.7%
Total	Count	123
	% within Sustainability of the water facilities	100.0%

From the cross tabulation, afforestation contributed towards sustainability at 43.1%, pollution management and hygiene practices at 38.2% and management of catchment areas at 18.7% .

4.6 Training and Sustainability of Community Water Projects

The second objective was to assess the impact of training on sustainability of community water projects.

4.6.1 Training of the Household User Respondents

The study sought to find out if the household user respondents had received any kind of training. The findings are indicated in table 4.18

Table 4.18: Training by Household User Respondents

Response	Frequency	Percent	Cumulative Percent
Yes	143	42.1	42.1
No	197	57.9	100.0
Total	**340**	**100.0**	

Among the household user respondents, 143(42.1%) indicated that they have received training concerning the water projects while 197(57.9) indicated that they have never received any kind of training. This implies that most of the beneficiaries lack proper skills and knowledge which could contribute towards sustainability of water projects.

4.6.2 Type of Training Received

The study sought to establish types of training the household user has ever received. Table 4.19 shows the findings.

Table 4.19: Type of Training

Type of Training	Frequency	Percent	Cumulative Percent
Conservation	55	38.5	38.5
Management	34	23.8	62.2
Operation &Maintenance	54	37.8	100.0
Total	**143**	**100.0**	

Among the 143 household user respondents who had received training, 55(38.5%) reported to have received training on conservation of water resources and catchment areas, 34(23.8%) received training on management aspects and 54(37.8%) received training on operation and maintenance of the water facilities. When 11 water management executives were asked on which trainings they have received, those serving under borehole projects reported to have received training on operation and maintenance. All the officials had received training on

conservation and management. An official from the Ministry of water and Irrigation indicated that the county had initiated afforestation programmes which encourage the communities to plant trees in water catchment areas and that training by the county officials on operating boreholes fixed with hand pumps has been done to management water committee executives and the household users.

4.6.3 Usefulness of Training in Operation and Maintenance

The water management committee executives were asked to indicate if they consider training an important aspect in Operation and maintenance. Table 4.20 shows the results.

Table 4.20: Usefulness of Training in O & M

Response	Frequency	Percent	Cumulative Percent
Yes	7	63.6	63.6
No	4	36.4	100.0
Total	**11**	**100.0**	

Among the 11 committee executives, 7(63.6%) stated that training on O & M is necessary and important in Operation and Maintenance while 4(36.4%) did not see the usefulness of training on O & M as the technology used in water springs is simple. The researcher sought to know the opinion of the executives because proper operation and maintenance of the water facilities contributes towards sustainability of water supply.

4.6.4 Extent of Usefulness of Training in O & M

Management committee executives were asked to indicate what extent to which they think Training is important for proper O & M of water facilities. Table 4.21 presents the findings

Table 4.21: Extent of Usefulness of Training for O & M

Response	Frequency	Percent	Cumulative Percent
To a very low extent	1	14.3	14.3
To a low extent	1	14.3	28.6
To a great extent	3	42.9	71.4
To a very great extent	2	28.6	100.0
Total	**7**	**100.0**	

Among the 7 management committee executives who regard training as important for proper O&M, 1 (14.3%) stated that it is important to a very low extent, 1(14.3%) stated that it is useful to a low extent, 3 (42.9%) stated that it is useful to a great extent and 2 (28.6%) stated that it is useful to a very great extent.

4.6.5 Level of Awareness on Training Opportunities

Household user respondents were asked to state the level of awareness on available training opportunities concerning the water projects and below are their responses.

Table 4.22: Level of Awareness on Training Opportunities

Response	Frequency	Percent	Cumulative Percent
High	0	0.0	0.0
Average	85	25.0	25.0
Low	255	75.0	100.0
Total	**340**	**100.0**	

None of the household user respondents indicated that level of awareness for training is high.85 (25%) indicated that the level of awareness on trainings is average whereas the majority 255(75%) indicated that the level of awareness was low. This explains why the number of those who have never received training is high at (57.9 %) as shown in Table 4.15

above. This could have a significant impact on sustainability of the community water projects.

4.6.6 Frequency of Training

The study sought to establish the frequency of trainings offered to the household users. Table 4.23 presents the findings.

Table 4.23: Frequency of Training

Response	Frequency	Percent	Cumulative Percent
Never	167	49.1	49.1
Rarely	117	34.4	83.5
Occasionally	56	16.5	100.0
Always	0	0.0	100.0
Total	**340**	**100.0**	

In responding to the frequency of trainings that are available, household users 167(49.1) indicated that there has never been training on various aspects of water projects. 117(34.4%) indicated that rarely were the trainings conducted, 56(16.5%) indicated that the trainings were occasional and none of the respondents indicated if the trainings are held always. Frequency of the trainings influences sustainability of water projects as the community is supposed to be regularly equipped with necessary skills and knowledge concerning management, O & M and conservation.

4.6.7 Training and Sustainability of Community Water Projects.

The study sought to establish whether the skills and knowledge acquired during training influences sustainability of water projects. Household user respondents were asked to indicate what extent to which they think training impacts on sustainability of water projects. Responses are shown in Table 4.24 below.

Table 4.24: Extent to which Training Impacts Sustainability of Water Projects

Response	Frequency	Percent	Cumulative Percent
To a very low extent	157	46.2	46.2
To a low extent	93	27.4	73.5
To a great extent	65	19.1	92.6
To a very great extent	25	7.4	100.0
Total	**340**	**100.0**	

Findings from the household user respondents indicated that the majority 157(46.2%) said that training had contributed to sustainability of water projects to a very low extent. 93(27.4%) indicated that it had contributed to a low extent, 65(19.1) said its contribution is to a great extent and 25(7.4%) indicated that training has contributed to a very great extent. The majority of the respondents indicated to a very low extent as the level of awareness on training opportunities is very low and training is a rare exercise on management, O & M and water resource conservation. Training of household users and Water management committee executives provides knowledge and skills on how to operate and maintain the water systems and where training levels are low, achieving of sustainability becomes a challenge.

4.6.8 Relationship between Training and Sustainability of Community Water Projects

Pearson's Product Moment Correlation (PPMC) analysis was computed between scores of the question on the extent to which household user respondents think training contributes to sustainability of water projects and sustainability of community water projects. The results of correlation analysis were as shown in Table 4.25

Table 4.25: Relationship between Training and Sustainability of Community Water Projects

		Extent to which training impacts sustainability of water projects	Sustainability of the water facilities
Extent to which training impacts sustainability of water projects	Pearson Correlation	1	.821**
	Sig. (2-tailed)		.000
	N	340	340
Sustainability of the water facilities	Pearson Correlation	.821**	1
	Sig. (2-tailed)	.000	
	N	340	340

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

PPMC analysis results indicate a strong correlation between training and sustainability of community water projects (r=0.821).The correlation was significant at the 0.01 level. This indicates that sustainability of the water projects was associated with training on O & M, conservation and management.

4.7 Technology and Sustainability of Community Water Projects

The objective was to determine how technology choice affects sustainability of community water projects.

4.7.1 Type of Technology

The study sought to find out type of technology used in respective water projects. The responses are presented below in Table 4.26

Table 4.26: Type of Technology Used

Type of Technology	Frequency	Percent	Cumulative Percent
Hand pump	12	3.5	3.5
Gravity fed pipe	328	96.5	100.0
Total	**340**	**100.0**	

Among the 340 household user respondents, 12(3.5 %) reported that they use hand pump whereas 328(96.5%) reported that they use gravity fed pipe. This indicates that majority of the people in this community draw water from community springs. The County official stated that since devolution, they have been able to initiate 12 boreholes across the Webuye sub-county which uses hand pumps.

4.7.2 Community Involvement in Choosing the Technology

The study sought to establish whether the community had been involved in deciding the technologies adopted for their water facilities. The household user respondents' responses are shown in Table 4.27

Table 4.27: Community Involvement in Choosing the Technology

Response	Frequency	Percent	Cumulative Percent
Yes	307	90.3	90.3
No	33	9.7	100.0
Total	**340**	**100.0**	

The results indicate that 307(90.3 %) had participated in the choice of the technology used while 33(9.7 %) had not participated in choosing the technology to be used. Majority were involved in construction of springs as the technology used is simple and affordable. Those who did not participated attributed this to County initiated water projects whereby the

community is not involved in choosing the technology to be used. The water management water committee executives also reported that they were involved in choosing the technology to be used except for the borehole that the County had initiated.

4.7.3 Community Conversancy with the Technology Used

The study sought to establish if the household users were conversant with the technology used in extraction of water

Table 4.28: Community Conversant with Technology Used

Response	Frequency	Percent	Cumulative Percent
Yes	330	97.1	97.1
No	10	2.9	100.0
Total	**340**	**100.0**	

Findings indicate that 330(97.1%) of the household user respondents are conversant with the technology used in drawing or extraction of water while 10(2.9%) indicate that they are not in a position to use the technology. Majority of the people are conversant in drawing water from the springs as it is a simple technology while the minority who are not able to use the technology draw water from the boreholes which use a hand pump and since they have not been trained they are not in a position to use it. Conversancy with the technology used has a positive influence on sustainability of water supplies. Management committee executives reported that most of the repairs of the springs are made by the community itself while breakdowns on hand pumps are made by technicians. Waiting on the technicians to repair hand pumps affects continued supply of water and is expensive for the community to raise the money for the spare parts.

4.7.4 Interruptions of Water Supply as a Result Breakdowns

Household user respondents were asked to indicate if they ever experience interruptions in water supply as a result of breakdowns. Table below gives their responses;

Table 4.29: Interruptions as a Result of Breakdowns of the Water System

Response	Frequency	Percent	Cumulative Percent
Yes	154	45.3	45.3
No	186	54.7	100.0
Total	**340**	**100.0**	

Findings indicate that 154(45.3%) reported that they have ever had interruptions with water supply as a result of breakdowns while 186(54.7%) reported that they have never had interruptions as a result of breakdowns. Management water committee executives indicated that they have ever experienced interruptions of water supply. An official from the ministry attributes interruptions to the negligence of the water facilities by the community who depend largely on external support from Non-governmental organizations and the county government.

4.7.5 Extent of Interruptions

Respondents who indicated that they have ever had interruptions were asked to indicate how often they experience the interruptions. The results are shown in Table 4.30

Table 4.30: Water Interruptions

Response	Frequency	Percent	Cumulative Percent
Rarely	48	31.2	31.2
Occasionally	39	25.3	56.5
Always	67	43.5	100.0
Total	**154**	**100.0**	

Among the 154 household user respondents who reported that had ever experienced the interruptions, 48 (31.2%) indicated it was a rare occurrence, 39(25.3%) it does happen occasionally, 67(43.5%) indicated they have always had interruptions of the water supply due to breakdowns.

4.7.6 Availability of Spare Parts

Household user respondents were asked if the spare parts for doing repairs for the water systems were available. Results are shown in the Table 4.31 below;

Table 4.31: Availability of Spare Parts

Response	Frequency	Percent	Cumulative Percent
Yes	314	92.4	92.4
No	26	7.6	100.0
Total	**340**	**100.0**	

The findings indicate that 314(92.4 %) reported that Spare parts for the water systems were readily available while 26(7.6%) reported that the Spare parts were not available. This could have an influence on when the repairs are done and could affect sustainability in a positive way.

4.7.7 Affordability of the Spare Parts

The study sought to find out if the Spare parts were affordable and the respondents gave their responses shown in Table 4. 32

Table 4.32: Affordability of the Spare Parts

Response	Frequency	Percent	Cumulative Percent
Yes	104	30.6	30.6
No	236	69.4	100.0
Total	**340**	**100.0**	

Among 340 household user respondents asked, 104(30.6%) indicated that the spare parts were affordable while 236(69.4) indicated that the spare parts were not affordable. The highest percentage reporting that they are not affordable is an indication that it could affect sustainability of water supplies in case of breakdowns.

4.7.8. Influence of Technology Choice on Sustainability of Community Water Projects

The respondents' views on the influence of technology choice on sustainability of community water projects are shown in Table 4.33

Table 4.33: Influence of Technology Choice on Sustainability of Water Projects

Response	Frequency	Percent	Cumulative Percent
Low	17	5.0	5.0
Average	182	53.5	58.5
High	141	41.5	100.0
Total	**340**	**100.0**	

Majority of the household user respondents 182(53.5%) indicated that choice of technology influenced sustainability at an average extent, 17(5%) reported that the influence was at low

extent while 141(41.5%) reported that technology choice influenced sustainability at a high extent.

4.7.9 Relationship between Appropriate Technology Choice and Sustainable Water Projects

The respondents' responses on the question on influence of technology choice on sustainability and responses on sustainability of water projects were used to compute the Pearson's Product Moment Correlation (PPMC) between technology choice and sustainability of the water supplies. The results of correlation analysis were as shown in Table 4.34 below;

Table 4.34: Relationship between Appropriate Technology Choice and Sustainable Water Projects

		Influence of technology choice on sustainability on water projects	**Sustainability of the water facilities**
Influence of technology choice on sustainability on water projects	Pearson Correlation	1	.879**
	Sig. (2-tailed)		.000
	N	340	340
Sustainability of the water facilities	Pearson Correlation	.879**	1
	Sig. (2-tailed)	.000	
	N	340	340

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

Pearson's Product Moment Correlation (PPMC) results indicate a strong correlation between technology choice and sustainability of community water projects (r=0.879).The correlation was significant at the 0.01 level.

4.8 Levels of Funding and Sustainability of Community Water Projects

The fourth objective was to assess the extent to which level of funding influence sustainability of community water projects. The researcher found it of great importance to have household user respondents' comment on the aspect as funds are necessary for purchasing materials and equipment for construction and repairs, paying labour services, cover operations and maintenance which determine sustainability of water projects.

4.8.1 Source of Funds for Construction of the Water Project

The study sought to find out the sources of funds for construction of the water projects. Responses from the household user respondents are shown in Table 4.35 below;

Table 4.35: Source of Funds for Construction of Water Projects

Source of Funding	Frequency	Percent	Cumulative Percent
Community	328	96.5	96.5
County	12	3.5	100.0
Total	**340**	**100.0**	

From the findings, 328(96.5%) indicated that the community contributed funds towards construction of the water projects while 12(3.5%) indicated that the county Government contributed funds for construction of the water project. The findings show that the community has greatly contributed towards the development of the water projects and the county Government efforts are less felt. The commitment of financial resources for construction by beneficiary communities is a clear indication that they value the projects as water scarcity issue is addressed. An official from the line ministry reported that the county government has plans to construct springs and wells and some have already been constructed, money have been budgeted for construction and maintenance.

4.8.2 Community Financial Contribution for Operation and Maintenance of Water Systems

Household user respondents were asked on community contribution towards operation and maintenance of the water systems. Findings are presented in Table 4.36

Table 4.36: Community Financial Contribution for Operation and Maintenance

Response	Frequency	Percent	Cumulative Percent
Yes	57	16.8	16.8
No	283	83.2	100.0
Total	**340**	**100.0**	

From findings, 57(16.8%) mentioned that the community is involved in financial contribution towards operation and maintenance of the water systems while the majority 283(83.2%) said the community does not get involved. Findings clearly show that operation and maintenance of the water systems is given little attention once the projects are developed. Insufficient financing is a major factor in poor maintenance which leads to project failure. The researcher considered this aspect because effective O & M is of great benefit in achieving sustainable water supplies.

4.8.3 User Fees

The household user respondents were asked to indicate if they have to pay to access water. Responses are shown in Table 4.37 below;

Table 4.37: User Fees

Response	Frequency	Percent	Cumulative Percent
Yes	4	1.2	1.2
No	336	98.8	100.0
Total	**340**	**100.0**	

It is observed that 4 (1.2%) pay to access water while the majority 336(98.8%) do not pay to access water. This implies that there are insufficient funds for operation and maintenance of water systems. Raising of adequate funds for maintaining water systems and activities are important in achieving sustainability.

4.8.4 Level of Funding

Household user respondents were asked to indicate the levels of funding. Table 4.38 shows the results.

Table 4. 38: Level of Funding

Response	Frequency	Percent	Cumulative Percent
High	4	1.2	1.2
Average	60	17.6	18.8
Low	276	81.2	100.0
Total	**340**	**100.0**	

From the household responses, 4(1.2%) indicated that level funding is high, 60(17.6%) indicated that level of funding is average and 276(81.2%) indicated that the level of funding for the water projects is low. The findings show that financing of water projects still remains a big challenge in the sub-county affecting sustainability of water projects. An official from

the line ministry rated the level of funding to be average and suggested that the community should not overlook what the NGOs world as it can be a great sponsor to their water projects.

4.8.5 Funding Levels and Sustainability of Community Water Projects

Household user respondents were asked to give their views on the extent to which funding levels have influenced sustainability of community water projects. Table 4.39 presents the results.

Table 4.39: Extent to Which Level of Funding Affects Sustainability of Water Projects

Response	Frequency	Percent	Cumulative Percent
To a very low extent	24	7.1	7.1
To a low extent	58	17.1	24.1
To a great extent	167	49.1	73.2
To a very great extent	91	26.8	100.0
Total	**340**	**100.0**	

Findings indicate that 24(7.1%) observes that level of funding for the community water projects have contributed to sustainability of water projects at a very low extent, 58(17.1%) said at a low extent, 167(49.1%) at a great extent and 91(26.8%) at a very great extent. From the results it is evident that funding levels influence sustainability of water projects at a great extent since the levels determine the quality of construction equipments and materials, technology used and maintenance. Both the management water committee members and official from the line ministry reported that level of funding influences sustainability of community water projects to a great extent.

4.8.6 Relationship between Funding Levels and Sustainability of Community Water Projects

The respondents' responses on the question related to the extent to which they thought level of funding affects sustainability was used to compute the Pearson's Product Moment Correlation (PPMC) between levels of funding and sustainability of the water supplies. The results of correlation analysis were as shown in Table 4.40

Table 4.40: Relationship between Funding Levels and Sustainability of Community Water Projects

		Extent to which level of funding affects sustainability of water projects	**Sustainability of the water facilities**
Extent to which level of funding affects sustainability of water projects	Pearson Correlation	1	.689**
	Sig. (2-tailed)		.000
	N	340	340
Sustainability of the water facilities	Pearson Correlation	.689**	1
	Sig. (2-tailed)	.000	
	N	340	340

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

The PPMC analysis indicates that there was a strong positive correlation between levels of funding and sustainability of community water projects (r=0.689).The correlation was significant at the 0.01 level. Levels of funding are low and this has been a challenge in achieving sustainability of thee water projects.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the study findings, discussions, conclusion and recommendations on the determinants of sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya and suggestions for further research.

5.2 Summary

This study purposed to investigate Determinants of Sustainability of Community Water Projects in Webuye East Sub-County, Bungoma, Kenya. This section provides a summary of the findings based on the objectives of the study. The findings are summarized and presented according to the four variables of the study namely; water resources conservation practices, training, technology choice and level of funding.

5.2.1 Water Resources Conservation Practices

The first objective was to assess the extent to which water resources conservation practices influence sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya. The study findings established that water sources /catchment areas included underground water, wetlands, forests, mountain/hill and rivers. It was noted that majority of the household users (63.8%) indicated underground water as their source. However, it was further established that the majority (63.8%) of the household users never participated in conservation of water resources. It was revealed that conservation practices by the

communities included afforestation at 43.1%, pollution management and hygiene practices (avoiding dumping and bathing into rivers, nor grazing in catchment areas especially the wetland) at 38.2% while management practices at 18.7% (fencing catchment areas and the water facilities). The findings in addition indicate that conservation practices were mainly initiated by the community and that the county government plays a minimal role. The majority (45.5%) of the respondents as the study found out they strongly agree that water conservation practices contribute to continued water supply and quality. The study recognized a positive and significant correlation between water conservation practices and sustainability of water supply after obtaining Pearson correlation coefficient of 0.959 at 0.01 level of significance.

5.2.2 Training

The second objective was to assess the impact of training on sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya. The study found out that the majority of the respondents (57.9%) had never received training concerning water projects while 42.1 % had received training. Among those who indicated they had received training (38.5%) reported to have been trained in conservation of water resources and catchment areas, 23.8% were trained in management aspects, and 37.8% were trained in operation and maintenance of the water facilities. Among the eleven water management committee executives 63.6% stated that training on O & M was very important while 36.4% did not see its usefulness. Among the 7 (63.6%) management committee executives who regard training as essential for proper O & M stated that: 1 (14.3%) it is important; scored a very low extent, 1 (14.3%) it is useful; scored a low extent, 3 (42.9%) it is useful; scored a great extent, and 2 (28.6%) it is useful; scored a very great extent.

The study furthermore found out that 25% of the household respondents rated the level of awareness for training opportunities at an average, while the majority (75%) rated it to be low. None of the respondents rated the level of awareness high. This implies that level of training was low and affecting sustainability of water projects. The study established that trainings were conducted occasionally and in some communities it was rare. This implies that most of the people in the communities lack necessary knowledge and skills concerning management, O & M, and conservation which is important in achieving sustainability of community water projects. Pearson's Product Moment Correlation (PPMC) analysis results shows a strong/positive and significant correlation between training and sustainability of community water projects (r=0.821).

5.2.3 Choice of Technology

The third objective was to determine how choice of technology affects sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya. The study established that there were only two technologies used; hand pump and gravity fed pipe at 3.5% and 96.5% respectively of which the later, a majority use to draw water from springs. It was found out that there was high community participation (90.3%) in choosing the technology used. Majority were involved in construction of springs whose technology of gravity fed pipe is simple and affordable. 9.7 % were not involved in choosing the technology used in drilling boreholes as the projects were initiated by the County Government. The study findings show that 97.1% were conversant with the technology used while 2.9% were not in a position to use hand pump technique on boreholes drilled by the County Government. Most of the repairs especially on the springs were done by the community as the technology used was simple. Breakdowns of hand pumps were repaired by technicians who took time to avail themselves leading to systems dysfunction and some were abandoned.

The study findings show that 45.3% had experienced interruptions with water supply as a result of breakdowns while 54.7% had never had interruptions. Rare interruptions at 31.2%, occasionally at 25.3% and 43.5% always were victims of interruption. The study besides established that spare parts were readily available at 92.4% and affordable at 30.6%. The availability and affordability of the spare parts have an impact on sustainability of water supplies in case of breakdowns. Pearson's Product Moment Correlation (PPMC) results showed a strong correlation between technology choice and sustainability of community water projects (r=0.879). The correlation was significant at the 0.01 level.

5.2.4 Levels of Funding

The fourth objective was to assess the extent to which levels of funding influence sustainability of community water projects in Webuye East Sub-County, Bungoma, Kenya. The study established that community financial contribution towards construction of the water projects was the highest at 96.5% while the County Government's contribution was at 3.5%. The commitment of financial resources for construction by beneficiary communities is a clear indication of sense of ownership and a key factor to influencing sustainability. Despite the active involvement in contribution towards construction, only 16.8% contribute towards operation and maintenance of the water systems. This clearly shows that operation and maintenance of the water systems were given little attention once the projects are developed. Insufficient financing is a major factor in poor maintenance which leads to project failure. The study as well revealed majority of the people in the community (98.8%) draw water for free from the water systems and only 1.2% pay to draw water. Responses shows level of funding as follows; 81.2% indicated low level, 17.6% indicated average level while 1.2 % indicated high level. The findings show that financing of water projects still remains a big

challenge in the Sub-County affecting sustainability of water projects. The findings establish that 49.1% level of funding had contributed to sustainability at a great extent since funding determines the quality of construction equipment and materials, technology used and maintenance. Results from PPMC showed that there was a strong positive correlation between levels of funding and sustainability of community water projects (r=0.689). The correlation was significant at the 0.01 level.

5.2.5 Correlation between Determinants of Sustainability and Sustainability of Community Water Projects in Webuye East Sub-County, Bungoma, Kenya.

The study established that there is a positive correlation between sustainability of community water project and water resources conservation practices, training, choice of technology and level of funding. The study used Pearson product-moment correlation analysis to measure the relationship/association between independent variables and the dependent variable and is denoted by *r*. The Pearson correlation coefficient can range from *+1* to *-1*. A value of *0* indicates that there is no relationship between the two variables. The value greater than *0* shows a positive relationship and the values less than *0* shows negative relationship. The value for relationship between community water project sustainability and water resources conservation practices, training, choice of technology and level of funding is 0.959, 0.821, 0.879 and 0.689 respectively. Water resources conservation practices have the highest influence while level of funding have the lowest influence.

5.3 Discussions of the Study Findings

The study examined types of community water projects and the findings shows the most common type of water project was springs and just a few community boreholes drilled by the County Government. Water systems that were 6 years and above since commissioning only

few were still functioning as many had been abandoned. Majority of the water projects were functioning while others were dysfunctional as a result of breakdowns, drying up of water sources/catchment areas and lack of technical capacity to operate and do repairs.

5.3.1 Water Resources Conservation Practices

Brikke & Davis (1995) states that conditions in the environment can have adverse effects on the quality and quantity of water source. Maintenance of a water supply includes the protection and conservation of the water source environment. The major sources of water supply included underground water, forests, mountain/hills, wetlands and rivers (Table 4.13). The sources and the environment need to be conserved and protected to ensure adequate water quantities. From the findings, community involvement in conservation and protection activities is very low at 36.2% (Table 4.14) as other stakeholders like the County Government has not been actively involved in the interventions apart from encouraging communities to plant trees in the catchment areas.

McLyor (2000) urged that the main reason why the water resources are being destroyed is because majority of people in the communities are passive observers of environmental degradation. Similarly, few communities were involved in conservation and protection activities; afforestation in the catchment areas, pollution management and hygiene practices with regard to no dumping, bathing in the rivers, no grazing in catchment areas especially the wetland and management practices like fencing catchment areas and the water facilities. Low levels of participation in conservation practices indicate that there is low level of awareness on the importance of conservation measures on sustainability of community water projects. The findings revealed there is a strong positive correlation (Table 4.17) between water resources conservation practices and sustainability of water projects. This implies that water

sustainability is highly dependent on conservation practices, similar with Mwangi (2014) who states that communities which practiced adequate water conservation practices like fencing and planting trees had more reliable water quantities than those who never got involved.

5.3.4 Training

Sarah & Katz (1997)states that training provides knowledge and skills to the community members and water committee members on how to operate and maintain the water systems. Komives et al., (2008) stated that training always results in proper operation and maintenance of water systems leading to sustainable water systems. Findings established that trainings were conducted occasionally and in some communities it was rare, this is contrary to Ongw'en (2014) who recommended that trainings need to be frequent to ensure effective learning.

The study found out that only 42.1 % had ever received training, this implies that most of the people in the communities lack necessary knowledge and skills concerning management, O & M and conservation that are important in achieving sustainability of community water projects. 63.6% management executive committee members were trained on O & M. Sarah & Katz (1997) states that training water management committee ensures trained personnel in charge of operations, inspection, monitoring and maintenance. It was established that training was low as a result of low awareness on training opportunities available. Communities who were trained by the county government on how to operate the hand pumps installed by the County had their water systems functional as they had technical skills to operate while those whole lacked skills had their hand pumps broken down and abandoned.

The findings revealed statistically significant correlation (Table 4.25) existed between training and sustainability of community water projects. This implies that water sustainability is highly dependent on training, similar with Beyene (2012) who observes that community water projects where household users and water committee members were trained most of the water systems were functional and where there was no training projects were nonfunctional. Mimrose et al., (2011) recommended capacity building program to ensure water systems continue to provide expected services and improve functioning and sustainability.

5.3.5 Choice of Technology

Haysom (2006), Brikke & Bredero (2003)suggests an affordable, simple, appropriate, alternative, village technology, self-help and low cost technology should be used in community water projects. They argue that choice of technology can have far-reaching consequences on sustainability of water projects. It was found out that only two technologies were used; use of hand pump extract water from the boreholes and use gravity fed pipes from the springs. 96.5% use gravity fed pipes to draw water from the springs, this can be referred to as village technology and it is very simple and appropriate while 9.7 % used hand pumps.

Musonga (2004) argues that the technology should be socially acceptable, technically effective and economically sustainable. The findings of the study indicate high community participation (90.3%) in choosing the technology. It was also revealed that the community was left out by County Government in choosing hand pump technology used in projects that they initiate. This has affected sustainability of most of the boreholes drilled by the county is there is no community ownership. The community is well conversant with the technology used by springs while few are not failure with technology used to extract water from the boreholes.

The availability and affordability of the spare parts have an impact on sustainability of water supplies in case of breakdowns. Tafara (2013) found out that factors affecting continued water supply included breakdown of generator pumps, breakage of pipes, vandalism and blockages of pipes. The study established that spare parts were readily available at 92.4%. while affordable at 30.6%. This implies that the spare parts were available but were not affordable resulting in non-functionality of the water systems as a result of breakdowns. This was similar to findings by Munyui (2015) who established that lack of spare parts was a major cause of non-functional of water systems.

5.3.6 Levels of Funding

Raising of adequate funds for construction, maintenance, repairs and operations for water systems is important in achieving sustainability of community water projects. Community contribution towards construction of the water projects was at 96.5% (Table 4.35) while the county government contribution was at 3.5%. This is a clear indication of sense of ownership by the community which is a key factor to influencing sustainability. The study established that only 16.8% contribute towards operation and maintenance of the water systems. Insufficient financing is a major factor in poor maintenance which results to project failure. Mechanisms to raise adequate funds for O & M are not in place as majority of the people (98.8 %) get water for free. Similar with Musonga (2004) in his study established that water systems in Munjili community which were not functioning as a result of the inability of the community to finance repairs as they needed external support. This is to the contrary to what Okemwa & Wanyoike (2015) recommended in their study that water should be used as an economic good by paying water user fees to cater for maintenance and conservation. The findings found out that level of funding had contributed to sustainability at a great extent at

49.1 %, since the funding determine the quality of construction equipments and materials, technology used and maintenance.

5.4 Conclusions of the Study

Water resources conservation practices play key role in ensuring sustainability of community water projects. It was revealed that community involvement in water resources conservation is low affecting water supplies. The study found out that levels of interventions including afforestation, management of catchment areas and pollution management/hygiene practices influence continued water supplies. This implies that community water sustainability is highly dependent on conservation practices.

Training of household users and management committee members play an important role in ensuring proper Operation and Maintenance of water projects leading sustainability of community water projects. The study established that training on various aspects including conservation, O & M and management was low resulting in lack of proper skills and knowledge to operate, manage and maintain water facilities that had lead to unsustainability of some water projects. Training should be in key areas including O & M, conservation and management.

Choice of technology to be used in water projects has far-reaching consequences on the sustainability of water projects. The study established that where appropriate, simple and affordable technology was used lead to sustainability. Where spare parts were expensive and unavailable had resulted in breakdowns and the water facilities were completely abandoned.

Adequate funding for construction and maintenance of water systems is important in achieving sustainability. Funds are required to cover operations, maintenance, repairs,

purchasing equipments and paying labour services. Findings show that the communities have been able to raise money for construction with little efforts from the County Government but maintenance have been given little attention due to insufficient financing which is a major factor in poor maintenance which leads to project failure.

5.5 Recommendations of the study

1. The County Government and experts in the environmental field should create awareness on the importance of water resources conservation, sensitize the community on water catchment areas and increase allocation of funds for interventions such as afforestation. This will enhance reliability and adequacy of the water sources.

2. Stakeholders should raise the level of awareness on available training opportunities regarding conservation, management and O & M in the community to ensure the management committee members and the entire community are impacted with proper skills and knowledge that enhance water project sustainability. The trainings should also be frequent to ensure effective learning.

3. The community and the County Government should explore other modern technologies like use of solar pumps, diesel engines and wind mill to pump water to households to reduce the distance covered by women and children to draw water. The community should be trained on how to use the technologies available and how to repair them in case of breakdowns to avoid disruptions in water supplies. Lastly the county government should subsidize prices for spare parts to ensure they are affordable.

4. County Government to increase level of funding on construction and maintenance of community water projects. The community should also explore other sources of funding like NGO's and individuals who can sponsor. The community should introduce user fee to ensure funds are secured for operations and maintenance of the water projects.

5.6 Suggestions for Further Research

1. Studies should be conducted on community participation in County Government initiated community water projects.

2. Studies should be conducted on influence of water resource conservation practices on the quality of water in community water projects.

3. Studies should be done on the role of women in enhancing the sustainability of community water projects in Kenya.

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APPENDICES

Appendix i: Letter of Transmittal

Suzzane Kiveu,

P.o Box 3900

Eldoret

Dear Sir/Madam,

REF: REQUEST FOR PARTICIPATION IN RESEARCH STUDY

I am a student of University of Nairobi undertaking a Master of Arts Degree in Project Planning and Management. I am conducting an academic research on Determinants of sustainability of community water projects in Webuye East Sub-County as part of the requirement for the ward of a degree.

You have been selected to participate in the study. The information you will provide will be of great importance to the Webuye East Sub-County, management team of the water projects and the community to ensure that the water projects initiated are sustainable.

I am therefore requesting for your support and cooperation in answering the questions. The information that will be provided will be treated with confidentiality. Thank you for your cooperation.

Yours faithfully,

Suzzane Kiveu,
L50/80288/2015

Appendix ii: Questionnaire for Household Users

Determinants of Sustainability of Community Water Projects in Webuye East Sub-County, Kenya.

Instructions

Please answer all questions in the relevant sections honestly and exhaustively. All the information given will strictly be used for this study only and will be treated with utmost confidentiality. Please tick where applicable (√)

Section A: Background Information

1. **Respondent Information (please tick appropriately)**

(a) Gender Male ( ) Female ( )

(b) Age group 20-30 years ( ) 30-40 years ( ) 40-50 years ( )
50-60 years ( ) Over 60 years ( )

(c) Highest level of education attained
Never attended school ( ) Primary level ( )
Secondary level ( ) College/University ( )

(d) How long have you stayed in this area?
0-6 months ( ) 6 months - 1 year ( ) 1-5 years ( ) Over 5 years ( )

Section B: Sustainability and Water supplies

a) Type of water project
   a. Borehole ( ) Spring ( )

b) When was the facility developed? Under 2 years ( ) 2-4 years ( )
   a. Between 4-6 years ( ) 6 years and above ( )

c) Is the facility functional? Yes ( ) No ( )

d) If No, why is the facility not functioning?

Breakdowns ( ) No one to operate ( ) Water source dried up

e) Is the water supply sustainable? Yes ( ) No ( )

f) If yes, to what extent? To a very low extent ( ) To a low extent ( )

To a great extent ( ) To a very great extent ( )

g) If No give reasons…….

h) What do you think influences sustainability of the water projects?

Water resources conservation practices ( ) Training ( ) Technology ( )

Levels of funding ( )

Section C: Water resources conservation practices and sustainability of community water projects

a) What is the main source/catchment area for the water project?

Groundwater ( ) Wetland ( ) Mountain/hill ( ) River ( )

b) Does the community get involved in conservation and protection of the water catchment areas? Yes ( ) No ( )

c) If yes list some of the conservation practices.....

d) Who initiates the conservation activities? Community ( ) County/ Government ( )

e) State your level of agreement with the following statement.

Water conservation practices contribute to continued water supply. Strongly Agree ( )

Agree ( ) Undecided ( ) Disagree ( ) Strongly Disagree ( )

Section D: Training and Sustainability of community water projects

a) Have you ever received any kind of training? Yes ( ) No ( )

b) What type of training have you received? .....

c) How will you rate the level of awareness on training opportunities available?

High ( ) Average ( ) Low ( )

d) How often does the community receive training? Never ( ) Rarely ( )

Occasionally ( ) Always ( )

e) To what extent do you think training influences sustainability of community water projects? To a very low extent ( ) To a low extent ( )

To a great extent ( ) To a very great extent ( )

Section F: Technology choice and sustainability of community water projects

a) Which type of technology is used for extraction of water for use?

Hand pump ( ) Use of a bucket ( )

b) Was the community involved in choosing the Technology? Yes ( ) No ( )

c) Is the community conversant with the use of the technology used for extraction?

Yes ( ) No ( )

d) Who does the repairs and maintenance on the water system?

Community ( ) Technician ( )

e) Do you experience an interruption of water supply as a result of breakdowns and failures in the systems? Yes ( ) No ( )

f) If yes in the above, how often are the interruptions?

Rarely ( ) Occasionally ( ) Always ( )

g) Are the spare parts for repairs for the water system available? Yes ( ) No ( )

h) Are the spare parts affordable Yes ( ) No ( )

i) To what extent do you think technology choice influence sustainability of community water projects? Low ( ) Average ( ) High ( )

Section E: Levels of funding and Sustainability of community water projects

a) What is the source of funds for construction of the water project?

Community ( ) County/Government ( )

b) Does the community contribute towards funding for O & M? Yes ( ) No ( )

c) Do you pay to get water? Yes ( ) No ( )

d) How will you rate the level of funding? High ( ) Average ( ) Low ( )

e) To what extent do you think levels of funding have contributed to sustainability of the water project? To a very low extent ( ) To a low extent ( )

To a great extent ( ) To a very great extent

Appendix iii: Questionnaire for Water Committee Members

Section A: Background Information

a) Gender Male ( ) Female ( )

b) Age group 20-30 years ( ) 30-40 years ( ) 40-50 years ( )

50-60 years ( ) Over 60 years ( )

c) Highest level of education attained

Never attended school ( ) Primary level ( )

Secondary level ( ) College/University ( )

d) How long have you served in this committee?

0-6 months ( ) 6 months - 1 year ( ) 1-5 years ( ) Over 5 years ( )

e) What is the composition of the water committee in terms of gender?

Men..... Women.....

Section B: Sustainability and Water supplies

a) Type of water project

a. Borehole ( ) Spring ( )

b) When was the facility developed? Under 2 years ( ) 2-4 years ( )

a. Between 4-6 years ( ) 6 years and above ( )

c) Is the facility functional? Yes ( ) No ( )

d) If No, why is the facility not functioning?

e) Breakdowns ( ) No one to operate ( ) Water source dried up

f) Is the water supply sustainable? Yes ( ) No ( )

g) If yes, to what extent? To a very low extent ( ) To a low extent ( )

h) To a great extent ( ) To a very great extent ( )

i) If No give reasons…….

j) What do you think influences sustainability of the water projects?

Water resources conservation practices ( ) Training ( )

Technology ( ) Levels of funding ( )

Section C: Water resources conservation practices and sustainability of community water projects

a) What is the main source/catchment area for the water project?

Groundwater ( ) Wetland ( ) Mountain/hill ( ) River ( )

b) Does the management committee get involved in conservation and protection of the water catchment areas? Yes ( ) No ( )

c) If yes list some of the conservation practices.....

d) Who initiates the conservation activities? Community ( ) County/ Government ( )

e) State your level of agreement with the following statement.

f) Water conservation practices contribute to continued water supply. Strongly Agree ( ) Agree ( ) Undecided ( ) Disagree ( ) Strongly Disagree ( )

Section D: Training and Sustainability of community water projects

a) Have you ever received any kind of training? Yes ( ) No ( )

b) What type of training have you received? .....

c) How will you rate the level of awareness on training opportunities available?

High ( ) Average ( ) Low ( )

d) How often does the management committee executives receive training?

Never ( ) Rarely ( ) Occasionally ( ) Always ( )

e) To what extent do you think training influences sustainability of community water projects? To a very low extent ( ) To a low extent ( )
To a great extent ( ) To a very great extent ( )

Section F: Technology choice and sustainability of community water projects

a) Which type of technology is used for extraction of water for use?

Hand pump ( ) Gravity fed pipes ( )

b) Was the management committee executive members involved in choosing the Technology? Yes ( ) No ( )

c) Is the management committee executive team conversant with the use of the technology used for extraction? Yes ( ) No ( )

d) Who does the repairs and maintenance on the water system? Community ( )
Technician ( )

e) Do you experience an interruption of water supply as a result of breakdowns and failures in the systems? Yes ( ) No ( )

f) If yes in the above, how often are the interruptions?

Rarely ( ) Occasionally ( ) Always ( )

g) Are the spare parts for repairs for the water system available? Yes ( ) No ( )

h) Are the spare parts affordable Yes ( ) No ( )

i) To what extent do you think technology choice influence sustainability of community water projects? Low ( ) Average ( ) High ( )

Section E: Levels of funding and Sustainability of community water projects

a) What is the source of funds for construction of the water project?

Community ( ) County/Government ( )

b) Does the community contribute towards funding for O & M? Yes ( ) No ( )

c) Do you pay to get water? Yes ( ) No ( )

d) How will you rate the level of funding? High ( ) Average ( ) Low ( )

e) To what extent do you think levels of funding have contributed to sustainability of the water project? To a very low extent ( ) To a low extent ( )

To a great extent ( ) To a very great extent

Appendix iv: Interview Schedule for Key Informant-from the Ministry

1. In your own opinion has the county government managed to conserve and protect the water sources? What are some of the strategies that have been employed?

2. In which ways has the county government gotten involved in creating awareness on conservation and protection of water sources and catchment areas?

3. What initiatives have you put in place to ensure the communities are trained and educated on management practices that ensures sustainability of water projects?

4. What new technologies has the county been able to introduce to communities to ensure sustainability of water projects?

5. What are the sources of funding for the community water projects in the county? do you think there are other sources which you have not explored?

6. From your own opinion has the county government been able to fund maintenance costs of county sponsored water projects?

7. What are your recommendations on how to ensure sustainability of water projects in the county?

Appendix v: Map of Webuye East Sub-County

KEY

- Maraka Ward
- Mihuu Ward
- Ndivisi Ward

Appendix vi: Community Water Projects in Webuye East Sub-County

1. Ndivisi Water Spring	2. Namwatikho Water Spring
3. Sang'alo Water Spring	4. Wabukhonyi Water Spring
5. Masibai Water Spring	6. Chetekei Water Spring
7. Makuselwa Water Spring	8. Chepkora Water Spring
9. Sinoko Water Spring	10. Sitabicha Water Spring
11. Namarambi Water Spring	12. Joseph Wafula Water Spring
13. Chebukwari Water Spring	14. Meso Water Spring
15. Magemo Water Spring	16. Masweveve Water Spring
17. Maasai Water Spring	18. Matumbufu Water Spring
19. Misemwa Water Spring	20. John Isoka Borehole
21. Makuselwa Primary Borehole	22. Sinoko health Center Borehole
23. Namarambi Primary Borehole	24. Magemo Dam Borehole
25. Stanley Sifuma Borehole	26. Johnstone Siundu Borehole
27. Iyaya Borehole	28. Silungai Primary Borehole
29. Makuselwa Secondary Borehole	30. Sinoko Water Spring
31. Marambakila Water Spring	32. Timotheo Water Spring
33. Luvande Water Spring	34. Marambakanywa Water Spring
35. Nabiswa Water Spring	36. Fwamba Water Spring
37. Khamunialo Water Spring	38. Aggrey Water Spring
39. Webi Water Spring	40. Wanjofu Water Spring
41. Pombo Toto Water Spring	42. Maruum Water Spring
43. Sirende Water Spring	44. Manyorori Water Spring
45. Mwasame Water Spring	46. Tete Water Spring
47. Muyaisi Water Spring	48. Njebwe Water Spring
49. Sinoko Misimo Water Spring	50. Wanene Water Spring

51. Mukonyole Water Spring	52. Lukorito Water Spring
53. Khutambi Water Spring	54. Brando Water Spring
55. Makokha Water Spring	56. Mapata Water Spring
57. Sitemu Water Spring	58. Khaoya Water Spring
59. Lumakanda Water Spring	60. Sipala Water Spring
61. Lusenaka Water Spring	62. Kakai Water Spring
63. Wanakacha Water Spring	64. Walindi Water Spring
65. Mwibanda Water Spring	66. Siundu Water Spring
67. Webale Water Spring	68. Mohammed Water Spring
69. Mwinami Water Spring	70. Walela Water Spring
71. Silapwe Water Spring	72. Ngosafia Water Spring
73. Namilama Water Spring	74. Namusasi Water Spring
75. Walubengo Water Spring	76. Sindano Water Spring
77. Siketi Water Spring	78. Lubwani Water Spring
79. Wafula Water Spring	80. Ndumbu Water Spring
81. Siyilila Water Spring	82. Mihuu Secondary Borehole
83. Mihuu Chief's Office	84. Mulachi Dispensary Borehole
85. Lugulu Borehole	86. Jesus Praise Temple Borehole
87. Simwelo-Magemo Borehole	88. Lugusi dispensary Borehole
89. Nabuyole Borehole	90. Lufwindiri Water Spring
91. Maraka Water Spring	92. Ngano Water Spring
93. Wanainchi Water Spring	94. Mkinisu Water Spring
95. Nzoia Water Spring	96. Makuma Water Spring
97. Lukhendu Water Spring	98. Lang'oto Water Spring
99. Sango Water Spring	100. Namukisu Water Spring

Appendix vii: Introduction Letter

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION

Telegram: "CEES"
Telephone: +254-202406706
Our Ref: Uon/Cees/Eld/2/3 /(64)

P.O. Box 594
ELDORET
KENYA

26th April, 2016

TO WHOM IT MAY CONCERN

REF: KIVEU SUZZANE – L50/80288/2015

The above named person is a bonafide student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department of Extra-Mural Studies, Eldoret Centre, pursuing a Postgraduate Studies leading to the award of Master of Arts in Project Planning Management (MAPPM). She has completed her course work and now working on her Project Paper entitled **"Determinants of Sustainability of Community Water Projects in Webuye East Sub-County, Bungoma County, Kenya".**

Any assistance accorded to her will be highly appreciated.

UNIVERSITY OF NAIROBI
CENTRE ORGANIZER
28 APR 2016
P. O. Box 594-30100 ELDORET
ELDORET CENTRE

Sakaja Y.M.,
Centre Organizer,
Eldoret and Environs.

Appendix viii: NACOSTI Permit

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

10587

Serial No.A

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MS. SUZZANE KIVEU
of UNIVERSITY OF NAIROBI, 3900-30100 eldoret ,has been permitted to conduct research in *Bungoma County*

on the topic: *DETERMINANTS OF SUSTAINABILITY OF COMMUNITY WATER PROJECTS IN WEBUYE EAST SUB-COUNTY, BUNGOMA COUNTY, KENYA*

for the period ending:
11th August,2017

Permit No : NACOSTI/P/16/84182/12294
Date Of Issue : 11th August,2016
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation