FACTORS INFLUENCING SUSTAINABILITY OF RURAL COMMUNITY BASED WATER PROJECTS IN MTITO ANDEI, KIBWEZI SUB-COUNTY, KENYA

BY

ABABA CHANASA TAFARA

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DECLARATION

This research project is my original work and has not been submitted for examination to any other university.

Signature………………………………… Date…………………………………….

ABABA CHANASA TAFARA

L50/69694/2011

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

Signature ………………………………. Date………………………………….

DR. HARRIET KIDOMBO

DEPARTMENT OF EDUCATION STUDIES

UNIVERSITY OF NAIROBI

DEDICATION

To my dear wife, Jillo Denge, my daughters Chaltu and Turunesh and my mum Ware for their support and encouragement that has always inspired me to work hard with determination in life.

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First, I thank God for enabling me to have good health while working on the document.

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Lastly I owe my gratitude to the sources of reference materials that have been used to build the literature review for this study, which include the University of Nairobi Library and different authors listed in the appendix of this Proposal.

TABLE OF CONTENTS

LIST OF FIGURES

Page

LIST OF TABLES

LIST OF ABBREVIATIONS/ACRONYMS

CT: Complexity Theory

KWAHO: Kenya Water for Health Organization

MDG: Millennium Development Goals

NGOs: Non Governmental Organizations

O & M: Operation and Maintenance

PM: Project Manager

RBT: Resource Based Theory

RBV: resource-based view

RTD: Resource Dependence Theory

SPSS: Statistical Package for Social Science

UN: United Nations

UNICEF: United Nations Children Education Fund

WASH: Water, Sanitation and Hygiene

WHO: World Health Organization

ABSTRACT

In developing countries national and regional governments, local and international NGOs and other concerned organizations invest large sums every year for the implementation of rural water supply projects. However, construction of water projects does not help if they fail after a short time. In order to make the investment in water supplies more effective, failure rates of these systems should be reduced. The main objective of the study was to establish the underlying factors influencing sustainability of community based water projects so as to make an appropriate recommendation for enhancing sustainability of water projects especially in a rural setting of the Mtito Andei. This study employed descriptive survey. The study population constituted of the household heads. The respondents were reached through household survey and purposive identification of the subject matter or key informants across relevant local institutions. The study used a combination of both probability and non-probability sampling techniques. This study collected quantitative data using a questionnaire from the respondents. The data was analyzed using descriptive statistics generated from statistical tools (SPSS V.17.0 and Excel). From the findings, the study concluded that the level of stakeholders' participation in the water projects was low which affected the sustainability of water project. The stakeholders' participation was critical in the implementation of the water projects. Stakeholders were involved in the water project through contribution of funds/other resources, through designing and in management. The stakeholders' participation positively enhanced the sustainability of the rural community based water projects to a great extent. The has transformed health, sanitation practices in the region, facilitated participation of local communities in development initiatives in the region, encouraged residents to take ownerships of their own community resources, improved security in the region by reducing conflicts over natural sources of water, encouraged residents to conserve available water resources and other natural resources, as well as helped the community gained substantial knowledge and technical skills from the water project. It has also united people from different cultures/tribes/clans in the region, builds community identity and pride and helped to uphold cultural norms as well as promoted social networks amongst residents in the region. The water project has enhanced partnerships between the local community and the government or non-governmental organizations. There is insufficient technical expertise to manage the project, and human resource for sustainability of the project. The level of adoption of technology in the management of water project was very low impairing the sustainability of water projects. Technology was a critical factor affecting the sustainability of the community based water project through reduction of operations costs, improving the efficiency of the project and increasing the longevity of the projects. The adoption of the technology in the water project was minimal. The study recommends that the level of stakeholders' participation in the project planning and implementation should be increased to enhance the sustainability of the water projects in the county. The project management should seek to adopt modern technology through increased budgetary allocations. The government should institute stringent measures to deal with persons vandalizing the community water project. This should be coupled with improved security offered by the security agencies to mitigate the cases of vandalism. The water projects should be managed more competently.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

There are more than 1 billion people in the developing world that are unable to access, on a daily basis, a reliable source of clean, freshwater. The challenge of water for all is one that has taken on renewed interest through the declaration of the Millennium Development Goals (MDG), which has, the specific target, of reducing by half the proportion of people without sustainable access to safe drinking water by 2015 (United Nations 2000). Progress has been made towards meeting the water supply needs for the world's poor, for example, in 2002, 79% of the population in developing countries had access to improved water supplies, bringing up the total world coverage to 83%. This is an increase of 8% from 1990 to 2002 (WHO/UNICEF 2008).

With over 75% of the Africa's poor living in rural areas the need to expand sustainable water service to these areas is imperative (De Regt 2005). When community based projects fail due to a lack of understanding of the specific context of the community or a lack of effective support structures (Reif et al. 1996; Baker 2000). Access to rural water supply remains low in Kenya. In particular, access to piped water has only increased from 9 to 10 percent of rural households over the past eight years. Small community-based water providers are seen as part of the solution and are supported by the Water Sector Act of 2002, which introduced regulatory and tariff reforms. However these small water projects lack funding, especially to improve existing systems (Gok, 2009). The recognition by the UN General Assembly, in 2010, of water and sanitation as a human right provides additional political impetus towards the ultimate goal of providing everyone with access to these vital services. With this in mind, the United Nations Millennium Development Goals (MDG) aims at halving the proportion of people without sustainable access to safe drinking water and basic sanitation by the year 2015 (WHO, 2010).

According to UNICEF, The use of improved sources of drinking-water is high globally, with 87% of the world population and 84% of the people in developing nations getting their drinking-water from such sources. Even so, 884 million people in the world still do not get their drinking-water from improved sources, almost all of them in developing regions. Sub-Saharan Africa accounts for over a third of that number, and is lagging behind in progress towards the Millennium Development Goals (MDG) target, with only 60% of the population using improved sources of drinking-water despite an increase of 11percenatge points since 1990. (JMP Report, 2010)

Lack of universal access to safe water and sanitation results in over a million preventable deaths each year. Nearly 10% of the total burden of disease worldwide is attributable to unsafe water, sanitation, and hygiene and the associated diseases claim 3.6 million lives annually (Pruss-Ustun et al., 2008). Access to improved water and sanitation is important because it is the foundation for healthy communities, and results in significant health, economic, and social gains (Mihelcic etal 2003) and in both the water and sanitation sectors, there is critical need for greater sustainability.

Agenda 21 provides a general framework for examining sustainability of water and sanitation. The document declares that ''sustainability is the integration of environmental and development concerns for the fulfillment of basic needs and improved living standards for all'' (UNDP-WSP 2006). For the purposes of this paper and given the inadequacy of operation and maintenance in some previous water and sanitation efforts, it is important to utilize the more specific, function-oriented definition provided by Carter et al. (1999), which states that ''sustainability is constancy in water and sanitation services which may be achieved through evolving and adaptive mechanisms.'' Thus, environment, development, and long-term functionality and reliability of service serve as the boundaries for distilling the key components of sustainability.

In relation to the foregoing, a closer look at Kenya's community based development projects leaves no doubt that sustainability is a challenge. This scenario is evident in most of the rural development projects that have been undertaken over time with little impact afterwards

despite the resources used. For example, Thematic Group (2005) finds out that, among 24 million rural dwellers in Kenya about 10 million have access to an improved water supply through piped or point source systems. Among those with access, 30% are served by community managed water supply schemes, many of which are developed by self-help groups through donor support. The study further reveals that most of them are inactive yet the Government of Kenya has continued to establish numerous new water projects, while giving little regard to rehabilitating existing non-functional ones. An Evaluation of agricultural projects in Kenya by the Development Bank (Roseland et al 2005) revealed that the essence of capacity building is sustainability, but many of the barriers to sustainability have the same root cause: the inadequacy of local resources to support project activities after donor funds have been drawn down.

The World Health Organization report, with specific focus on rural Sub-Saharan Africa has made not only does the region lay claim to some of the world's greatest water and sanitation challenges (UNESCO, 2006), but over half of its population is expected to remain rural until at least 2030 (UN, 2000). Community water projects in mtito andei within the Kibwezi County presents such a typical case of rural communities with water projects previously developed by community through donor support. The region is characterized by both operational, (though at small scale), and seasonal water projects that are mainly ran by water user committees or water users association. The situation in the region poses the question of sustainability of such rural development projects. It is due to this scenario that the study intended to assess the factors influencing sustainability of community water projects beyond donor support in such a rural setting.

Effective management by competent project managers play a number of different roles in community based projects. According to Mbata (2006) the sustainability of any community projects require a team of highly competent managers owing to many dynamics of the project implementation. The failure of community based project is largely blamed on lack of professionalism and management skills of the project implementers owing to poor academic background. In order to establish good rapport leaders need time, resources and authority to

invest in a project. Flexibility is critical in the way leaders interpret their own and others' roles and in the activities they and the projects undertake (Carter et al. 1999).

The key causes for failure of community based water projects include inappropriate policy or legislation; insufficient institutional support; unsustainable financing mechanisms; ineffective management systems; and lack of technical backstopping (Niyi et.al, 2007). This study will seek to find out the extent of stakeholders' participation in the sustainability of community based water projects. The Rural communities usually have strong cultural relations with each other and would hardly deny their neighbours access to their water facilities, which they acknowledge as basic necessity for life. Water supply schemes to communities should therefore consider the effects of this culture of 'nondenial' on the capacity of the facility they provide since it may serve neighbouring communities (Gebrehiwot, 2006). It would therefore important to investigate how cultural practices affect sustainability of the rural community based water projects.

Adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance. The effective operation and maintenance (O & M) of rural water supply systems is crucial element for the sustainability of the water project. The community management of rural water supply systems on operation and maintenance (O & M) is not successful, if financing resources are not available and frequent supports are not provided (Binder, 2008). Budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance but not only one (Niyi et.al, 2007).

1.2 Statement of the Problem

In developing countries national and regional governments, local and international NGOs and other concerned organizations invest large sums every year for the implementation of rural water supply projects (Gebrehiwot, 2006). However, construction of water projects does not help if they fail after a short time. In order to make the investment in water supplies more effective, failure rates of these systems should be reduced. According to Gebrehiwot (2006), this can be

accomplished by better integration of people who receive the water and water project suppliers in decisions concerning planning construction and management of water supply systems. However, in Kenya, community based project are characterized with low or poor stakeholders involvement.

Williams, (2003) observes 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. In fact, Harvey and Reed (2007) report showed that community issues like perceived lack of ownership, lack of education on water supply and sanitation, poor management system and limited demand are related to low sustainability rates of water supply systems (Harvey and Reed, 2007). According to Admassu *et.al*, (2002) an important factor for the sustainability of projects is the genuine involvement of local people as active participants and equal partners whose concerns and experience are intrinsic to the project's success. The level of community support determines whether a project becomes established, how quickly and successfully it consolidates, and how it responds and adapts to meet changing needs (USAID, 2009). It is therefore important that involving local communities, starts at the planning stage, when decisions are being made about what type of project is required. However, this has not been the case in most water projects in Kenya where only the elite in the community are involved in planning and implementation and running of such projects.

Good leadership play a number of different roles in community based projects, all of which require trust and good working relationships with local people and professionals. In order to establish good rapport leaders need time, resources and authority to invest in a project. Flexibility is critical in the way leaders interpret their own and others' roles and in the activities they and the projects undertake. Leadership is critical for the success of community based projects. Leadership offer management to the project and thus ensures sustainability. However, most community water projects are faced with financial management problems thereby depicting a challenge in leadership. This threatens survival of the said projects. Some projects are trapped in mismanagement which hinders the natural development of the project an. Poor leadership has

led to over dependence on funding boxing community based projects into a dependency syndrome which is threatening the sustainability.

Research has shown that rural water supplies in sub-Saharan Africa, often demonstrate low levels of sustainability (Gebrehiwot, 2006). The key causes for this include inappropriate policy or legislation; insufficient institutional support; unsustainable financing mechanisms; ineffective management systems; and lack of technical backstopping (Niyi et.al, 2007). Rural communities usually have strong cultural relations with each other and would hardly deny their neighbours access to their water facilities, which they acknowledge as basic necessity for life. Water supply schemes to communities should therefore consider the effects of this culture of 'nondenial' on the capacity of the facility they provide since it may serve neighbouring communities (Gebrehiwot, 2006). The poor water access is particularly acute in rural areas and small communities, where water collection may require hours of physical effort, water sources may be contaminated, or must be purchased at rates too expensive to allow for proper health and hygiene. Rural areas are also typically where water resources are managed by the end users, i.e., community management. Community managed water systems are some of the oldest forms of social organization, however, due to a number of postcolonial issues, such as dynamic political change, rapid population growth, environmental degradation, climate change, misguided development policies, and the shift from agrarian economies to market economies, these systems are in jeopardy of losing their resilience and effectiveness (USAID, 2009).

There are four major topic areas that contribute to community water project sustainability, including the physical environment, the financial conditions, the socio-political context of the country and community, and a community's ability to access some form of outside development assistance, be it private, public, or non-governmental (Niyi et.al, 2007). In Kenya like in other sub-Saharan Africa countries, inadequate technologies have threatened survival of many community water projects. These projects like essential equipment like water pump to ensure that water is pumped to reach all the members of the community. With this problem, community members still walks for long distances to look for water undermining the reason for

such community water projects and thus threatens sustainability of community based water projects.

Despite, the immense importance of community based water project in ensuring access to clean drinking water for all, no study has been conducted locally or internationally to establish factors influencing sustainability of Community based water projects in Mtito Andei, Kibwezi County. This study therefore sought to establish various factors influencing sustainability of Community based water projects; this was achieved through investigations on how stakeholders' participation, cultural practices, management skills and technology influences sustainability of community based water projects in Kenya.

1.3 Purpose of the study

The purpose of this study was to establish the factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya.

1.4 Research Objectives

This study was guided by the following research objectives:

1. To establish how the extent of stakeholders' participation affects the sustainability of the rural community based water projects.

2. To assess how cultural practices influence sustainability of the rural community based water projects.

3. To examine how management skills influence sustainability of the rural community based water projects.

4. To determine how technology influence sustainability of the rural community based water projects.

1.5 Research Questions

This study sought to answer the following research questions.

1. To what extent does stakeholders' participation influence the sustainability of the rural community based water projects?

2. What is the influence of cultural practices on sustainability of the rural community based water projects?

3. How do the management skills affect sustainability of the rural community based water projects?

4. What is the effect of technology on sustainability of the rural community based water projects?

1.6 Significance of the Study

The study may be important in identifying and understanding reasons for failure or operation of projects below the expectation after donor support. The knowledge would therefore provide important information that can be integrated to project cycle before or towards completion by government, private and non-governmental organizations.

The findings of this study may provide important information and knowledge that influences policy and reforms for enhancing sustainability pertaining to water projects. In this case it can be of importance to the government institutions initiating and supporting community based water projects in rural setting.

Lesson drawn from this study may be utilized by the communities, implementing partners, Donors and International NGOs to address the sustainability challenges and plan the better ways of implementing the sustainable community based water projects.

1.7 Basic Assumption of the Study

The study assumed that;

1. The study respondents will be conversant with the factors influencing sustainability of community based water projects.

2. The respondents will be cooperative and honest in giving the required information.

1.8 Limitation of the study

Limitations of this study are related to external validity and length of study. Caution in interpretation is advised because personality measures are susceptible to measurement error (Zeidner & Matthews, 2000). Due to the self-report nature of data, responses on the survey might not have accurately conveyed their competence in the project implementation.

This study may not be generalizable to other areas since differing cultural and environmental conditions affect project implementation differently. Nevertheless, the underlying theoretical assumptions and methodology of this study, as well as the findings of this study should be of assistance to other areas.

The study was further affected by the high level of insecurity in some areas of Kibwezi County which slowed the data collection process. The researcher sought assistance from the local leadership. The study was further affected by the poor road network in Kajiado Kibwezi which made the area inaccessible and slowed the smooth flow of the data collection. The researcher found assistance from the relevant local authorities for transportation to the areas that were inaccessible.

1.9 Delimitation of the study

In achieving the study's objectives, the study may have been limited by willingness of the respondents to give relevant information that may be useful in the study. This may be

brought about by uncooperative respondents for fear of victimization. Further, the residents who benefits from these community based water projects may not be aware of some of the challenges that these projects face. To ensure cooperation of the respondents to the study, the researcher obtained introduction letter from the University and local authorities explaining that the study was for pedagogical purposes only. Further, the researcher explained to the respondents that their responses would be treated with anonymity and confidentially.

To overcome the challenge of resources, the researcher used his savings plus friends and family support to carry out the study. Further, the researcher employed two (2) research assistants who would help in data collection.

1.10 Definitions of significant terms used in the study

A number of key words and terms have been used in this report, which is defined in this study as follows:

Community based projects: These are projects undertaken with and for the community and are addressing their interest, local needs and aspirations. These are projects where the local people play an active role in them.

Project: A project is an undertaking that has an objective of meeting human needs and aspiration and has specific budget and timeframe

Sustainability: The continuing ability of a project to meet the needs of its community and embraces the concept of doing this beyond the time of donor agency involvement (adopted from Brinkerhoff and Goldsmith, 1992).

Stakeholders' participation: refers to individuals, families, or communities assuming responsibility for their own welfare and develop a capacity to contribute to their own and the community's development

Cultural practices: generally refers to the manifestation of a culture or sub-culture, especially in regard to the traditional and customary practices of a particular ethnic or other cultural group.

Management skills: refers to using expertise in coordinating the efforts of people to accomplish desired goals and objectives using available resources efficiently and effectively. It comprises planning, organizing, staffing, leading or directing, and controlling an organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal.

Technology influence: refers to the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, and methods of organization, in order to solve a problem, improve a preexisting solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function.

1.11 Organization of the Study

Chapter one entailed the background of the study, statement of the problem, purpose of the study, objectives, research questions, justification, significance, basic assumptions, limitations, delimitation and definition of significant terms used in the study. In addition, chapter two, the introduction has been covered, theoretical framework, related empirical literature on factors influencing sustainability of rural community based water projects, as well as the conceptual framework.

Chapter three contained the following under research methodology: research design, target population, sampling procedure, research instruments, validity and reliability of the instruments and data analysis. In chapter four, the areas focused on were: data analysis and interpretations while chapter five gave the study summary, conclusions, recommendations and areas for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed how literature is relevant to the current study with a focus on community based project sustainability beyond donor support. The review includes other scholar's work both at international and local scale. By pointing at the weaknesses and gaps of the previous researches, it will help support the current study with a view of suggesting possible viable measures or ways of filling them.

This chapter therefore begins by looking at background to sustainability, followed by sustainability approaches, and efforts to enhance sustainability, challenges, the Kenyan project sustainability scenario, the conceptual framework and finally concludes by identifying key gaps from the literature.

2.2 The Concept of sustainable rural water project

According to Sugden (2003), Sustainability "has become one of the most over used and abused words in the development vocabulary". In the most obvious sense, the term "sustainable" refers to something which can be kept going. But, it also refers to resource use and lifestyles which do not damage resources or society (Merriam Webster, 2010). Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future" (UN 1987). "Sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs."

Hodgkin (1994) in a WASH Technical Report, *The Sustainability of Donor-Assisted Rural Water Supply Projects* defined sustainability as the ability of a development project to

maintain or expand a flow of benefits at a specified level for a long period after project inputs have ceased. Mihelcic *et al.* (2003) highlighted that sustainable development refers to the design of human and industrial systems to ensure that humankind's use of natural resources and cycles do not lead to diminished quality of life due either to losses in future economic opportunities or to adverse impacts on social conditions, human health, and the environment.

Ingle (2005), indicated that sustainability encompasses conventional approaches while adding a longer-term perspective. This longer-term perspective invites other, less traditional considerations for project identification and selection. Further, Ingle (2005) highlighted that, for a project to achieve sustainability, it needs to be implemented through a strategic approach. The strategic approach incorporates four main elements, future Orientation: assuming things will change, and planning to maximize benefits which can be derived during and from that change; external emphasis: recognizing the diversity of the project environment and the many dimensions which impact on project outcomes, including technology, politics, society, and economics; environmental fit: planning for a continual fit between the project (both benefits and delivery institution) and its environment, including mission, objectives, strategies, structures, and resources; and process Orientation: planning and management priorities evolve in an iterative cycle of conscious and deliberate learning from experience as the reality changes.

In the last three decades, literature in the water supply sector has shown that sustainability of rural water supply structures has become positively associated with small-scale initiatives, which maintain public participation (Davis and Liyer, 2002). Involving the users in the planning, implementation, operation, protection and maintenance of water supply systems meaningfully is the key to sustainability. Community members' contributions might take the form of money, labor, material, equipment, or participation in project-related decision-making and meetings (Davis and Liyer, 2002).

The United State Agency for International Development, over the past three decades, has shown that water and sanitation activities are most effective and sustainable when they adopt a participatory approach that acts in response to genuine demand, builds capacity for operation and

maintenance and sharing of costs, involve community members directly in all key decisions, develop a sense of communal ownership of the project, and uses appropriate technology that can be maintained at the village level. Also important are educational and participatory efforts to change behavioral practices (USAID, 2009).

The effective operation and maintenance (O & M) of rural water supply systems is crucial element for the sustainability of the water project. The community management of rural water supply systems on operation and maintenance (O & M) is not successful, if financing resources are not available and frequent supports are not provided (Binder, 2008). Budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance but not only one. Binder (2008) states that "increasing the budget allocation for rural water supply systems is very important, but that is not the only thing to meet the challenges of achieving the Millennium Development Goals (MDGs)." Enhancing the capacity of the operators' related to the choice of appropriate institutional management is also mandatory to achieve the Millennium Development Goals (MDGs).

2.3 Scenario of the development projects in Kenya

The history of foreign development assistance, however, is one of movement away from addressing immediate needs and toward focusing on the underlying causes of poverty. A recent manifestation is the move towards sustainability, which stresses community mobilization, education, and cost-recovery (Thematic Group, 2005) Converse to this, majority of community development projects in Africa faces challenges of sustainability. As noted elsewhere in this study, it is estimated that 35% of improved rural water supplies in sub-Saharan Africa are non-operational and this scenario is no exception in Kenya

In Kenya, Netwas International (2009) notes that provision of water and sanitation services through projects is one thing and maintaining the services is quite another. Evaluations and assessments done a few years after commissioning of various WASH (Water, Sanitation and Hygiene) projects in developing countries, of which Kenya form part, come with the dismal report that the project is dead, or it is performing far below the par.

Despite the Kenyan government effort of setting an ambitious targets to provide access to safe drinking water and basic sanitation facilities to 85 % of the population by 2015 and 100 % by 2025 in line with MDGs. However, the country still faces considerable challenges in reaching the water and sanitation Millennium Development Goals (USAID/Kenya). According to the Joint Monitoring Programme's 2012 progress report, access to safe water supplies throughout Kenya is 59% with access in rural areas remaining as low as 47%.

Despite this challenge, aid to Kenya, which stood at $770m in 2005, has been steadily rising since 2002, supporting several projects all geared towards development. Some of the projects have, however, been successful. According to the Kenya Water for Health Organization (KWAHO) founded 30 years ago the sustainability of the water projects at the grassroots has been due to the strategies integrated before the projects are completed such as: Effective mobilization of communities through sensitization and training to achieve ownership; Collaboration with various stakeholders (the government, local leaders, politicians and the target communities) in the project sites that ensures actual implementation of projects and continuity of those projects when KWAHO pulls out of the area; Application of appropriate technologies; Gender considerations that empower women to handle community projects; Environmental impact considerations into a project; Sensitivity to socio-cultural factors in the communities; Capacity building for communities and Effective monitoring and evaluation. Other factors include effective networking with all stakeholders

The foregone scenario presents an example of the characteristic nature of the community water projects supported by World Vision in Mtito Andei where some projects are operational and some have become intermittent after its completion. It is because of such a situation that the study focuses on Mtito Andei In Kibwezi County to assess the factors that have influenced the sustainability of the projects beyond the support of the donor.

2.4 Theoretical Review

This section presents relevant theories that this study will be based on. This study is built upon certain theories that have much links with sustainability in organizations. The most outstanding

ones that have found much application in sustainability include Resource Based Theory (RBT), Resource Dependence Theory (RTD) and Complexity Theory (CT).

Despite the fact that community based projects are classified as non-profit making organizations, they still remain economic institutions in that they use society's scarce resources (land, labour and capital) to produce goods and services of value. These organizations have operating costs, impose costs on society to the extent that they use contributions and voluntary services to provide superior value to society and need a reliable flow of revenue to finance their mission and be financially sustainable.

2.4.1 Resource Based Theory

From resource-based view, resources are important unit of analysis to understand a firm's strategy. These resources develop organizational capabilities; heterogeneity and immobility of these resources define an organization's competitive advantage in an industry; sustained competitive advantage reward superior economic and financial performance. The currently dominant view of business strategy resource-based theory or resource-based view (RBV) of firms is based on the concept of economic rent and the view of the company as a collection of capabilities. This view of strategy has a coherence and integrative role that places it well ahead of other mechanisms of strategic decision making (Kay, 2005).

The resource-based view (RBV) offers critical and fundamental insights into why firms with valuable, rare, inimitable, and well organized resources may enjoy superior performance (Barney, 1995). Its current prominence is reflected not only by its dominance in the academic journals, by its inclusion in leading strategic texts which warrants the conclusion that it is widely taught to students and practitioners in undergraduate, masters' and executive programs.

Building on the RBV, Hoopes, Madsen and Walker (2003) suggest a more expansive discussion of sustained differences among firms and develop a broad theory of competitive heterogeneity. The RBV seems to assume what it seeks to explain. This dilutes its explanatory power. For example, one might argue that the RBV defines, rather than hypothesizes, that sustained performance differences are the result of variation in resources and capabilities across firms. The

difference is subtle, but it frustrates understanding the Resource Based View's possible contributions (Hoopes et al., 2003). The Resource Based View's lack of clarity regarding its core premise and its lack of any clear boundary impedes fruitful debate. Given the theory's lack of specificity, one can invoke the definition-based or hypothesis-based logic any time. Again, we argue that resources are but one potential source of competitive heterogeneity. Competitive heterogeneity can obtain for reasons other than sticky resources (or capabilities) (Hoopes et al. 2003). Competitive heterogeneity refers to enduring and systematic performance differences among close competitors.

The RBV uses firms' internal characteristics to explain firms' heterogeneity in strategy and performance. A firm is an organized, unique set of factors known as resources and capabilities, and RBV theory cites two related sources of advantages: resources and capabilities. Resources are a firm's accumulated assets, including anything the firm can use to create, produce, and/or offer its products to a market. Resources are eligible for legal protection (as such, firms can exercise property rights over them; Amit and Schoemaker, 1993); can operate independently of firm members (Camisón, 2005); and intervene as factors in the production process to convert input into output that satisfies needs (Grant, 1991).

In this study, since resources develop organizational capabilities; heterogeneity and immobility of these resources define an organization's competitive advantage in an industry; sustained competitive advantage reward superior economic and financial performance, the researchers seeks to establish whether the community based project had enough resources that will offer them sustainability. Further, it will seek to unearth factors that hinder these community based projects to gain enough resources that help them gain sustainability.

2.4.2 Resource Dependence Theory (RDT)

Resource Dependence Theory (RDT) is based upon how the external resource of organizations affects the behaviour of the organization. The theory is based upon the following tenets: Organizations are dependent on resources, these resources ultimately originate from the environment of organizations, the environment to a considerable extent contains other organizations, the resources one organization needs are thus often in the hand of other

17

organizations, resources are a basis of power, legally independent organizations can therefore be dependent on each other (Pfeffer and Salancik 1978).

In as much as organizations are inter-dependent, the theory of Resource Dependence needs a closer examination. Its very weakness lies in its very assertions of dependence. With changing trends of financial uncertainties, there is need to lean towards other theories of uncertainties. According to this theory, organization depends on resources for their survival; therefore, for any organization to achieve sustainability, resources are indispensable. For community based projects to achieve sustainability, resources are important. These resources will come in the form of human resource – therefore the need to involve all the stakeholders in the project for sustainability, other resources of land and finances.

2.4.3 Complexity Theory (CT)

Complexity theory, which is the study of nonlinear dynamic systems promises to be a useful conceptual framework that reconciles the essential unpredictability of industries with the emergence of distinctive patterns. Despite the fact that the theory was originally developed in the context of physical and biological sciences, today it has found applications in social, ecological and economic systems which also tend to be characterized by nonlinear relationships and complex interactions that evolve dynamically over time (Kiel and Elliott, 1996).

During the 1990s, there was an explosion of interest in complexity as it relates to organizations and strategy. The theory suggests that simple deterministic functions can give rise to highly complex and often unpredictable behavior. Thus, applying this theory in strategic planning presupposes flexibility on the part of an organization. Any strategic planning should be done in such a manner that it accommodates the "unexpected". Thus organizations would not only depend on others but devices alternative strategies to counter the unexpected. The two theories (resource dependency and complexity theories) thus fit well in the current study, but not one without the other. Community based projects need a merger of these theories in strategic financial planning to acquire sustainability.

2.4.4 Theoretical Framework

```
┌─────────────────────────┐
│  Resource Based Theory  │──────────┐
└─────────────────────────┘          │
                                      │
┌─────────────────────────┐          ▼     ┌──────────────────────────┐
│  Resource  Dependence   │───────────────▶│  Sustainability  of  community │
│  Theory (RDT)           │                │  based projects          │
└─────────────────────────┘          ▲     └──────────────────────────┘
                                      │
┌─────────────────────────┐          │
│  Complexity Theory (CT) │──────────┘
└─────────────────────────┘
```
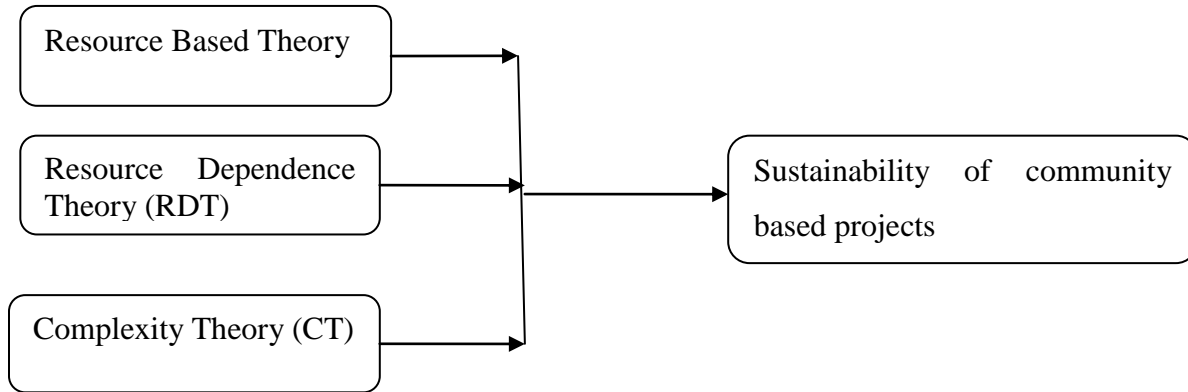
Figure 2. 1: Theoretical Framework

2.5 Sustainability of Community Based Projects

The determinant factors for the sustainability of rural water supply systems are categorized in to two main categories. These are pre implementation factors and post implementation factors. Community participation, technology selection, site selection, demand responsiveness, construction quality, population and training are some of the pre-implementation factors. And post-implementation factors are technical support, community satisfaction, institutional and financial management, training and willingness to sustain the water project (UNDP-WSP, 2006).

One of the pre implementation factors for rural water supply systems is demand responsive approach. In this context 'demand' is defined as the quantity and quality of water, where community members will choose to consume at a given price (Gizachew, 2005). In a demand responsive approach, beneficiaries should feel the need for safe drinking water supply, in order to identify safe drinking water supply projects. Water projects are more or less demand responsive to the degree that beneficiaries make choices and carry out resources in support of their choices (Gebrehiwot, 2006). If there is willingness in the community to provide valued resources in the exchange for services then these community members valued the service. As a

result demand for supply of water will facilitate the management of the water supply system and it enhances the rate of sustainability of the water supply system (Gizachew, 2005).

The literature on the framework for sustainable water and sanitation supplies in developing countries emphasizes varying but related themes. Harvey and Reed (2004) identify eight main sustainability factors. These factors are presented as building blocks and include: policy context, institutional arrangements, financial and economic issues, community and social aspects, technology and natural environment, spare parts supply, maintenance, and monitoring. For each of these factors, issues relating to planning, effective demand, financing, and management are explored along with guidance for addressing sustainability.

2.5.1 Stakeholders' participation and Sustainability of Community Based Projects

According to Aras and Crowther (2008), there are four aspects of sustainability, which are needed to be recognized and analyzed, namely; societal influence, which measures the impact a society makes upon the corporation in terms of the social contract and stakeholder influence; environmental impact, which is the effect of the actions of the corporation upon its geophysics environment; organizational culture, which is the relationship between the corporation and its internal stakeholders and finances an adequate return for the level of risk undertaken in pursuit of sustainable development and financial sustainability.

Brager, Specht, and Torczyner (2001) defined participation as a means to educate citizens and to increase their competence. It is a vehicle for influencing decisions that affect the lives of citizens and an avenue for ensuring success of a project. However, it can also be a method to co-opt dissent, a mechanism for ensuring the receptivity, sensitivity, and even accountability of social services to the consumers. Armitage (2003) indicated that citizen participation as a process by which citizens act in response to public concerns, voice their opinions about decisions that affect them, and take responsibility for changes to their community, their support, he pointed out is key for the sustainability of a community project. Pran Manga and Wendy Muckle (Chappel, 2005) suggest that stakeholders support may also be a response to the traditional sense of powerlessness felt by the general public when it comes to influencing government decisions: by

their support, community ensures the success of a project through collective efforts to increase and exercise control over resources and institutions on the part of groups and movements of those hitherto excluded from control". Further, Group on Participatory Development (2001) indicated that this support ensures that stakeholders influence and share control over development initiatives, and the decisions and resources which affect them. This is key in ensuring that resources in community based projects in Kenya are managed effective, minimising wastes and thereby ensuring their sustainability more so financial sustainability.

According to Oakley and Marsden (2007) stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare and develop a capacity to contribute to their own and the community's development. In the context of development, community participation refers to an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits. In their support, the community participates in the community projects and therefore saves the projects resources which can later be channelled to produce more benefits to the project. As noted therefore by Chappel, (2005), through their participation the community shares project costs: (money or labour) during the project's implementation or operational stages. This save the project money and can therefore contribute to ensuring financial sustainability.

As pointed out by Oakley and Marsden (2007), community participation is a major form of stakeholder support. In fact, Admassu *et.al*, (2002) notes that involvement of the communities is crucial for the sustainability of rural water supply systems. Sustainability rate of rural water supply systems increases as a result of communities' owning and managing their schemes, existence of management organization at the village level, protection of the water point, communities cost recovery for operation and maintenance, technology type and availability of their spare parts and recognition of women.

Chappel (2005) indicated that community support increasing project efficiency: therefore, he recommended that there should be consultation with the community during project planning or beneficiary involvement in the management of project implementation or operation to ensure

project sustainability. Further, Arbitrage (2003) highlighted that community support increases project effectiveness as it helps to ensure that the project achieves its objectives and that benefits go to the intended groups. Also community support coupled with community participation, helps in building beneficiary capacity: either through ensuring that participants are actively involved in project planning and implementation or through formal or informal training and consciousness-raising activities.

Building a partnership with the communities that should lead towards improving the people's problem solving capacities improves the expectation that the sustainability to be achieved. Communities' better participation in hand dug wells is much better than in developed spring because of the difference in approach used by stakeholders for community mobilization and communities thinking about developed spring. "However, it is impossible to rule out whether, the weakness came from the stakeholders' participatory approach related to wells or not, which is as important as the other water points (Admassu *et al*., 2002)."

Stakeholders willingness-to-pay in cash, materials, labor, and idea can be taken as a useful indicator of the demand for improved and sustained water services (Bhandari and Grant, 2007; Mbata, 2006). According to Mbata (2006), if willingness to pay for specific services increases in the community, then it is possible to conclude that the awareness of the community about ownership also increase for that service. Similarly, if households are willing to contribute cash and labor useful for the management of water sources, then the service that they obtain from a source is valued; and, it is a means of promoting its sustainability.

2.5.2 Cultural Practices and Sustainability of Community Based Projects

Culture is gradually emerging out of the realm of social sustainability and being recognized as having a separate , distinct , and integral role in sustainable development. Within the community development field, culture is broadly defined as the whole complex of distinctive, spiritual, material, intellectual and emotional features that characterize a society or social group. It includes not only the arts and letters but also modes of life, the fundamental

rights of the human being, value systems, traditions and beliefs (UNESCO, 1995). Within the sustainability field, culture is discussed in terms of cultural capital, defined as "traditions and values, heritage and place, the arts, diversity and social history" (Roseland et al., 2005). The stock of cultural capital, both tangible and intangible, is what we inherit from past generations and what we will pass onto future generations. From a policy perspective, UNESCO (2006) encompass cultural development as related to social policy and goals such as fostering social inclusion, cultural diversity, rural diversity, rural revitalization, public housing, health, ecological preservation, and sustainable development. Culture needs to be protected from globalization and market forces, as many fear that individual communities will lose their cultural identity, traditions, and languages to dominant ideals and culture. In response to these concerns, sustainability discussions focus on education, community development, and locally based policy that is open to change and consistent with the cultural values of the community. The creation of opportunities to expand and deepen diversity may act as a balance to this. Sustainability discussions on cultural heritage focus on the need to preserve cultural heritage for future generations, and to recognize the history of a place and the tangible and intangible attributes of its landscapes and communities (Matthews and Herbert, 2004).

Mills and Brown (2004) argued that cultural development in a community has come to be understood as a collective process, often involving creativity interpreted in the broadest sense. This contributes to changes in people's lives and long-term developmental benefits for a community. Cultural development in a community encompasses a huge range of activities that give communities the opportunity to tell their stories, build their creative skills, and be active participants in the development of their culture (O'Hara, 2002).

Discussion of sustainability, as Doubleday, Mackenzie, & Dalby (2004) observe, now incorporate both dynamic understandings of culture and the recognition that place matters because the practice that is in need of sustaining, as well as those that pose threats, happen in particular communities and in specific geographic contexts. Serious discussions of sustainability require considerations of the dynamics of complex cultural arrangements in particular places, rather than assumptions of either peoples or their ecological contexts" and that fundamental

debates on sustainability must contrast environmental and cultural preservation with active practices of living in culturally constituted places" (p p . 3 8 9 - 3 9 0).

As Ledwith (2005) observes, community development begins at the everyday lives of local people. Community development projects empower communities to position local issues within a larger political context. An important aspect of community development is that it is not handed down from experts or governments. Community development aims to strengthen the economy and the social ties within a community through locally based initiatives. The community development process is often characterized as a bottom line of amalgamating environmental, social, and economic well-being into a common audit. The bottom line is now expanding to include cultural well-being and good governance. The central goals of community development rely on residents having the ability to express their values, be self-reliant, satisfy basic human needs, and have greater participation and accountability in their community. This is accomplished by education, citizen participation, consensus building, and access to information. Creating a sense of place in the community is central as it empowers residents to become decision-makers over their own environment, resources, and future.

According to Williams (2003), sustainability is reflected in the capacity of the community to cope with change and adapt to new situations. Community sustainability is about creating a more just and equitable community through encouraging social and cultural diversity (Roseland et al., 2005). It also requires the community to define sustainability from its own values and perspective. This involves community participation and a collective decision-making process that meets the social, cultural, environmental, and economic needs of the community. Sustainable community involves development of a local and self-reliant economy that does not damage the social well-being of communities. Community residents in sustainable communities employ strategies and solutions that are integrative and holistic. They seek ways of combining policies, programs, and design solutions to bring about multiple objectives (Beatley and Manning, 1997). Sustainable project design utilizes essential aspects of cultural identity, can serve to synthesize the past with the present for the benefit of the future (Matthews and Herbert, 2004). Including residents in the design process can contribute to improving their quality of life.

2.5.3 Management Skills and Sustainability of Community Based Projects

Management of projects involves increasing the alignment of development projects with host communities priorities and coordinating aid efforts at all levels (local, national, and international) to increase ownership and efficient delivery of services. It is therefore basically offering leadership to achieve certain laid objectives. According to McDade (2004), good management ensures that sufficient local resources and capacity exist to continue the project in the absence of outside resources.

Community based projects are complex (Weinberg, 2008) and require multifaceted management skills. A project manager (PM) has to manifest not only project management related skills (Kirsch, 2000), but also technical and expertise as required by the project (Thite, 2001). Project management activities include but are not limited to defining project scope and requirements gathering, managing resources and relevant training issues within a project, advising about technical architecture, identifying specific and general project management practices and escalation procedures, estimating project schedule and budget, ascertaining and managing risks within a project and preparing risk mitigation

The matching or fit between a PM and project extends not only to the technical skills as enumerated above, but also to other general project-PM profile attributes, such as prior exposure to the methodology experience (Swanson and Beath, 2000). A PM is likely the most senior person within a project and is often perceived as a sounding board for technical and architectural decisions made for the project. In addition, the PM is also expected to demonstrate a deep knowledge of the business objectives of the project being undertaken (Bloom, 2006). Prior literature has shown that task familiarity helps in improving performance and increasing sustainability of a project (Goodman and Leyden, 2001). Prior exposure to the project characteristics such as technology, or methodology would make the current task more familiar to the PM, and hence improve sustainability (Banker and Slaughter 2000).

According to Espinosa, *et al.* (2007) task familiarity is important in the community based projects and this is usually linked to performance which in turn is linked to sustainability. As irsch (2000) and Thite (2001) suggest, a PM should be able to take on the leadership role with respect to not only managing the project but also leading the technological initiatives.

Fiedler, Chemers and Mahar, (2004) define leadership as a process by which one individual influences others toward the attainment of group or organizational goals. They emphasize three points about the definition of leadership. First, leadership is a social influence process. Leadership cannot exist without a leader and one or more followers. Second, leadership elicits voluntary action on the part of followers. The voluntary nature of compliance separates leadership from other types of influence based on formal authority. Finally, leadership results in followers' behavior that is purposeful and goal-directed in some sort of organized setting. Many, although not all, studies of leadership focus on the nature of leadership in the workplace, however, leadership has benefits in a wider scope.

McDade (2004) indicated that individuals with good management skill are considered to be good leaders and therefore, through their leadership organizations are steered to prosperity. Precise nature of leadership and its relationship to key criterion variables such as subordinate satisfaction, commitment, and performance is still uncertain, leadership does remain pretty much of a 'black box' or unexplainable concept." However, not all leaders are good managers. Therefore, in the quest to establish effect of management skills on sustainability of community projects, leadership should be distinguished from management. Chemers and Mahar, (2004) indicated that management involves planning, organizing, staffing, directing, and controlling, and a manager is someone who performs these functions. A manager has formal authority by virtue of his or her position or office. Leadership, by contrast, primarily deals with influence. A manager may or may not be an effective leader. A leader's ability to influence others may be based on a variety of factors other than his or her formal authority or position (Andriessen and Drenth, 2007).

Project managers have to influence all that they interact with so that project sustainability can be achieved; therefore they need not only to possess good management skill but leadership skills as well. The PMs have to interact with many stakeholders, they have to not only manage internal project teams, their peers and superiors, but also interact with clients, using skills that are essentially non-technical in nature, and which may not be easily imitable. These include but are not limited to organizational knowledge, tacit knowledge in handling people within the organizational structure, leadership and management skills, and customer handling skills (Kirsch, 2000). Within project teams, as individuals' progress from technical roles to more managerial roles, these skills come into play, and help in effective project management. Wagner and Sternberg (1985) focus on skills that are tacit, and gained through experience rather than being taught in a classroom. They classify these skills as related to managing self, others, and career. They find that differences in these skills between a novice and an expert are consequential for career performance in professional and managerial career pursuits.

Kirsch (2000) has highlighted that successful project management requires both hard and soft skills. Hard skills comprise technological skills, domain expertise, experience as well as project management experience, and project management skills such as planning, monitoring, risk management and scheduling. Soft skills are intangible, and are primarily concerned with managing and working with people and fostering inter- and intra- organizational "relationships." Such skills include but are not limited to organizational knowledge, tacit knowledge in handling people within the organizational structure, leadership and management skills, and customer handling skills (Becker, 1975; Lee et al., 1995; Kirsch, 2000). Thite (1999) has emphasized that both technical and transformational leadership skills are required of IT managers. As prior research has found (e.g., Byrd and Turner, 2001), both hard and soft skills are necessary in IT professionals to achieve higher performance. However, to the best of our knowledge, there has been no study that measures the direct impact of the PM's skills, especially soft skills, on project success.

General human capital comprises technological skills, domain expertise, experience as well as project management experience, and project management skills such as planning, monitoring,

27

risk management and coordination. An individual can use general human capital to increase productivity in many firms. Specific human capital utilizes skills that are intangible, and may be specific to a particular firm or environment (Becker, 1975; Lee et al., 1995; Kirsch, 2000). While the PM's hard skills play a role in determining project performance, team members also play a crucial role. When team members are more familiar with each other, the coordination effort required is lower, because familiarity can provide information about the task and task stakeholders (Espinosa et al., 2007). For example, when team members interact with each other over the course of a project, they develop a road map of expertise, that is, they know where and how to locate the expertise needed when in the next project (Boh et al., 2007). Because coordination is easier to accomplish in a more familiar team, we expect that the PM's soft skills are more helpful for less familiar teams, in terms of facilitating project performance and therefore ensuring sustainability of the said projects.

Prior literature has examined the congruence between personnel's management skills and project success (Pagell *et al.,* 2000). This approach inherently assumes that there is a congruent relationship between the performance, organization, and context, and thus predicts a unidirectional effect between skills and performance. While the direct impact of these skills is anticipated, it is important to explore how the fit – between PM skills and the project characteristics – impacts project sustainability. Pagell *et al*., (2000) find that the impact of fit between skills and environment on performance is more significant compared to the direct impact of skills on performance.

Project managers need to match resources to the project needs. Resource allocation requires a matching of project characteristics with the skill sets of the PM. Such a matching can also be viewed as a strategic choice in response to the (project) environment. Venkatraman and Prescott (1990) suggest that any deviation from an optimal pattern of resource allocation should be significantly and negatively related to performance and thus sustainability (Martin *et al*., 2004),

2.5.4 Technology and Sustainability of Community Based Projects

Project manager have always appreciated the role technology plays in the production process, project performance, and human welfare (Sampat, 2006). Repeated economic crises and steadily increasing failure in community projects, brought about in particular by poor management and accountability, are forcing an unprecedented rationalization of resources (Hagedoorn and Cloodt, 2003). Sustainability has thus become a concern of all community projects. At the same time, technology is developing with blinding speed and is becoming the principal instrument for meeting this concern. This explains why many community based projects are investing large amounts of money in implementing information systems. However, the advantages offered by technologies, especially in terms of enhancing productivity, depend upon how well these technologies are integrated into the projects objectives.

Recently, Information Technology (IT) has moved beyond the implementation of IT applications to an age of IT-enabled change. The trend towards increasing use of IT continues and the challenge remains how to better manage IT projects in order to maximize their economic benefits. Mbithi and Rasmuson, (1999) stressing the importance of technology on sustainability of community based projects indicated that, sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality and factors that are not controlled by the project for example, communities' poverty level, access to technical assistances and spare parts.

Adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance. The effective operation and maintenance (O & M) of rural water supply systems is crucial element for the sustainability of the water project. The community management of rural water supply systems on operation and maintenance (O & M) is not successful, if financing resources are not available and frequent supports are not provided (Binder, 2008). Budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance but not only one.

Technological innovation has enormous influence on community based project (Nohria and Gulati, 2006). Technological innovation should also be an important factor influencing the improvement of performance and therefore ensuring project sustainability. With more rapid technical change, it has become clear that the ability of organizations to develop innovative new products and services is a crucial influence on sustainability (Hitt & Rothaermel, 2003). Numerous studies have repeatedly shown a positive relationship between a project's technological innovation and project sustainability, and concluded that technological innovation is important for performance and sustainability (Foster, 1986).

Value, rarity, imitability and substitutability are desirable characteristics of a community based projects. The economic value of many firms and community project is increasingly derived from intangible assets (Dunning and Lundan, 2010; Kramer et al., 2011), meaning that they should focus more on dynamic resource, such as knowledge and inimitable and distinct technologies (Prahalad and Hamel, 1990). Technological innovation is important for sustainability of community projects. These innovations drive performance. There are two meanings of the definition of innovation performance (Hagedoorn and Cloodt, 2003). In the broad sense, innovation performance refers to knowledge of technological, inventive and innovative operations. Similarly, innovation performance can also be expressed in product performance and process performance (Cockburn et al., 2010). A performance gap exists between companies that embrace technology and those that resist it (Hopkins & Brynjolfsson, 2010); therefore, innovation is usually closely connected with technologies. Similarly, community projects that embrace technology exhibits better performance and sustainability than those that doesn't. Accordingly, sustainability driven by technology depends largely on the effective management of the innovation process, and managers should continue to identify, develop, protect, and allocate resources and capabilities in order to gain a sustainable competitive advantage (Amit and Schoemaker, 1993).

The advances in information technology have significantly changed the way computerized information systems can be used in community based projects. The role of information technology in service-sector firms and its impact on the effectiveness of the firm's operations

and sustainability have been identified (Rubenstein and Greisler, 2000). In addition, increased reporting requirements by stakeholder for ease of assessment of community projects have made it necessary for many communities based project to invest in information systems. Information technology can support a number of functions in such community based project. Information technology can significantly change the way projects interact with stakeholders. Stakeholders "see" the effect of automated admissions into the project for those who were not there at inception, fault reporting, and the improved efficiency and accuracy of billing and office systems. In addition, community based project members information systems can provide information extracted from their records to improve members satisfaction (Li, 1997); this ensures personalized service delivery to members.

2.6 Conceptual Framework

This section provides a structural narrative description of the relationship between the variables forming the concepts of the study on sustainability. In this study the framework below is an illustration of possible underlying factors and also influencing sustainability for community based water projects beyond donor support.

Conceptual Framework on factors influencing sustainability of rural community water projects

Independent variables   **Intervening variable**   **Dependent variables**

```
┌─────────────────────────────────┐        ┌──────────────────┐
│   Stakeholders' Participation   │        │     Weather      │
│   • Decision making             │        │   Government     │
│   • Share in development        │        │     policy       │
│     activities                  │        └──────────────────┘
│   • Share project costs         │
│   • Labor provision             │
└─────────────────────────────────┘
                                            ┌──────────────────────────────┐
┌─────────────────────────────────┐        │    Community projects        │
│        Cultural practices       │        │      Sustainability          │
│   • Social networking amongst   │        │                              │
│     residents                   │        │  ▪ Year-round access to water│
│   • Building of community       │        │                              │
│     identity and pride          │        │    ▪ Maintenance of          │
│   • Promotion of cultural norms │        │      viability/benefits/gains│
│   • Participation of local      │        │                              │
│     communities in development  │        │  ▪ Continued improvement of  │
│     initiatives                 │        │      the project             │
└─────────────────────────────────┘        │                              │
                                            │    ▪ Capacities of people    │
┌─────────────────────────────────┐        │      strengthened -          │
│        Management skills        │        │      empowerment             │
│   • Technical expertise         │        │                              │
│   • Managing resources          │        │  ▪ Environmental protection  │
│   • Estimating project schedule │        │      and conservation        │
│     and budget                  │        └──────────────────────────────┘
└─────────────────────────────────┘

┌─────────────────────────────────┐
│          Technology             │
│   • Choice of pumping tech      │
│     (Solar energy vs. Generator,│
│     borehole, dams, water pans) │
│   • Spare parts availability    │
│   • Information communication   │
│     systems                     │
└─────────────────────────────────┘
```
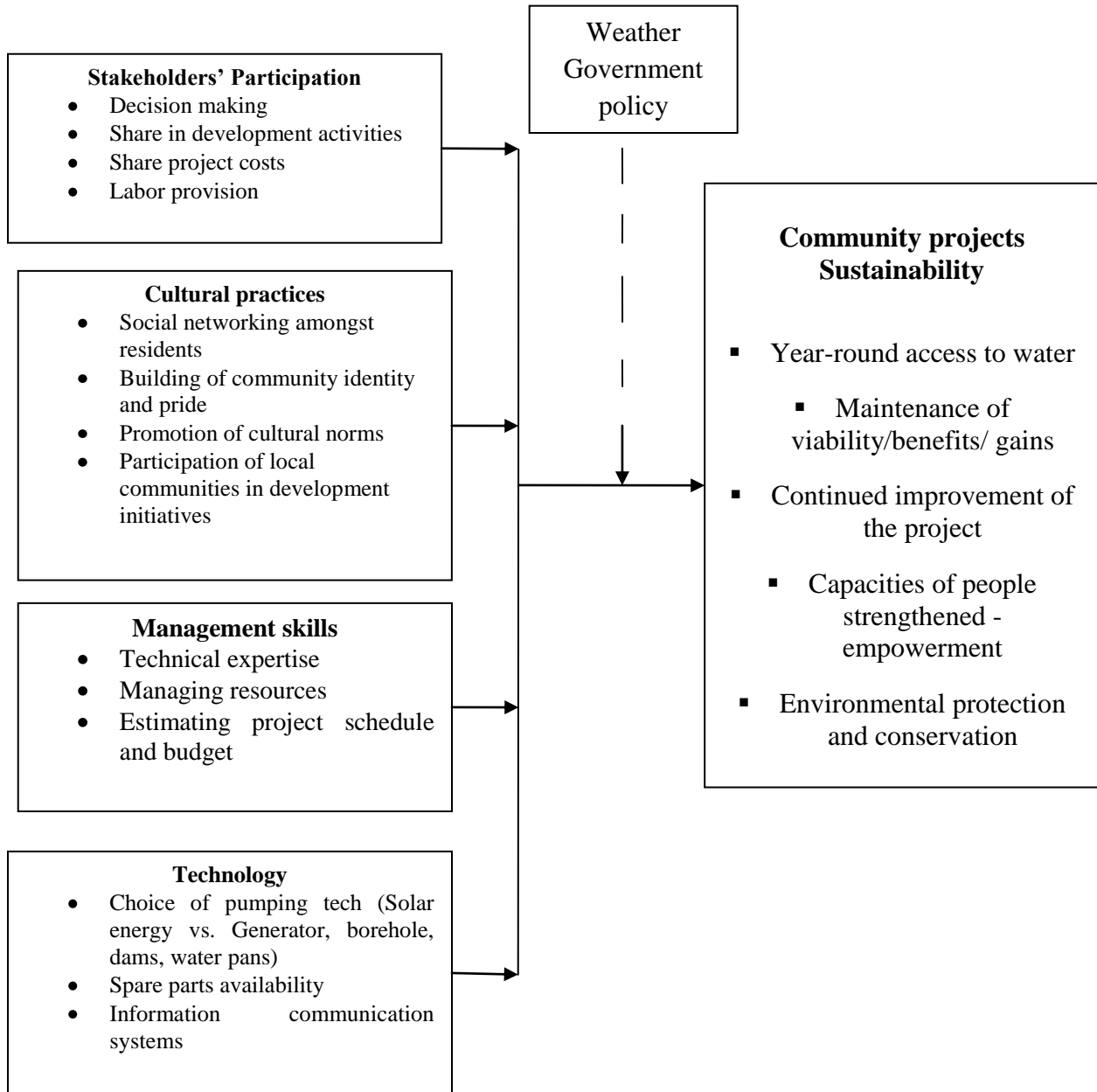
Figure 2.2: Conceptual Framework

2.7 Summary

This chapter has discussed in details the concept of sustainability. It therefore have highlighted that sustainability is resource use and lifestyles which do not damage resources or society. Communities in the world seek to achieve sustainability in their life and also improve it – sustainability development. Sustainability encompasses conventional approaches while adding a longer-term perspective. To achieve sustainability, efforts have been applied, while others have paid off, other effort have run into drain for lack of proper management, resources and commitment of the management and all stakeholders. This points out a clear lapse in effort to attain sustainability in community based project. The current study sought to establish the effect of stakeholders' participation, cultural practices, management skills and technology on sustainability of community based water projects in Kenya

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section is about the methodology that was applied in the research. It describes the research design, sampling procedure, data collection methods, validity and reliability and data analysis and presentation.

3.2 Research Design

Orodho (2003) defines research design as the scheme outline or plan that is used to generate answers to research to research problems. This study employed descriptive survey. A descriptive study attempts to describe or define a subject, often by creating a profile of a group of problems, people, or events, through the collection of data and tabulation of the frequencies on research variables or their interaction as indicated by Cooper and Schindler (2003). Thus, this approach is appropriate for this study as it helped to describe the state of affairs as they exist without manipulation of variables which was the aim of the study. According to Churchill (1991) descriptive study is appropriate where the study seeks to describe the characteristics of certain groups, estimate the proportion of people who have certain characteristics and make predictions. Orodho, (2004) notes that the choice of the descriptive survey research design is made based on the fact that in the study, the research is interested on the state of affairs already existing in the field and no variable would be manipulated. Further, According to Bryman and Bell, (2003) descriptive study is concerned with determining the relationship between variables. This choice for descriptive design in this study was based on the fact that this study sought to establish the factors that influence sustainability of rural community based water projects in Mtito Andei, Kibwezi County.

Three sub locations (Nzambani, Kambu and Nthonguni) with different projects that were formerly supported by WVK, USAID and OFDA were purposively considered. These projects

were initiated at different times and phases and some of them are actively operational while others are seasonal in nature. The sustainability issues were explained using both qualitative and quantitative data focusing a wide cross section of characteristics including those of households, and socio-economic activities, technological and structural issues affecting projects' sustainability. Data gathered and analyzed was used to make generalization with regard to the sustainability factors for community based water projects.

3.3.1. Target population

The study population constituted the inhabitants of the three sub locations and the water and sanitation key informants found in the same locality. This formed and cross section of people involving those who have been involved in the development of the projects, use, management, as well as those with expert information or data about these community based projects. The respondents were reached through household survey and purposive identification of the subject matter or key informants across relevant local institutions. From the census data of 2009, Mtito Andei has a population of 44,568 who were targeted in the study. Further, the study focused on the 23 employee in the water project.

3.4. Sample Size and sampling procedure

3.4.1 Sample Size

The area of study is found in Kibwezi County. According to the 2009 census, Mtito division had seven sub-locations (Mtito, Kitengei, Kambu, Mukaange, Mangelete, Muthingiini and Kithekani) of which the identified three sub-locations forms part with a total population of 44,568 (Census data, 2009). The region has high and low potential areas in terms of resource distribution. The low potential areas constitute the ASAL with many water projects that have been undertaken by the local community with different external donors.

This study intended to collect data from communities residing in the three sub locations and specifically around the water projects. A mix of both probability and non-probability sampling methods was combined to achieve maximum reliable responses for triangulation of themes.

A sample from the households was picked because a household was taken in this study as an appropriate unit providing reliable information regarding the objectives of the study. Van Dalen (1979) lists three factors that he considers to determine the size of an adequate sample as (1) the nature of the population, (2) the type of investigation, and (3) the degree of precision desired. The formula for estimating the sample size and a table for determining the sample size based on confidence level needed from a given population is therefore provided by Krejcie and Morgan (1970).

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

Where

S = required sample size

N = the given population size

P = population proportion that for table construction has been assumed to be .50, as this magnitude yields the maximum possible sample size required

d = the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion p about the population proportion P - the value for d being .05 in the calculations for entries in the table, a quantity equal to $\pm 1.96 \sigma_p$

X^2 = table value of chi square for one degree of freedom relative to the desired level of confidence, which was 3.841 for the .95 confidence level represented by entries in the table

According to the 2009 census, the population of the three sub-locations was 44,568. Applying this to the above formula the minimum sample size obtained was 384. According to the Evaluation report of 2012, the average household size is 4.27. This was divided by the sample, giving a minimum of the 89.90 (**90** households to be interviewed).

3.4.2 Sampling Procedure

The study used a combination of both probability and non-probability sampling techniques.

The probability sampling techniques included cluster sampling procedure, simple random sampling and systematic sampling procedure. To collect quantitative data, ***Cluster sampling procedure*** was applied where the settlements were not evenly distributed but settled in clustered households near the water projects. To start with, ***Simple random sampling*** was applied within the clusters to randomly pick the first household for administration of questionnaires. Once the first household was randomly identified, ***Systematic sampling procedure*** was used to collect data through questionnaires in the subsequent households within the cluster. The systematic procedure was continually applied where the settlements exist in some linear order.

According to Kerry and Bland (1998), cluster sapling is cheaper than other methods because it involves fewer travel expenses and administration costs and consumes less time. Cluster sampling takes into account large populations. Since these groups are so large, deploying any other sampling technique would be very difficult task. It is very feasible when you are dealing with large Population. The advantage of systematic sample is that it really fast, it is very simple to use, saves time and cost, it checks bias in subsequent selections of samples, its variances are most often smaller than other alternative sampling technique, convenient when the researcher has a list of the units in the population and allows the researcher to add a degree of system or process into the random selection of subjects and has the assurance that the population was evenly sampled.

The non-probability sampling technique for the study was purposive sampling. This procedure was applied to collect qualitative data especially in identifying and reaching the key informants on particular themes, ***Purposive sampling*** procedure which involved selection of a sample on the basis of the researcher's own judgment depending on the elements and the nature of the research objective. This was applied in identifying and conducting informant interviews for various government departments, non-governmental and local institutional leaders. The purposive sampling was also applied in the selection of participants for group discussions. Purposive sampling is appropriate when the informants have a specific type of knowledge or skill required in the study. Purposive sampling may be used together with the both qualitative and quantitative methods of data collection and statistical analyses such as regression models (Neupane *et al.*, 2002).

3.5. Research Instruments

In order to generate quantitative and qualitative data a number of methods were used to collect both primary and secondary data. This study collected quantitative data using a questionnaire from the respondents (community members that benefits from the community project water). Also, the study sought responses from staffs working in the projects. The researcher informed the respondents that the instruments being administered were for research purpose only and the responses from the respondents would be kept secret and confidential. The researcher obtained an introductory letter from the University to collect data from the community based project and then deliver the questionnaires to the respondents with the help of research assistants and have them filled in. Secondary data collection included a review of records or published information obtained from the existing literature relevant to the area and topic of study. It involved a review of Ministry of water Publications, journals, water project reports, development plans, newspapers, and survey maps.

3.6. Pretesting of the instrument

Before the research tools were finally administered to participants, pre-testing was carried out to ensure that the questions were relevant, clearly understandable and made sense. The pre-testing aimed at determining the validity and reliability of the research tools including the wording, structure and sequence of the questions.

3.6.1 Validity of the instrument

According to Bridget and Lewin (2005), validity is the degree by which the sample of test items represents the content the test is designed to measure. Saunders et al., (2007) indicated that content validity is a measure of the degree to which data collected using a particular instrument represents a specific domain or content of a particular concept as intended. Lacity and Jansen (1994) define validity as making common sense, and being persuasive and seeming right to the reader while Cronbach, (1971), indicated that validity refers to results that have the appearance of truth or reality. Therefore, a pilot study was conducted to refine the research instrument so that results obtained from the field would be a true representation of situation the ground.

Therefore, validation of the research instrument would be important to this study as it would ensure that the study collected relevant information to answer the research questions. Mugenda and Mugenda (2003) contend that the usual procedure in assessing the content validity of a measure is to use a professional or expert in a particular field. To establish the validity of the research instrument the researcher sought the opinions of experts in the field of study especially the researcher's supervisor and lecturers. This facilitated the necessary revision and modification of the research instruments thereby enhancing validity

3.6.2 Reliability of the instrument

Reliability refers to the consistency of measurement and is frequently assessed using the test–retest reliability method. Reliability is increased by including many similar items on a measure, by testing a diverse sample of individuals and by using uniform testing procedures. Reliability

gives the internal consistency of data collected. This ensured that the data has certain internal consistent pattern. When no pattern is found in the responses, this indicates that probably the test is too difficult and as a result the respondents just guess the answers randomly.

Reliability of the research instrument was enhanced through a pilot study that was done in Equity bank selecting a pilot group of 30 respondents. The respondents were conveniently selected since statistical conditions were not necessary in the pilot study (Cooper and Schindler, 2003). The pilot data was not included in the actual study. The pilot study allowed for pre-testing of the research instrument. This reliability estimate was measured using Cronbach Alpha coefficient (α). Nunnally (1978) recommends that instruments used in research should have reliability of about 0.70 and above.

3.7 Data Collection Procedure

Data was collected through a self-administered questionnaire for the respondents. The researcher obtained approval from the University and a permit from the National Council for Science and Technology to conduct the study. The researcher explained the purpose of the study and offered guidance to the respondents on the way to fill in the questionnaire before administering the questionnaire. For those respondents with difficulties in reading and filling in, the researcher interviewed and filled in the information in the questionnaire for them. The study used drop and pick later method during data collection where the respondents were left with the questionnaire to fill in their convenient time. The researcher made subsequent visits and courtesy calls to remind the respondents to fill in the questionnaire thereby increasing the response rate.

3.8 Data Analysis Techniques

The researcher edited completed questionnaires completeness and consistency. Data clean-up followed; this process involves editing, coding, and tabulation in order to detect any anomalies in the responses and assign specific numerical values to the responses for further analysis. The data was then analysed using descriptive statistics. The descriptive statistical tools (SPSS V.17.0 and Excel) helped the researcher to describe the data. The Likert scale was used to analyse the mean

score and standard deviation. The findings were presented using tables and graphs for further analysis and to facilitate comparison. This generated quantitative reports through tabulations, percentages, and measure of central tendency.

The researcher further employed a multivariate regression model to study the relationship between cultural practices, technology, management skills and stakeholders' participation and financial sustainability. The research deemed regression method to be useful for its ability to test the nature of influence of independent variables on a dependent variable. Regression is able to estimate the coefficients of the linear equation, involving one or more independent variables, which best predicted the value of the dependent variable. This is what a correlation analysis cannot provide as compared to a regression analysis. Further, correlation analysis was meant to illustrate the direction of relationship between two variables but not how much the independent variable influences the dependent variable. Therefore, the researcher used the linear regression analysis to analyze the data. The regression model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Where: Y = Community Based Project Sustainability; β_0 = Constant Term; β_1, β_2, and β_3 = Beta coefficients; X_1=stakeholders' participation; X_2= Cultural practices; X_3= management skills; X_4 = Technology and ε = Error term

3.9 Operationalization of variables

Table 3.1: Operationalization of variables

Objectives	Variables	Indicators	Measurement scale	Tools of Analysis	Specific Tool
To establish the influence of stakeholders' participation on sustainability of the rural community based water projects	**Independent:** Stakeholders' participation **Dependent:** Sustainability of the rural community based water projects.	-Decision making -Share in development activities -Share project costs -Labor provision -Year-round access to water -Maintenance of viability/benefits/ gains -Continued improvement of the project -Capacities of people strengthened - empowerment -Environmental protection and conservation	-Nominal -Nominal	Causal relationship	Correlation analysis
To assess the influence of cultural practices on sustainability of the rural community based water projects.	**Independent:** Cultural practices	-Unity of residents -Social networks amongst residents -Building of community identity and pride -Promotion of cultural norms -Participation of local communities in development initiatives -Encouragement on ownerships of community resources	-Interval -Nominal -Nominal -Interval	Central Tendency Dispersion, and Causal relationship	Mean, standard deviation, regression and Correlation analysis
To examine the influence of management skills on sustainability of the rural community based water projects.	**Independent:** Management skills	-Technical expertise -Managing resources -Advising about technical architecture -Estimating project schedule and budget -Ascertaining and managing risks -Knowledge of business -Leadership	-Interval -Nominal -Nominal	Central Tendency Dispersion, and Causal relationship	Mean, standard deviation, regression and Correlation analysis

To determine the influence of technology on sustainability of the rural community based water projects.	**Independent:** Technology .	-Pumping technology -Choice of technology -Spare parts availability -Information communication systems -Accounting systems -Payment systems -Reporting systems -Service delivery -Fault reporting	-Interval -Interval -Interval	Central Tendency Dispersion, and Causal relationship	Mean, standard deviation, regression and Correlation analysis

3.10 Ethical Consideration

For the purpose of this study, approval was sought from the University of Nairobi and a letter granted to allow the researcher to carry out the research. The researcher also obtained approval from the National Council for Science and Technology to conduct the study.

The researcher further sought approval from the local administration and water projects management to carry out the study. The researcher explained the purpose of the study to the respondents and assured them of confidentiality of their responses and identities. The researcher adhered to appropriate behavior in relation to the right of the respondents. A verbal consent was sought from sample respondents before being interviewed.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the data that was found on factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya.

4.1.1 Questionnaire Return Rate

As shown in Table 4.2, the study targeted 90 household respondents and 23 water project employees out of which all the 90 household respondents and 20 water project employees responded and returned their questionnaires contributing to the response rates of 100% for household respondents and 86.9% for the water project employees. This response rates were sufficient and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. This commendable response rate was due to extra efforts that were made via personal calls and visits to remind the respondent to fill-in and return the questionnaires.

Table 4.2 Questionnaire Return Rate Rates

	Targeted	Returned	Percent
Household respondents	90	90	100%,
Water project employees	23	20	86.9%

4.2 Socio-Demographic Information

The study sought to establish information on various aspects of respondents' background such as time of being a resident, gender, academic/professional qualification, occupation, and average income. This information aimed at testing the appropriateness of the respondent in answering the questions regarding factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya.

4.2.1 Being a resident

The study sought to find out the whether the household respondents were resident of the area.

Table 4.3 Being a resident

	Frequency	Percentage
Yes	90	100
No	0	0
Total	**90**	**100**

From the Table 4.2, majority (100%) of the household respondents were residents of Kibwezi County and therefore they would give valid and reliable information about water project in Kibwezi County.

4.2.2 Years of being a resident

The study sought to find out for how long the household respondents had lived in Kibwezi County.

Table 4.4 Years of being a resident

	Frequency	Percentage
10 years and below	11	12.2
11-20 years	14	15.6
21-30 years	44	48.9
31 years and above	21	23.3
Total	**90**	**100**

From the findings in Table 4.4, most of the household respondents (48.9%) had lived in Kibwezi County for 21-30 years, 23.3% for 31 years and above while 15.6% had lived for 11-20 years. This implies that the household respondents had lived in Kibwezi County for long enough to give credible information about the sustainability of water projects in Kibwezi County.

4.2.3 Gender distribution of Respondent

The study sought to find out the gender of the respondents

Table 4.5 Gender distribution of Respondent

	Frequency	Percentage
Male	51	56.7
Female	39	43.3
Total	**90**	**100**

From the findings in table 4.5, majority (56.7%) of the household respondents were male while minorities (43.3%) were female. The findings indicate that majority of the households were headed by males who were involved in the water projects in the locality.

4.2.4 Highest level of school/level

The study sought to find the highest academic qualifications of the respondents

Table 4.6 Highest level of school/level

	Frequency	Percentage
Never	7	7.8
Primary	23	25.6
Secondary level	47	52.2
Tertiary level; (colleges, polytechnics	11	12.2
University level	2	2.2
Total	**90**	**100**

From the Table 4.6 majority of the household respondents (52.2%) had secondary level of education, 25.6% had primary, 12.2% had tertiary level while 7.8% had never attended school. Therefore it can be noted that majority of the household respondents had attained the basic education and thus would provide valid and consistent information about sustainability of water project in their locality.

4.2.5 Occupation

The respondents were requested to indicate their occupation.

Table 4.7 Occupation

	Percentage
Livestock sale	45
Vegetable sale	47
Charcoal sale	33
Firewood sale	27
Carpentry	12
Quarrying (sand/stone)	14
Casual labour	56
Employment	8

From the findings in Table 4.7, 56% were casual labourers, 47% sold vegetables, 45% sold livestock, 33% were involved in charcoal sale, 27% in firewood sale, 12% in carpentry, 14% in quarrying while 8% were in the employment. Therefore the majority of the respondents worked in the informal sector and were poor since their occupation could only help them raise income for daily household needs.

4.2.6 Average income range per month

The study sought to find out the respondents' average income range per month from all their income sources.

Table 4.8 Average income range per month

	Frequency	**Percentage**
Less than 2500	15	16.7
2500 – 5000	48	53.3
5000 – 7500	17	18.9
7500 – 10000	6	6.7
More than 10,000	3	3.3
Total	**90**	**100**

From the Table 4.8, majority of the households in Kibwezi County (53.3%) had an average monthly income from all their financial sources of Kshs 2500 – 5000, 18.9% had Kshs 5000 – 7500 while 16.7% had a average monthly income from all their financial sources of less than Kshs 2500. Therefore the majority of the households were poor and could barely afford the basic household needs due to lack of finances.

4.3 Stakeholders' participation and the sustainability of the rural community based water projects

The first objective of the study was to establish how the extent of stakeholders' participation affects the sustainability of the rural community based water projects.

4.3.1 Participation in the initiation/start of water projects

The study sought to find out whether the households respondents had ever participated in the initiation/start of the water projects in this area.

Table 4.9 Participation in the initiation/start of water projects

	Frequency	Percentage
Yes	41	45.6
No	49	54.4
Total	**90**	**100**

From the study findings in Table 4.9, the majority (54.4%) of the households' respondents never participated in the initiation/start of the water projects while only 45.6% participated in the initiation/start of the water projects. This depicts that the level of stakeholders' participation in the water projects was low.

4.3.2 Area of participation in the project initiation

The study inquired on the area of participation that the household respondents had participated in.

Table 4.10 Area of participation in the project initiation

	Frequency	Percentage
I was consulted through a meeting	23	56.1
I contributed materials	16	39.0
As a leader/part of the committee	2	4.9
Total	**41**	**100**

From the results of the study in Table 4.10, the majority (56.1%) of the household respondents participated in the initiation/start of the water projects when they were consulted through a meeting, 39.0% contributed materials while 4.9% were leaders/part of the committee. This implies that the stakeholders' participation was critical in the implementation of the water projects in the county through reduction of operations costs, improving the efficiency of the project and increasing the longevity of the projects.

4.3.3 Stakeholders' involvement in water project operation

The respondents were required to indicate whether other partners/stakeholders were involved in the water projects in this area.

Table 4.11 Stakeholders' involvement in water project operation

	Frequency	Percentage
Yes	67	74.4
No	23	25.6
Total	**90**	**100**

According to the findings in Table 4.11, majority (74.4%) of the respondents indicated that other partners/stakeholders were involved in the water projects in this area. This illustrates that involvement of the all the stakeholders determined the efficiency and sustainability of the water projects.

4.3.4 Stakeholders' involvement in water project operation

The respondents were to indicate the ways that the stakeholders were involved in the implementation of the project.

Table 4.12 Stakeholders' involvement in water project operation

	Frequency	Percentage
Designing	24	26.7
Contribution of funds/other resources	56	62.2
In management/running of the operation of the rural community based water projects	10	11.1
Total	**90**	**100**

According to the findings, the majority of the household respondents (62.2%) posited that the stakeholders were involved in the water project through contribution of funds/other resources, 26.7% through designing while 11.1% posited that stakeholders were involved in management/running of the operation of the rural community based water projects. Thus the stakeholders brought many contributions to the running of the water projects in terms of financial supports, designing of the project and the operation of the water projects.

4.3.5 Stakeholders' participation positive contribution to the sustainability of the rural community based water projects

The respondents were further to identify the extent that the stakeholders' participation positively enhanced the sustainability of the rural community based water projects

Table 4.13 Stakeholders' participation

	Frequency	Percentage
To a very low extent	2	2.2
To a low extent	5	5.6
To a moderate extent	13	14.4
To a great extent	43	47.8
To a very great extent	27	30.0
Total	**90**	**100**

According to Table 4.13 most of the household respondents (47.8%) posited that stakeholders' participation positively enhanced the sustainability of the rural community based water projects to a great extent, 30.0% to a very great extent while 14.4% said that it enhanced the sustainability of the rural community based water projects to a moderate extent. Therefore the stakeholders' participation enhanced the efficiency of the water project to a great extent consequently improving the sustainability of the project.

4.3.6 Benefits associated with stakeholders' participation

The study inquired from the respondents on the main benefit associated with stakeholders' participation in the project.

Table 4.14 Benefits associated with stakeholders' participation

	Percentage
Strong ownership of the projects	44
Timely maintenance/repairs	56
Continuity of the project	67
Expansion of the project	31
Better service delivery	33
Harmony/conflict management	46

From the findings in Table 4.14, the majority of the household respondents (67%) indicated that the main benefit associated with stakeholders' participation in the project was continuity of the project, 56% said it was timely maintenance/repairs, 46% cited it as harmony/conflict management, 44% cited strong ownership of the projects, 33% said it was better service delivery while 31% cited expansion of the project.

4.3.7 Stakeholders' participation and sustainability of the rural community based water projects

The study sought to establish the influence of stakeholders' participation on the sustainability of the rural community based water projects. The respondents were requested to indicate their level of agreement on the extent to which stakeholders' participation affected the sustainability of the rural community based water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree   3 - Neutral 4- Agree and 5- Strongly Agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.15.

Table 4.15 Stakeholders' participation and sustainability of the rural community based water projects

Statements	Mean
Involvement of the target communities is crucial for the sustainability of rural water supply systems	4.09
Stakeholders' support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness- raising activities.	4.39
Stakeholders' involvement in the project implementation has enhanced continuity in the operation of the water project	2.43
Stakeholders' participation has enabled them to clearly understand their roles	4.23
Stakeholder are better placed to lobby for government and donor support for the community project	3.89
By the Stakeholders' support, the community ensures the success of a project through collective efforts to increase and exercise control over project	4.03
Stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them	4.05
Stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability	3.06
Stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership)	3. 01
Stakeholders' contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits	3.56
Community support has increased project efficiency	3.87
Building a partnership with the communities lead towards improving the people's problem solving capacities	4.01

From the study findings, the majority of the respondents agreed that; stakeholders' support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness- raising activities (M=4.39), stakeholders'

participation has enabled them to clearly understand their roles (M=4.23), involvement of the target communities is crucial for the sustainability of rural water supply systems (M=4.09), stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them (M=4.05), by the Stakeholders' support, the community ensures the success of a project through collective efforts to increase and exercise control over project (M=4.03), building a partnership with the communities lead towards improving the people's problem solving capacities (M=4.01), stakeholder are better placed to lobby for government and donor support for the community project (M=3.89), community support has increased project efficiency (M=3.87), stakeholders' contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits (M=3.56), stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability (M=3.06), stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership) (M=3. 01), stakeholders' involvement in the project implementation has enhanced continuity in the operation of the water project (M=2.43) respectively.

4.3.8 Stakeholders' involvement in the project

The study inquired from the water project employees on whether the stakeholders were adequately involved in the project.

Table 4.16 Stakeholders' involvement in the project

	Frequency	Percentage
Yes	8	40
No	12	60
Total	**20**	**100**

From the findings in Table 4.16, the majority of the water project employees (60%) posited that the stakeholders were not adequately involved in the project. Only 40% of the water project employees attested to the stakeholders being adequately involved in the project. Therefore the

lack of sufficient stakeholders' participation in the project implementation contributed to the project failure.

The water project employees further explained that in decision making the stakeholders endorsed the project budgetary allocations, vetted the employees to work in the project, proposed the policies to be implemented. In the sharing of development activities the stakeholders approached strategic personalities and institutions to aid in management of the project, and in lobbying for support from the government and private sector.

4.4: Cultural practices and sustainability of community based projects

The second objective of the study was to assess how cultural practices influence sustainability of the rural community based water projects.

4.4.1 Cultural practices and sustainability of the rural community based water projects

The study sought to establish the influence of cultural practices on the sustainability of the rural community based water projects. The respondents were requested to indicate their level of agreement on the extent to which various cultural practices affected the sustainability of the rural community based water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree   3 - Neutral 4- Agree and 5- Strongly Agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.17.

Table 4.17 Cultural practices and sustainability of the rural community based water projects

Statements	Mean
People from different cultures/tribes/clans in the region benefit from the water project	2.42
The water project unites people from different cultures/tribes/clans in the region	3.66
The water project promotes social networks amongst residents in the region	3.26
The water project has enhanced partnerships between the local community and the government or non-governmental organizations	3.26
The water project builds community identity and pride	3.54
Through the water project the cultural norms are upheld in the community around	3.52
The water project has positively transformed health, water and sanitation practices in the region	4.57
The water project has facilitated participation of local communities in development initiatives in the region	4.53
The project has improved security in the region by reducing conflicts over natural sources of water	4.27
The project has encouraged residents to take ownerships of their own community resources	4.37
The water project has encouraged residents to conserve available water resources and other natural resources	4.23
The community has gained substantial knowledge and technical skills from the water project	4.01

From the study findings, the majority of the respondents agreed that the water project has positively transformed health, water and sanitation practices in the region (M=4.57), the water project has facilitated participation of local communities in development initiatives in the region (M=4.53), the project has encouraged residents to take ownerships of their own community resources (M=4.37), the project has improved security in the region by reducing conflicts over natural sources of water (M=4.27), the water project has encouraged residents to conserve available water resources and other natural resources (M=4.23), the community has gained substantial knowledge and technical skills from the water project (M=4.01), the water project

57

unites people from different cultures/tribes/clans in the region (M=3.66), the water project builds community identity and pride (M=3.54), through the water project the cultural norms are upheld in the community around (M=3.52), the water project promotes social networks amongst residents in the region (M=3.26), the water project has enhanced partnerships between the local community and the government or non-governmental organizations (M=3.26), and that people from different cultures/tribes/clans in the region benefit from the water project (M=2.42) respectively.

4.4.2 Effect of cultural practices on the project

The study further inquired from the water project employees on how they would rate the effect of cultural practices in the project.

Table 4.18 Effect of cultural practices on the project

	Frequency	Percentage
Excellent	1	5
Good	2	10
fair	6	30
poor	8	40
Very poor	3	15
Total	**20**	**100**

From the findings in Table 4.18 most of the water project employees (40%) rated the effect of cultural practices in the project as poor, 30% as fair while 15% rated it as very poor.

4.5 Management skills and sustainability of the rural community based water projects

The third objective of the study was to examine how management skills influence sustainability of the rural community based water projects.

4.5.1 Managers of the water point

The household respondents were to indicate who managed the water point

Table 4.19 Managers of the water point

	Frequency	Percentage
Committee	42	46.7
An elected leader	31	34.4
Headman	11	12.2
Politician	6	6.7
Total	**90**	**100**

As shown in Table 4.19, 46.7% of the household respondents said that the water point was managed by a committee, 34.4% by elected leader, 12.2% by headman, while 6.7% indicated that water point was managed by a politician.

4.5.2 Responding to concerns

The household respondents were requested to indicate whether those who managed the water project responded adequately to concerns whenever raised.

Table 4.20 Responding to concerns

	Frequency	Percentage
Yes	57	63.3
No	33	36.7
Total	**90**	**100**

As shown in Table 4.20, the majority of the household respondents (63.3%) posited that those who managed the water project responded adequately to concerns whenever raised. Only 36.7%

said that those who managed the water project did not respond adequately to concerns whenever raised.

4.5.3 Efficiency of the water project managers

The household respondents were to indicate whether the people appointed to manage the water project were effective.

Table 4.21 Efficiency of the water project managers

	Frequency	Percentage
Yes	57	63.3
No	33	36.7
Total	**90**	**100**

From the results of the study in Table 4.21, the majority of the household respondents (63.3%) indicated that the people appointed to manage the water project were effective while 36.7% indicated that the people appointed to manage the water project were not effective.

4.5.4 Management skills and sustainability of the rural community based water projects

The study sought to establish the influence of management skills on the sustainability of the rural community based water projects. The respondents were requested to indicate their level of agreement on the extent to which various management skills affected the sustainability of the rural community based water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree   3 - Neutral 4- Agree and 5- Strongly Agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.22.

Table 4.22 Management skills and sustainability of the rural community based water projects

Statements	Mean
There is sufficient technical expertise to manage the project	4.01
Project managers have adequate and experience (task familiarity) in management	3.69
There is sufficient human resource for sustainability of the project	3.88
Advise about technical architecture was made available for the project	3.60
There are clear and achievable estimates in the project schedule and budget	3.66
Risk management is satisfactory	3.77
The leadership skills of the managers is satisfactory	3.63
The community is satisfied with the overall management of the water project	3.79
Management of projects has increased the alignment of development projects with host communities priorities	3.71
Community based projects are complex and require multifaceted management skills	3.65

From the findings, the majority of the respondents agreed that there is sufficient technical expertise to manage the project (M=4.01), there is sufficient human resource for sustainability of the project (M=3.88), the community is satisfied with the overall management of the water project (M=3.79), risk management is satisfactory (M=3.77), management of projects has increased the alignment of development projects with host communities priorities (M=3.71), project managers have adequate and experience (task familiarity) in management (M=3.69), there are clear and achievable estimates in the project schedule and budget (M=3.66), community based projects are complex and require multifaceted management skills (M=3.65), the leadership skills of the managers is satisfactory (M=3.63), and that advise about technical architecture was made available for the project (M=3.60) respectively.

4.5.5 Management qualities affecting sustainability of the rural community based water projects

In order to further to establish the influence of management skills on the sustainability of the rural community based water projects, the water project employees were requested to indicate

their level of agreement on the extent to which the management possessed various qualities that affected the sustainability of the rural community based water projects. The responses were rated on a five point Likert scale where: 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.23.

Table 4.23 Management qualities affecting sustainability of the rural community based water projects

Management qualities	Mean
Technical expertise (domain expertise)	4.40
Experience (task familiarity)	3.13
Managing resources	4.26
Advising about technical architecture	4.18
Estimating project schedule and budget	3.16
Ascertaining and managing risks	3.15
Knowledge of business	3.89
Leadership	3.51

From the findings, the majority of the respondents agreed that the management qualities that affected the sustainability of the rural community based water projects were technical expertise (M=4.40), managing resources (M=4.26), advising about technical architecture (M=4.18), knowledge of business (M=3.89), leadership (M=3.51), estimating project schedule and budget (M=3.16), ascertaining and managing risks (M=3.15) and experience (task familiarity) (M=3.13) respectively.

4.6 Technology and sustainability of the rural community based water project

The fourth objective of the study was to determine how technology influence sustainability of the rural community based water projects.

4.6.1 Technology used to pump water

The household respondents were to indicate how they got water from the point/source mentioned.

Table 4.24 Technology used to pump water

	Frequency	Percentage
By use of pulley	47	52.2
Water is pumped out of well/ source to storage tanks	33	36.7
Water is piped to all household	10	11.1
Total	**90**	**100**

From the results of the study in Table 4.24, the majority of the (52.2%) used pulley to get water from the point/source, 36.7% used water pumped out of well/ source to storage tanks while 11.1% indicated that water is piped to all household.

4.6.2 Meters installed to monitor consumption of water

The household respondents were to indicate whether there were meters installed to monitor consumption of water.

Table 4.25 Meters installed to monitor consumption of water

	Frequency	Percentage
Yes	2	20
No	8	80
Total	**10**	**100**

According to the findings in Table 4.25 the majority of the household respondents (80%) attested that no meters had been installed to monitor consumption of water. Only 20% indicated that meters had been installed to monitor consumption of water. Therefore, the level of adoption of

technology in the management of water project was very low impairing the sustainability of water projects.

4.6.3 Water payment mode

The study required the household respondents to indicate the various mode of payment that they used to pay for the water consumed.

Table 4.26 Water payment mode

	Frequency	Percentage
Mobile money payment (Mpesa, YuCash, Airtel money)	31	34.4
Bank account	15	16.7
Cash	44	48.9
Total	**90**	**100**

According to the findings in Table 4.26 most of the household respondents (48.9%) paid for water using cash, 34.4% using mobile money payment (Mpesa, YuCash, Airtel money) while 16.7% used bank account. This illustrates that various payment modes were used in the management of the water projects.

4.6.4 Challenges affecting constant supply of the water

The study required the household respondents to indicate the various challenges affecting constant supply of the water to the households form the water points.

Table 4.27 Challenges affecting constant supply of the water

	Percentage
Breakage of pipes	44
Vandalism	31
Blockages of pipes	23
Breakdown of generator pumps	45
Expensive parts/fuel	56

According to the findings in Table 4.27, the challenges affecting constant supply of the water to the households form the water points expensive parts/fuel (56%), breakdown of generator pumps (45%), breakage of pipes (44%), vandalism (31%) and blockages of pipes (23%) respectively.

4.6.5 Water project systems being broken down

The household respondents were also requested to indicate the persons who maintained the water project systems when they broke down.

Table 4.28 Water project systems being broken down

	Frequency	Percentage
Government MOWI officer	21	23.3
Local artisans	53	58.9
Water project Committees	16	17.8
Total	**90**	**100**

According to the findings in Table 4.28, majority of the household respondents (58.9%) reported that the persons who maintained the water project systems when they broke down was the local artisans, 23.3% cited government MOWI officer while 17.8% cited water project committees. Therefore the water project suffered major setbacks due to breakdown as the local artisans who were relied on lacked adequate skills to maintain the water project.

4.6.6 Possession of appropriate/relevant training

The study inquired on whether the persons who fixed the water project systems breakdown had had the appropriate/relevant training.

Table 4.29 Possession of appropriate/relevant training

	Frequency	Percentage
Yes	42	46.7
No	48	53.3
Total	**90**	**100**

As shown in Table 4.29, the majority (53.3%) of the respondents indicated that the persons who fixed the water project systems breakdown lacked the appropriate/relevant training. Only 46.7% of the respondents indicated that the persons who fixed the water project systems breakdown had the appropriate/relevant training. This implies that the sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community were not fully equipped with adequate skills.

4.6.7 Technology and sustainability of the rural community based water projects

The study sought to establish the influence of technology on the sustainability of the rural community based water projects. The respondents were requested to indicate their level of agreement on the extent to which technology affected the sustainability of the rural community based water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree   3 - Neutral 4- Agree and 5- Strongly Agree. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.30.

Table 4.30 Technology and sustainability of the rural community based water projects

Statements	Mean
The project is using modern technology	3.46
Use of modern technology has helped to curb poor management and accountability of the project	3.92
The advantages offered by technologies in terms of enhancing productivity, depend upon its integration into the projects objectives.	3.18
Sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality	4.40
Adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance	3.10
Technological innovation has enormous influence on community based project	3.41
community projects that embrace technology exhibits better performance and sustainability	3.67
sustainability driven by technology depends largely on the effective management of the innovation process	3.56
community based project members information systems can provide information extracted from their records to improve members satisfaction	3.95
Sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality	3.21
Enhancing productivity does not depend upon its integration into the projects objectives.	3.73

From the findings, the majority of the respondents agreed that sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality (M=4.40), community based project members information systems can provide information extracted from their records to improve members satisfaction (M=3.95), use of modern technology has helped to curb poor management and accountability of the project (M=3.92), enhancing productivity does not depend upon its integration into the projects objectives (M=3.73), community projects that embrace technology exhibits better performance and sustainability (M=3.67), sustainability driven by technology depends largely on the effective

management of the innovation process (M=3.56), the project is using modern technology (M=3.46), technological innovation has enormous influence on community based project (M=3.41), sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality (M=3.21), the advantages offered by technologies in terms of enhancing productivity, depend upon its integration into the projects objectives (M=3.18), adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance (M=3.10) respectively

4.6.8 Technology and sustainability of the community based water project

The water project employees were required to indicate whether technology has influenced efforts to achieve sustainability of the community based water project.

Table 4.31 Technology and sustainability of the community based water project

	Frequency	Percentage
Yes	15	75
No	2	25
Total	**20**	**100**

According to the findings in Table 4.31, majority of the water project employees (75%) attested to technology influencing efforts to achieve sustainability of the community based water project. Therefore technology was a critical factor affecting the sustainability of the community based water project.

4.6.9 Forms of technology used in rural community based water projects

In order to further to establish the influence of technology on the sustainability of the rural community based water projects, the water project employees were requested to indicate their level of agreement on the extent to which various forms of technology were used in the rural community based water projects. The responses were rated on a five point Likert scale where: 1

= not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.32.

Table 4.32 Forms of technology used in rural community based water projects

Forms of technology	Mean
Information communication systems	4.39
Accounting systems	4.26
Payment systems	4.12
Reporting systems	4.13
Service delivery	4.23
Fault reporting	4.15

According to the findings, majority of the respondents agreed that the forms of technology were used in the rural community based water projects included information communication systems (M=4.39), accounting systems (M=4.26), service delivery (M=4.23), fault reporting (M=4.15), reporting systems (M=4.13), payment systems (M=4.12) respectively.

4.6.10 Technology and projects' sustainability

In order to further to establish the influence of technology on the sustainability of the rural community based water projects, the water project employees were requested to indicate the extent to which various aspects of technology influenced the projects sustainability. The responses were rated on a five point Likert scale where: 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.33.

Table 4.33 Technology and projects' sustainability

Technologies	Mean
Pumping technology	4.23
Spare parts availability	3.87
Payment systems	4.01
Choice of tech (Solar energy vs. Generator, borehole, dams, water pans)	4.03
Service delivery	3.06
Fault reporting	3. 00

According to the findings, majority of the respondents agreed that the various aspects of technology influenced the projects sustainability included; pumping technology (M=4.23), choice of tech (Solar energy vs. Generator, borehole, dams, water pans) (M=4.03), payment systems (M=4.01), spare parts availability (M=3.87), service delivery (M=3.06) and fault reporting (M=3.00) respectively.

4.6.11 Sustainability plan in place

The water project employees were asked to indicate whether there was a sustainability plan in place.

Table 4.34 Sustainability plan in place

	Frequency	Percentage
Yes	11	55
No	9	45
Total	**20**	**100**

According to the findings in Table 4.34, majority of the water project employees (55%) indicated that there was a sustainability plan in place while 45% indicated that there was no sustainability plan in place. This depicts that through majority of the water projects in the county were professionally managed to ensure the sustainability of the project.

4.6.12 Efficiency of sustainability plan

The water project employees were to further to indicate how effective the sustainability plan in place was.

Table 4.35 Efficiency of sustainability plan

	Frequency	Percentage
Very effective	7	35
Less effective	12	60
Not effective	1	5
Total	**20**	**100**

As shown in Table 4.35 majority of the water project employees posited that the sustainability plan was less effective while 35% said that it was very effective. Therefore the sustainability of the water project was low owing to the lack of efficiency of the sustainability plan put in place.

The water project employees further indicated that there were various the policies or measures either initiated or undertaken by the department to ensure proper: utilization, conservation, planning or management of the water projects. However the policies were not fully implemented owing to lack of financial resources, lack of support by the top management, lack of community ownership of the project and lack of skilled manpower to run the water projects.

4.6.13 Sustainability of water projects

The study required the water project employees to indicate whether they considered the water projects in the area to be sustainable.

Table 4.36 Sustainability of water projects

	Frequency	Percentage
Yes	7	35
No	13	65
Total	**20**	**100**

According to the findings in Table 4.36, majority of the water project employees indicated that the water projects in the area was not sustainable while 35% indicated that the water projects in the area were sustainable. This illustrates that the sustainability of majority of water project in Kibwezi County was low.

The water project employees indicated that the indicators of sustainability included improved access to water by the area residents, reduced cost of running the project and environmental protection and conservation.

The water project employees indicated that the main factors contributing to sustainability were Use of modern technology, full participation by the stakeholders, proper management of the water project by qualified personnel and integration of local community culture in the planning and implementation of the project. The water project employees suggested that the sustainability of community based projects included stakeholders' participation, cultural practices, use of best management skills and practices by the managers of the projects and adoption of modern technology in the running of the project.

4.7 Inferential statistics

4.7.1 Correlation analysis
To quantify the strength of the relationship between the variables, the study used Karl Pearson's coefficient of correlation.
The Pearson product-moment correlation coefficient (or Pearson correlation coefficient for short) is a measure of the strength of a linear association between two variables and is denoted by *r*. The Pearson correlation coefficient, *r*, can take a range of values from +1 to -1. A value of 0 indicates that there is no association between the two variables. A value greater than 0 indicates a positive association, that is, as the value of one variable increases so does the value of the other variable. A value less than 0 indicates a negative association, that is, as the value of one variable increases the value of the other variable decreases.

Table 4.37: Correlation and the coefficient of determination

	Community project sustainability	Stakeholders' participation	Management skills	Cultural practices	Technology influence
Community project sustainability (r) (p) Sig. (2 tailed)	1.000				
Stakeholders' participation (r) (p) (2 tailed)	0.894 0.018	1.000			
Management skills (r) (p) Sig. (2 tailed)	0.493 0.031	0.316 0.047	1.000		
Cultural practices (r) (p) Sig. (2 tailed)	0.661 0.024	0.163 0.019	0.216 0.047	1.000	
Technology influence (r) (p) Sig. (2 tailed)	0.402 0.046	0.161 0.029	0.233 0.0464	0.462 0.014	1.000

According to the Table 37, there is a positive relationship between community project sustainability and stakeholders' participation, cultural practices, management skills and technology influence of magnitude 0.894, 0.661, 0.493, and 0.402 respectively. The positive relationship indicates that there is a correlation between the factors influencing sustainability and sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya with stakeholders' participation having the highest value and technology influence having the lowest correlation value.

This notwithstanding, all the factors had a significant p-value ($p < 0.05$) at 95% confidence level. The significance values for relationship between sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya and Stakeholders' participation, Management skills, Cultural practices and Technology influence were 0.018, 0.031, 0.024 and 0.046 respectively. This implies that stakeholders' participation was the most significant factor, followed by management skills, cultural practices and technology influence respectively.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, discussions, conclusion and recommendations on the factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya.

5.2 Summary

This section provides a summary of the finding based on the objectives of the study as they are presented in the previous chapter.

5.2.1 Stakeholders' participation and sustainability of rural community based water projects

The study established that the majority (54.4%) of the community members never participated in the initiation/start of the water projects. Thus level of stakeholders' participation in the water projects was low which affected the sustainability of water project. The household participated in the initiation/start of the water projects when they were consulted through a meeting, contribution of building materials and as leaders of the committees. This implies that the stakeholders' participation was critical in the implementation of the water projects in the county. The involvement of the all the stakeholders determined the efficiency and sustainability of the water projects.

The stakeholders' participation positively enhanced the sustainability of the rural community based water projects to a great extent. Therefore the stakeholders' participation enhanced the

efficiency of the water project to a great extent consequently improving the sustainability of the project. The main benefit associated with stakeholders' participation in the project was continuity of the project (67%), timely maintenance/repairs (56%), harmony/conflict management (46%), strong ownership of the projects (44%), better service delivery and expansion of the project. The stakeholders were not adequately involved in the project. Therefore the lack of sufficient stakeholders' participation in the project implementation contributed to the project failure.

The study also revealed that; stakeholders' support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness- raising activities (M=4.39), stakeholders' participation has enabled them to clearly understand their roles (M=4.23), involvement of the target communities is crucial for the sustainability of rural water supply systems (M=4.09), stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them (M=4.05), by the Stakeholders' support, the community ensures the success of a project through collective efforts to increase and exercise control over project (M=4.03), building a partnership with the communities lead towards improving the people's problem solving capacities (M=4.01), stakeholder are better placed to lobby for government and donor support for the community project (M=3.89), community support has increased project efficiency (M=3.87), stakeholders' contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits (M=3.56), stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability (M=3.06), stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership) (M=3. 01), stakeholders' involvement in the project implementation has enhanced continuity in the operation of the water project (M=2.43) respectively.

5.2.2 Cultural practices and sustainability of community based projects

From the study findings, the study established that water project has positively transformed health, water and sanitation practices in the region (M=4.57), the water project has facilitated participation of local communities in development initiatives in the region (M=4.53), the project has encouraged residents to take ownerships of their own community resources (M=4.37), the project has improved security in the region by reducing conflicts over natural sources of water (M=4.27), the water project has encouraged residents to conserve available water resources and other natural resources (M=4.23), the community has gained substantial knowledge and technical skills from the water project (M=4.01), the water project unites people from different cultures/tribes/clans in the region (M=3.66), the water project builds community identity and pride (M=3.54), through the water project the cultural norms are upheld in the community around (M=3.52), the water project promotes social networks amongst residents in the region (M=3.26), the water project has enhanced partnerships between the local community and the government or non-governmental organizations (M=3.26), and that people from different cultures/tribes/clans in the region benefit from the water project (M=2.42) respectively.

5.2.3 Management skills and sustainability of the rural community based water projects

The study established that those who managed the water project responded adequately to concerns whenever raised. The people appointed to manage the water project were effective. The study also found out that there is sufficient technical expertise to manage the project (M=4.01), there is sufficient human resource for sustainability of the project (M=3.88), the community is satisfied with the overall management of the water project (M=3.79), risk management is satisfactory (M=3.77), management of projects has increased the alignment of development projects with host communities priorities (M=3.71), project managers have adequate and experience (task familiarity) in management (M=3.69), there are clear and achievable estimates in the project schedule and budget (M=3.66), community based projects are complex and require multifaceted management skills (M=3.65), the leadership skills of the managers is satisfactory (M=3.63), and that advise about technical architecture was made available for the project

(M=3.60) respectively. The study established that the management qualities that affected the sustainability of the rural community based water projects were technical expertise (M=4.40), managing resources (M=4.26), advising about technical architecture (M=4.18), knowledge of business (M=3.89), leadership (M=3.51), estimating project schedule and budget (M=3.16), ascertaining and managing risks (M=3.15) and experience (task familiarity) (M=3.13) respectively.

5.2.4 Technology and sustainability of the rural community based water project

The study revealed that in the majority of the household there were no meters installed to monitor consumption of water. Therefore, the level of adoption of technology in the management of water project was very low impairing the sustainability of water projects. There were various payment modes used in the management of the water projects such as cash, mobile money payment (Mpesa, YuCash, Airtel money) and bank account.

The challenges affecting constant supply of the water to the households form the water points expensive parts/fuel (56%), breakdown of generator pumps (45%), breakage of pipes (44%), vandalism (31%) and blockages of pipes (23%) respectively. The water project suffered major setbacks due to breakdown as the local artisans who were relied on lacked adequate skills to maintain the water project. The sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community was not fully equipped with adequate skills.

The study established that sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality (M=4.40), community based project members information systems can provide information extracted from their records to improve members satisfaction (M=3.95), use of modern technology has helped to curb poor management and accountability of the project (M=3.92), enhancing productivity does not depend upon its integration into the projects objectives (M=3.73), community projects that embrace technology exhibits better performance and

sustainability (M=3.67), sustainability driven by technology depends largely on the effective management of the innovation process (M=3.56), the project is using modern technology (M=3.46), technological innovation has enormous influence on community based project (M=3.41), sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality (M=3.21), the advantages offered by technologies in terms of enhancing productivity, depend upon its integration into the projects objectives (M=3.18), adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance (M=3.10) respectively. Therefore technology was a critical factor affecting the sustainability of the community based water project. Mbithi and Rasmuson, (1999) stressed the importance of technology on sustainability of community based projects indicated that, sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality and factors that are not controlled by the project for example, communities' poverty level, access to technical assistances and spare parts.

The study established that the forms of technology used in the rural community based water projects included information communication systems (M=4.39), accounting systems (M=4.26), service delivery (M=4.23), fault reporting (M=4.15), reporting systems (M=4.13), payment systems (M=4.12) respectively. Other aspects of technology influencing the projects sustainability included; pumping technology (M=4.23), choice of tech (Solar energy vs. Generator, borehole, dams, water pans) (M=4.03), payment systems (M=4.01), spare parts availability (M=3.87), service delivery (M=3.06) and fault reporting (M=3.00) respectively.

The study established that there were various the policies or measures either initiated or undertaken by the department to ensure proper: utilization, conservation, planning or management of the water projects. However the policies were not fully implemented owing to lack of financial resources, lack of support by the top management, lack of community ownership of the project and lack of skilled manpower to run the water projects.

The indicators of sustainability included improved access to water by the area residents, reduced cost of running the project and environmental protection and conservation. The main factors contributing to sustainability were; use of modern technology, full participation by the stakeholders, proper management of the water project by qualified personnel and integration of local community culture in the planning and implementation of the project. The sustainability of community based projects was dependent on included stakeholders' participation, cultural practices, use of best management skills and practices by the managers of the projects and adoption of modern technology in the running of the project.

5.3 Discussions

From the findings, the stakeholders were involved in the water project through contribution of funds/other resources, through designing and in management/running of the operation of the rural community based water projects. Thus the stakeholders brought many contributions to the running of the water projects in terms of financial supports, designing of the project and the operation of the water projects. The findings are in line with Chappel, (2005) who urged that by their support, community ensures the success of a project through collective efforts to increase and exercise control over resources and institutions on the part of groups and movements of those hitherto excluded from control.

In decision making the stakeholders endorsed the project budgetary allocations, vetted the employees to work in the project, proposed the policies to be implemented. In the sharing of development activities the stakeholders approached strategic personalities and institutions to aid in management of the project, and in lobbying for support from the government and private sector. According to Oakley and Marsden (2007) stakeholders' support ensures that stakeholders influence and share control over development initiatives, and the decisions and resources which affect them. This is key in ensuring that resources in community based projects in Kenya are managed effective, minimizing wastes and thereby ensuring their sustainability more so financial sustainability.

The study also revealed that; stakeholders' support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness- raising activities, stakeholders' participation has enabled them to clearly understand their roles, involvement of the target communities is crucial for the sustainability of rural water supply systems, stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance). The findings are similar to Oakley and Marsden (2007) who posited that stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare and develop a capacity to contribute to their own and the community's development. In the context of development, community participation refers to an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits. In their support, the community participates in the community projects and therefore saves the projects resources which can later be channelled to produce more benefits to the project.

The study established that water project has positively transformed health, water and sanitation practices in the region, the water project has facilitated participation of local communities in development initiatives in the region, the project has encouraged residents to take ownerships of their own community resources, the project has improved security in the region by reducing conflicts over natural sources of water, the water project has enhanced partnerships between the local community and the government or non-governmental organizations and that people from different cultures/tribes/clans in the region benefit from the water project respectively.

The findings are similar to Roseland et al., (2005) who indicated that project sustainability involves community participation in a collective decision-making process that meets the social, cultural, environmental, and economic needs of the community. Sustainable community involves development of a local and self-reliant economy that does not damage the social well-being of communities. Community residents in sustainable communities employ strategies and solutions that are integrative and holistic.

The study established that those who managed the water project responded adequately to concerns whenever raised. The people appointed to manage the water project were effective. The study also found out that there is sufficient technical expertise to manage the project ; there is sufficient human resource for sustainability of the project; the community is satisfied with the overall management of the water project and risk management is satisfactory.

The findings are corroborated by Weinberg (2008) who said that community based projects are complex and require multifaceted management skills. A project manager (PM) has to manifest not only project management related skills but also technical and expertise as required by the project (Thite, 2001). Project management activities include but are not limited to defining project scope and requirements gathering, managing resources and relevant training issues within a project, advising about technical architecture, identifying specific and general project management practices and escalation procedures, estimating project schedule and budget, ascertaining and managing risks within a project and preparing risk mitigation (Kirsch, 2000).

The factors affecting constant supply of the water to the households form the water points expensive parts/fuel, breakdown of generator pumps, breakage of pipes, vandalism and blockages of pipes (23%) respectively. The water project suffered major setbacks due to breakdown as the local artisans who were relied on lacked adequate skills to maintain the water project. The sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community was not fully equipped with adequate skills.

According to Binder, (2008) adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance. The effective operation and maintenance (O & M) of rural water supply systems is crucial element for the sustainability of the water project. The community management of rural water supply systems on operation and maintenance (O & M) is not successful, if financing resources are not available and frequent supports are not provided. Budgeting sufficient funding for rural water supply systems is an important issue for sustainability and proper maintenance but not only one (Binder, 2008).

5.4 Conclusions

5.4.1 Stakeholders' participation and the sustainability of the rural community based water projects

The study concluded that the majority of the community members never participated in the initiation/start of the water projects. Thus, level of stakeholders' participation in the water projects was low which affected the sustainability of water project. The household participated in the initiation/start of the water projects when they were consulted through a meeting, contribution of building materials and as leaders of the committees. This implies that the stakeholders' participation was critical in the implementation of the water projects in the county. The involvement of the all the stakeholders determined the efficiency and sustainability of the water projects. The stakeholders were involved in the water project through contribution of funds/other resources, through designing and in management/running of the operation of the rural community based water projects. Thus the stakeholders brought many contributions to the running of the water projects in terms of financial supports, designing of the project and the operation of the water projects. The stakeholders' participation positively enhanced the sustainability of the rural community based water projects to a great extent. Therefore the stakeholders' participation enhanced the efficiency of the water project to a great extent consequently improving the sustainability of the project. The main benefit associated with stakeholders' participation in the project was continuity of the project, timely maintenance/repairs, harmony/conflict management, strong ownership of the projects, better service delivery and expansion of the project. The stakeholders were not adequately involved in the project. Therefore the lack of sufficient stakeholders' participation in the project implementation contributed to the project failure. In decision making the stakeholders endorsed the project budgetary allocations, vetted the employees to work in the project, proposed the policies to be implemented. In the sharing of development activities the stakeholders approached strategic personalities and institutions to aid in management of the project, and in lobbying for support from the government and private sector.

The study also concluded that; stakeholders' support ensured that participants were actively involved in project planning and implementation, improved the projects ownership by the community, enhanced the sustainability of rural water supply systems through sharing control over water development initiatives, and the decisions and helped in building a partnership with the communities lead towards improving the people's problem solving capacities as well as helped in lobbying for government and donor support for the community project.

5.4.2 Cultural practices and sustainability of community based projects

From the study findings, the study concluded that water project has positively transformed health, water and sanitation practices in the region, facilitated participation of local communities in development initiatives in the region, encouraged residents to take ownerships of their own community resources, improved security in the region by reducing conflicts over natural sources of water, encouraged residents to conserve available water resources and other natural resources, as well as helped the community gained substantial knowledge and technical skills from the water project. It has also united people from different cultures/tribes/clans in the region, builds community identity and pride and helped to uphold cultural norms as well as promoted social networks amongst residents in the region. The water project has enhanced partnerships between the local community and the government or non-governmental organizations as well as people from different cultures/tribes/clans in the region benefit from the water project.

5.4.3 Management skills and sustainability of the rural community based water projects

The study concluded that those who managed the water project responded adequately to concerns whenever raised. The people appointed to manage the water project were effective. The study also found out that there is sufficient technical expertise to manage the project, there is sufficient human resource for sustainability of the project, the community is satisfied with the overall management of the water project, risk management is satisfactory, management of projects has increased the alignment of development projects with host communities priorities, project managers have adequate and experience (task familiarity) in management, there are clear and achievable estimates in the project schedule and budget, community based projects are

complex and require multifaceted management skills, the leadership skills of the managers is satisfactory, and that advise about technical architecture was made available for the project.

The study concluded that the management qualities that affected the sustainability of the rural community based water projects were technical expertise, managing resources, advising about technical architecture, knowledge of business, leadership, estimating project schedule and budget, ascertaining and managing risks and experience (task familiarity).

5.4.4 Technology and sustainability of the rural community based water project

The study concluded that the level of adoption of technology in the management of water project was very low impairing the sustainability of water projects. There were various payment modes used in the management of the water projects such as cash, mobile money payment (Mpesa, YuCash, Airtel money) and bank account.

The challenges affecting constant supply of the water to the households form the water points expensive parts/fuel, breakdown of generator pumps, breakage of pipes, vandalism and blockages of pipes respectively. The water project suffered major setbacks due to breakdown as the local artisans who were relied on lacked adequate skills to maintain the water project. The sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community were not fully equipped with adequate skills.

The study concluded that sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality, community based project members information systems can provide information extracted from their records to improve members satisfaction, use of modern technology has helped to curb poor management and accountability of the project, enhancing productivity does not depend upon its integration into the projects objectives, community projects that embrace technology exhibits better performance and sustainability, sustainability driven by technology depends largely on the

effective management of the innovation process, the project is using modern technology, technological innovation has enormous influence on community based project, sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality, the advantages offered by technologies in terms of enhancing productivity, depend upon its integration into the projects objectives adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance respectively. Technology was therefore a critical factor affecting the sustainability of the community based water project.

The study concluded that the forms of technology were used in the rural community based water projects included information communication systems, accounting systems, service delivery, fault reporting, reporting systems, and payment systems. The various aspects of technology influenced the projects sustainability included; pumping technology, choice of tech, payment systems, spare parts availability, service delivery and fault reporting. However, the adoption of the technology in the water project was minimal.

5.5 Recommendations of the study

1. The level of stakeholders' participation in the project planning and implementation should be increased to enhance the sustainability of the water projects in the county.

2. The project management should seek to adopt modern technology through increased budgetary allocations.

3. The government should institute stringent measures to deal with persons vandalizing the community water project. This should be coupled with improved security offered by the security agencies to mitigate the cases of vandalism.

4. The water projects should be managed by highly competent personnel to increase its efficiency and sustainability.

5.6 Suggestions for further studies

Since this study was on the factors influencing sustainability of rural community based water projects in Mtito Andei, Kibwezi County, Kenya, the study recommends that;

i.   Similar study should be done in Mandera and Wajir Counties for comparison purposes and to allow for generalization of findings on the the factors influencing sustainability of rural community based water projects.

ii.   Other studies should be conducted on the challenges facing the sustainability of rural community based water projects in Kenya.

iii. Similar studies should be conducted on the role of women in enhancing the sustainability of rural community based water projects in Kenya.

REFERENCES

Admassu *et.al*, (2002) Identifying key characteristics of technical project leadership. *Leadership & Organization Development Journal* 20(5) 253-261.

Admassu, M., Kumie, A., & Fantahun, M. (2002). Sustainability of Drinking Water Supply Projects in Rural of North Gondar, Ethiopia, *Ethiopian Journal of Health Development*, 2003(3):221-229.

Amit, R. & Schoemaker, P J H. (1993). Strategic assets and organizational rent, *Strategic Management Journal*, 14 (1), 33-46.

Andriessen and Drenth, (2007) Rapid Appraisal for Rural Project Preparation. *Agricultural Administration* 8, 463-471.

Aras, G., and Crowther, D. (2008). Governance and sustainability: An investigation into the relationship between corporate governance and corporate sustainability, *Management Decision*, 46(3),433 - 448

Armitage (2003). The institutional origins of dynamic capabilities in multinational enterprises, *Industrial and Corporate Change*, 19(4), 1225-1246.

Baker, R. D., & Slaughter, S. A. (2000). The moderating effects of structure on volatility and complexity in software enhancement. *Information Systems Research* 11(3) 219–240.

Barney, N.L. (1995). Select the right IS project manager for success. *Personnel Journal* S6(4).

Bhandari and Grant, (2007). Rural Appraisal: Rapid Relaxed, and Participatory. *IDS Discussion Paper 311*, Institute of Development Studies, University of Sussex

Binder, (2008). User Satisfaction and Sustainability of Drinking Water Schemes in Rural Communities of Nepal.

Bloom, (2006). Understanding qualitative data: A framework of text analysis methods. *Journal of Management Information System*, 11, 137-160.

Brager, Specht, and Torczyner (2001) The ecology of place: Planning for environment, economy, and community. Washington, DC: Island Press .

Bridget, S., and Lewin, C. (2005). *Research Methods in the Social Sciences*. London: Sage publications Inc.

Byrd and Turner, 2001 Climate and Rainfall Variability in the Humid Tropics In: Bonell M, MM Hufschmidt, JS Gladwell Eds. *Hydrology and Water Management in the Humid Tropics: Hydrological research issues and strategies for water management. International Hydrology Series.* Cambridge University Press.

Camisón H., (2005). Patent thickets, licensing and innovative performance, *Industrial and Corporate Change*, 19(3), 899-925.

Carter, R., Tyrrel, S., and Howsam, P. (1999). The impact of sustainability of community water supply and sanitation programs in developing countries. *Journal of Chartered Institute of Water and Environment Management*. 13, 292.

Chappel (2005) Artand well being. Sydney, Australia: Australia Council for the Arts.

Chemers and Mahar, (2004). Adoption of agroforestry in the hills of Nepal: A logistic regression analysis. *Agricultural Systems*, 72:177-196.

Chemers and Mahar, (2004). *Developing Smallholder Agriculture: A Global Perspective*. AgBė Publishing. Brussels, Belgium.

Churchill (1991), *Research Design in Occupational Education*, © 1997. James P. Key. Oklahoma State University

Cooper, D. R., and Schindler, P. S. (2003). *Business Research Methods* (8th edn). McGraw-Hill: New York.

Cronbach, L. J. (1971). *Test validation*. In R. L. Thorndike (Ed.). Educational Measurement (2nd Ed.). Washington, D. C.: American Council on Education.

Davis and Liyer, (2002) Reimagining sustainable cultures: Constitutions, land and art. The Canadian Geographer, 48(40), 389-402 .

Doubleday, Mackenzie, & Dalby (2004). Indicators for the Water Sector: Examples from Malawi. London, UK. WaterAid.

Dunning and Lundan, (2010) Low-Cost Sanitation, A Survey of Practical Experience. London, UK. Intermediate Technology Publications.

Espinosa Nohria, N., & Gulati, R. (2007). Is slack good or bad for innovation? *Academy of Management Journal*, 39, 245-64.

Gebrehiwot, M. (2006). An Assessment of Challenges of Sustainable Rural Water Supply: The Case of OflaWoreda in Tigray Region. *Msc Thesis*, Regional and Local Development Study (RLDS). A.A.U. Ethiopia.

Gizachew,G. (2005) *Innovation: The Attacker's Advantage*, Summit Books, New York, NY.

Gok, (2009)Water Privatisation in Kenya, *Issue Paper* Government Printer Narobi.

Goodman and Leyden, (2001). Community development: A critical approach. Bristol, UK: Policy Press.

Grant, D (1991). Familiarity and group productivity. *Journal of Applied Psychology*, 76(4) 578–586.

Hagedoorn and Cloodt, (2003) Household energy consumption behaviour in a pre-Saharan small town in Morocco. Research report No. 2 from Environmental Policy and Society, Uppsala University.

Hagedoorn and Cloodt, (2003) What Works When Traditional Approaches Fail. San Francisco, CA. Berret-Koehler Publishers Inc.

Hagedoorn, J. & Cloodt, M. (2003). Measuring innovative performance: Is there an advantage in using multiple indicators, *Research Policy*, 32(8), 1365-1379.

Harvey, P., & Reed R. (2004). Rural Water Supply in Africa: Building Blocks for Sustainability: *Loughborough University UK*: Water, Engineering, and Development Centre (WEDC).

Harvey, P., & Reed, R. (2007). Community-managed water supplies in Africa: Sustainable or dispensable? *Community Development Journal*, 42(3), 365.

Hill, C.W.L., & Rothaermel, F.T. (2003). The performance of incumbent firms in the face of radical technological innovation, *Academy of Management Review*, 28(2), 257-74.

Hodgkin J. (1994). The Sustainability of Donor-Assisted Rural Water Supply Projects. Washington, D.C. United States Agency for International Development. *WASH Technical Report,* No. 94.

Hoopes, Madsen and Walker (2003). Global cost benefit analysis of water supply and sanitation interventions, *Journal of Water Health*, 5, 481.

Hopkins & Brynjolfsson, (2010) One hundred million improved cookstoves in China: how was it done? World Development 21(6): 941-961.

Hopkins, M.S. & Brynjolfsson, E. (2010). The four ways it is revolutionizing innovation, *MIT Sloan Management Review*, 51(3), 51-56.

Ingle B. (2005). Ensuring Sustained Beneficial Outcomes for Water and Sanitation Programmes in the Developing World. *IRC International Water and Sanitation Centre Occasional Paper Series*, Delft, NL.

Kay (2005). Statistics notes: The intracluster correlation coefficient in cluster randomisation. British Medical Journal, 316, 1455–1460.

Kerry and Bland (1998), *Sampling Procedures*. NY. Edwards

Kiel and Elliott, (1996). *Software Project Management: An Integrated Perspective for an Emerging Paradigm*. In R. W. Zmud (Ed.), Framing the Domains of IT Management: Projecting the Future...Through the Past 285-304.

Kirsch (2000) Globalization, Forest Resurgence, and Environmental Politics in El Salvador, *World Development*, (34)2: 308-323.

Kirsch, (2000). Familiarity, complexity, and team performance in geographically distributed software development. *Organization Science* 18(4) 613- 630.

Krejcie, Robert V. Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.

Lacity and Jansen (1994) Validity and Reliabilty NY Springer

Ledwith (2005). *Mugged: Poverty in Your Coffee Cup*. Oxfam International, Washington D.C.

Marsden (2007)). Departmentalization in software development and maintenance. *Communications of the ACM*, 33(6) 658-667.

Mathews, J. & Herbert, D. (2004). Unifying geography: Common heritage, shared future? (Eds.). Oxfordshire, UK: Routledge.

Matthews and Herbert(2004). A Water Distribution System for La Laguneta, El Salvador. Unpublished Professional Paper, College of Engineering, Colorado State University

Matthews and Herbert, (2004). The History of Central America. Palgrave Macmillian, New York, NY.

Mbata, J. (2006) Estimating Household Willingness for Water Services in Rural economy: the Case of Kanye in Southern Botswana. *Development of Southern Africa*, 23(1), 29-43.

McDade (2004) The Cinotepeque Range of central El Salvador: Geology, magma origin and volcanism. *Bulletin of Geosciences*, 80(4): 277-286.

McDade S. (2004) December. Gender and Energy for Sustainable Development: A Toolkit and Resource Guide. New York, NY. United Nations Development Programme.

Mihelcic, J. R., Crittenden J. C., Small, M. J., Shonnard, D. R., Hokanson, D. R., Zhang, Q., Chen, H., Sorby, S. A., James, V. U., Sutherland, J. W., & Schnoor, J. L. (2003). Sustainability science and engineering: emergence of a new metadiscipline. *Environmental Science & Technology*, 37 (23), 5314-5324.

Mills and Brown (2004). Exporting People and Recruiting Remittances: A Development Strategy for El Salvador? *Latin American Perspectives,* 151(33).

Mugenda, O.M and Mugenda, A.G (2003) Re*search Methods, Quantitative & Qualitative Approaches.* Acts Press: Nairobi.

Niyi Gbadegesin & Felix Olorunfemi (2007) Assessment of Rural Water Supply Management in Selected Rural Areas of Oyo State, Nigeria. *ATPS Working Paper,* Series No. 49 (African Technology Policy Studies)

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Oakley and Marsden (2007). Low-Cost Sanitation, A Survey of Practical Experience. London, UK. Intermediate Technology Publications

Okoth, J. A. (2012). Factors influencing sustainability of community based projects: the case of Arid Lands Resource Management Project II in Ganze constituency, Kilifi County, Kenya.

Pagell (2000) From linear fuel switching to multiple cooking strategies: a critique and alternative to the energy ladder model for rural households. World Development 28: 12, pp. 2083-2103.

Pfeffer and Salancik (1978). The dismal science and the endless frontier: How and why economists think about S &T policy: A guide for further reading. Available at: http://ideas.repec.org/p/wpa/wuwpit/0411007.html.

Prahalad, C.K. & Hamel, G. (1990). The core competence of the corporation, *Harvard Business Review*, 68(3), 79-91.

Pran Manga and Wendy Muckle (Chappel, 2005). Hand ON! Practices and projects supported by the Community Cultura Development Board. NSW, Australia: Australia Council for the Art s .

Pruss-Ustun, A., Bos, R., Gore, F., and Bartram, J. (2008). Safer Water, Better Health: Cost, Benefits and Sustainability of Interventions to Protect and Promote Health. Geneva: *World Health Organization*.

Rietbergen-McCracken J, Narayan D. (1998). *Participation and Social Assessments: Tools and Techniques*, World Bank Publications, Washington DC.

Roseland, M., Connelly, S., Hendrickson. David, L., Chris and Lithgow, M (2005). Towards sustainable communities: Resources for citizens and their governments. (ed.) Gabriola Island, BC: New, Society Publishers.

Rubenstein and Greisler, (2000) Indicators for the Water Sector: Examples from Malawi. London, UK. WaterAid.

Swanson and Beath, (2000). Strategies adopted for sustained water supply and sanitation through community participation in Sri Lanka. *31st WEDC International Conference*, Kampala, Uganda.

Thite, (2001). The Purchasing Power Parity Puzzle. *Journal of Economic Literature*, 34: 647-668

UN. (2000). Agenda 21: Earth Summit—The United Nations Programme of Action from Rio. Rio de Janeiro, Brazil: *United Nations Division for Sustainable Development*

UNDP-WSP. (2006). Getting Africa on Track to Meet MDGs on Water and Sanitation: A Status Overview of Sixteen African Countries. Nairobi, Kenya: Water and Sanitation Program—Africa, World Bank.

UNESCO (2006). Culture and Development. Cultural Sector. Available at : http://portal.unesco.org/culture/en/ev.php

UNESCO. (1995). The cultural dimension of development: Towards a practical approach. Culture and Development Series. Paris: UNESCO Publishing .

USAID KENYA (2009). http://kenya.usaid.gov/programs/water-and-sanitation/projects

Weinberg, (2008), *Improving Leadership Effectiveness: The Leader Match Concept*, 2nd Ed., Wiley, New York,U.S.A

WHO. (2010). Millennium Development Goals (MDGs). [online]. [Accessed on 22.04.2013] Available at **http://www.who.int/topics/millennium_development_goals**.

WHO/UNICEF. (2008). Progress on Drinking Water and Sanitation: Special Focus on Sanitation. New York: UNICEF, Geneva: WHO.

Williams (2003). Globalization, Forest Resurgence, and Environmental Politics in El Salvador, *World Development*, (34)2: 308-323.

Williams, M. (2003). Sustainable development and social sustainability. Hull, QC: Strategic research and Analysis, Department of Canadian Heritage. Reference: SRA-724.

APPENDICES

Appendix I: Introduction Letter

Ababa Chanasa Tafara

P.O BOX 30197, 00100

NAIROBI

Dear Sir/Madam,

RE: REQUEST FOR YOUR PARTICIPATION IN M.A. RESEARCH PROJECT

Hello, my name is **Ababa Chanasa Tafara** from the University of Nairobi and I am conducting a survey to establish sustainability of water projects that were formerly supported by World Vision Kenya within Mtito Andei. This study is for academic purpose but will be useful for the government, NGOs and other private and corporate institution involved in development projects in communities.

Your participation in the exercise is voluntary and so you are free to choose to or not participate. But it would be helpful if you could participate fully.

The results of this research will be completely confidential and no identification data will be collected. Some of the questions I will ask may also be quite personal and I hope they will be okay with you. If, however, you do not feel comfortable answering any questions, please feel free to say so or seek clarification where you do not understand.

Yours faithfully

Ababa Chanasa Tafara

Appendix II: Household Survey Questionnaire

SECTION I: PROJECT IDENTIFICATION INFORMATION

1) Location: _____ Sub-location: _____

2) Village: _____

3) Name of the Water project: _____ Year of Establishment …………

SECTION A: SOCIO-DEMOGRAHIC CHARACTERISTICS

(To be answered by a person above 18 years in a household, preferably a household head)

4) Are you a resident of ………………. village (village named above)

        Yes   [ ]   No   [ ]

   i) If yes, how long have you lived here,

        10 years and below   [ ]   11-20 years   [ ]

        21-30 years   [ ]   31 years and above [ ]

5)	6)	7)	8)
Gender Of Respondent	*What is your highest level of school/level completed?*	*What is your occupation*	*What is your average income range per month (from all sources)*
1. Male 2. Female	1. Never, 0 2. Primary; 3. Secondary level; 4. Tertiary level; (colleges, polytechnics…..) 5. University level	Livestock, Vegetable sale, Charcoal sale, Firewood sale, Carpentry, Quarrying (sand/stone), Casual labour, Employment Other (specify) ……..	Less than 2500 1. 2500 – 5000 2. 5000 – 7500 3. 7500 – 10000 More than 10,000

SECTION B: STAKEHOLDERS' PARTICIPATION AND THE SUSTAINABILITY OF THE RURAL COMMUNITY BASED WATER PROJECTS

9) . Have you ever participated in the initiation/start of the water projects in this area? Yes No

If yes, what was your area of participation?

     -I was consulted through a meeting

     -I contributed materials

     -As a leaders/part of the committee

     -

     -Others – specify…….

10). Are other partners/stakeholders involved in the water projects in this area? Yes No

If yes, name at least two:

-

-

-

In which ways are they involved:

     -Designing-

     - Contribution of funds/other resources

     - In management/running of the operation of the rural community based water projects?

     -

In your opinion, to what extent has the stakeholders' participation positively enhanced the sustainability of the rural community based water projects?

     To a very low extent [ ]   To a low extent [ ]   To a moderate extent [ ]

     To a great extent [ ]   To a very great extent   [ ]

14) Name at least two main benefit associated with stakeholders' participation in the project?

     Strong ownership of the projects

   Timely maintenance/repairs   [ ]

Continuity of the project

Expansion of the project

Better service delivery   [   ]

Harmony/conflict management

Others (specify) ………………………………….

The following statements relates to how the extent of stakeholders' participation affects the sustainability of the rural community based water projects. To what extent are they reflected in your community based water projects Use scale where:

1- Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree.

Statements	1	2	3	4	5
Involvement of the target communities is crucial for the sustainability of rural water supply systems					
Stakeholders' support has ensures that participants are actively involved in project planning and implementation or through formal or informal training and consciousness- raising activities.					
Stakeholders' involvement in the project implementation has enhanced continuity in the operation of the water project					
Stakeholders' participation has enabled them to clearly understand their roles					
Stakeholder are better placed to lobby for government and donor support for the community project					
By the Stakeholders' support, the community ensures the success of a project through collective efforts to increase and exercise control over project					
Stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them					
Stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability					
Stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership)					
Stakeholders' contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits					
Community support has increased project efficiency (how quic repairs					

are done, …..				
Building a partnership with the communities lead towards improving the people's problem solving capacities				

SECTION C: CULTURAL PRACTICES AND SUSTAINABILITY OF COMMUNITY BASED PROJECTS

15) **The following statements relates to how cultural practices affects the sustainability of the rural community based water projects. To what extent are they reflected in your community based water projects.**

Use scale where: 1- Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree.

Statements	1	2	3	4	5
People from different cultures/tribes/clans in the region benefit from the water project					
The water project unites people from different cultures/tribes/clans in the region					
The water project promotes social networks amongst residents in the region					
The water project has enhanced partnerships between the local community and the government or non-governmental organizations					
The water project builds community identity and pride					
Through the water project the cultural norms are upheld in the community around					
The water project has positively transformed health, water and sanitation practices in the region					
The water project has facilitated participation of local communities in development initiatives in the region					
The project has improved security in the region by reducing conflicts over natural sources of water					
The project has encouraged residents to take ownerships of their own community resources					
The water project has encouraged residents to conserve available water resources and other natural resources					
The community has gained substantial knowledge and technical skills from the water project					

Section D: Management skills and sustainability of the rural community based water projects

16) Which water point do you know about?

Name --------------------

17) Who manages the water point?

Committee	[ ]	An elected leader	[ ]
Headman	[ ]	Politician	[ ]
Not know	[ ]		

Any other (specify) ………………………..

18) What main concerns normally arise from the use of the water points?

----

19) Do those who manage respond adequately to concerns whenever raised?

Yes   [ ]   No   [ ]

20) Do you think that people appointed to manage the water project are effective (are meeting your expectation)?

Yes   [ ]   No   [ ]

i.   Explain your answer above

……………………………………………………………………

………………………………………………………………………………………

21) The following statements relates to how management skills affects the sustainability of the rural community based water projects. To what extent are they reflected in your community based water projects. **Use scale where: 1- Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree.**

Statements	1	2	3	4	5
There is sufficient technical expertise to manage the project					
Project managers have adequate and experience (task familiarity) in management					
There is sufficient human resource for sustainability of the project					
Advise about technical architecture was made available for the project					

There are clear and achievable estimates in the project schedule and budget				
Risk management is satisfactory				
The leadership skills of the managers is satisfactory				
The community is satisfied with the overall management of the water project				
Management of projects has increased the alignment of development projects with host communities priorities				
Community based projects are complex and require multifaceted management skills				

TECHNOLOGY AND SUSTAINABILITY OF THE RURAL COMMUNITY BASED WATER PROJECT

22) How do you get water from the point/source mentioned above – Qtn 16?

By use of pulley   [   ]

Water is pumped out of well/ source to storage tanks   [   ]

Water is piped to all household   [   ]

Etc

23) If water is pumped to the households, are there meters installed to monitor consumption?

Yes   [ ]   No   [ ]

24) If you pay for your water, what is the mode of payment?

Mobile money payment (Mpesa, YuCash, Airtel money)   [   ]

Bank account   [   ]

Cash

[   ]

25). What kind of challenges affect constant supply of the water to the Households form the water points

- Breakage of pipes

-Vandalism

-Blockages of pipes ………

-Breakdown of generator pumps

-Expensive parts/fuel

Etc

26). If a water project systems are broken down, who normally maintains? – or Who fixes these problems?

-government MOWI officer

-Local artisans

-Water project Committees

-

27). whoever fixes the problems, do you think they have the appropriate/relevant training (according to your knowledge)?

Yes   No

If yes! Who trains them?

The following statements relates to how technology affects the sustainability of the rural community based water projects. To what extent are they reflected in your community based water projects. Use scale where: 1- Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree.

Statements	1	2	3	4	5
The project is using modern technology					
Use of modern technology has helped to curb poor management and accountability of the project					
The advantages offered by technologies in terms of enhancing productivity, depend upon its integration into the projects objectives.					
Sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality					
Adoption of technology is key in sustainability of community based water projects as it eases operations and maintenance					
Technological innovation has enormous influence on community based project					
community projects that embrace technology exhibits better performance and sustainability					

sustainability driven by technology depends largely on the effective management of the innovation process				
community based project members information systems can provide information extracted from their records to improve members satisfaction				
Sustainability of rural water supply system depends on factors controlled by the project like; training, technology, cost of the project and construction quality				
Enhancing productivity does not depend upon its integration into the projects objectives.				

Thank you for your time and participation

Appendix III: Water Project Employee Questionnaire

1) Do you have a sustainability plan in place?

   Yes   [ ]   No   [ ]

i. If Yes, how effective is it,

   Very effective   [ ]   Less effective   [ ]   Not effective   [ ]

ii. If No, is there any way in which you contribute to sustainability of these projects currently?

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

2) State (if any) the policies or measures either initiated or undertaken by your department to ensure proper: utilization, conservation, planning or management of the water projects.

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

3) How do you deal with any deviation from the laid down policies and regulations?

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

4) Do you consider the water projects in the area to be sustainable?

   Yes   [ ]   No   [ ]

i. If Yes, what are the indicators of sustainability?

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

ii. What main factors do you this you think has contributed to this?

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

iii. If no, what are the indicators of poor or lack of sustainability?

   ……………………………………………………………………………………………
   ……………………………………………………………………………………………

iv. What main factors do you think have contributed to this?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

5) Do you think that stakeholders are adequately involved in this project?

Yes   [ ]   No   [ ]

i. If yes, comment on stakeholders' involvement in;

Decision making…………………………………………………………………………………

……

Share in development activities……………………………………………………………………

……

Sharing of project costs……………………………………………………………………………

……

Labor provision……………………………………………………………………………………

……

6) In your own assessment, how would rate the effect of cultural practices in this project?

Excellent [ ]   Good [ ]   fair   [ ]   poor   [ ]   Very poor   [ ]

7) Comment on the management of the project.

……

……

8) To what extent do you think the management of the water project possesses the following qualities essential to achieve sustainability in community based projects? Use a scale of 1 to 5 where 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent.

	1	2	3	4	5
Technical expertise (domain expertise)					
Experience (task familiarity)					
Managing resources					

Advising about technical architecture					
Estimating project schedule and budget					
Ascertaining and managing risks					
Knowledge of business					
Leadership					

9) Do you think that technology has influenced efforts to achieve sustainability of this community based project?

     Yes   [ ]   No   [ ]

10) To what extent does the project use the following forms of technology? Use a scale of 1 to 5 where 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent.

	1	2	3	4	5
Information communication systems					
Accounting systems					
Payment systems					
Reporting systems					
Service delivery					
Fault reporting					

11) To what extent do you think the following aspects of technology have influenced efforts by the project to achieve sustainability? Use a scale of 1 to 5 where 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent.

	1	2	3	4	5
Pumping technology					
Spare parts availability					
Payment systems					
Choice of tech (Solar energy vs. Generator, borehole, dams, water pans)					
Service delivery					
Fault reporting					

12) What would you suggest be done to achieve sustainability in community based projects like this one? (*Give you suggestion under the following key areas*)

Stakeholders' participation

……

……

Cultural practices

……

……

Management skills

……

……

Technology

……

……

Appendix iv

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size   "S" is sample size.

Krejcie, Robert V. Morgan, Daryle W., "Determining Sample Size for Research Activities", <u>Educational and Psychological Measurement</u>, 1970.