

**FACTORS INFLUENCING SUSTAINABILITY OF  
COMMUNITY BASED BOREHOLE WATER SUPPLY  
PROJECTS IN KITUI SOUTH SUB-COUNTY, KENYA**

**BY  
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and Management of the University of Nairobi**

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## DECLARATION

This research project report is my own work and has not been submitted for any academic award in any University.

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

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## **DEDICATION**

I would like to dedicate this project to my parents Mr. Henry Mwakazi and Mrs. Odiliah Machocho, my dear wife Grace Mkanjala and my lovely children Daniel Mwakazi, Shavonne Chao and Zadok Wamati. They have allowed me to use family resources to undertake this research.

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## TABLE OF CONTENTS

	<b>PAGE</b>
DECLARATION .....	ii
DEDICATION .....	iii
ACKNOWLEDGEMENT .....	iv
LIST OF TABLES .....	ix
LIST OF FIGURES .....	xi
LIST OF ABBREVIATIONS AND ACRONYMS .....	xii
ABSTRACT .....	xiii
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Background to the study .....	1
1.2 Statement of the problem .....	2
1.3 Purpose of the study .....	4
1.4 Objectives of the study .....	4
1.5 Research questions .....	4
1.6 Research hypothesis .....	4
1.7 Significance of the study .....	5
1.8 Delimitation of the Study .....	5
1.9 Limitations of the study .....	6
1.10 Assumptions of the study .....	6
1.11 Definitions of Significant Terms Used in the Study .....	6
1.12 Organization of the study .....	7
<b>CHAPTER TWO: LITERATURE REVIEW .....</b>	<b>8</b>
2.1 Introduction .....	8
2.2 Sustainability of Community based Borehole Water supply Projects .....	8
2.3 Project Management Skills and Sustainability of Community Borehole water supply projects .....	10
2.4 Social Factors in management of water projects and Sustainability of Community Borehole water supply projects .....	11

2.5 Technical Support and Sustainability of Community Borehole water supply projects .....	13
2.6 Government policies and Sustainability of Community based Borehole Water supply Projects .....	15
2.7 Theoretical Framework .....	16
2.7.1 Sustainability theory .....	17
2.7.2 Stewardship theory .....	17
2.7.3 Decentralization theory .....	18
2. 8 Conceptual Framework .....	19
2.9 Summary of the literature review .....	20
2.10 Research Gaps .....	22
<b>CHAPTER THREE: RESEARCH METHODOLOGY .....</b>	<b>23</b>
3. 1 Introduction .....	23
3.2 Research Design .....	23
3.3 The Target Population .....	24
3.4 Sampling size and sampling procedure .....	25
3.4.1 Sample Size .....	25
3.4.2 Sampling Procedures .....	26
3.5 Research Instruments .....	27
3.5.1 Piloting the Research Instruments .....	28
3.5.2 Validity of the Research Instruments .....	29
3.5.3 Reliability of Research Instruments .....	29
3.6 Data Collection Procedure .....	30
3.7 Data Analysis Techniques .....	31
3.8 Ethical Considerations .....	32
3.9 Operationalization of variables .....	32

**CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION ... 37**

4.1 Introduction ..... 37

4.2 Questionnaire Response Rate ..... 37

4.3 Project Management Skills of borehole water committees in relation to sustainability of community borehole water projects ..... 40

4.4 Hypothesis tests on Project Management Skills ..... 46

4.5 Social Factors influencing sustainability of community borehole water projects in Kitui South..... 47

4.6 Hypothesis test on Social Factors..... 50

4.7 Technical Support ..... 51

4.8 Hypothesis test on technical support ..... 54

**CHAPTER FIVE: SUMMARY OF FINDINGS DISCUSSIONS AND CONCLUSIONS.. 56**

5.1 Introduction ..... 56

5.2 Summary of the Findings ..... 56

5.2.1 Project management skills on sustainability of community borehole water projects in Kitui South ..... 56

5.2.2 Social factors on sustainability of community borehole water projects in Kitui South 56

5.2.3 Technical support on sustainability of community borehole water projects in Kitui South ..... 57

5.3 Discussion of the study findings ..... 57

5.3.1 Project management skills on sustainability of community borehole water projects in Kitui South ..... 58

5.3.2 Social factors on sustainability of community borehole water projects in Kitui South 58

5.3.3 Technical support on sustainability of community borehole water projects in Kitui South ..... 59

5.4 Conclusions ..... 59

5.5 Recommendations ..... 59

5.5.1 Recommendations to Policy makers ..... 60

5.5.2 Recommendations for further research ..... 60

<b>REFERENCES.....</b>	<b>61</b>
<b>APPENDICES .....</b>	<b>66</b>
Appendix 1: Letter of Transmittal of Data Collection Instruments .....	66
Appendix II: Questionnaire .....	67
Appendix III: Key Informant Interview guide .....	77
Appendix IV: List of Water Projects with Water Management Committees in Kitui South Sub-County.....	81



## LIST OF TABLES

Table 3.1: The study Population .....	24
Table 3.2: The Study Sample size.....	26
Table 3.3: Summary of Operational Definition of Variables .....	33
Table 4.1: present the questionnaire return rate.....	37
Table 4.2: Gender of respondents .....	38
Table 4.3: Composition of the respondents .....	38
Table 4.4: Age of respondents .....	39
Table 4.5: Highest level of education of the respondents.....	39
Table 4.6: Committee understanding and ability to communicate to stakeholders their terms of reference.....	40
Table 4.7: Committee understanding and ability to communicate to stake holders the project scope.....	41
Table 4.8: Committee capacity to properly handle official communication .....	42
Table 4.9: Committee Training on Leadership.....	42
Table 4.10: Committee knowledge on delegation and team management .....	43
Table 4.11: Water project committees' negotiation skills .....	44
Table 4.12: Water project committees risk management skills .....	44
Table 4.13: Project monitoring and evaluation.....	45
Table 4.14: Committee members' personal organization.....	46
Table 4.15: Chi-square test on Project Management Skills.....	47
Table 4.16: Community Priorities.....	47
Table 4.17: Community Participation.....	48
Table 4.18: Reasons for non- participation of community members in project activities .....	48
Table 4.19: Social inclusion- equal opportunity to select project management committees' .....	49
Table 4.20: Gender and equity.....	50
Table 4.21: Chi-square test on social factors .....	51
Table 4.22: Community training on operation and maintenance.....	51
Table 4.23: Availability of technical expertise .....	52
Table 4.24: Adequacy of technical support received.....	53

Table 4.25: Availability of borehole spare parts.....	53
Table 4.26: Affordability of technical support .....	54
Table 4.27: Chi-square test on technical support.....	55

## LIST OF FIGURES

Figure 1: Conceptual Framework .....	20
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## **LIST OF ABBREVIATIONS AND ACRONYMS**

C.G.o.K	County Government of Kitui
EUC	European Union Commission
FAO	Food and Agriculture Organization
G.o K	Government of Kenya
GP	Government Policy
MDG	Millennium Development Goals
MWI	Ministry of Water and Irrigation
NACOSTI	National Commission for Science, Technology and Innovation
NGO	Non-governmental organizations
OM	Operation and Maintenance
SADA	Swiss Agency for Development and Cooperation
SDG	Sustainable development goals
SPSS	Statistical Package for Social Science
VLOM	Village Level Operation and Maintenance
WHO	World Health Organization
WRMA	Water Resources and Management Authority
WSSP	Water Sewerage Services Policy

## ABSTRACT

The study was purposed to investigate factors influencing sustainability of community managed borehole water supply systems in Kenya with focus on Kitui South sub-county. There were three objectives for this study, namely; to determine whether project management skills of project committees managing community boreholes water supply influence sustainability of the projects; to assess how Social factors impact sustainability of community managed boreholes water supply and to establish if the technical support provided by government officers from the line ministries and private technicians is enough to sustain community managed bore holes water supply. The study was based on three theories namely Sustainability theory, Stewardship theory and Decentralization theory. Research methodology used in this study is descriptive survey. Simple random sampling and purposive sampling was employed in this study. To collection of primary data, questionnaires and interview guides were used. Sample was drawn from a total target population of 195 people comprising of executive and non- executive members of community borehole water projects. Fitty six (56) executive members out of population of 65 members and ninety eight (98) non-executive committee members out of population of 130 members were to be interviewed. 95.5% of the respondents completed the questionnaires. Four (4) Key management staff from the government ministry of water, non-governmental organization (Mutomo Sweden group and World vision International) were interviewed as key informants. Research instruments used include structured questionnaire and interview guide. The data that was collected was analysed using descriptive statistics. Microsoft word, excel spread sheet and the Statistical Package of Social Science was used in data analysis. Tables were used to present analysed. The study established that among the respondents interviewed sixty seven (67) representing 45.6% were men and eighty (80) representing 54.4% were women. Among the respondents those between the ages of 41-60 were the majority with 57.1%. The study findings showed that 59.2% of the community based borehole water project committee members received training on leadership and 55.8% of the community water project committee members understood the terms of reference of the water management committees. 52.4% of the respondents were satisfied with the level at which community priorities are considered and 45.6 % of the respondents believed that community members participate in water project activities. 46.9% of the community borehole water project committee members interviewed received some training on project operations and maintenance. Going by findings in this research, it was concluded that project management skills, social factors and technical support have significant influence on community based water projects. Based on this research findings the following recommendations were made; the ministry of water and the ministry of social services should factor in their annual budgets capacity building funds for committees managing community based water project committees to enhance sustainability of these projects. Since water and sewerage services are devolved to County Governments, the County Governments should come up with regulations guiding how service providers should charge for the services they render to community water projects. This will cushion community projects from exploitation by unscrupulous service providers. It is recommended that choice of technology to be used in community water projects, be based on maintenance cost, spare parts availability and technical know-how required for maintenance of the water project. This should be regulated by the ministry in charge of water resources. The following are suggestions for further studies; Conduct research on the effectiveness of the existing policy guidelines regulating operations of community based water projects in Kenya and give appropriate recommendations. Carryout research on various technologies being deployed in community based borehole water projects and make recommendations on the most appropriate technologies for rural community water projects. Conduct research on factors that hinder social inclusion in management of community water resources in Kenya.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background to the study

The national objectives for water and sanitation are documented in various policy papers specifically the Constitution of Kenya, vision 2030 manuscript, and the Strategy National Water Services. According to the current Kenya constitution (2010) article 43 (d), each individual has a right to clean and safe water in acceptable amounts. One of the vision 2030 goals is to guarantee water and better hygiene accessibility and to all. Its targets for 2015 were; 80% accessibility to potable and consistent water for metropolitan areas, 75% (availability to potable and consistent water) for countryside areas, plummeting amounts of unaccounted-for water to under 30%, 77.5% and 72.5% access to pleasant sanitation for metropolitan and countryside homes and 40% and 10% sewerage availability for built-up and countryside areas (2013-2014 Performance Review of Kenya's Water Services Sector 2. 3 out of 17 Sustainable Development Goals (2015 – 2030) address water availability. These are goal number 3, 6 and 11. Almost 10% of the entire problem of disease globally is associated to non-potable water, hygiene, and hygiene and the related illnesses cause 3.6 million deaths each year (Pruss-Ustun et al., 2008).

Availability of better-quality water and sanitation is significant as it is the base for healthy populations. It results to in major health, economic, and social advantages (Mihelcic et al 2003). As per Kitui County Integrated development plan (2013-2017), there is inadequate water for both domestic and agriculture use in Kitui County. Inadequate Water is ranked as problem number one in Kitui County. People of Kitui South cover the longest distances to water points some walking up to 29.9 kilometers.

Inefficiencies in management of the boreholes is cited as one of the major contributing factor to this problem. 10% of the population in Kitui County depend on water from boreholes which is considered relatively safe compared to other unprotected sources. There are a total of 264 boreholes in Kitui County. About half of these are either operating under capacity or have broken down. (Kitui County Integrated development plan 2013-2017).

Water being a devolved function, County Government of Kitui (CGoK) continues to invest heavily on sinking more boreholes yet little is being done to investigate contribution of boreholes management committees in the sustainability of the already drilled and equipped boreholes. Eight boreholes were constructed in Kitui County in the financial year 2014/2015 and Six were planned for the financial year 2015/2016 (Kitui County Government programmes based budget for the fiscal year ended June 2016) yet percentage of functional borehole management committees is not included as sustainability indicator of these water projects.

Poor management of community boreholes has serious implications touching on health, economic and education and social life of Kitui south communities. Break down of boreholes mean more time has to be spent queuing or tracking to available water sources, compromising on Hygiene and Sanitation issues resulting to ill health, increased schools absenteeism by schools going children and teachers as well as increase in conflicts related to water access. (Kitui County Integrated development plan 2013-2017).

## **1.2 Statement of the problem**

Un- sustainability of Community water boreholes water supply projects in Kitui South is a major contributor to health, education and other Socio economic challenges facing the community. There has been a lot of investment made by the government and non-governmental organization on developing community water projects in many rural areas of Kenya including Kitui south sub-County. Despite this heavy investment in rural water supplies which are mainly managed by elected project committees, such projects are either operating under capacity, stalled, have become nonfunctional or benefit few individual among them the management committee members. Failure of these projects to operate in full capacity or collapsing before their design period has negative impact to the community members who rely on these projects for access to safe water in sufficient quantities within acceptable distances.

As per the World Bank report (2010), about half of the countryside populace has access to potable water, contrasting 32% of the town population which has 85% of its population accessing potable water. As a result of constant populace increase, it is projected that come the

year 2025, Kenya's per capita water accessibility will be 235 cubic meters yearly, which is almost 2/3 short of the present 650 cubic meters.

According to Global Majority E-Journal, Vol. 2, No. 1 (June 2011),pp 31. Scarcity of water continue to be issue of great concern in Kenya, occasioned majorly by periods of repeated droughts, inappropriate administration of water supply systems, pollution of the existing water, and a steady upsurge in water needs occasioned by comparatively increase in growth of population.

Nyangaresi and Kiarie(2015) on their case study on challenges hindering Sustainability of community water pans projects in Kenya; a case of Kitui County, found out that mismanagement of community water projects is a major contributing factor of failure of community water projects. Even though substantial research effort has been directed to investigate water problems in Kitui County, there has been little focus on the contribution of project management skills, Social factors and support in technical aspect of the projects in sustainability of community based borehole water supply projects.

According to Wanyoike and Wanyaoke(August 2014) on their case of ' Factors Affecting Sustainability of Rural Water Supply Schemes in Nyandarua County' They defined sustainability of water project as sustenance of an satisfactory level of services during the design life of the water project. It is common knowledge that some water projects turn out to be evidently unsuccessful not due to technical letdowns, yet some are able to succeed in meeting their objects without major problems. By finding out the underlining reasons causing failure of community based water projects, this would be important beyond just sustaining already existing projects, but informing design and implementation of new community based water projects

This study therefore made attempt to investigate the extent to which project management skills of community borehole project committees, social factors and the kind of technical support provided by either government officers or private technicians influence the sustainability of these projects in Kitui South Sub- County.



### **1.3 Purpose of the study**

The purpose of this study was to establish the factors which are influencing sustainability of community based bore holes water supply projects in Kenya with focus in three wards of Kitui South sub County.

### **1.4 Objectives of the study**

The study was guided by the following research objectives:

- i. To establish the influence of project management skills on the sustainability of community bore holes water supply projects in Kitui South Sub County.
- ii. To assess how Social factors influence sustainability of community based boreholes water supply projects in Kitui South Sub County.
- iii. To explore how technical support influence sustainability of community based bore holes water supply projects in Kitui South Sub County.

### **1.5 Research questions**

The study attempted to answer the following research questions:

- i. How does project management skills of project committee members managing community borehole water supply projects in Kitui South Sub County influence the sustainability of the projects?
- ii. How does social factors influence sustainability of community bore holes water supply projects in Kitui South Sub County?
- iii. In what ways do technical support influence sustainability of community managed borehole water supply projects in Kitui South Sub- County?

### **1.6 Research hypothesis**

- i) H1: Management skills influence sustainability of community based borehole water projects.
- ii) H1: Social factors have great influence on the sustainability of community managed borehole water projects.
- iii) H1: Technical support influence sustainability of community managed borehole water projects.

### **1.7 Significance of the study**

Continued funding and implementing community water projects which are managed by elected water committees can only be justified if such projects are proved to have sound structures for sustainability. This study was intended to provide beneficial information to be used by stakeholders in water sector implementing community water projects and to inform formulation of policies by County Government of Kitui to regulate and improve on how community water projects are managed.

This study may also provide a starting point for other researchers who would be interested to pursue similar topic in future. The findings of this study may also inform non-governmental organizations and other donors on areas which may require more emphasis in order to strengthen sustainability and accountability structures of community managed water projects.

It was also expected that the study would be able to identify capacity gaps of project committee members managing community borehole water supply projects in Kitui south which can be used to inform capacity building plans of Government line ministry and other non-state actors involved with community water projects within and outside Kitui County.

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

The study assessed the factors influencing sustainability of community managed boreholes water supply projects in Kitui South Sub- County. It focused on three independent variables namely: Project management skills, Social factors and project technical support. Independent variable was sustainability of community managed boreholes. This study was restricted within three wards of Kitui South Sub County. These are Mutomo, Mutha and Kanziko. The three wards have boreholes water supplies established by the Government of Kenya, non-governmental organizations and faith based organizations

### **1.9 Limitations of the study**

The bore holes were scattered in the different direction of the three wards of Kitui South Sub County and some of them were in very remote area. This limitation was overcome by hiring five research assistants who are residents of the three wards of Kitui South where respondents were sampled from.

### **1.10 Assumptions of the study**

This study was carried out with assumption that all the factors considered in this research would hold true. It was also assumed that that community water project management committee members, community leaders Government officers and staff from funding organizations sampled would provide honest and accurate information and lastly, it was assumed that there would be no political or social factors which would interfere with community day to day activities to the extent of making it difficult for this research to be conducted within the scheduled time.

### **1.11 Definitions of Significant Terms Used in the Study**

The following are definitions of the key terms that were used in the study:

**Government Policies:** These are the guiding statutes framed by government to direct the design and implementation of water projects.

**Project Management Skills:** These include skills such as communication, leadership, team management, networking and risk management which are essential in effective day to day running of a project.

**Project Committees:** These are democratically elected individual who manage water projects in their area. They serve for a period agreed by the members before another election is held.

**Sustainability of community based bore water supply projects:** This refers to the capacity of the project beneficiaries to maintain the boreholes in good working conditions for continue supply of water for extended periods of time.

**Social Factors:** These are factors such as priorities of the project beneficiaries, participation of all stakeholders involved in a project, social inclusion of all categories of people within the project catchment area and consideration of gender equity in setting and managing the project.

**Technical Support:** This refers to support provided by Government Officers, Private Practitioners or Non-Governmental Organization staff which ensure project assets remain serviceable.

### **1.12 Organization of the study**

There are five Chapters in this research project report. In the first Chapter, the researcher provided detailed information on the background of the study, statement of the problem, purpose of the study and also the research objectives and questions. In chapter Two, the researcher reviews available literature on the independent and dependent variables from the global, regional, national and local contexts and presents a conceptual framework. In chapter Three, the researcher presents details of the research methodology. Chapter Four has presentation of research findings and chapter five which is the last chapter of this study has summary of the research findings and recommendations.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter reviews available literature on key factors that influence the management of community based borehole water projects. It provides analysis of case scenarios from the global, regional and local contexts. The chapter also provides a conceptual framework showing relationship between the identified dependent variable which is sustainability of water projects and independent variables which are project management skills, social factors and technical support.

#### **2.2 Sustainability of Community based Borehole Water supply Projects**

Community based water supply going by Bakker definition is public water system which is used by not less than 25 people all through the year and can be comprised of at least one or several boreholes, wells or reservoirs. The significance of participation of community in decision making in community based projects is emphasized by diverse worldwide organizations. The second principle in the Dublin statement emphasized that water advancements and administration should be based on an approach that is participatory, user involvement and other stakeholders at all levels. The resolutions ought to be made at the appropriate grass root level after extensive consultations. (Bakker, 2008).

According to European Union Commission (EUC) definition, a sustainable project is one which has ability to continue delivering its benefit to the intended beneficiaries and other populations long after the financier's stop funding the project. Binder (2008) defines a sustainable water scheme being one which is able to function in recommended capacity for extended period of time. These schemes have structures which support delivery of service capable of meeting or exceeding the set prospects, the ability to fulfil public safety and healthy prerequisite on a longstanding foundation, negligible support required in the long-run, users having capacity to finance operation and maintenance cost; and sustained course of benefits for extended periods. Accessibility to potable water can be defined as the percentage of persons using upgraded

drinking water sources such as home connection, community standpipe, borehole protected wells, protected spring and rainwater (WHO, 2010).

According to Global Majority E-Journal, Vol. 2, No. 1 (June 2011),pp 31. Scarcity of water continue to be issue of great concern in Kenya, occasioned majorly by periods of repeated droughts, inappropriate administration of water supply systems, pollution of the existing water, and a steady upsurge in water needs occasioned by comparatively increase in growth of population.

As per the joint monitoring programme report (2012) of water .org organization, Across Kenya, access of potable water supply is at fifty nine percent while access to upgraded sanitation is at thirty two percent. Water need remain unmet both in the rural and buildup areas. The right to water as a basic resource for all communities is undebatable. Putting this into consideration, the United Nations Millennium Development Goals (MDG) had intended to lessen the percentage of individuals deprived the continued accessibility to potable water and basic sanitation by fifty percent by the year 2015 (WHO, 2010). Resulting from sustained growth in population, it's projected that by the year 2025, Kenya's per capita water accessibility will be 235 cubic meters per year, which is close to  $\frac{2}{3}$  compared to the present 650 cubic meters.

According to Global Majority E-Journal, Vol. 2, No. 1 (June 2011),pp 31. Water scarcity has been a major issue in Kenya, caused mainly by years of recurrent droughts, poor management of water supply, contamination of the available water, and a sharp increase in water demand resulting from relatively high population growth.

Although there are many factors which influence sustainability of community based borehole water supply projects, only three factors will be considered in this study. These are project management skills, social factors and technical support.

### **2.3 Project Management Skills and Sustainability of Community Borehole water supply projects**

Sustainability of community water projects is dependent on management skills of the project management committee. This includes the soft and the hard skills which are required by water project management committee members to enable them manage water projects effectively, efficiently and in a sustainable way. Leadership skills, management skills, communication skills and aptitude in problem-solving can be referred as soft skills. These must be complimented by technical skills which include some basic knowledge to perform some mathematical chores, knowledge on information technology and necessary scientific knowledge required to manage a project. (Cesar, 2015).

The definition given by Kerzner (2003) on project management skills are the abilities which enable one to plan, organize, direct, and control resources of a company or organization to be able to achieve the set objectives. Project Management require the ability to apply knowledge, abilities, gears and techniques for a project to deliver what is required. It is carried out by use of the procedures which include: initiating, planning, executing, controlling, and closing. This word project management is at times used to refer to an organizational method to the running of its continuing operations also denoted as management by objectives.

According to Cesar (2015), there are six project management skills which are key to successful management of any project. These are abilities to; Communicate, Lead, Manage teams, Negotiate, manage risks and believe in Personal organization. 90% of the time in project management is used in communicating. As such, it is therefore desirable that that project management committees have the ability of excellently explain to others vision, ideas, goals, and issues as well as prepare and share reports among other abilities. Leadership is the present catchword in the project management field. If water project management committees can provide proper leadership then chances of project sustainability are high. Executive water project committee members should be able to excel at organizing and overseeing groups of people by stimulating joint effort, delegation of tasks, ability to resolve conflicts, defining goals and objectives as well as ability to evaluate performance. This encompasses assigning use of resources, budgeting, scheduling, defining of scope, and managing other unpredictable eventualities. These abilities by project management committees

greatly rises the chances of implementing projects which are successful (Cesar, 2015). Project committee members should be people who have the ability to organize their own personal life and projects. They should be people who can be emulated by others. This way they win respect from water users and other stake holders. (Cesar, 2015).

Spendlove (2007) stressed that in the previous ten years research work in the area of leadership effectiveness has progressed on the road to recognizing the leadership proficiencies which include knowledge, skills, abilities and behaviors of individuals. Spendlove (2007) continue to state that, proficiencies are defined as collection of behaviors that are influential in the achievement of desired effects or products. (Bartram 2005). Regardless that some competencies are more demanding to learn than others (Tubbs and Schultz, 2005), nevertheless defining precise proficiencies can govern strategic human resource management practice in the area of recruiting and planning for succession. Proficiencies and roles, provide an important means which facilitate effective leadership. For successful leadership, proficiency models are not a recommendation, they actually characterize an effort to grasp the understanding and experience, make use of lessons learnt, and benefitting from knowledge of experienced leaders in order to provide a guiding framework which benefit others as well as organization Leaders who have higher competencies in the core areas are likely to be more effective. Competency can be gained through education, training and experience (Spendlove, 2007).

## **2.4 Social Factors in management of water projects and Sustainability of Community Borehole water supply projects**

Social factors in project management include community priorities, participations, social inclusion and gender and equity.

Community projects have greater chances of being sustainable when community members who are beneficiaries of the project are the primary protectors of such projects because they are convinced it is their priority project. According to Food and Agriculture Organization (FAO) (FAO.org, 2006), if any community project is to win community ownership which is a key pillar in sustainability of projects, then it must focus on the target community priorities as per beneficiaries felt needs. Communities shun or even vandalize projects which they feel do not



address their needs or were imposed on them. Sustainability of community water projects is most assured when project beneficiaries and other project stakeholders fully at all stages of the project. In the field of community development, community participation in project activities refer to deliberate effort though which project beneficiaries are able to meaningfully influence the direction and execution of development projects as opposed to them being passive recipients of project benefits. (Paul, Bamberger, 1986). By promoting community participation, practitioners enhance the ability of communities to resolve conflicts amicably by allowing diverse opinions to be heard. By so doing, there are benefits such as promoting learning as well as people being able to find solutions for their problems (Nampila, 2005).The purpose of promoting community participation in projects does not just overturn existing power relations in ways that create sense of agency and raising voice for the poor, it also makes it possible for the poor to have better control over development aids. The expectation is that this will culminate in distribution of development funds in a way that is responsive to meet needs of the poor by proper targeting of the beneficiaries.

Sustainability of community owned water projects can only be assured if there is social inclusion of all its members at all stages of the project. A community can be referred as being socially inclusive when its members feel valued and equal opportunity to freely take part in what constitutes life of that particular community. This can be simplified further to mean a community in which each of its members is able to freely enjoy the right of participation whether in sport activities, cultural events, communal work or learning opportunities; where more people are ‘one of us’ than ‘one of them (Val chier, 2009).

Social inclusiveness promotes values such as fairness, equality, respect, trust and right to equal participation. These values facilitate community cohesiveness which promotes community working together and ownership of projects and their willingness to support its sustainability. This ensures balanced representation in management of community projects and minimizes conflicts which arise from a shared resource. Projects which have minimal conflicts are more sustainable than those which have conflicts which times leads to even court injunctions barring or limiting the operations of the projects. For community water projects to be sustainable they require contribution of both gender and they should be managed in a way that that shows there is

equity. Going by Gender in practice Swiss Agency for Development and Cooperation (SADC), gender determination is through the conceptualization of chores, function and role attribution to women and men in a given society both in public and private life.

World Water Vision defines gender mainstreaming in relation to water as the inclusion of all initiatives aimed at addressing both the practical and gender needs in such ways as improvement of conditions surrounding women such as providing water and sanitation facilities closer to their homes. In addition it involves addressing strategic gender needs such as improvement of women position in the society by way of supporting their increased awareness of her situation and her capacity to make decisions and influence needed change. Additionally gender approach seek to stop continued overloading of women but stress the importance of not mechanically strengthening and maintaining traditional roles. This suggests the need to address both men as well as women, considering men are also required to change their attitude and behavior in support of this” (World Water Vision, 1999]

“We recognize that gender equality and women’s empowerment are important for sustainable development and our common future. We reaffirm our commitments to ensure women’s equal rights, access and opportunities for participation and leadership in the economy, society and political decision-making. We underscore that women have a vital role to play in achieving sustainable development. We recognize the leadership role of women, and we resolve to promote gender equality and women’s empowerment and to ensure their full and effective participation in sustainable development policies, programs and decision-making at all levels”. (General Assembly resolution 66/288, annex, paragraphs.31 and 45). This study attempted to find out the synergy between female and male gender in managing borehole water projects in a sustainable way.

## **2.5 Technical Support and Sustainability of Community Borehole water supply projects**

The kind of technology used in a community borehole water projects has a big bearing on the probability of sustainability of that project. Use of technology which is appropriate includes technologies which can be rated as low cost, can be maintain with easy, user friendly and whose

spare parts can be gotten easily. It should be tailored to respond to the challenge of sustainability. Appropriate technology is important to the theory of Village Level Operation and Maintenance (VLOM) which began in the Water Decade (1981 – 1990). Most of its basic principles continue to guide water sector, although the debate about the intercourse between the durability of a system and ease of maintaining it (Reynolds, 1992).

The VLOM conceptualization of the community as an island also disregards the role played by significant others in project sustainability. These include the role of government among others. (Webster et al, 1999). The importance of effectiveness in operation and maintenance (O & M) of rural water distribution schemes is critical component for ensuring sustainability of water project. If 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 the project ends up collapsing (Binder, 2008).

According to [www.fwr.org](http://www.fwr.org) report number TT/126/00, Community-based technical operators are considered to be most appropriate option for undertaking technical operational O&M activities for a community- based water services provider. To make this option feasible, these roles ought to be assigned individuals who have undergone technical training, especially O&M training, in addition to having gained hands on experience in their area of expertise. Technicians should be hired and enumerated commensurate to the work they do. Demands for maintenance should inform decision on whether to hire them as part time or on a regular basis. Technicians should have clear job descriptions.

Technology selections, management choices and pricing are issues that affect sustainability significantly. If project settle for technology that is too complicated as well too expensive to operate or replace this end up undermining its sustainability. Unsuitable management systems would equally do the same. Pricing also plays a crucial role, determination on how much should be charged for water must be sufficient in order to cover at majority of its operations and maintenance costs, and preferably to cover eventual replacement costs in the long run. (Water aid Tanzania, June 2009).

According to Water aid Organization, Sustainability of Community Own Water Supply organizations (COWSOs) in countryside remain to be a challenge. This pitfall can be closely associated with absence of funding particularly for big maintenance and replacement, lack of technical personnel at project level, inaccessibility of spare parts at a very low convenient places. This could be attributed to the fact that water supply related spare parts are not fast moving stocks kept by spare parts dealers, or it could be due of some water schemes using outdated technologies whose spares are no longer in the market. Additionally regulatory statutes in water sector may not have adequately addressed pertinent issues which concerns repair and maintenance of community based water projects. ([www.wateraid.org](http://www.wateraid.org)).

Anytime specialized know-how or equipment is required for the exploration of water sources in complex hydrogeological settings or other technically intricate accomplishments, for example sanitization of surface water, special caution must be taken to safeguard and ensure materials and equipment to establish a water supply and distribution system are found locally, to the maximum extent possible. General rule dictates that technology must be kept simple. It must be appropriate to the country and consider local experience. Deliberate attempt should be made to standardize, all special equipment. In this regards, its availability in local markets, as well as that of the necessary fuel and spare parts and the local familiarity with them and with their operation and maintenance should be priority considerations (Water manual for refugee situations, November 1992).

## **2.6 Government policies and Sustainability of Community based Borehole Water supply Projects**

Government policies provide guidance on how community groups should be formed and registered. They also provide guidance on how community owned projects should be managed for them to be sustainable. Kenya Water Act of 1974 was subjected to major changes in 1999 and 2002, these changes mainly concentrated on facilitating decentralizing water services through separation of water policies formulation from regulation's and service provisions. Moreover, the 2002 National Water Policies demarcated government's role as regulatory and went further to delegate water services provisioning to the private sectors, municipality and Community. By decentralizing and separating roles of the different players who have stake in the

water sector still realization of its intended goal proved a challenge due to ambiguity obvious conflicting roles. Although all stakeholders were encouraged to participate in the process, incorporation of ethics in water use management remain a challenge. Full incorporation of people rights in accessing water and controlling their environment was not included in the water policy. (George and Ong'oa, 2009).

Ministry of Water and Irrigation (MWI) as it was referred then, come up with institutions which include; Water Resources Management Authority (WRMA), Water and Sewerage Services Policy and others aiming to restructure its' operations in service delivery frontier of the water sector. The mandate of Water Resources Management Authority included: Ensuring rational and equitable means in allocating water resources, monitoring of water quality by carrying out quality tests, and vigilance in ensuring required standards for drinking water are adhered to as well as enforcing compliance to other standards which regulate different water uses and handling of effluent releases to public sewers. Their mandate also include mapping of and publishing main water catchment areas, groundwater resources and flood prone areas.(IHub Research, 2012).

As per the Government of Republic of Kenya (GoK) National Water Development Report of 2006, there is mismanagement of water resources a failure facilitated by having unsustainable water and policies which guide land use. "s water resources have been mismanaged through unsustainable water and land use policies, increase in pollution, degradation of rivers and lakes among other issues (GoK Report 2006)

## **2.7 Theoretical Framework**

Sustainable development is defined as "development which meets the needs of the present without comprising the ability for future generations to meet their own needs." (WCED, 1987, p.43)

Three theories were considered in this study of factors influencing sustainability of community borehole water supply projects. These are Sustainability theory, Stewardship theory and decentralization theory.

### **2.7.1 Sustainability theory**

Going by Berkshire Encyclopedia of Sustainability (pg, 382), it is in 1972 when the idea of sustainability gained public interest following publishing of 1972 report known as *Limits to Growth* which was released by the worldwide think tank Club of Rome. Subsequently the World Conservation Strategy formulated by the International Union for Conservation of Nature, which had joined hands with the United Nations Environment Programme and World Wildlife Foundation, their efforts were to style sustainability a standard of international action. After this the terminology *sustainable development* attained international public fame through the 1987 report of the World Commission on Environment and Development known as *Our Common Future* frequently so-called the “Brundt-land Report” which was named after the Prime Minister of Norway who chaired the committee.name of its chair,. It offered the famed definition; “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987, 43).

The theory relevancy in this study is based on the fact that it helps to integrate environmental and social problems. Mismanagement of water resources leads communities to overuse the few functional water resources putting a lot of strain to the environment. Lack of adequate safe water leads other social problems such as conflicts over resources, health problems and even schools absenteeism as parents and children go looking for water.

### **2.7.2 Stewardship theory**

The derivations of this theory can be traced in Sociology and psychology. This theoretical framework was amended to enable researchers to scrutinize the process of making decisions, action taking, and how executives who serve as trustworthy stewards perform duties assigned to them by the principals. (Davis, Schoorman, and Donaldson, 1997; Deutsch, 2005; Donaldson and Davis, 1991). This theory deduces that administrators are truthful and skilled managers of resources for the corporates and are chiefly positioned to make the most in the best interest of investors because they are largely acquainted with the complexities of company strength, weakness, opportunity, and threats there in (Boyd, 1995). Establishment managers are comprehended as persons who get motivated by the urge to succeed. Surmount challenges in the

area of expertise, demonstrate the extent of their authority in their responsibilities and by so doing be recognized by aristocrats and superiors (McClelland 1961; Herzberg et al. 1959)

The framework through which Stewardship theory is formulated claims that individuals are inherently inspired to labor for other people or for establishments to complete the work and accountabilities entrusted to them. It reasons that folks are communal inclined and support organizations as opposed to having individualistic interests, and as such they do their best towards achievement of organizations , societal or group goals because out of this they derive utmost satisfaction. This theory therefore provide a framework through which characterization of motives which drive managerial behavior in different organizations can be done.

This theory is relevant in this study because the water user's management committees are elected and accept the responsibility of ensuring community owned borehole water supply system is maintained and in some instances expanded to serve its original purpose. Water users including the members of the project pay for water. The water management committees are trusted to manage project resources including the funds realized from sale of water for common good.

### **2.7.3 Decentralization theory**

If interpreted in Kenya Context, decentralization is a practice of distribution of authority between the Central Government and the County governments. This ought to be done in such a way that Central Government assigns some of its authority, function, statutes, skills, and resources to the forty seven Counties across Kenya.

According to Kokor (2001) by creating the connectedness between participatory authority and devolution, county governments should establish participatory egalitarianism in which the people of a given County participate unswervingly in the governance of both County and Central Governments through development of comprehensive policies for development. This theory is relevant to in this study because the management of water supply to citizens is a function that is devolved to County Governments in Kenya. It's expected that after funding organizations or institutions hand over borehole water projects to communities, the County Government is

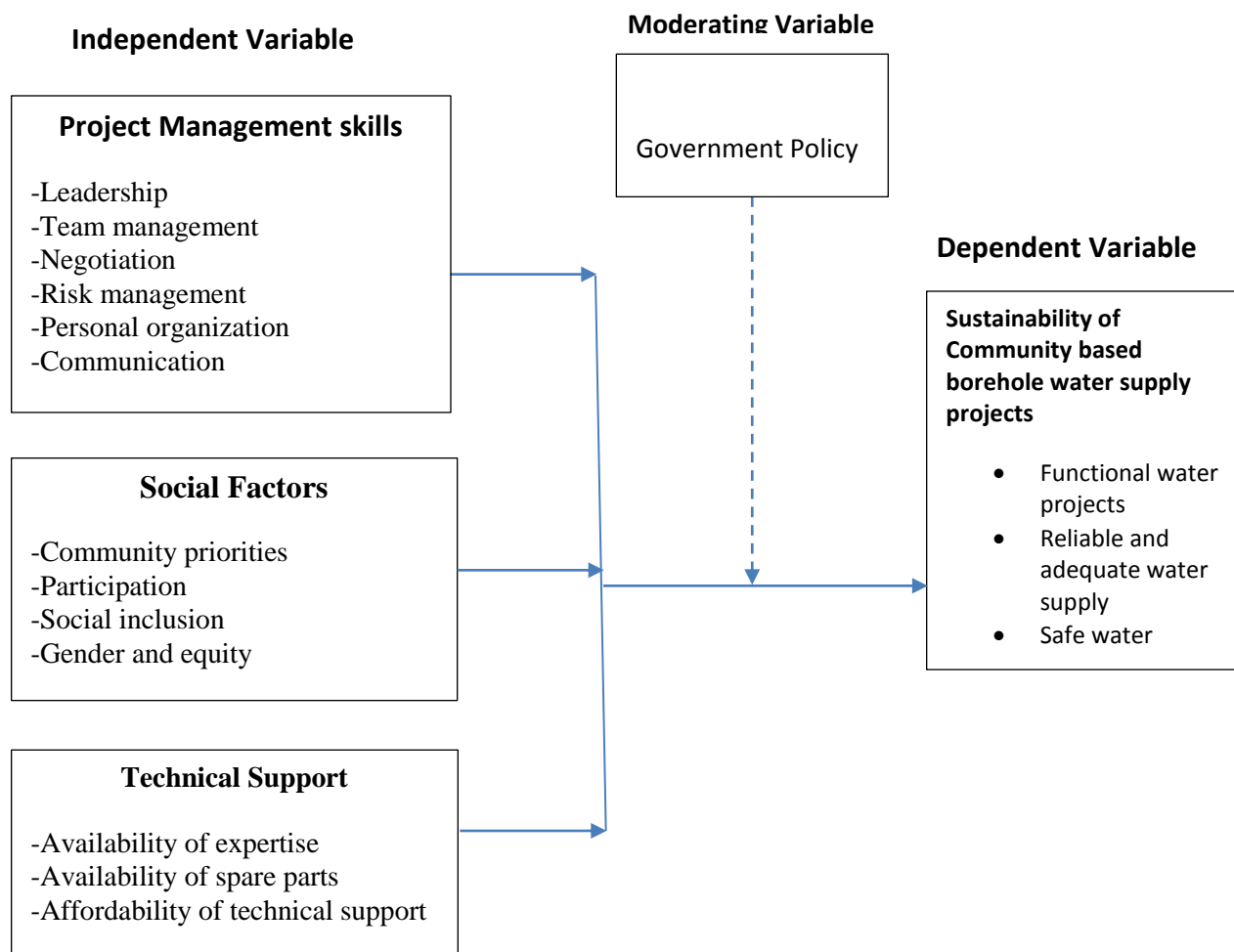
expected to support these communities to sustain these projects. This could be through financial support, technical support or skill transfer.

The Government of Kenya has through water policy and the current constitution decentralized the responsibility of water resources management to County governments and other local institutions such as water users committees. Based on the strength of the prevailing legal background and water policy guidelines that community managed water projects exist in all parts of this country. This makes this theory relevant in this study.

## **2. 8 Conceptual Framework**

The purpose of conceptual framework is to provide clarity of concept through which the existence of important associations of variables. (Kothari, 2008). The focus of this research was to establish constraints that hinder sustainability of community borehole water supply projects in Kenya. This study narrowed down to three independent variables which were studied. If these three independent variables are to be changed or adjustments done on them result in change in the dependent variable. This association is clarified in the figure below.





**Figure 1: Conceptual Framework**

## 2.9 Summary of the literature review

According to European Union Commission definition, a sustainable project is one which has ability to continue delivering its benefit to the intended beneficiaries and other populations long after the financier's stop funding the project.

Sustainability of community water projects is dependent on management skills of the project management committee. This includes the soft and the hard skills which are required by water project management committee members to enable them manage water projects effectively, efficiently and in a sustainable way. Leadership skills, management skills, communication skills and aptitude in problem-solving can be referred as soft skills. These must be complimented by

technical skills which include some basic knowledge to perform some mathematical chores, knowledge on information technology and necessary scientific knowledge required to manage a project.

There are six project management skills which are key to successful management of any project. These are abilities to; Communicate, Lead, Manage teams, Negotiate, manage risks and believe in Personal organization. 90% of the time in project management is used in communicating. As such, it is therefore desirable that that project management committees have the ability of excellently explain to others vision, ideas, goals, and issues as well as prepare and share reports among other abilities. Leadership is the present catchword in the project management field. If water project management committees can provide proper leadership then chances of project sustainability are high. Executive water project committee members should be able to excel at organizing and overseeing groups of people by stimulating joint effort, delegation of tasks, ability to resolve conflicts, defining goals and objectives as well as ability to evaluate performance. This encompasses assigning use of resources, budgeting, scheduling, defining of scope, and managing other unpredictable eventualities. These abilities by project management committees greatly rises the chances of implementing projects which are successful.

Sustainability of community owned water projects can only be assured if there is social inclusion of all its members at all stages of the project. Social inclusiveness promotes values such as fairness, equality, respect, trust and right to equal participation. These values facilitate community cohesiveness which promotes community working together and ownership of projects and their willingness to support its sustainability. This ensures balanced representation in management of community projects and minimizes conflicts which arise from a shared resource. Projects which have minimal conflicts are more sustainable than those which have conflicts which times leads to even court injunctions barring or limiting the operations of the projects. For community water projects to be sustainable they require contribution of both gender and they should be managed in a way that that shows there is equity.

The kind of technology used in a community borehole water projects has a big bearing on the probability of sustainability of that project. Use of technology which is appropriate includes technologies which can be rated as low cost, can be maintain with easy, user friendly and whose spare parts can be gotten easily. It should be tailored to respond to the challenge of sustainability. Community-based technical operators are considered to be most appropriate option for undertaking technical operational and maintenance activities for a community- based water services provider. To make this option feasible, these roles ought to be assigned individuals who have undergone technical training, especially operation and maintenance training, in addition to having gained hands on experience in their area of expertise

## **2.10 Research Gaps**

Several researchers have conducted studies on sustainability of community water projects in Kenya but few detailed studies have been conducted specifically to measure sustainability of community managed borehole water supply system. Through literature review, it is evident that most studies focused on water pans in rural areas and piped water systems in urban water supply schemes.

The main gap which was identified in the literature reviewed was lack of research studies conducted to investigate factors that influence sustainability of community based borehole water projects. Most previous studies focused on water pans in rural areas and piped water systems in urban water supply schemes. This study therefore attempted to bridge this gap by focusing on factors that influence the sustainability of community managed borehole water supply systems in rural communities.

Although there is literature to show research conducted focusing on Gender and other social factors which influence sustainability of community based projects, there is little research work which focused specifically on how social factors influence sustainability of community based borehole water supply system. Technical support is a critical component in ensuring sustainability of water projects. Although there is a lot of research work on other components of project cycle, there remain a gap in search work that detail contribution of technical support in sustainability of community based water projects.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter has provided details of the research methodology used in this study. The area covered are; how research was designed, location where research was undertaken, population of the study, sample size and procedure used in sampling. It has also listed the instruments used, measures which were put in place to ensure validity and reliability and how data was collected and analysed.

#### **3.2 Research Design**

The designing of a research establishes the outline of data will be collected, measured and analysed. (Kothari, 2003). Kombo and Tromp, (2006), define research design as an arrangement of conditions for guiding data collection and analysis in away feared towards combination of research relevancy and purpose.

Descriptive research design is one which was used in this study. It embroils data gathering which gives description to happenings and then consolidate, arrange, illustrate, and describe the data collected (Glass and Hopkins, 1984). It is also defined as methodology of information collection through interviews or administration of questionnaires to individuals sampled. It comes in handy if a researcher want to gather information about people attitude, opinion, behaviors and any other public issue (Orondo and Kombo, 2002).

According to Polit and Hungler (1999) descriptive study consist of data collection in a way that provide an explanation or account of persons, clusters or circumstances. Questionnaires, interview guides and observations are some of the research instruments used in data gathering.

A combination of qualitative method and quantitative method was employed during data collection in this research project. Key informant information was gathered through qualitative data collection method by interviewing key informants while quantitative data was collected through administering interview questionnaires to sampled respondents.

### 3.3 The Target Population

According to Mugenda and Mugenda (1999), The entire group that a searcher has interest in or would which to make conclusions is what is referred to as the population whereas sample population is a set of people or cluster that have similarities in characteristics. Mutomo, Mutha and Kanziko wards of Kitui South Constituency have thirteen (13) functional bore holes with active water management committees. Each water management committee consist of five officials (5) and at least ten (10) committee members making a total of fifteen (15). The executive leadership consists of chairperson, treasurer, and secretary. Chairperson and Secretary have deputies while office of the treasurer has only one person.

This study involved both the executive water management committee members and non-office holder members. This is because all water committee members are key in ensuring sustainability of water projects. A total of 154 respondents from a target population of 195 water management committee members were sampled in this study. Key management staff from the government ministry of water, non-governmental organization (Mutomo Sweden group and World vision International) were interviewed as key informants. To ensure effectiveness of the sample, the respondents who were sampled were persons who were considered to be knowledgeable on matters concerning community borehole water projects.

**Table 3.1: The study Population**

<b>Respondent</b>	<b>Source</b>	<b>Target Population</b>
Government Official	Kitui South Sub county office	1
NGO officials	World Vison Kenya-Mutomo Program	2
	Mutomo Sweden group	1
Community Borehole water executive committee officials	Mutomo, Kanziko and Mutha (13 projects)	65
Community Borehole water non-executive committee officials	Mutomo, Kanziko and Mutha (13 projects)	130
<b>Total Target population to draw sample for questionnaire respondents</b>		<b>195</b>

### **3.4 Sampling size and sampling procedure**

Selection of subsets of units from a particular target population aimed at gathering information is what is referred to as sampling. (Polit & Hungler, 1999).

Probability sampling was used to sample respondents from water management committee. In respect to key informant interviews conducted, a non- probability sampling method was employed. Webster define sample as a finite portion of statistical populace whose qualities are considered for the purpose of gaining evidence concerning the entire population (Webster, 1985). Mugo in his definition of a sampling in relation to research stated that as when it concerns people, it refers to a cluster of respondents who are selected from a bigger population (Mugo, 2002).

Simple random sampling and purposive sampling was used in this study. There were nineteen (19) community boreholes with management committees. Out of the 19 borehole water project committees, there were 13 functional committees. For the purposes of this study respondents were drawn from the 13 functional committees. Fifty six (56) executive members and ninety eight (98) non-executive committee members were sampled to be interviewed. Four (4) Key management staff from the government ministry of water, non-governmental organization (Mutomo Sweden group and World vision International) were interviewed as key informants. Kitui South Sub county water officer in charge, water engineer in charge of World Vision Kenya Mutomo Water and Sanitation project, Program Managers for World Vision Kenya- Kitui area program and Mutomo Sweden group project manager were interviewed as key informants.

#### **3.4.1 Sample Size**

Purposive sampling was used in the study to select respondents for administering research questionnaire. Non-probability sampling approach was used to identify respondents for key informant interviews. The key informants were one government official from the ministry of water and agriculture of Kitui County and three officials from non- governmental organizations implementing community borehole water projects in Kitui south. These non- governmental organizations are World Vision Kenya and Mutomo Sweden group. These Officials have technical and operational knowledge on how community borehole water projects are designed,

implemented and maintained. In addition they are also familiar with government policies governing water sector. According to Mugenda and Mugenda (1999), Purposive sampling is used when information required can only be obtained from a specific source.

### 3.4.2 Sampling Procedures

There were 13 borehole water project committees which were functional in the targeted area comprising of 15 members on average. Each had 5 executive members composing of Chairperson and deputy chairperson, secretary and deputy secretary and 1 treasurer. The remaining ten members were non- executive members of the borehole water supply management committees. The total members of borehole water committee projects in the three target wards therefore are 195 (15X13=195). Non-executive members are 130 (13x 10+=130) and Executive members are 65 (5X13=65).

Yamane (1967:886) provides the following formula for calculation of sample size:

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

The same formula is provided by online survey <https://www.chechmarket.com/2016>.

Where

n = is the sample size

N = is the population size

e = is the level of precision.

**Table 3.2: The Study Sample size**

<b>Category</b>	<b>Target Population size</b>	<b>Margin of error</b>	<b>Confidence level</b>	<b>Sample size</b>
Community Borehole water non-executive committee officials	130	5%	95%	98
Community Borehole Water Projects executive committee officials	65	5%	95%	56
<b>Total</b>	<b>195</b>			<b>154</b>

For Key informant interviews purposive sampling was used to pick one government official in charge of Water resources management department in Kitui South Sub-county, one project Manager from Mutomo Sweden group which is a local NGO and two Officials from World Vision Kenya which is an international NGO.

According to Kombo and Tromp (2006), data collection refers to gathering of specific information aimed at proving or refuting some facts. In this study, the data collection methods included: asking of questions through filling in structured questionnaires that executive and non-executive members of water user committees. Structured interviews involved selected government official and NGO officials of non-governmental organizations based in Mutomo. Review of available secondary data on this topic was also used.

Competent research assistants were selected, trained, and properly briefed on how to go about this research. The researcher made impromptu field visits to the field to ensure research assistants were collecting data within acceptable standards.

The researcher used primary and secondary data sources. Primary data were gathered directly from the respondents using structured data collection instruments. The secondary data include data that has been already collected by other researchers as well as other existing literature relevant to this research such as published government policies on water resource management. Secondary data was also sought from the University of Nairobi Libraries, Kitui South sub county ministry of water office and through online from reliable websites such as UNDP, WHO, UNICEF, Government Kenya official website among others.

### **3.5 Research Instruments**

The research instruments used were two: questionnaire and interview schedule. The questionnaires was administered to respondents by the research assistants while the interview schedule was used by the researcher to interview key informants. The questionnaires were prepared to align and respond to the research objectives and questions as they relate to sustainability of community managed borehole water supply projects in Kitui South visa vie the three independent variables which are project management skills, social factors and technical



skills. The questionnaires were used to collect data from borehole water management committee members while interview guide was used to collect data from key informants who include government official in the line ministry and project management senior staff from non-governmental organization. The questionnaire had structured open and closed ended questions. The open ended questions were used to collect qualitative data while the close ended ones were used to collect quantitative data.

The questionnaire was divided into five sections. The first section sought to collect demographic information about the respondent, the second section collected information about project management skills of the community borehole water management committee members, and the third sections collected information on social factors influencing sustainability of community managed borehole water projects. The fourth section of the questionnaire collected information on technical support water management committees were receiving while the fifth and last section of the questionnaire collected information on recommendations made by the respondents.

### **3.5.1 Piloting the Research Instruments**

Conducting of a preliminary research before embarking on the core study is what is referred to as piloting, prior to the main study. The benefit therein is that it provides the basis for reflection and informed way of making necessary adjustments to the research tools, design, logistical arrangements and addressing other emerging issues among other considerations (Michael and Fiona 2006). The tools used in this study were subjected to reviews by research supervisor plus other significant others and thereafter pre-tested on a lesser sample of respondents who had similar characteristics of sampled study respondents.

According to Mugenda and Mugenda (1999) sample for pilot exercise need to be 1 to 10% of established study sample however this may depend on the sample size of the study. In this study fifteen questionnaires were given out for the purpose of pilot testing. Six were for executive members and nine were for non-executive borehole water project committee members. This was done in Kitui west sub-county which is a different sub county from where the research was conducted.

### 3.5.2 Validity of the Research Instruments

Joppe (2000) describes validity as the factor in research which defines whether indeed the research study was capable of measuring what was intended to measure or in what way the results of the study are reflective of the truth. The study supervisor reviewed the research instruments to ensure content validity. This was to ensure the instruments were detailed and structured in a way that facilitates collection of data which can lead to logical conclusion once analysed actually representing the topic under study. In adherence with validity requirements in a scientific study, the researcher used conventional ways of sampling methodology and emphasised on accurate sampling for impartial depiction and appropriate data organisation techniques. Piloting of data collection instruments was done before actual data collection so that adjustments could be made to improve on accuracy of data collection tools. To ensure authenticity and accuracy, triangulation was done through cross checking the generated information with other sources such as secondary data already available in Kitui South ministry of water office.

### 3.5.3 Reliability of Research Instruments

Joppe (2000) defined the degree to which findings remain consistent overtime as reliability. That is, if different methodology was employed, would the findings of a study be replicated? Split-half technique was used to determine the coefficient of internal consistency or reliability coefficient. Reliability coefficient expresses the relationship between scores of the same individual on the same instrument at two different times or between two parts of the same instrument. In this study, the research instruments were split into two subsets for each person in the pilot study, one consisting of odd and the other even numbered questions. The score of responses of all odd and even numbered questions in the pilot study were then computed and the correlation coefficient of the two scores calculated. A correlation coefficient was then computed. The guiding factor being if the correlation became greater than 0.8, it was to be described as strong, but if the correlation were to be less than 0.5 it would have then been described as weak. The calculations were done using Pearson (r) formula below;

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right) \left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Where

R=Pearson product moment correlation coefficient

Y=Score in odd number questionnaire items

X= score in even number questionnaire items

N= number of respondents

Spearman Brown Prophecy formula was then used to compensate for the reduction of the instruments to one half of the final length. The reliability coefficient (re) for the full length was given by the following formula:

$$Re = \frac{2r}{r-1}$$

r- 1

Where

r = Spearman Correlation coefficient between the two halves where the first half will be odd numbers and the second half will be even numbers.

re = the reliability co-efficient for the full length.

Statistical Program for Social Sciences (SPSS) was used to calculate the reliability coefficient of the research instrument (equal length Spearman-Brown coefficient).

### **3.6 Data Collection Procedure**

Data was collected after permission given to do so by the University of Nairobi and applying a permit from the National Commission for Science, Technology and Innovation (NACOSTI). Five research assistant were engaged to assist in data collection. The research assistants were taken through a training for them to understand the purpose of the study, familiarise themselves with research instruments and sensitised on research ethics which needed to be adhere to.

The research assistants were hired from Mutomo, Kanziko and Mutha wards because the questionnaires were administered face to face and as such the research assistants needed to be people who understood the local language and the geography of Kitui South Constituency especially the three wards where this study was conducted.

Data was collected using pre-coded questionnaires and interview guide administered by the researcher and the research assistants. Both primary and secondary data were collected using structured questionnaires and structured interview guide. Information from the key informants was obtained through the interview guide. Secondary data was collected from the department of Water resource management publications, department of social services, NGO project reports and published journals.

The questionnaire and the interview guide used in the study was developed and organised based on the research objectives. They were structured and divided into sections as per the research objectives detailing the project management's skills, social factors and technical support.

### **3.7 Data Analysis Techniques**

Data collected from the field must be cleaned, coded, key-punched into a computer and analysed (Mugenda and Mugenda 1999). Regression analysis and Chi square was used in analysing the collected data for this research. Regression was used to test the strength of association of the number of project management committee who had skills on project management and how well the water projects were managed. Chi square test was used to measure the difference between observed and expected borehole break downs in Kitui South sub-county.

This study used the Statistical Package for Social Sciences (SPSS) tool to process and analyse the collected data. SPSS was used because of its flexibility and it's proved ability in data analysis and it's conventionally accepted as data analysis tool for social research.

Both descriptive and inferential analysis were used to analyse data. Descriptive analysis were used to determine the mean and standard deviation while inferential analysis was used in determining correlations (Pearson's correlation). The study findings were summarised in form of tables to compare relationship between dependent and independent variables.

The formula below was used to test the hypothesis which were formulated in chapter one under section 1.6.

$$Z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

Where

$\bar{x}$  = sample mean

$\mu_0$  = hypothesized population mean

s = sample standard deviation

n = sample size

### **3.8 Ethical Considerations**

Research ethics were adhered to in the study by ensuring participation of respondents was voluntary, full disclosure to those who were involved in this study that the data collected was for academic purpose only. Measures were also put in place to ensure privacy and confidentiality of the study respondents. The researcher endeavoured to obtain informed consent from the respondents.

### **3.9 Operationalization of variables**

The rationale of operationalization of variables was to allow variables to be expressed in measurable terms. This made it possible for easy identification of each indicator that was to be measured for each variable and the measurement scale.

**Table 3.3: Summary of Operational Definition of Variables**

<b>Objective</b>	<b>Variable</b>	<b>Indicator</b>	<b>Measurement</b>	<b>Measurement Scale</b>	<b>Data Analysis</b>	<b>Tools of analysis</b>
General Objective: To analyze the factors influencing sustainability of community borehole water projects in Kitui South Sub county	<u>Dependent:</u> project sustainability	1. Adequacy of project managements skills	Number of project committee members with good project management skills	Ordinal	Descriptive	Mean
			Number of Social factors.	Nominal	Descriptive	Standard deviation Correlation
		2. Social factors influence	Number of project Committees receiving adequate technical support		Descriptive	Chi-square
		3 Adequacy of technical support				

<p>Specific objectives: To determine the extent to which Project Management skills influence sustainability of community managed borehole Water supply projects</p>	<p><u>Independent Variables:</u> i. Project management skills</p>	1. level of communication skills	Number of Committee members with good Communication skills	Nominal	Descriptive	Mean
		2.level of leadership skills	Proportion of project committee members with good leadership skills	Ordinal	Descriptive	Standard deviation
		3. Team management skills	.Number of project committee members who can manage teams Team well	Nominal	Descriptive	Chi-square
		4. Negotiation skills	Number of project committee members with capacity to negotiation.	Nominal	Descriptive	

		5. Ability to identify and mitigate project risks	Number of project management committee members who are able to identify and mitigate project risks	Nominal	Descriptive	
To determine the extent to which Social Factors influence sustainability of community managed borehole Water supply projects	<u>Independent</u> 2.Social factors	1. People priorities	Number of projects considering -People priorities	Nominal	Descriptive	Mean
		2. participation	Number of projects whose beneficiaries participated in their design and implementation	Ordinal	Descriptive	Standard deviation Chi-square
		3 Social inclusion in project implementation and management	Level of Social inclusion in project implementation and management -Number of persons with special needs	Ordinal	Descriptive	



			included in project management committees. -Gender composition of project management committees	Ordinal  Nominal	Descriptive  Descriptive	
To determine the extent to which Technical Support factors influence sustainability of community managed borehole Water supply projects	<u>Independent</u> 3.Availability and affordability of Technical support	1. Availability of technical expertise within the project area 2.Availability of spare parts, fixing & maintenance 3.Affordability of labor Fees charged by technicians	Number of project committees accessing technical support within the project area Number of project committees accessing spare parts within the project area Number of projects charged affordable labor fees for project maintenance	Nominal  Nominal  Nominal	Descriptive	Mean  Standard deviation  Chi-square

## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION

#### 4.1 Introduction

This chapter presents the data analysis, presentation, interpretation of the analysed data and discussions of the study findings on the factors influencing sustainability of community managed borehole water projects in Kitui South Sub County in Kenya. The presentation of the findings after the analysis were done are presented in tables.

#### 4.2 Questionnaire Response Rate

There were one hundred and fifty four questionnaires that were distributed to respondents as per the calculated sample. One hundred and forty seven questionnaires were filled and received back. While the target was to achieve one hundred percent return rate, this was not achieved.

**Table 4.1: Present the questionnaire return rate**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Returned	147	95.5
Not Returned	7	4.5
<b>Total</b>	<b>154</b>	<b>100</b>

Table 4.1 shows that 95.5% of the respondents completed the questionnaires. As such according to Mugenda and Mugenda (2003) and Salkind (2005), the study results are representative, reliable and acceptable.

**Table 4.2: Gender of respondents**

Community water project committee membership comprise of both male and female gender.

Respondents were asked to indicate their gender in the questionnaire.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Male	67	45.6
Female	80	54.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.2 shows that among the respondents interviewed sixty seven (67) representing 45.6% were men and eighty (80) representing 54.4% were women. This shows good composition of the elected community borehole water committee members. It meets the Constitution of Kenya requirement of at least one third of either gender.

**Table 4.3: Composition of the respondents**

Among the community water projects committee members, there are some who are elected to executive office holder positions such as the Chairperson, Secretary and Treasurer. The study undertook to find out who among the respondents were officer holders.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Yes	51	34.7
No	96	65.3
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.3 reveals that 34.7% of the respondents were holding official position and 65.3 were ordinary committee members who were not holding any official position. Since majority of the respondents did not hold any official position in the water committee and therefore were not involved in day to day running of the projects, this may have influenced the findings of project management committee members on project management skills.

**Table 4.4: Age of respondents**

Somebody age may have a relationship with his or her training, experience and exposure to life challenges. Respondents were requested to indicate which age bracket they were in.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
<20	12	8.2
21-40	36	24.5
41-60	84	57.1
61-80	15	10.2
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.4 demonstrates that among the respondents, 8.2% were less than twenty years, 24.5% were between 21-40 years, and those between the ages of 41-60 were the majority with 57.1% while senior citizens between 61-80 years were 10.2 %. This shows that water projects are mainly managed by committee members who are above youth age bracket.

**Table 4.5: Highest level of education of the respondents**

Respondents were requested to indicate their highest level of formal education.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Never attended school	2	1.4
Primary Level	59	40.1
Secondary Level	51	34.7
Collage Level	35	23.8
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.5 reveals that majority of the respondents comprising of 40.1% had only attended primary schools followed by those who had gone through secondary education forming 34.7%. Those who had gone through collage formed 23.8 % and only 1.4% of the respondents had never attended school. This means that community members were electing members of the community with limited post-secondary school formal training to manage community borehole water

projects. This may have affected the findings of this study due to some respondents not being able to fully understand the questions in the questionnaire so as to provide appropriate answers.

#### **4.3 Project Management Skills of borehole water committees in relation to sustainability of community borehole water projects**

The study sought to establish whether the people who were elected to manage community borehole water projects had adequate skills on project management to be able to sustainably manage community borehole water projects.

**Table 4.6: Committee understanding and ability to communicate to stakeholders their terms of reference**

The study attempted to find out whether the respondents were able to communicate to stakeholders their terms of reference as community water project committee member

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	14	9.5
Agree	68	46.3
Neutral	29	19.7
Disagree	34	23.1
Strongly Disagree	2	1.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

The research findings as shown in table 4.6 show that 55.8% of the community water project committee members understood the terms of reference of the water management committee while 24.5% of the respondents did not understand the terms of reference. The remaining 19.7% of the respondents could not tell whether they understood or not. This shows that 44.2% of the water project management committee members in Kitui South do not understand their terms of reference. Lack of full understanding of the terms of reference may hinder the project management committee to provide proper leadership in the water projects hence compromising their sustainability. Key informant interviews revealed that lack of understanding of terms of

reference of water project committees was a major source of conflict among project committee members and other stakeholders in the community.

**Table 4.7: Committee understanding and ability to communicate to stake holders the project scope**

The study attempted to find out whether the respondents were able to confidently communicate to other stake holders the project scope.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	7	4.8
Agree	73	49.7
Neutral	21	14.3
Disagree	44	29.9
Strongly Disagree	2	1.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.7 reveal that 54.5% of the water project management committee members in Kitui South understood and were able to communicate the project scope. 14.3% were neutral while the remaining 32.3 were not able communicate the project scope. Nearly half of the project committee members not being able to communicate the project scope indicate skill and knowledge gap that can compromise water projects being implemented and managed sustainably. Key informants interviews also revealed that majority of the project committee members were not interested in pre and post project implementations activities. This shows that project committee members had limited knowledge on projects cycle.

**Table 4.8: Committee capacity to properly handle official communication**

The study attempted to find out whether the respondents were able to properly handle official communication.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	9	6.1
Agree	82	55.8
Neutral	20	13.6
Disagree	32	21.8
Strongly Disagree	4	2.7
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.8 Shows that 61.9% of the respondents were confident that official communication of the water projects is properly handled and filed for future reference. Those who believed borehole water projects' information is not properly handled comprised 24.5% while 13.6% of the respondents remained neutral. Proper handling of official communication is very important in project management not only for audit purposes but making reference to old records to inform current and future decisions and actions. Key informants interviews revealed that there was no proper segregation of duties and therefore it was not clear whether the records were to be kept by the Chairperson or the secretary.

**Table 4.9: Committee Training on Leadership**

The study wanted to find out if the respondents had been trained on leadership and whether the training was adequate.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	16	10.9
Agree	71	48.3
Neutral	23	15.6
Disagree	30	20.4
Strongly Disagree	7	4.8
<b>Total</b>	<b>147</b>	<b>100.0</b>

As reflected in Table 4.9, the research findings showed that 59.2% of the community based borehole water project committee members received training on leadership. Some committee members comprising of 15.6% of the management committee could not tell whether they had received the training or not. 25.2% of the respondents indicated that they had not received leadership training. Lack of training on leadership limit the ability of those charged with the responsibility of leading others to act professionally. Projects which lack good leadership are likely not to be sustainable. Key informants interviews confirmed that majority trainings which had been conducted to water project committee members mainly focused on book keeping, minutes taking, filing and general financial management. Leadership training had not been prioritised.

**Table 4.10: Committee knowledge on delegation and team management**

The study gauged the respondents’ knowledge on delegation and team management.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	14	9.5
Agree	69	46.9
Neutral	22	15.0
Disagree	39	26.5
Strongly Disagree	3	2.0
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.10 shows that 56.4% of water project Committee members had leadership skills on delegation and team management. The results of the research also revealed that 28.5% of the respondents had no skills on delegation and team management while 15% of the respondents were not sure whether had the skills or not. Delegations and team management are essential skills which are desirable for all committee members of community water project management committee should have.



**Table 4.11: Water project committees’ negotiation skills**

The study wanted to find out of the respondents had negotiation skills.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	13	8.8
Agree	60	40.8
Neutral	28	19.0
Disagree	43	29.3
Strongly Disagree	3	2.0
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.11 demonstrate that 50.4 % of the community based borehole water supply projects committee members in Kitui South did not have negotiation skills. Only 49.6 of the respondents affirmed that they were skilled in negotiation. 19% of the respondents were neutral. Negotiation skills are critical in management especially when managing crisis in a project and during procurement of goods and services. This was further confirmed during key informant interviews when it was reported that negotiation skills is not part of the skills which are prioritised during committee trainings.

**Table 4.12: Water project committees risk management skills**

The study wanted to find out if the respondents had skills on project risk management.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	13	8.8
Agree	60	40.8
Neutral	28	19.0
Disagree	43	29.3
Strongly Disagree	3	2.0
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.12 shows that 49.6% percent of the water project management committee members had skills to help mitigate borehole water supply risks. While 19% of the respondents were not sure if they had the skills or not, 31.3% of the respondents reported not to have project risk management skills. Project whose risks are not mitigated on time are very likely not to be sustainable.

**Table 4.13: Project monitoring and evaluation**

The study intended to find out if community water projects were being properly monitored and evaluated.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	11	7.5
Agree	61	41.5
Neutral	21	14.3
Disagree	46	31.3
Strongly Disagree	8	5.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.13 reveal that only 49% of the respondents were confident that the water projects they are in charge of are properly monitored and evaluated. 35.7% of the respondents were convinced that their projects were not properly monitored and evaluated while 14.3% of the respondents were not sure about monitoring and evaluation of their projects. Weak capacity of project management committees to monitor is related to their weak capacity in risk mitigation as demonstrated in Table 4.12. Key informant interviews revealed that there were some water project committee members who were part of the ward and Sub- county joint project monitoring committee.

#### **Table 4.14: Committee members' personal organization**

The study attempted to find out if respondents considered personal organization as important aspect in leadership.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Strongly agree	12	8.2
Agree	66	44.9
Neutral	28	19.0
Disagree	36	24.5
Strongly Disagree	5	3.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.14 demonstrate that 53.1% of the project committee members managing community borehole water projects in Kitui South believe that personal organization in an important trait for a leader. Out of the remaining respondents, 27.9% did not believe personal organization is important while 19% did not state their position. Conviction in personal organization as a leader is important factor in project management especially when it comes to matters related to integrity and character.

#### **4.4 Hypothesis tests on Project Management Skills**

Hypothesis test was carried out to find out if project management skills as an independent variable had influence on sustainability of community borehole water projects which was the dependent variable. The null and alternative hypothesis were;

H0: Management skills have no influence on the sustainability of community based borehole water projects.

H1: Management skills influence sustainability of community based borehole water projects.

**Table 4:15: Chi-square test on Project Management Skills**

	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	6.981 <sup>a</sup>	1	.008
Continuity Correction <sup>b</sup>	6.061	1	.014
Likelihood Ratio	6.898	1	.009
Fisher's Exact Test			
Linear-by-Linear Association	6.933	1	.008
<b>N of Valid Cases</b>	<b>147</b>		

A chi-square test was performed and the results showed significant relationship between management skills and sustainability of community managed borehole water projects,  $X^2 (2, N = 147) = 6.98, p = 0.008$ . The obtained value was less than 0.05 hence the null hypothesis was rejected and alternative hypothesis accepted.

#### **4.5 Social Factors influencing sustainability of community borehole water projects in Kitui South**

The study sought to establish how social factors influence the sustainability of community borehole water projects in Kitui South Sub-County. The social factors considered in this study include; Community priorities, participation, Social inclusion and Gender and equity.

**Table 4.16: Community Priorities**

This refers to what community consider to be their top ranking development needs in their area.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Yes	77	52.4
No	70	47.6
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.16 demonstrates that 52.4% of the respondents were satisfied with the level at which community priorities are considered during inception, designing and implementation of the water projects. The remaining 47.6 % This means that there is need for deliberate efforts to be put by all water sector stakeholders to ensure community priorities a considered when funding and implementing community borehole water projects.

**Table 4.17: Community Participation**

This refers to the willingness of community members to take part in their community development activities.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Yes	67	45.6
No	80	54.4
Total	147	100.0

Table 4.17 shows that 45.6 % of the respondents believed that community members who form water users in the project catchment area participate in water project activities. Among the respondents 54.4 % believed that community members in the project catchment area did not participate in the project activities. This means that the number of community members who own the project is low making sustainability of the water project unlikely.

**Table 4.18: Reasons for non- participation of community members in project activities**

Reasons given by respondents for community non participation of community members in community water projects were as follows:

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Nepotism	28	19.0
Non-attendance of public meetings	34	23.1
leaders don't seek community views	16	10.9
others	1	.7
No responses	68	46.3
Total	147	100.0

Table 4.18 reveal that non- attendance to public meetings was cited as the main reason for non-participation at 23.1% followed by nepotism at 19% and leader’s not seeking community views at 10.9%. Sixty eight respondents comprising 46.3 % of the respondents did not respond to this question. These findings show there are underlying social factors which are making community members not to participate in the water projects within the area hence compromising the sustainability of these projects.

**Table 4.19: Social inclusion- equal opportunity to select project management committees’**

The purposes of considering this aspect in the study was to find out if social inclusion was considered in the selection of community water project committee members.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Yes	69	46.9
No	78	53.1
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.19 reveals that 53.1 % of the respondents were convinced that equal opportunity was not given to community members within the project area to democratically choose the project committee members. 46.9 % of the respondents were confident that all members of the community were given equal opportunity to choose their borehole water project committee’. Since the respondents were drawn from the borehole water management committee members this mean that majority of their colleagues in management committee. Key informants interviewed reported that wrangles resulting from mistrust between committee members were common in all the water projects. This lack of confidence with each other among the committee members dilute the spirit of team work and confidence to delegate duties. Projects which are managed by members of the management committee who lack team work are unlikely to be sustainable.

### **Table 4.20: Gender and equity**

The study intended to find out whether the respondents were satisfied with the way gender and equity issues were handled in the community water projects.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Very satisfactory	27	18.4
satisfactory	65	44.2
unsatisfactory	55	37.4
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.20 demonstrate that 62.6 % of the respondents were convinced that there was good representation of gender and equity in the manner the affairs of borehole water projects compared to smaller percentage of 37.4 percent of those who felt gender and equity was unsatisfactory. Nearly one third of the respondents being convinced there was no satisfactory gender representation and equity means there is need for more deliberate effort to lower this number.

### **4.6 Hypothesis test on Social Factors**

Hypothesis test was carried out to find out if social factors as independent variable had influence on sustainability of community borehole water projects which was the dependent variable. The null and alternative hypothesis were;

H0: Social factors do not have great influence on the sustainability of community based borehole water projects.

H1: Social factors have great influence on the sustainability of community based borehole water projects.

**Table 4.21: Chi-square test on social factors**

	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	13.015 <sup>a</sup>	1	.000
Continuity Correction <sup>b</sup>	11.603	1	.001
Likelihood Ratio	12.754	1	.000
Fisher's Exact Test			
Linear-by-Linear Association	12.926	1	.000
<b>No of Valid Cases</b>	<b>147</b>		

A chi-square test was performed and the results showed significant influence of social factors on sustainability of community managed borehole water projects,  $X^2(2, N = 147) = 13.02, p < 0.001$ . The obtained value was less than 0.05 hence the null hypothesis was rejected and alternative hypothesis accepted.

#### **4.7 Technical Support**

The study sought to establish whether the technical support that the water project committees receive was adequate to support sustainability of community water projects.

**Table 4.22: Community training on operation and maintenance**

This skill helps project committee members to know what to do when faced with technical challenges.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
yes	69	46.9
No	78	53.1
<b>Total</b>	<b>147</b>	<b>100.0</b>



Table 4.22 Show that 46.9 of the community borehole water project committee members interviewed received some training on project operations and maintenance. 53.1% of the project committee members had not received any training on project operations and maintenance. This shows majority of the project committee members were not knowledgeable on operation and maintenance which is an important component in project sustainability. Key informants interviewed confirmed that most of the trainings focused on book keeping and financial management. The few on site trainings on operation and maintenance mainly focused on a few project members and most of them had personal commitments which denied them enough time to support the water projects

**Table 4.23: Availability of technical expertise**

The study wanted to find out whether the project committee members are able to get spare parts for maintenance of the water projects.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
government water officers	68	46.3
private technicians	60	40.8
vendor who installed the borehole	19	12.9
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.23 shows that 46.3% of the respondents reported to be getting technical support from government officers. Private technicians came second at 40.8% while vendors who own the technology used at the borehole comprised only 12.9 %. This shows that water stakeholders should enhance the capacity of government officers and private technicians since they are the people who work with water committees to keep water projects in serviceable condition.

**Table 4.24: Adequacy of technical support received**

The study wanted to find out if the technical support provided was adequate to maintain the projects in serviceable condition.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Poor	59	40.1
Fair	67	45.6
Good	21	14.3
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.24 reveal that 14.3% of the respondents considered technical support provided to the water borehole projects as good. Nearly half of the respondents comprising of 45.6% reported that the technical support they received could be rated as average while 40.1 % or the respondents rated the technical support as 40.1%. Technical support must be adequate if the water projects are to be maintained in serviceable condition throughout the design period of the project for them to be sustainable. Two key informants from non-governmental organizations operating in Kitui South reported that it was common practice for water project committee members to frequently seek technical support from their organization. This was mainly resulting from failure of committee to get timely technical support from private and line ministry staff.

**Table 4.25: Availability of borehole spare parts**

For water projects to remain in service, the worn out parts have to be replaced. The study wanted to find out if spare parts were easily available within the project area.

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Yes	5	3.4
No	142	96.6
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.25 demonstrate that 96.6% of the respondents straggle to get spare parts for maintenance of community borehole water projects. Only 3.4% of the respondents reported that they were able to access borehole water projects spare parts readily. If those charged with the responsibility of managing water projects are not able to easily access spare parts, there is a big possibility of project not being sustainable.

**Table 4.26: Affordability of technical support**

The study intended to find out if community water projects were able to avoid the technical services they receive during maintenance of water projects.

<b>Responses</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	58	39.5
No	89	60.5
<b>Total</b>	<b>147</b>	<b>100.0</b>

Table 4.26 show that 60.5 % of the water community water project committees were stragglng to meet the labor fees charged by the technical persons of maintain their water projects. 39.5 % of the respondents were able to afford the labor fees churched by technicians used maintain the community water projects. Projects must be able to meet their operations costs for them to be sustainable. Interviews with key informants showed that there are no guidelines or regulations both at National or County level regulating how service providers should charge for services they render at community water projects. Lack of such regulations makes community water projects vulnerable to exploitation by service providers.

**4.8 Hypothesis test on technical support**

Hypothesis test was carried out to find out if technical support as an independent variable had influence on sustainability of community borehole water projects which was the dependent variable. The null and alternative hypothesis were;

H0: Technical support does not influence sustainability of community based borehole water projects

H1: Technical support significantly influence sustainability of community based borehole water project.

**Table 4.27: Chi-square test on technical support**

	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-Square	8.913 <sup>a</sup>	1	.003
Continuity Correction <sup>b</sup>	7.898	1	.005
Likelihood Ratio	8.873	1	.003
Fisher's Exact Test			
Linear-by-Linear Association	8.852	1	.003
<b>No. of Valid Cases</b>	<b>147</b>		

A chi-square test was performed and the results showed significant influence of technical support on sustainability of community managed borehole water projects,  $X^2(2, N = 147) = 8.91$ ,  $p=0.003$ . The obtained value was less than 0.05 hence the null hypothesis was rejected and alternative hypothesis accepted.

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS DISCUSSIONS AND CONCLUSIONS**

#### **5.1 Introduction**

This chapter provides a summary of findings, conclusion and recommendations based on the study findings.

#### **5.2 Summary of the Findings**

This section provides a summary of key findings from the study arranged per variable.

##### **5.2.1 Project management skills on sustainability of community borehole water projects in Kitui South**

The study findings showed that 59.2% of the community based borehole water project committee members received training on leadership and 55.8% of the community water project committee members understood the terms of reference of the water management committees. The study also established that 54.5% of the water project management committee members in Kitui South understood and were able to communicate the project scope. Concerning risk mitigation, 49.6% of the water project management committee members had skills to help mitigate project risks. In addition the study established that 56.4% of water project Committee members have leadership skills on delegation and team management. The study also established that 53.1% of the project committee members managing community borehole water projects in Kitui South believe that personal organization is an important trait for a leader. Although the study findings showed that majority of community borehole water project committee members in Kitui South rated slightly above average on majority of leadership competencies parameters, there is need for water stake holders in Kitui South to invest in building leadership competencies of those elected to manage community water projects.

##### **5.2.2 Social factors on sustainability of community borehole water projects in Kitui South**

The study found out that 52.4% of the respondents were satisfied with the level at which community priorities are considered during inception, designing and implementation of the water projects. On participation, the study found out that 45.6 % of the respondents believed that

community members who form water users' membership in the project catchment area participate in water project activities. In relation to social inclusion the study established that 53.1 % of the respondents were convinced that equal opportunity was not given to community members within the project area to democratically choose the project committee members. Regarding gender and equity, 62.6 % of the respondents were convinced that there was good representation of gender and equity in the manner the affairs of community borehole water projects were conducted. Going by the study findings, participation and social inclusion were areas that were found to have more than half of the respondents dissatisfied. It is therefore desirable for all water sector stake holders in Kitui South to put more efforts to increase community participation and social inclusion in all aspects of community based borehole water projects for sustainability of community water projects.

### **5.2.3 Technical support on sustainability of community borehole water projects in Kitui South**

The study established that 46.9% of the community borehole water project committee members interviewed received some training on project operations and maintenance. Concerning availability of expertise, 46.3% of the respondents reported to be getting technical support from government officers. Private technicians came second at 40.8% while vendors who own the technology used at the borehole comprised 12.9 %. On availability of spare parts, only 3.4% of the respondents reported that they were able to access borehole water projects spare parts easily. Regarding affordability of the spare parts 60.5 % of the water community water project committees were straggling to meet the labor fees charged by the technical persons.

### **5.3 Discussion of the study findings**

This section of the report provides a summary that compares the study findings to the existing body of knowledge in the area under study.

### **5.3.1 Project management skills on sustainability of community borehole water projects in Kitui South**

The study established that 59.2% of the community based borehole water project committee members received training on leadership and 55.8% of the community water project committee members understood the terms of reference of the water management committees. The study findings agree with Susane M. (2014) who according to her study findings projects failure result from vague scope and success benchmarks, absence of sound strategy, lack of change management expertise, unrealistic estimation, insufficient risk management, and lack of acceptance and consistent follow-up by project sponsors. The study findings further agree with the finding of a study conducted by Sendlove (2007) who according to his study findings, leaders who have higher competencies in the core areas are likely to be effective and competency can be gained through education, training and experience. The results are also consistent with findings of Rossane L. (2016), that bad leadership, inadequate documentation, inexperienced project managers, poor communication skills social economic factors and poor risk management are the factors which influence project success or failure.

### **5.3.2 Social factors on sustainability of community borehole water projects in Kitui South**

The study found out that 52.4% of the respondents were satisfied with the level at which community priorities are considered during inception, designing and implementation of the water projects. On participation, the study found out that 45.6 % of the respondents believed that community members who form water users' membership in the project catchment area participate in water project activities. The study findings agree with Depledge and Rai (2007) that good comprehension of factor relations at various levels would succor managers and other team leads in enabling proper group collaborations that result in enablement of project teams. By considering significance of social factors starting from individual level, three parameters are predominantly relevant. These are control, confidence and conscientiousness. These parameters are vital as they appraise how that particular individual conduct him/herself in a group setup in three dimensions: the person's willingness to interrelate and follow directives, the person's sagacity of self-efficacy and aptitude to overcome traditional stabling blocks and judgement to participate and the person's sagacity of duty to accomplish duties.

### **5.3.3 Technical support on sustainability of community borehole water projects in Kitui South**

The study established that 46.9% of the community borehole water project committee members interviewed received some training on project operations and maintenance. This agrees with findings of Markwel (2009) who according to his research findings, technical skills influence new methods of handling current and past things, and dealing with emerging as well as old glitches, this does not always call for use of technical paraphernalia – it can be just innovative ways of discerning or organizing. It's also consistent with study findings of Iles and Sutherland (2001) who stated that knowledge on technical skills has impact on developing technologies, diminishing cost of communication as well as augmented remote operations, research and development undertakings.

### **5.4 Conclusions**

The purpose of the study was to assess the factors influencing sustainability of community based borehole water projects. The study results showed that Project management skills, Social factors and Technical support have significant influence on sustainability of community managed borehole water projects. The study also established that sustainability of community water projects requires concerted efforts of not only stakeholders in water sector but all players involved in community development work. Community participation, gender and social inclusion are overarching factors with potential of ripple effect which can positively impact community development in other sectors. To meaningfully build the capacity of committees managing community water projects for them to develop desired competencies in project management, the government should develop a curriculum to be followed by all stakeholders involved in community development.

### **5.5 Recommendations**

This section provides recommendations to the policy makers for improvement and suggestions for future research work based on the findings and conclusions generated from the study.



### **5.5.1 Recommendations to Policy makers**

Based on the findings of the study, it is recommended that:

- a) The ministry of water and the ministry of social services should factor in their annual budgets capacity building funds for committees managing community based water project committees to enhance sustainability of these projects.
- b) Since water and sewerage services are devolved to County Governments, the County Governments should come up with regulations guiding how service providers should charge for the services they render to community water projects. This will cushion community projects from exploitation by unscrupulous service providers.
- c) It is recommended that choice of technology to be used in community water projects, be based on maintenance cost, availability of spare parts and technical expertise required for maintenance of the water project. This should be regulated by the ministry in charge of water resources.

### **5.5.2 Recommendations for further research**

Based on the findings of this study, further research is recommended in the following areas:

- a) Conduct research on the effectiveness of the existing policy guidelines regulating operations of community based water projects in Kenya and give appropriate recommendations
- b) Carryout research on various technologies being deployed in community based borehole water projects and make recommendations on the most appropriate technologies for rural community water projects.
- c) Conduct research on factors that hinder social inclusion in management of community water resources in Kenya.

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## APPENDICIES

### Appendix 1: Letter of Transmittal of Data Collection Instruments

Letters to research participants

Gershon M. Mwakazi

P.O.BOX 662-80300

Voi.

Dear Respondent,

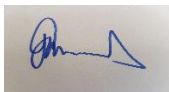
RE: An assessment of the factors influencing sustainability of community managed boreholes water supply in Kitui south sub- county.

I am a postgraduate student at the University of Nairobi pursuing a Master of Arts degree in Project Planning and Management. I am currently undertaking a research project on the factors that influence sustainability of community managed boreholes water supply in Kitui South Sub County- Kitui County.

The purpose of this letter is to inform you that you have been selected to participate in the study. As such, I hereby request you to provide data through the questionnaire that will be administered to you.

Your identity will remain confidential and the data provided will be used for academic purposes only.

Yours faithfully,



Gershon M. Mwakazi

**L50/51869/2014**

## Appendix II: Questionnaire

This questionnaire has five sections (A-E) and 48 questions. You are kindly requested to answer all the questions. If you tick 'other' as your answer please specify your answer in the space provided.

### A. Demographic Characteristics

1. Please indicate your gender M ( ) F ( )

2. Please indicate your age group

- (a) Below 20 years
- (b) 21-40 years
- (c) 41-60 years
- (d) 61-80 year
- (e) Over 81 years

3. What is your marital status?

- (a) Married
- (b) Single
- (c) Divorced
- (c) Others

(Specify).....

4. Please indicate the highest level of education attained

- (a) Never attended school
- (b) Primary level
- (c) Secondary level
- (d) College level

5. Are you an official in the committee?

- (a) Yes
- (b) No



## B. Project Management Skills

Ref	Statement	1.Strongly agree	2.Agree	3.Neutral	4.disagree	5.Strongly disagree
6	I clearly understand the terms of reference of our water project committee					
6	As a member of borehole water project management committee I can clearly communicate the scope of the project					
7	I can clearly communicate to others all project phases of our borehole water project					
8	I have received adequate leadership training to fully support realization of our project objectives					
9	As a member of borehole water project I clearly understand who is responsible for the realization of project objectives					

10	Our borehole water project management committee has put measures in place to mitigate project risks					
11	We have guidelines in place for project organization and quality assurance					
12	I'm convinced processes related to the borehole water project meet the needs of all stakeholders					
13	Our borehole water project progress is properly monitored and evaluated					
14	We have a clear approval process for key decisions made regarding the borehole water project					
15	Our Project objectives reflect priorities for majority of the Project members					
16	I believe personal organization is important in leadership					

17	As Project management committee, we consults relevant stake holders before making key decisions concerning the borehole water project					
18	As Project management committee, we negotiate for better prices when procuring goods and services for the water project					
19	I provide leadership based on approved policies and guidelines					
20	Our project information is properly filed for future reference?					
21	We update our project plans regularly and ensure project members are informed of the key changes/adjustments made					

**C. Social Factors**

22. Are you aware of any community borehole water projects that are well implemented in your community?

- (a) Yes
- (b) No

23. If yes, who made the most contribution to the successful implementation of the community borehole/s water projects?

- (a) Community members
- (b) Community leaders
- (c) Project Committee
- (d) GoK Staff
- (e) Non state actor's staff
- (f) Other (Please specify)

.....

24. How would you rate the level at which community members are involved in the affairs of the community bore hole water project?

- (a) Poor
- (b) Fair
- (c) Good
- (d) Excellent

25. Were all members of this community given opportunity to participate in the conception and design of the community borehole water project/s?

- (a) Yes
- (b) No

26. If yes, how would you rate the level of their participation in the inception and design of the borehole water projects?

- (a) Poor
- (b) Fair
- (d) Good
- (e) Excellent

27. If No, what could be the reasons for non-participation of all community members?

- (a) Nepotism
- (b) Community members don't Attend public meetings
- (c) Community views are Normally not sought by our leaders
- d) Other (Please specify)

.....

28. Did the members of the community participate in the implementation of the water projects?

- (a) Yes
- (b) No

29. If yes, what is your assessment of the level of their participation in the implementation of the Project?

- (a) Poor
- (b) Fair
- (c) Good
- (d) Excellent

30. In your opinion, do you think that community suggestions/ contributions influenced decisions made concerning inception, design and implementation of water projects?

(a) Yes

(b) No

31. Do community members make any form of contributions either in kind or cash for implementation and maintenance of water projects?

(a) Yes

(b) No

32. How is the management of the resources generated from the borehole water project by project management committees?

(a) Poor

(b) Fair

(c) Good

(d) Excellent

33. Are all members of the community given equal opportunity to select management committees of the borehole management committee?

(a) Yes

(b) No

34. In your opinion, what is the level of women, youth and people who are physically challenged representation in the membership in the management of the community borehole water projects?

(a) Very satisfactory

(b) Satisfactory

(c) Un satisfactory

35. Is there a community borehole water project that you are aware in your community that operated well for some time then later on failed?

(a) Yes

(b) No

36. If yes, what are the reasons for the failure? Explain.

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.....

**D. Technical support**

37. Were any members of the community trained on operation, maintenance and management of borehole water systems?

(a) Yes

(b) No

38. Since inception of the borehole water project how many trainings have you received on operation and maintenance of water systems?

(a) 1-5

(b) 6-10

(c) >10

39. Would you consider the kind of technical training received adequate?

(a) Yes

(b) No

40. If you have been trained in operation and maintenance of the borehole water systems, how do you rate the effectiveness of the training?

- (a) Poor
- (b) Fair
- (c) Good
- (d) Excellent

41. Are those trained members of your water committee involved in the day to day operation and maintenance of the borehole water projects?

- (a) Yes
- (b) No

42. If No, why?

- (a) Lack of the technical skills
- (b) Donors responsible for maintenance
- (c) Government responsible for maintenance
- (d) Technology vendor is responsible for maintenance

Any other (specify).....

43. Do you get external technical support?

- (a) Yes
- (b) No

44. If yes, from where?

- (a) Government water officers
- (b) Private technicians
- (c) Vendor who installed the borehole
- (d) Other (Specify)

.....



45. Is your water project able to meet the labor cost for maintenance comfortably?

- (a) Yes
- (b) No

46. Are the spare parts for borehole components readily available?

- (a) Yes
- (b) No

47. In your opinion, how would you rate the level of technical support you receive?

- (a) Poor
- (b) Fair
- (c) Good
- (d) Excellent

Give reasons for your answer

.....

.....

.....

**E. Sustainability**

In your assessment can the project run without external assistance for the next 10 years?

- (a) Yes
- (b) No

**F. Recommendations**

48. What are your recommendations in order to have sustainable water projects?

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*Thank You*

## **Appendix III: Key Informant Interview guide**

### **Introductory Remarks**

I am Gershon M Mwakazi, a student at the University of Nairobi, School of Continuing and Distance Education. I am currently undertaking my research project as a requirement for award of the degree of Masters of Arts in Project Planning and Management. The study is on the factors that influence sustainability of community managed boreholes water supply in Kitui South Sub **County**.

The findings and recommendations of the study will contribute to the knowledge base in the water and community development sectors. For this purpose, I'm collecting data that will assist in accomplishing the objectives of this study. Kindly answer the questions in the questionnaire by ticking and/or explaining. Your contribution will be much appreciated and the information provided will be handled with total confidentiality.

### **A. Respondent's details**

1. Position of respondent \_\_\_\_\_

## B. Project Management Skills

This section has ten questions. Please provide answers to all the questions.

On a scale of 1 to 5 (where 1 is the lowest scale at the poorest and 5 is the highest scale at the best) how do you rate the performance of borehole water management committees in Kitui South sub-county in relation to project management approaches? (Tick appropriately)

Practice	Scale				
	5	4	3	2	1
1. Water management committees have received adequate training on project management.					
2. Water Management Committees clearly understand the terms of references in relation to the office they hold					
3. Water management committees have necessary financial and human resources skills					
4. Leadership competencies is one of key considerations when electing borehole water management committees					
5. Water management committees have necessary Design Monitoring and Evaluation (DME) skills					
6. Water management committees have adequate communication and record keeping skills					
7. Water management committees have necessary negotiation skills					
8. There is clear understanding of roles of all project team members					
9. Water management committees are able to predict and mitigate project risks					
10. Elected members of water management committees are people of high standing in the community					

### **C. Social Factors**

11. Are the community borehole water projects addressing unmet water needs of the people of Kitui South?
12. If the borehole water projects are properly managed, will this contribute to reduced water resource related conflicts, water related health issues and school absenteeism in Kitui South Sub-County?
13. What type of support do the community managed water project committees look for from the organization/government?
14. What contribution, if any, do project beneficiaries make to support sustainability of the community borehole water projects?
15. Before deciding on the project type and site, are the community beneficiaries supported to build consensus on the same?
16. When determining the project beneficiaries, are women and other marginalized people involved?
17. Are environmental impact assessments conducted before implementing the projects?
18. Do these projects influence gender relations in any way?
19. What measures are put in place to ensure communities are able to sustain the community borehole water projects before the organization/government stops providing financial and other support?
20. What level of organization exists in the community that supports sustainability of community borehole water projects?

### **D. Technical skills**

21. What factors do you consider before deciding on the technology to be deployed on community water projects?
22. Does your organization/ Government have enough trained personnel to provide technical backstopping for all borehole water projects implemented in Kitui South Sub County?
23. Are the spare parts for the water abstraction technologies installed in the boreholes readily available within Kitui County?
24. What alternative is there for the community members when they are not able to get technical services from Government line ministry staff or non- governmental technical staff?

**E. Government Policies**

25. How effective are the existing government policies in sustaining community borehole water projects?

26. Since the time water resources management becomes a devolved function, has the County Government of Kitui Come up with County guidelines on management of water resources?

27. If yes, in your opinion, how effective are these policies and guidelines in supporting sustainability of community managed boreholes water supply?

28. Was there adequate citizen’s participation in the drafting and validating these water policies and guidelines?

29. Are there adequate government water officers to enforce the policies and guidelines at the grass roots?

**F. Sustainability**

In your assessment can the project run without external assistance for the next 10 years?

**G. Recommendations**

What are your recommendations for enhancing sustainability of community managed borehole water supply projects?

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.....  
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**Appendix IV: List of Water Projects with Water Management Committees in Kitui South Sub-County**

<b>S/No</b>	<b>Project</b>
1	Kithini 1 Borehole Project
2	River Athi Borehole Project
3	Kawandei Borehole
4	Kilisa Borehole
5	Mivuni/Kaliani Borehole
6	Ngingani Borehole
7	Masaa Shallow Borehole
8	Kituvwi Borehole
9	Mukolosoni Borehole
10	Ikanga Borehole
11	Ndii borehole
12	Iengi Borehole
13	Mwangeni Borehole
14	Kituvui borehole
15	Kamutei Borehole
16	Ikutha Borehole
17	Uae Borehole
18	Yongela borehole
19	Kavoo borehole

**Source: Water and Agriculture office, Kitui South**