STRATEGIES OF WATER RESOURCE USERS ASSOCIATIONS IN PROMOTING SUSTAINABLE WATER PROJECTS: A CASE OF TANA CATCHMENT AREA, KENYA

KIRIMI LILIAN MUKIRI MWORIA

A Thesis Submitted to the Graduate School in Partial Fulfillment of the Requirements for the Award of Degree of Doctor of Philosophy in Community Development of Chuka University

CHUKA UNIVERSITY

SEPTEMBER, 2019

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented for an award of diploma or degree in this or any other University.

Signature _____ Date 12-9-2019

Kirimi Lilian Mukiri Mworia
AD20/28955/16

Recommendations

This thesis has been examined, passed and submitted with our approval as the University supervisors.

Signature _____ Date 12/9/19

Dr. Anne Sande, Ph.D
Chuka University

Signature _____ Date 12-9-2019

Dr. Christopher Kiboro, Ph.D
Chuka University

DEDICATION

This thesis is dedicated to my parents Mr. Geoffrey Kirimi Itania and Mrs. Jeniffer Kirimi who built a strong foundation for my life and always believed in me.

ACKNOWLEDGEMENT

I wish to express my appreciation to my supervisors, Dr. Anne Sande and Dr. Christopher Kiboro for their academic guidance, professional advice and overwhelming moral support. I also acknowledge the invaluable contribution and inputs of Dr. Simon Rukangu and Dr. Stephen Karanja who guided me through this study. In particular, I appreciate the support from Prof. Gitonga Mburugu, Prof. Alfred Mutema and Prof. Peter Masinde for encouraging me to complete my studies.

In a very special way, I also thank my siblings Naitore, Mureti and Kanana for giving me unwavering support throughout my study. Post humously, I would like to thank my late brother Steve, who consistently encouraged me to study. I appreciate the support of Paul Mworia Bagine for making me value education. I also thank Mwiti Murugu and Catherine Mwiti for consistently supporting me. I also acknowledge the support offered to me by Mrs. Millicent Karithi, James Maina, Margret Wawia and Kathini Mitau, officers from Water Resource Authority, for their support.

I thank my colleagues in the Examination Department at Meru University of Science and Technology, namely: Antony Irungu, Silvia Kinyamu, Karen Kimathi, Benson Murithi and Rose Gakii, for enabling me to balance work and personal life, and for taking up my responsibilities from time to time during my study. I thank Dr. Eric Mworia, Mrs Susan Kirema and Karimi Mbugua who encouraged me to persevere in my studies. I appreciate Dr. Kirema Nkanata Mburugu for being a pace setter and role model.

I am indebted to Dr. Florah Mutwiri for providing very constructive comments that improved my work. I appreciate Mr. Dennis Mhuri for guiding me through the vigorous data analysis. I also appreciate Watene Munenge for taking time to edit my work. To my valuable, supportive, generous friends Ruth Gibendi and Col. John Gatobu, I thank God for you.

ABSTRACT

Sustainability of Water Supply initiatives have been launched around the world with the aim of managing water resources. In Kenya, the enactment of the Water Act 2002 and its subsequent revision in 2016, introduced the involvement of Water Resource Users Associations (WRUAs) in water resource management in the Tana Catchment Area. The WRUAs are community based associations for collective management of water resources and resolution of conflicts concerning use within a river basin. Information from the Water Resource Authority show that although WRUAs have been in existence for a long time, equitable water distribution has not been achieved in rural areas and water flow in the river basins shows decreasing trends. Previous studies conducted on water in Tana Catchment Area mainly examined water governance, water utilization and participation of users but did not focus on the effectiveness of strategies used by WRUAs in the promotion of sustainable water projects. This study sought to assess the strategies used by WRUAs in promoting sustainable water projects. Specific objectives of the study examined the relationship between resource mobilization strategies, infrastructure maintenance strategies, conflict management strategies, and catchment management strategies in promoting sustainable water projects. The study also examined the moderating effect of institutional support on the relationship between WRUA strategies and the sustainability of water projects. Five hypotheses in line with the five specific objectives were tested to determine the relation between the variables. The theoretical framework to guide the study were: the theory of common pool resource management and institutional analytical framework. The study used convergent research design and mixed methods approach to conduct the study. A sample of 377 respondents comprising of 5 officers of the Water Resource Authority, 48 WRUA committee members and 324 water users were selected using cluster, purposive and random sampling techniques. Questionnaires and interview schedule were used in data collection. Cronbach's Alpha Co-efficient test of reliability from 0.621 to 0.901 was applied for all variables. The data obtained was analyzed with descriptive and inferential statistics aided with Statistical Package for Social Sciences (SPSS version 19.0). Chi-square test for independence was used to determine the significance of relationship between each WRUA strategy and sustainability of water projects. Binary logistic regression models constructed at a 5 % level of significance was used for testing the moderation effect of institutional support. The study's findings revealed that there was a significant association between three WRUA strategies (resource mobilization, infrastructure maintenance and conflict management) and sustainability of water projects. Water catchment management strategy was found to be insignificantly associated with sustainability of water projects. Institution support had a positive significant moderation effect on the relationship between water catchment management and sustainability of water projects. These study concludes that WRUA strategies should be adequately implemented to augment the sustainability of water projects. The study recommended that WRUAs should leverage on mobilizing support from all stakeholders to mobilize resources in order to promote sustainable water projects.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

BWRC	Basin Water Resources Committees
CPR	Common Pool Resources
GoK	Government of Kenya
MWI	Ministry of Water and Irrigation
JICA	Japan International Cooperation Agency
NEMA	National Environment Management Authority
SCMP	Sub-Catchment Management Plans
SDG	Sustainable Development Goal(s)
SPSS	Statistical Package for Social Sciences
TARDA	Tana and Athi Rivers Water Development Authority
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	US dollar
WASREB	Water Services Regulatory Board
WCED	World Commission on Environment and Development
WHO	World Health Organization
WRMA	Water Resource Management Authority
WRUA	Water Resources Users Association
WSFT	Water Sector Trust Fund
M and E	Monitoring and Evaluation

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Sustainable development refers to development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (Scoones, 2010). Designing and executing interventions that are sustainable is key to realizing sustainable development (Hagen, 2002). One of the significant measures to promote sustainable development and reduce poverty is to promote universal access and the use of clean water and sanitation (United Nations Children's Fund, 2008). However, the amount and quality of water has been decreasing over time. Sustainable access to safe water is an indicator of health status and the well-being of people in a given society (United Nations, 2009; Ifejike, 2018; Klug, 2019).
At the global level, changes in land use, demographic changes, urbanization, and misuse of water, among other factors, contribute to the decreasing levels of water in streams and lakes (Shivoga, Muchiri, Kibichi, Odanga, Miller, Baldyga,& Gichaba, 2007). Water scarcity at all levels contributes to conflicts between communities due to competition for water. This shows the need to initiate strategies that address equitably shared water issues.

In order to enhance sustainability of shared water resources, initiatives have been launched around the world that aimed at managing this important natural resource (World Bank, 2008). Many rivers of the world such as in South Asia, Turkey and Africa no longer reach the ocean and initiatives put in place to revive them have resulted in mixed performance (Croswell, 2015). Initiatives from Turkey, South Asia and South Africa not only show challenges of water availability, quantity and quality but also the need for improving performance and sustainability of water projects. Kloezen (2002) found out that the introduction of WRUAs in water management dramatically boosted cost recovery and achieved the policy goal of reducing dependence on the state in Mexico. However, assessment of water institutional performance by Mukherji, Fuleki, Shah, Suhardiman, Giordano & Weligamage (2009) in India, established that water scarcity, whether in quantity, quality or both, originated from inefficient use and poor management. The analysis of the studies in India and Mexico show the importance of incorporating WRUAs in water

management that could lead to cost recovery and equitable water allocation as well as reduce dependence on state.

In Africa, the concept of WRUAs has gained popularity in the last two decades owing to the need for initiating measures aimed at achieving Sustainable Development Goals (SDGs). The 6th SDG on clean water and sanitation states that "ensuring universal access to safe and affordable drinking water by 2030 requires investment in adequate infrastructure and protection of water related ecosystems to mitigate against water scarcity" (UNDP,2006,pg 104). In the 1990s, water supply and management was the responsibility of central governments in Africa. Water systems were characterized by unsatisfactory operation, poor maintenance of physical infrastructure, lack of equitable water allocations, and dissatisfied users (Mehta, Fugelsnes & Virjee, 2005).

A common perception of the causes of the water management problem at the time was that water systems had been designed with no consideration of involvement of users in the aspects of water management (Whittington, Davis, Komives, Thorsten, Lukacs, Bakalian, & Wakeman *et al.,* 2008). The water problems led to decentralization of water systems from state controlled water supply to demand-oriented water supply which included users in water resources management (UN, 2003). Incorporation of users in water management alone may not be a guarantee of continued service delivery, resolved conflict and infrastructure maintenance or technology uptake. Sustainability of projects require support from all stakeholders and government in planning for supply options that users are able and willing to operate and maintain.

Whittington, *et al.,* (2008) studied decentralized water projects in Ghana that were operated by WRUAs and found out that 89-95 percent of the water projects were functioning four or more years after construction. As government support continued to be withdrawn, WRUAs faced challenges in raising enough resources necessary for construction of water intakes and maintenance of water point sources. The study recommended capital contribution by users, determination of how contributions would be paid (in cash or in kind) and a means of determining what percentage was reasonable for operating sustainable projects. However, a study carried out by Reis & Mollinga, (2009) in Vietnam found out that households in the rural areas were

unwilling to contribute to water management because they had prohibitively low monthly earnings of 500,000–5,000,000 VND. In Sudan, funds collected for Operation and Management (O&M) from users was also found to be insufficient as the fees paid (USD 12 per ha. per year) was considered too low (Bashir, *et al.*, 2012). Thus, the studies in Vietnam and Sudan show that financial contributions to capital or recurrent expenditure by users were either insufficient or unaffordable and the Communities expected subsidies from the government (Bashir *et al.*,2012). Contributions by users, whether in cash or in kind, would be used to repair broken water pipes to reduce leakage, rehabilitate water intakes to keep water free from contamination by livestock, and construct water tanks to ease water distribution, management and sustainability problems.

Kerr, Pangare & Pangare (2002) in India established that in order to enhance water flows and ease water management problems, external technical support needs to be available to help communities continuously maintain water flows in the rivers and monitor water system performance. External Technical capacity needed by WRUAs for repairs and rehabilitation of water intakes would depend on the availability and type of equipment for operating the water systems. People would be trained to not only operate equipment and construct the water system but also protect water sources, riparian plains and catchment areas (Katz & Sara, 1998, WRMA, 2005). Soil erosion and environmental degradation could be caused by destruction of swamps, springs, encroachment of riverbanks and planting of non-water friendly trees near the river banks. The rivers dry up, especially under drought conditions, due to over-abstraction which could be reduced by implementation of river regulations, protection of catchment areas and environmental conservation (Al-Mohannad, 2003; WRMA, 2005).

Environmental conservation and protection of catchment areas would require user participation in surveillance of illegal abstraction, protection of water point sources, riparian plains and planting vegetation for protection of water sources which are prone to soil erosion. However, in Sudan, Kolavalli & Brewer (1999) reported that users indicated that the rules and regulations for water abstraction and allocation did not have sufficient punitive punishments for defaulters. Protection of water point sources,

water abstraction control and water allocation plans may result in the easing of pressure on water flows and decrease competition for the water by users which initiates conflicts that require effective interventions (Kabogo, Anderson, Hyera, & Kajanja, 2017; UNDP, 2006). For reduction of conflicts and sustainability of water volumes in rivers to be maintained, managed and equitably distributed, internal structures need to be established and regulations formulated and implemented to control water use (Asante, 2010).

An effective intervention is a measure of how well the outcomes of a project meet the desired targets (Ul Hassan, Qureshi & Heydari, 2007) .WRUAs set targets, budgets, plan activities, identify priorities in order to improve water resource management with support from Water Resources Authority (WRA) within a period of 1 to 5 years (WRMA, 2013). The Water Sector Trust Fund (WSTF) may provide financial support through conditional or unconditional grants for WRUAs to implement their intervention plans (GOK, 2016). For intervention plans to be implemented, WRUAs with support of WRA carry out regular monitoring of intervention activities and evaluate whether the desired objectives are met (Mumma, Lane, Kairu, Tuinhof, & Hirji, 2011). However, WRUAs in Kenya are often managed by committee members who may not have formal skills in either monitoring or evaluation practices (World Bank, 2002; JICA, 2013; Njonjo & Lane, 2002). Insufficient skills in monitoring or evaluation may lead to failure of implementation of planned intervention activities. WRUAs with unskilled managers would require training in monitoring and evaluation among other managerial skills for water resource management.

NEMA (2003) and Agwata (2005) revealed that the Tana catchment area was vulnerable to degradation, due to destruction of swamps and springs, planting of tree species that use lots of water and encroachment of river basins which increase drought and floods. As of 2010, water use in Athi and Tana catchment areas had already exceeded environmentally sustainable limits by a 6% margin (JICA, 2013). These arguments show river basins in the Tana Catchment Area have been destroyed to the extent that effective long-term and short-term interventions are required for sustainability to be achieved. WRUAs are a central component in the established framework that defines how water is sustainably managed at the river basin level

(GoK, 2016). There are 56 WRUAs in Tana Catchment Area which mobilize resources and receive grants from the Kenya Water Trust Fund and other agencies to enhance water resource management. By use of mobilized resources WRUAs may prepare and implement strategies and interventions for sustainable water management in river basins. This study is designed to assess strategies used by WRUAs in the promotion of sustainable water projects in the Tana Catchment Area, Kenya.

1.2 Statement of the Problem

Medium Term Plans for Vision 2030, recognize that Kenya's Availability of Fresh Water Resources Index estimated at 1093 m3/capita/year in 2010 could decline to 586 m3/capita/year by 2025 unless effective strategies to address the issues are implemented. Diverse water use activities could either lead to drying up of water sources or increase soil erosion in the uplands and siltation in the lowlands. Tarigan, 2016; Langar, Kumar &Koech, (2018) found out that the Tana catchment experiences frequent water shortage, altered surface run-offs and water yields due to increased land use and cover transformation over years. Such activities could reduce water flows in rivers and cause competition for water among users. Although various initiatives have been launched to enhance public participation and management of water resources through WRUAs, water levels in rivers show decreasing trends. Thus the need to assess the relationship between WRUA strategies and promotion of sustainable water projects in Tana Catchment Area, Kenya which is the concern of this study.

1.3 Purpose of the Study

The purpose of the study was to assess the relationship between strategies used by Water Resources Users Associations (WRUAs) and promotion of sustainable water projects in the Tana Catchment Area, Kenya.

1.4 Objectives of the Study

The following were the specific objectives of the study:

i) To examine the relationship between resource mobilization strategies and promotion of sustainable water projects in the Tana Catchment Area, Kenya.

ii) To assess the relationship between infrastructure maintenance strategies and promotion of sustainable water projects in Tana Catchment Area, Kenya.

iii) To establish the relationship between conflict management strategies and promotion of sustainable water projects in Tana Catchment Area, Kenya.

iv) To determine the relationship between catchment management strategies and promotion of sustainable water projects in Tana catchment Area, Kenya.

v) To establish the moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.

1.5 Research hypothesis

The researcher sought to test the acceptance of the following hypotheses

H_0: There is no relationship between resource mobilization strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_a: There is a statistically significant relationship between resource mobilization strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between infrastructure maintenance strategy and sustainability of water projects

H_a: There is a statistically significant relationship between infrastructure maintenance strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between conflicts management strategy and sustainability of water projects

H_a: There is a statistically significant relationship between conflicts management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between water catchment management strategy and sustainability of water projects

H_a: There is a statistically significant relationship between water catchment management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.

H_a: There is a statistically significant moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.

1.6 Significance of the Study

The Kenya Vision 2030 social pillar notes that Kenya's water resource has been declining from 1093 m3/capita/year in 2010 and could decline to 586 m3/capita/year by 2025 unless effective strategies to address the issues are implemented. Vision 2030 also has a water component to address conflicts in rural areas which tend to be associated with resources, especially shared water.

The 6th Sustainable Development Goal on clean water and sanitation states that ensuring universal access to safe and affordable drinking water by 2030 requires investment in adequate infrastructure, and protection of water-related ecosystems to mitigate against water scarcity. The understanding of WRUA strategies that influence sustainability of water projects could assist the Kenya water sector to achieve goals of water resource management. The sector puts effort in mitigating the challenges that arise from poor sustainability of water projects. The study could thus benefit the government in making policies that could assist WRUAs in the protection and preservation of water related ecosystems to enhance sustainable water projects.

Sustainability of water projects would be one of the strategies that could enhance achievement of the Kenya Vision 2030 goals. WRUAs manage water resources at the local level thus the findings of the study could assist them in evaluating the strategies used to enhance improvement of water resource management. The results of the study would be published to create a platform for further research on matters concerning water resource management.

1.7 Scope of the Study

The study was conducted in the Tana Catchment Area, Kenya. The study assessed the effectiveness of strategies of Water Users Associations in promoting sustainable projects in the Tana Catchment Area, Kenya. The study was restricted to Water Users Associations in the Tana Catchment Area, which have been formed and operated for three years. Further, the study targeted WRUAs that were funded by WSFT in

2017/2018 financial year. Geographically, the study was confined to the Tana Catchment Area in Kenya. The study assessed the effectiveness of WRUAs strategies of resource mobilisation, maintenance of water infrastructure, water catchment management strategies, and conflict management in promoting sustainable water projects. The respondents in the study were WRUA committee members and users and Water Resource Authority officers in the Tana Catchment sub-regions.

1.8 Limitations of the Study

In this section, three sets of limitations are presented. One set relates to the methodology of the study which was envisaged to improve the outcomes of the study. The other set identified and included aspects that the study did not seek to explore but which failure to include qualified as a limitation.

Implementation of WRUA strategies in resource mobilization, infrastructure maintenance, conflict management and catchment management in promoting sustainable water projects largely grow over time and accumulate benefits. As such, the study would have wished to use a longitudinal research design that allows incorporation of long term participants, constant observations and repeated visits to yield detailed information on variables of study. This would have provided greater perspectives on exact ways in which WRUA strategies could affect sustainable water projects. However, due to resources and time constraints, longitudinal research was deemed beyond the purview of the study. Nevertheless, the study mitigated the limitation by combining different methods of data collection. Open ended and closed questions, and interviews with key informants were carried out. The Variable on sustainability had questions to check the number of years WRUAs had been functioning and the number of conflicts resolved in the period of one year. Hence, methodological triangulation in data collection assisted in generating valid findings and conclusions.

This study relied on data collected from WRUA committee members and water users and WRA Officers. To overcome the limitation of ambiguity, a pilot study aimed at identifying difficulties in the language used in the formulation of questionnaires was carried out before the main study. Hence questions were paraphrased before the study

was carried out, to avoid misunderstanding. Further, the study did not involve WRUAs operating in different geographical locations (other catchment areas) but was restricted to the WRUAs that were in operation for at least three years in Tana catchment Area by the time of the study..

1.9 Assumptions of the Study

The study was based on the following assumptions:

i) That different Water Resource Users Associations play roles in project management and sustainability.

ii) That respondents would provide useful and honest responses relating to the variables of study .This was because they had developed operational structures for their own associations

1.10 Operational Definition of Terms

The following were the operational definition of terms as used in the study:

Assessment:	Performance of an intervention in the achievement of set goals
Financial management	Capacity of the committee members to handle finances, regular payment of water tariff by members.
Monitoring and Evaluation	Continuous and periodic evaluation of projects.
Operation and maintenance practices	The capacity for repair, access to tools and spare parts, and condition of water supply.
Physical infrastructure condition	This refers to the construction quality, pressure level, leaks or defects in the system and vulnerability, for example breakages, theft and contamination.
Resource mobilization	The collection of resources from users in cash or kind required in the operation, maintenance and promotion of sustainable water projects.
Sustainable water projects	Water projects that operate effectively with minimal non-user financial support, sufficient storage facilities with conservation of water catchment, strategies to protect users from long periods of service failure.
Willingness to sustain water projects	The willingness to pay or offer resources for improvements of water management.
Water Resource Users Associations	A non-profit-making organization that has been initiated and registered by WRA in Tana Catchment Area for the last three years and was funded by WSFT in 2017/2018 Financial year.
Tana Catchment Area	The Tana Catchment Area is one of the regions created under the Water Resource Authority by the Kenya Water Act (2016).

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In recent times there has been renewed interest among researchers and policy makers on management of water resources which have been declining and could be polluted, destroyed, or can adversely affect human life unless effective strategies to address the limits for acceptable use are devised and enforced. Many of the studies in this area have focused on sustainability of water management (Ediriweera, 2005; Harvey & Reed, 2007; Aarts, 2012; Olorunfemi & Gbadegesin 2011). There is however little research work carried out to assess the strategies of Water Users Associations in promoting sustainable water projects. This chapter presents a review of relevant literature on strategies of Water Resources Users Associations in promoting sustainable water projects.

The literature presented in this chapter is organized into different themes originating from the study. The main purpose is to show the gaps that the study sought to fill. Section 2.2 and 2.3 reviewed literature on sustainable water projects while section from 2.4 to 2.6 contain a review on strategies used by Water Resources Users Associations, 2.7 covers the theories, section 2.8 and 2.9 present a summary of literature and conceptual framework respectively.

2.2 Sustainable Water Projects

The World Commission on Environment and Development (WCED, 1987) defines sustainable development as development which meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition has formed the basis of current thoughts on the subject of sustainability. To define sustainability in water projects, Kabila & Norman (2004) state that sustainability is achieved when projects produce a continuous flow of outputs and benefits throughout their intended life cycle. This definition includes five different aspects which describe the sustainability of a water system. These are: reliability of a water system, equity, human institutional capacity and environmental management, the cost of operation and maintenance; demand responsiveness, participation and collaboration between various agencies. Collectively, these components of

sustainability lead to sustenance and maintenance or continuity of a resource. When these components are not balanced, projects would fail. Although in recent years there has been increased focus on understanding the hydrological changes, design and implementation phases of water projects in an effort to make them more viable, the trend with sustainability is poor (Baker, 2000). Many rivers of the world have either dried up or are on the verge of dying up and their flows no longer reach the ocean (Crosswell, 2015).

Binder (2008) defines a sustainable water project as one that can meet performance requirements over a long period. Such projects display characteristics of a commitment to meet service expectations, the capacity to monitor and evaluate the water system, financing of regular operation and maintenance by the users and continued flow of benefits over a long period. Cleaver & Franks (2003) points out that a significant number of projects based in the water sector fail to deliver long term benefits in developing countries. Part of the cause for this failure lies in poor understanding of the issues of sustainability, the specific context of users or a lack of effective support structures (Baker, 2000). It has been identified that some projects become noticeably unsuccessful, even without any technical failures, while others achieve their targets without facing many difficulties (Abdulla, Kazbekov, Manthritilake & Jumaboev, 2009). Therefore, identification of underlying causes for the performance differences of water projects was important not only for sustainable management of existing projects but also in establishing new projects.

Sustainability of new or existing water projects depend on monitoring and evaluation results for constant feedback regarding implementation and status of project activities (Agwata, 2005). Feedback results require sharing and discussion by all stakeholders in order to formulate relevant corrective intervention to enable achievement of set goals. Monitoring of project activities require continuous gathering of information and analysis so as to determine and implement corrective measures. For Water projects that involve participation of users, monitoring process does not only involve evaluation of project activities but also the relationship between the project members and other stakeholders.

Holvet and Renard (2007) studied sustainability of projects in eleven countries in developing countries and established that there was a fragmented approach towards M&E planning and data utilization. The study concluded that for projects to be improved and sustained, it was necessary to collect the information on expected project outcomes, analyze it and use it to improve the water systems .The study recommended M&E planning, data collection, and result utilization to be done in order to identify strengths and weaknesses as baseline to inform an effective M&E practice. Other studies revealed that evaluation results enhance project management by improving planning, identifying challenges, decision making, pointing out where technical assistance and training were required (UNDP, 2006) .While project M&E practice offers potential benefits to projects, it could also result in a waste of time and resources and failure to realize implementation problems when carried out poorly (Rondinelli, 2003). The study sought to evaluate users' participation in decision making processes that promoted development of sustainable water projects in Tana Catchment Area

In Sri Lanka, Ediriweera (2005) assessed project sustainability of 20 water projects and found out that 14 out of 20 schemes were sustainable while the remaining six were unsustainable. The study established that projects failed because users did not have the managerial capacity to sustain the system. Managerial skills include making optimum use of resources required to enable implementation of plans, determining what needs to be done in a situation and monitoring progress against plans to enable collective action towards sustainable projects, as well as participatory decision making and generating plans for action; (Cleaver Franks, 2003). However, in North Africa, FAO (2011) reported that women and youth participation in decision making on water resource management was limited and deliberate effort to create enabling environments for participation was required. Meaningful participation of women and youth in decision making would not only mean increasing the number in discussions but also addressing the root cause of gender inequalities and creating platforms that spark interest in water management.

Harvey & Reeds (2007) in their report on water management in Ethiopia, show that user issues like perceived lack of ownership, lack of education on equitable water

supply, poor water source management skills and limited assessment of water demand to supply are related to low sustainability rates of water projects. However, Shisanya, Onywere and Obando (2017) established that monitoring of water resources (rainfall, stream flow, abstraction and water quality) and catchment condition should be carried out frequently in order to evaluate interventions that promote sustainable water projects. Evaluation of water demand and monitoring of water resources can form bases for planning and implementation of water projects with improved rates of sustainability.

In Sudan, (Abdelgail, 2018) assessed sustainability of water projects and established that sustainability was influenced by members participation in project activities. The study found out that only 50% of members participated in provision of finances, 30% participated in labor provision and only 40% participated in the mapping of the riparian land. The study established that partial participation of members lead to prolonged periods of system failure. Uncooperative members with partial commitment in the implementation of water project activities could increase conflicts and promote unfair distribution of water resources. Water projects would require high level of commitment between all stakeholders in order to improve sustainability rates of water projects.

Sustainability rates of rural water projects increase as a result of users owning and managing their projects, protecting the water source points, resource mobilization, operation and maintenance, choice of appropriate technology and availability of spare parts for the water system, and water conflict management (Aarts, 2012). To operate and maintain accessible and adequately functional water projects would require established institutions grounded in cultural values, procedures, rules for operation as well as, capable leaders with water management skills to ensure sustainability. The study used some of the indicators of sustainability as used by Cleaver & Franks (2003), Ediriweera (2005), Harvey & Reed (2007), Aarts (2012) and Abdelgail, (2018) of protection of sub-catchments and water source points, equity, participation, institutional support and decision making processes to assess the promotion of water project sustainability in Tana Catchment Area, Kenya.

2.3 Water Resource Management

Water Resource Management refers to institutionalized activities of water resource development, utilization, allocation and conservation of natural environment (Hutton & Batram, 2008). Water mangement systems aim at attaining equitable distribution and allocation of water resources among users, protectin gusers from diminishing supplies, governing the sharing of limited water supplies to meet users' needs and facilitating efficient water-use. As the population increases, water resource management needs to be conserved and shared to meet human needs while conserving the environment. Cleaver & Franks, (2003) observed that conservation of water reserves and development of long term management interventions would be required to ensure optimum benefits to all users. Arguments by Hutton & Batram (2008) and Cleaver & Franks (2003) indicate that development of strong water institutions with viable interventions would play the role of setting boundaries for use, access, equitable sharing of water resources and continuous support of capacity building to ensure continous flow of rivers in all the catchment areas.

Komives, Akanbang, Wakeman, Thorsten, Tuffuor, Bakalian,& Whittington (2007) carried out a study in Ghana to investigate how practices in water resources management at the local level were carried out. The study found that catchment and sub-catchment councils were absent at the local level and there were no local people influencing practices in water resource management at the river basin. However, study carried out in Nigeria by Olorunfemi & Gbadegesin, (2011) on rural water supply management found out that the knowledge bases of different stakeholder groups about water resource management was very low especially technology uptake and ecological management limiting meaningful participation. Local knowledge would be required in the formulation and implementation of self-created rules for water management Tang, (1999), Ostrom, (2000), Nishimoto, (2003), Komives *et al.*, (2007) and Olorunfemi & Gbadegesin, (2011). These arguments showed the need for adequate involvement of local water committees in training on surveillance of water abstraction, formulation of rules and water management. The study assessed the level of skills among WRUAs and application of self-created rules in water management.

Whittington et al. (2008) studied water projects in Africa that were operated by WRUAs and found out that 89-95 percent of the water projects were functioning four or more years after construction. The study however, established that WRUAs had challenges of raising enough resources necessary for operation and maintenance of their projects. Another study by Garces-Restrepo et al. (2007) assessed WRUA projects on indicators of operation and maintenance; costs incurred by both governments and WRUAs, rate of fee collection, timeliness of contributions, and equity of water distribution. The indicators were tested to quantify their impacts on crop yields and farm income. The study established that there was inadequate analysis of resource contribution for water project operation. The study recommended an analysis of suitable capital contribution by users; determine how contributions would be paid (in cash or in kind), and what percentage was reasonable to operate sustainable projects. Inadequate analysis of contributions whether given in cash or kind could lead to inaccurate estimation of resources and poor accountability of availed resources.

Although studies by Whittington et al. (2007) and Garces-Restrepo et al. (2007) tested project activities on farming activities, contribution by users whether in cash or kind would be used to improve project activities. In water projects the contributions could be used to repair broken water pipes to reduce leakage, rehabilitate water intakes to keep water free from contamination by livestock and construct water tanks to ease water distribution problems.

According to the Regional partnership for resource development (2009), development projects with participatory approach allow users groups that are most affected by the project outcomes to assume responsibility for designing initiatives and implementing them. Participation in project activities that users get involved and design could promote ownership and protection of projects from wastage and destruction. Such ownership could promote and maintain high levels of project sustainability. The observations underscored in the study show the critical role that the water user's participation could play in promoting sustainability of water projects .This study sought to determine involvement of water users in resource mobilization for promotion of sustainable water projects.

2.4 Water Resource Users Association

Water Resources User Associations may be defined as non-profit-making organizations consisting of water users, riparian land owners and other stakeholders who voluntarily associate for purpose of sharing, conserving and managing common water resources (GoK 2016). The Water Act (2002 revised in 2016) recognize the vital role that could be played by WRUAs in water management at the grass root level. WRUAs formed in all the catchment areas in Kenya namely: Lake Victoria North Basin, Lake Victoria South Basin, Athi River Basin, Tana River Basin as well as Ewaso Ngiro River Basin are involved in the water resources management (GoK 2016). The objectives of WRUAs as supported by GoK 2016 are: to promote sustainable use of water resources, safeguard the reserve flows for downward requirements, promote water conservation practices, reduce water use conflicts and develop sustainable and responsive institutions for water resource management. This implies that WRUAs offer a chance to all local stakeholders at the grassroots level to effectively participate in decision making regarding water resource management.

The water resources users agree to pool their financial and technical skills, materials, and human resources to promote equitable sharing of water resources within their jurisdiction (Fadul, 2012). WRUA operations are thus guided by the project development cycle that adopts a comprehensive view that water resources management was a long-term process that required various strategies in order to be achieved. However, WRA performance report (2015) indicated that only 56% of the expected WRUAs had developed their operation plans. It was thus necessary to make a concerted effort in developing requisite institutions for effective water management. While it was recognized that WRUAs were relatively new institutions in water management, their existence was justified on the grounds that water users who participated in the formulation and implementation of a water management plan were more likely to understand it, own it and comply with the rules because they used their local knowledge to address persistent water management issues (Mansuri & Rao 2004*).*

Water management by WRUAs had increasingly been regarded as a central component in the establishment of the framework that defined how water was

managed at the river basin (Nishimoto, 2003). This was due to the fact that WRUAs would have the motivation to distribute water effectively in order to address local water needs. Kanpur, (2008) studied WRUAs formed at the local level to distribute water and maintain field channels. The study established that although WRUAs had information on local needs, the capacity of WRUAs for operation management was limited and water infrastructure was poorly managed. For water infrastructure to be efficient, there was need for trained technical personnel to operate and maintain water allocation systems for equitable distribution.

A study by Abdulla *et al.,* (2009) in Uzbekistan on transfer of management and water operations from state to WRUAs, revealed improvements in terms of equity (tail-end users), transparency of water management, responsiveness of water managers to water user's complaints and reductions of illegal water withdrawals. The study also reported improvement in the quality of maintenance, and that farmers had physically participated in terms of hours of labor which reduced the cost of maintenance and improved the quality of water supply infrastructure. Holvoet & Renard, (2007) agreed that the goal of project efficiency could only be achieved by practicing rational and optimum maintenance, rehabilitation and renewal strategies.

In a USAID-funded project on integrated water management in Egypt, WRUAs were expected to participate in the planning and selection of rehabilitation, maintenance, and minor works and engage in inspection of the branch canals and the drainage systems with support from Integrated Water Management engineers and technicians (Barakat, 2009). It was reported that at the end of the project there was no strong cooperation between the Integrated Water Management Directors and WRUAs in all activities Barakat, (2009). Similar study in India by Holvoet & Renard, (2007) found that the participating farms in WRUA activities were technically more efficient in crop production than the non-participating farms. The study concluded that lack of unity, cooperation and interest among water users had been found to be the most limiting factor, followed by the inequity in water allocation which could be achieved by strengthening WRUAs as institutions.

The study carried out by Abdelgalil, (2018) in Sudan found out although WRUAs were functioning within a common legislative framework, WRUAs operating in different river basins had different characteristics. The study further established that even two WRUAs that shared the same river basin had significant differences in the styles of operation and maintenance. The WRUAs had different perceptions on ways used to involve water users in decision making processes. However, study Alison, M. (2010) Kenya, established a positive relationship between the involvement of users in decision making processes and adoption of water conservation activities .The study however suggested building capacity of users in water management to enable them embrace reforms of water management. It would be expected that empowered water users would participate in making decisions that select appropriate technology for building of water intakes and enforcement of conservation activities to enable water management.

Establishment of WRUAs by various governments in Africa was done to create a forum for water users to discuss and agree on utilization of water resources at the local level in a sustainable way. Effective management and utilization of WRUA resources would require participation of trained committee members, water users and stakeholders within the legal framework that ensured sustained interest in WRUA activities. However, a study by Mollinga, (2008) in Tanzania revealed that institutional capacity in terms of technical, budgeting and managerial skills hindered effective mobilization and utilization of funds received from the government and other funding agencies. Limited capacity for management and utilization was a challenge to the functionality of WRUAs. Yet, the WRUAs were expected to prepare regular reports on implementation of strategies to their members as well as the Regional office (Butler, 2015). In order to establish strong WRUA institutions, effective participation in water management, there was a need to develop and implement strategies to enhance sustainable water projects.

2.5 Resource Mobilization Strategies

Resource mobilization is a basic requirement without which water projects would have challenges in operation and maintenance of water systems. The goal of project resource mobilization was to enhance availability of finances, labor supply and

materials required for promoting sustainable projects. However, insufficient resource planning, insufficient knowledge on resource mobilization and unwillingness to contribute required resources may cause underestimation of the recurrent and future costs of a project resulting in poor financial planning (Harvey & Reeds, 2004; Ifejike, 2018).

According to Baker, (2000), financial planning involved setting objectives, assessing assets and resources, forecasting future financial needs and making plans to achieve a monetary goal. Harvey & Reed (2004) noted that a financial plan should calculate and determine sources of funding for direct operation costs, maintenance, institutional training costs, monitoring, and costs of user mobilization. Without a comprehensive project Cost Benefit Analysis determination, it would not be possible to inform water users of the true cost of service sustainability or to determine the level of external financial support that would be required to promote sustainable projects. Hutton & Bartram, (2008) and Baker, (2000) argue that determination of the real costs of projects affects development of sustainable financing strategies. Although emphasis was laid on accounting and financial administration of project finances, financial management skills among WRUAs was not well developed in the developed world (Mumma, 2005). It was necessary to establish the financial administration capacity of water users in planning, mobilizing of project resources to ensure financial self sufficiency of projects in the Tana Catchment Area of Kenya.

In the financial administration of a project, the receipt, maintenance, expenditure and accounting of assets was necessary. Accounting of assets included the art of analyzing and recording financial transactions, classifying and summarizing the information of reports, and interpreting the resources. Users would contribute to project investment by providing labor, land, and local materials which required proper computing and record keeping for effective management to enhance decision making for project sustainability (Tickner, Parker, Moncrieff, Oates, Ludi & Acreman, 2017). Although financial management is vital for project management, in Kenya, study by Ifejika, (2018) established that 65% of water users who contributed labor and finances, had not received the intended benefits. Thirty five percent of them reported little consultation was done during the decision making process. User participation in

decision making process which could take the form of discussions, consultations is considered a vital component in project management (Tickner et al., 2017). Involvement in decision making processes would ensure the opinions of various stakeholders were taken into account when setting required resources and how each member would contribute to promote project sustainability. The current study examined the level of participation of various stakeholders in decision making process in the management of water resources.

Olajuyigbe, (2013) found out that Nigeria improved public water points were not functioning three years after construction. The study associated the problem with poor mechanisms of cost recovery needed for continuous operation and maintenance of water supply facilities .The study recommended formation of committees to assist the community in the management of rural water supply projects However, an evaluation of water projects in Gunea Bissau by United Nations, (2010) established that the failure of water projects was caused by failure to develop and implement appropriate strategies for operation and maintenance which undermined the sustainability of water project benefits. The formulation and implementation of project activities required for operation and maintenance could keep the projects functioning for longer periods. The study sought to investigate activities formulated and implemented by water users in order to promote project sustainability.

Uysal, & Atis (2010) reported that in Gezira irrigation scheme in Sudan, the quality of project maintenance improved because users participated physically in terms of hours of labor which reduced the cost of maintenance and improved the quality of water supply. However, the study established that it was difficult to consistently mobilize cash in time from farmers and they were allowed to pay the dues in kind, and goods received from farmers were sold and the proceeds used for maintenance of water supply systems (Uysal, & Atis 2010). Although such flexibility improved the rate of fee collection, users were left with the risk of marketing the produce which would lead to prolonged inadequacy of funds for project management and cost recovery (Adam 2003).A similar study carried out by Abdelgail, (2018) in Sudan, established that although 60% of members contributed finances towards project management, 20% of the members got water without payment of agreed amounts and another 15%

interfered with gate valves to access water illegally. Studies by Uysal, & Atis (2010) and Abdelgail, (2018) show a variance in water fee collection strategies by the water committee members. It was necessary to establish whether committee members in the Tana catchment face similar situations when collecting water fees from members.

Braimah, (2011) observed that although users in Ghana, made contributions the monthly levies were inadequate to ensure effective operation and maintenance of water projects. Interviews with the Committees revealed that funds to carry out required maintenance activities were sometimes lacking or inadequate decisions were taken (Al-Mohannad, 2003; Fadul Bashir, 2012). Engaging stakeholders in decision making to raise required resources for projects needed new techniques to break social barriers that hinder active participation when formulating resource mobilization strategies.

Cornish, Boswarth, Perry, Burke, (2004) and Berkoff, (2008) revealed WRUAs in Morocco, Tunisia and Turkey faced financial shortfalls because the fees set were too low to cover actual costs, and the rate of recovery payment was low. The study established that in Tunisia, the shortfall in resources occurred because users were unwilling to pay while in Morocco, shortfalls in resources occurred during drought periods when users had poor crop yields (Gunchinmea and Yakubar, 2010). However in Turkey, the strategy of resource mobilization was based on irrigation service but dysfunctional infrastructure led to the users' unwillingness to pay for a service that was more of a constraint than an asset *per se* (Cornish *et al.,* 2004) .From the above studies in Morocco, Tunisia and Turkey, some projects had faced financial shortfalls because decisions to charge user fees was set either too low to cover actual costs or WRUAs failed to take appropriate collection decisions. However, user participation in planning of activities of resource mobilization could generate a sense of ownership, break dependency patterns and give decision making power to the contributors (Gunchinmea & Yakubar, 2010).

Ifejika, (2018) found out that in Laikipia, inadequate capacity to mobilize resources was associated with human capital (education, knowledge, skills and experience) of the committee members. 40% of the respondents reported that inadequate resources

delayed achievements of project objectives and 30% linked limited resources to incomplete water projects which resulted to water scarcity. Poor Human resource attributes could lead to poor construction of water intakes, poor mobilization of resources as well as poor maintenance of water infrastructure. The fore mentioned studies indicated the need to investigate project resource mobilization strategy. It was necessary to assess the strategies used by WRUAs officers to engage users in designing and implementing activities that raise resources to sustain their water projects.

2.6 Water Infrastructure Maintenance Strategies

Water projects require adequate and efficient infrastructure that operates efficiently, and at a viable cost (Abdelhadi, A. W., Adam, H. S., Hassan, A. M., & Hata, T., (2004). This was achieved by practicing sound land-use plans, timely upgrade of intakes and rehabilitation of water abstraction points and catchment renewal strategies Abdelhadi, *et al.,* (2004). A Gezira Scheme study by Abdelhadi, *et al.,* 2004 revealed that WRUAs had scheduled plans that described standards of operation and implementation that were enforceable. In using the scheduled plans, users did not suffer water shortages after engaging in activities of water allocation scheduling, cleaning the water canals and operation and maintenance of the irrigation infrastructure. An allowable length of time, decided upon by users, was allocated for servicing broken pipes or equipment (Abdelhadi, *et al.,* 2004). While such a plan worked in Gezira, a study by Rusfandi, (2001) in Indonesia, established that users suffered water shortage during dry seasons because users obstructed water and allocated themselves more water than was required and when pipes were broken or blocked, users would suffer prolonged shortage because of declining water flows downstream.

Klug, Cronk, Shields & Bartram, (2018) categorized water system breakdowns using examples from Liberia, Nigeria, Tanzania and Uganda and established a significant difference in system break down categories based on age, management styles and fee collection types. The study recommended use of monitoring instruments to educate stakeholders on different breakdowns types and explain reasons for water system malfunctions. Identification of causes of system break down when done in time can

lead to procurement of spare parts and search for skilled labor required for infrastructure repairs. Information on water system breakdown can be used to train water managers at the local level and equip them with skills for management and care of water infrastructure to increase system economic life through planned maintenance.

Cornish *et al.,* (2004) found out that in Turkey, scheduling of maintenance and rehabilitation activities depended on fee collected from users. The study established that water fees collection rate was insufficient to cater for operation and maintenance expenses. However, an increase in water fees would not be acceptable to users. In Sudan however, study by Adams, (2003) reported that the transfer of the Abdel Hakan pilot project improved quality of maintenance and reduced water leakages and wastage because farmers gave financially and physically in hours and labor which greatly reduced the maintenance costs and improved water supply to the distribution tanks. Although farmers provided finances, labor and time for the water projects, a study carried out by Tickner *et al.,* (2017) established that maintenance practices by WRUAs were not coordinated in a systematic manner. Further, the study found that rules and regulations on infrastructure maintenance were not effectively implemented which created disagreements in water allocation among users. Studies in Turkey and Sudan show differing performance in maintenance practices of WRUA water projects. It was necessary to investigate WRUA plans for users' engagement in planning activities for repair and maintenance of infrastructure and water intakes in the Tana Catchment Area.

Abdelhadi, *et al.*,(2004); Tickner *et al.,* 2017; Rusfandi, (2001) and Avellino, (2012) in Ghana, found out that the spirit of voluntarism in maintenance practices which was expected to drive the local managers to effective management of the projects was fading away. The local managers were unable to mobilize adequate user support to cover operation, rehabilitation and management of the projects leaving burst pipes and water intakes with leakages. Although voluntarism failed in Ghana, volunteer services by members may lower the costs of operation and enhance ownership of water projects. Further, Abdelhadi, *et al.,* (2004) argued that ownership of projects leads to greater care of resources by members who protect the resources against waste, destruction and reduce conflicts. While many water projects were started through

communal resource mobilization, it was necessary to explore available communal plans and contribution of resources for water infrastructure maintenance in Tana Catchment Area.

Barakat, (2009) established that project evaluation reports in the Central Nile Delta, revealed nine out of ten users expressed willingness to participate in maintenance activities which included removing material deposited on river beds and obstructed river flows during the rainy season, planting plant creepers to reduce erosion and upgrading the water system when upgrading was associated with promises of continuous water flows. The study recommended that users be engaged in water distribution (water scheduling, rotations, improved delivery) and maintenance and upgrading of physical works by use of professional technicians who would in turn train the local users. Sustainable water maintenance may require annual maintenance schedules, monitoring plans, rehabilitation plans formulated prior to implementation of the planned activities to mobilization of participants (Braham, 2016). While the recommendation by (Barakat, 2009) would be successfully implemented in a funded irrigation water project, the recommendation would not be easily implemented in large rivers with many water projects for domestic use involving many stakeholders competing for water use.

Bergh, (2007) established that in Morocco, lack of involvement of local stakeholders in the design of infrastructure technical design lead to installation of expensive water pumps which required spare parts that users could not afford all the time. The plans to use water pumps at the water intake for water distribution was not openly shared and opinion was not sought, causing hostility among stakeholders during the implementation phase. However, in Azerbaijan, rehabilitation works were carried out with stakeholder participation and contribution towards procurement of spare parts and approval of maintenance schedules, which led to high levels of satisfaction among the stakeholders (World Bank, 2011b). This view is shared by Bergh, (2007) who posits that when stakeholders were not effectively involved in planning of their infrastructure activities, the projects remained dysfunctional or limited in interventions by the supporting institutions. Support by other institutions was needed

to purchase spare parts, carry out abstraction surveys, train technical staff and rehabilitate water infrastructure.

Barakat, (2007) found that in Egypt, when full responsibility of maintenance was handed over to farmers, they lacked spare parts and tools to repair the equipment, repair broken pipes or replace old ones, and they often would switch to their individual pumps. The revenue collected only covered light repairs leading to deferment of long term rehabilitation. However, Barakat (2007) found out that when WRUAs were involved in annual inspections, cleaning works, rehabilitation of canals, and government subsidy given, the farmers rated their projects as 70 to 100 percent successful. When farmers in Gezira scheme were given funding by government to supplement their resources for repair and maintenance, farmers' commitment to making regular contributions increased and they were able to effectively maintain infrastructure during the five years of project life (World Bank, 2011b). The mixed observations regarding the unwillingness or inability to take part in financial contribution and maintain water systems may lower long term sustainability levels of the water projects. Reasons for unwillingness, reluctance or inability to make adequate payments to projects could be associated with unsatisfied users who receive insufficient services. This study sought to explore available strategy for maintenance of water infrastructure maintenance in Tana Catchment Area.

2.7 Water Catchment Management Strategies

A water shed has physical limits in regard of water resource development and it should be developed so that its exploitation does not exceed its generative capacity (Cosgrove & Loucks, 2015). Catchment generative capacity occurs when small streams merge continuously into big rivers supported by sound land protection mechanisms such as tress planting along riparian land, spring protection, wetland, land protection, terracing and gabion building on sloped grounds as well as silt traps building along the rivers (Chowdhury, 2010). Such protection activities could reduce surface run off and lead to slow water infiltration into the soil and continuous flow of water into rivers.

Cosgrove & Loucks, (2015) found out that competing priorities over water use for livestock, household, agricultural and other rural livelihood activities required a deliberative process through which stakeholders could negotiate in the design, norms of access and management to ensure continuous and sustainable use. Further, the study established that unchecked competition for water resources would lead to construction of faulty water abstraction points, cutting of trees along the river beds for fuel, over-use of vegetation along river beds (leaving the river banks without vegetation cover to hold the soils together), causing surface run-off which interferes with natural infiltration and reduces water flows in rivers (Cosgrove & Loucks, 2015). Poor vegetation cover along steep slopes may cause soil erosion upstream and siltation downstream interfering with ecological balance. This study will establish whether WRUAs in Tana catchment area implement approved water abstraction designs and agree on water allocation to ensure water flows to downstream users as a measure to enhance sustainable water management.

Chowdhury (2010) established that in order to promote equity of water distribution and preserve the environment, the users have to participate in activities of water land conservation like water harvesting, water storage , planting trees, pegging the riparian plane as well as protecting springs. However, the study found that user activities were limited to de-silting of a pan or dams and fencing of water points and that no user received any kind of training on environmental protection. Training of users in environmental management would protect natural processes which ensure natural water recharge and filtration. However, in South Western Nigeria, Olajuyigbe & Fasakin, (2010) established that training for WRUAs often reached only a select group of people which did not include all water users. In the study, 60% of respondents reported that they learnt little in the trainings on water source protection, environmental issues, law and legislation of the riparian protection. Little learning in trainings related with conservation of environment was associated with low literacy levels and low knowledge on necessity for environment conservation.

Jawuoro, Koech, Karuku and Mbau (2017) found out that in Kitui, 51.5% of respondents identified sand harvesting, 31% identified illegal land use next to river and 15.4% identified tree cutting as an environmental concern which led to low water

flow in rivers. However, a very low percentage (15.2%) reported that they had neither taken part in riparian area protection, nor community sensitization on conservation. Although conservation strategies improve degraded wetlands, WRUAs in Kenya used traditional river gauging methods to monitor water availability in rivers and fluctuation levels in order to enforce abstraction rules. The study identified the committee members were neither trained in modern methods of determining river volumes or scientific methods of tracking degradation. The information of river fluctuation could lead to decisive negotiations and agreed scheduling for equitable distribution to reduce conflicts. However, due to the demand for use of river water for activities of irrigation and livestock, conflicts were noted during the dry seasons.

NEMA, (2003) and Agwata, (2005) found that in Kenya, catchment areas were vulnerable to degradation due to destruction of swamps, springs and planting of tree species that use lots of water, and over-abstraction as well as encroachment of river basin. Encroachment and over-withdrawal of water could lead to reduced water flow downstream in the dry seasons, resulting in severe water shortage (Aarts, 2012). Although Kenya has many perennial rivers, water shortage is experienced during the dry season (Aarts, 2012). It was necessary to find out whether existing regulations were capable of directing users to engage in building strategies for long term sustainable water use.

Rolston, Jennings & Linnane, (2017) established that 81% of respondents did not feel included in decisions that concerned their water environment management despite 95% of them believing that community should have a say in how the environment could be managed. While attendance to local water management initiatives could lead to shared knowledge and ownership of strategies, the study found out that only 31% of respondents were willing to attend local water management initiatives. Unwillingness to attend discussions of water management could be associated with low literacy levels or poor training methods. Training methods may incorporate demonstrations, role plays and practical lessons in order to take care of learning levels of all participants. Effective engagement of stakeholders could lead to better decision making and delivery of intended services.

Kabogo et al (2017) established that in Tanzania, 80% of water users agreed to participate in water resources management in order to promote protection of water point sources. Water users had to take part in meetings to discuss water allocation and distribution, protection of the riparian plain by planting trees and preservation of the environment. The study found out that although water catchment management was fundamental in sustaining supply of water to communities, user activities were limited to de-silting of a pan or dams and fencing to protect direct use of water by livestock. Protection of water point sources only would not sustain flow of required water to end point users. In order to enhance adequate water flows, water users would need to protect the water sources, the riparian plain, practice good farming methods, plant trees and ground cover crops to reduce degradation on non-point water sources and reduce soil erosion. However, according to World Bank, (2006) participation was regarded as a critical component which could promote development initiatives. For water users to effectively engage in development initiatives such as water management, user capacity building and empowerment would be necessary. Such activities could enable users learn conservation activities that slow water surface run off and enhance natural water filtration. The study was designed to examine WRUAs activities in protecting source point and non-source water points in Tana Catchment Area.

Barakat, (2009) established that in Ethiopia, implementation of watershed management intervention activities reduced soil erosion and improved water availability and quality. The study however revealed that 17% of respondents did not participate in any activities while all respondents participated in less than 60% of the water shed intervention activities. Poor participation in intervention activities was associated with lack of involvement of members at the project initiation stage. However, Chepyegon, & Kamiya, (2018) in a study carried out in Kenya, recommended that members needed to participate in intervention activities to curb soil erosion, and protect the riparian land in line with the Agricultural Act. Participation of members at the project initiation stage raises the perception of inclusion and project ownership.

Alufa, (2012) on assessment of WRUA performance in Kiserian established that members participated in training on scheduled conservation activities. 79.9% of the members had taken part in de-silting activities, 75% had engaged in tree planting, 45.5% had participated in river pegging and 32% had taken part in planting creepers on the river beds. Further the study found out that only 15.9% of the members had participated in fencing of water point sources and community sensitization activities. The study associated low participation in sensitization activities to low level literacy of the members. The cited studies by Alufa, (2012); Rolston, Jennings & Linnane S., (2017) show that efforts were put to train members in imparting user skills to protect their catchment areas. While training is important, it was necessary to establish strategies to enable users to learn beneficial lessons for checking the cutting of water-guzzling trees, run-off collection mechanisms, planting of water-friendly indigenous trees, raising public awareness on pollution, rehabilitation of riverbanks and introduction of new technologies for water harvesting which was the concern of the study.

2.8 Conflict Management Strategies

Conflicts occur in water resources planning and management when people and institutions disagree on the amount of water that is required or obligated at a specific location for a purpose of specified quality (Palmer, Moglen, Nancy, Brooks, Pizzuto, Wiegand, & VanNess, 1999). However, even when water supplies are not severely limited, allocation of water among different uses and users can be highly contested and may be a source of potentially violent disputes (Ohlsson, 2000). Conflicts in water resource management may also arise due to intense competition for water, lack of adequate administrative capacity, lack of transparency, ambiguous jurisdictions, overlapping functions and lack of necessary infrastructures (Matiru, 2000). Presentation of such factors could cause tension and disputes among water members regarding allocation or distribution of the water resources.

Studies on the water resource management show that the self-governed organizations are more effective than the public agencies in conflict management (Tang, 1999: Ostrom, 2000: Gleitsmann, 2007) .Self-governed organizations could create a forum for formulation of rules and agree on enforcement mechanisms. Enforcement

mechanisms could take the form of graduated sanctions, setting aside control teams to oversee the implementation of agreed activities, legal training on by-laws, land agreements and penalties for non-compliance (Ostrom, 2000). The study sought to examine regulation enforcement mechanisms put in place in order to promote sustainable projects in Tana Catchment Area, Kenya.

Regner, Salman & Wolff, (2006) in Jordan, established that WRUAs in the Jordan valley took ten years of effort to restore trust after conflicts both between users of the same WRUA, and between WRUAs and the Jordan Valley Authority. As WRUAs were empowered, they were able to remove illegal connections, an action that gained substantial credit and generated support from members (Regner *et al.*, 2006). The study further established that WRUAs were able to handle internal conflicts which resulted in trust-building other benefits, accrued including users abandoning the practice of over-irrigation, giving up destruction of meters, better maintenance of the pump, and more predictable water supply. However, the study by Regner, *et al.*, (2006) did not establish strategies used in the empowerment or trust building of WRUAs that lead to incorporation and adoption of activities of conflict resolution that reduced conflicts which this study sought to establish.

Tang, (2009); Ganesh Keremane & Jennifer McKay, (2007) assessed implementation of self-created rules and conflict management processes in two WRUAs on the Waghad Canal in India. The study established that WRUAs upstream abstracted more water than WRUAs downstream and powerful members gave bribes to staff employed by WRUAs in exchange for more water allocation. Favoritism in water allocation mechanisms would fuel animosity between users and contribute to building of hard stands concerning water allocation hence increased conflicts. Positions ones taken by stakeholders would be difficult to break. Strengthening psychological aspects that tap into emotions aimed at developing a sense of hope, trust, cooperation, inclusiveness and nonviolence behavior would need to be applied. Such emotions could be considered basic foundations for building peace and fostering friendships (Regner *et al.,* 2006).Building friendship scenarios would encourage in-depth discussions that weaken positions taken by different parties and encourage the focus of stakeholders on the underlying matters of concern in water sharing. However, without effective

formulation and enforcement of the self-created rules based on knowledge of the locally available resource, attempts at conflict management would fail (Gleitsmann, 2007). Members who participate in formulation and enforcement of the rules are likely to understand and adhere to them and reduce disputes.

Abdulla et al., (2009) established that WRUAs in Uzbekistan had rules and regulations that existed only on paper but which in practice did not work and most powerful users gained better access to water resources. Further, the study established that the administration and enforcement of regulations was very weak leading to inequity in distribution of resources. It was established that, access to water resources was a preserve of the strongest, quickest or for water users with close relations with the water managers. Favoritism and informal rules lead to unequal distribution of water resources. Inequity over water distribution would mostly occur during the dry season when water levels are low. At the formation of WRUAs, articles of association and statutes provide for fines, sanctions and punishments for violation of laws governing water conservation (GOK, 2016). However, WRUAs codes of practice may not always guarantee conflict resolution. Without the effective formulation and enforcement of the self-created rules based on knowledge of the locally available resource, attempts at conflict management would fail (Gleitsmann, 2007).

Garces-Restrepo, (2007) in Kyrgyzstan established that rules governing water distribution were weakly instituted and upstream farmers unfairly used more water than farmers downstream causing recurrent disputes between farmers over water inequity in distribution. The study established that 64% of upstream members of the WRUA enjoyed more privileges in water use than downstream members. The study further established that wealthy farmers bribed staff employed by WRUAs to control water. Weak enforcement of law could result in inequitable water distribution to members as powerful stakeholders benefit more than other members. Inefficient law enforcement leads to illegal water diversion, encourages rent seeking behavior and raises disputes between users (Garces-Restrepo, 2007). However, poor administration of rules would cause loss of integrity in managing common pool resources and provoke disputes over water distribution.

Svendsen & Nott, (2000) established that in Turkey, frequency of water distribution disputes was reported to increase during the dry seasons because control of water sharing was not enforced,thus creating hatred and mistrust among farmers. Mistrust among users could be caused by perceptions that users had an unfair share of resourced while others were deprived of the due share. Mistrust over water sharing, can cause tensions and trigger violent actions among water users in times of high demand when water availability reduces. Inefficient water use and poor management as well as poor enforcement of rules could increase water conflicts. Studies carried out in India and Turkey established the importance of self-created rules and mediation processes since strategies for conflict resolution can be used to build consensus among users. However, the WRUAs under the study were in Turkey, a different geographical environment from that of WRUAs in Kenya. It was necessary to find out whether such water conflicts and strategies were used by WRUAs in Tana catchment area to address mistrust arising from water sharing and distribution among users.

Allouche, (2016) established that in Tanzania, when WRUAs were formed, conflicts on water distribution fell from 22% to 4%, which was statistically significant (I=3.391, P=0.015). Further, the study established that the best solution for reducing conflicts in the sub-catchment was to ensure equitable water distribution by the committee members. The study further recommended that in order to ensure equitable water distribution, user education was needed on alternative ways of water storage during the rainy seasons for use during dry seasons when there were shortages. However, other studies by Aarts, (2012) reported that conflicts over water were noted to increase in WRUA managed water systems because there was high expectation that new management mechanisms provide better water services to users.

Aarts, (2012) established that in Ewaso Nyiro North Catchment, 83.6% of the WRUA members indicated that WRUA Managers were able to resolve water conflicts and 86.2% indicated that WRUA leaders were influenced in their respective communities. However, the study depicted a negative correlation between WRUA conflict resolution strategies to solve conflict and conflict prevalence. Recurrent water conflicts could arise from acute water shortage during drought, due to biased

leadership, political interference, exclusion from decision-making and breaking of rules governing water use.

Aarts (2012) carried out a study in the Upper Ewaso Ng'iro river basin in Kenya, and established three reasons why WRUAs were able to reduce water-related conflicts. The reasons established were that; WRUAs had platforms for discussion when water disputes between users arose; WRUA officials were able to arrange for discussions and solve conflicts through dialogue and that WRUAs created awareness among the upstream and downstream members of their interconnectedness within the river basin to ensure water use control .Awareness creation on water control among upstream and downstream users could be difficult due to inequality in knowledge ,wealth and power difference between users. Challenges could be experienced when convincing the upstream users on the benefits of equitable water sharing due to the privileged position on the river source that never experienced water shortage. The downstream WRUAs would have difficulties of persuading members on the need for water rationing and sharing.

Studies by Svendsen and Nott, (2000); Allouche, (2016) and Aarts (2012) show that WRUAs had the ability to put effort towards sharing of the scarce water resources. However, to formulate and implement strategies of water management at the local level, gradual and persistent interventions would be required to bring together different water users to share the little available water resource to avert conflicts. When conflict averting mechanism were not strictly implemented, rules could only exist on paper and not executed to manage water resources on day to day basis. The study concluded that when the legislative arms of the WRUAs were weak, favoritism would be noted and informal rules could lead to misuse of water resources. Creation of workable strategies would involve creation of fora for negotiation when conflicts arose and initiation of dialogue to enhance control and sharing of water use. This study sought to establish conflict management strategies to enforce the rule of law used by water users in the Tana Catchment Area, Kenya.

2.9 Institutional Support

Mandated institutions arise from laws, regulations, rules and other statement-formulating sanctions (Tickner, et al., 2017). Under Kenyan law (GoK, 2016), management of water resources was managed by the Water Resources Authority while WRUAs are engaged at the grassroots level as managers. WRA have the responsibility of planning, management, protection and conservation of water resources, allocation, apportionment, assessment and monitoring water resources, issuance of permits, regulation of conservation and abstraction structures, catchment and water quality control. WRUAs are mandated institutions who carry the roles that ensure the involvement of users in decision making, collaboration in water allocation and catchment management, conflict resolution and cooperative management of water resources. While the WRA may support WRUAs to implement their plans and offer conditional or unconditional grants through WSFT to implement their intervention plans, WRUAs may not qualify for funding (GoK, 2016). Disqualification for financial support may be associated with limited capacity for proposal writing, inadequate capacity to handle finances or poor identification of priories.

The Water Resource Authority supports WRUAs in identifying priorities in order to improve water resource management within a period of 1 to 5 years (WRMA, 2013). To implement the intervention plans, the Water Sector Trust Fund (WSFT) may provide conditional or unconditional grants to WRUAs after the evaluation of plans for a specific period (GoK, 2016). For intervention plans to be implemented and yield desired results, regular monitoring of intervention activities have to be carried out and evaluation done to check whether the desired objectives are met and adjustment of the plans made (Mumma, *et.al*,. 2011). However, WRUAs in Kenya may be managed by committee members who may not have formal skills in either monitoring or evaluation practices (World Bank, 2002; JICA, 2013; Njonjo & Lane, 2002). Insufficient skills in monitoring or evaluation may lead to failure of implementation of planned intervention activities. WRUAs with unskilled managers would require training in monitoring and evaluation among other managerial skills for water resource management by WRA.

Jenkings, (2007) established that in Ghana, Burkina Faso and Kenya, training on governance and financial management for committee members was a prerequisite in order to create sustainable water projects. The study recommended that due to low education levels, training methodology should include practical lessons to build capacity in WRUA management skills and create awareness in water management. To create an effective capacity building strategy to support institutions managing water at the local level, a participatory assessment of institutional training needs would be necessary. The identified needs would form a base for for support in building local skills according to the level and stage of development. Training of people at the grassroots may focus on how to measure the performance on legal and regulation issues, identifying priorities, challenges and implementing improvement strategies in order to align and work alongside other institutions in water governance structure and addressing changing needs.

Rolston, Jennings and Linnane, (2017) established that in Ireland, although water bodies were important in supporting human life, 81% of respondents felt excluded from decisions regarding their water environment management, despite 95% of respondents advocating for a community voice on how the water environment is managed. However, only 31% of respondents indicated willingness to attend to water engagement initiatives. Engagement of stakeholders in decision making processes that affect them may lead to trust building, better communication and may increase project success. However, in most projects, effective user participation in decision making is inadequate (Jennings, 2007). Although the study was carried out in Ireland, it was necessary to assess institutional support offered to WRUAs to ensure effective participation in making decisions on water management.

Holvoet and Renard (2007) carried out a survey in eleven countries of the developing world and established that there was a fragmented support in the approach towards M&E planning of water projects. The study recommended M&E planning, data collection, and result utilization to be done in order to identify strengths and weaknesses of water project management as a starting point for effective M&E practice (Holvoet & Renard, 2007). Strengthening institutional capacity to monitor and evaluate water abstraction, enforcement of regulations, climatic changes would be

instrumental in promoting effective land use techniques and water management at the catchment level. Institutions managing water at the local level would also need support to guard against over abstraction and wastage of the water resource. Such institutions also would offer a platform for discussions in order to build consensus with water users on how the scarce resource would be protected and equitably shared. However, at the local level, water users to be organized in order to be participate development interventions when faced with common challenges. It was necessary to find out how WRUAs were supported to carry out M&E processes to improve the management of water projects.

The United Nations Development Program, (2006) report showed that there was greater frequency in floods and droughts of greater intensity and duration in Africa, Kenya included .The evaluation report recommendations on water management indicated that concerted effort was required from all stakeholders to support WRUAs planning, decision making, technical assistance and training (UNDP, 2006). Support in planning would ensure that rules were formulated and enforced to promote fairness, water security and reduce conflicts in water sharing. While project evaluation offers many potential benefits to projects, it could also result in a waste of time, resources and a failure to identify problems if it was carried out poorly or if the corrective issues were not acted upon (Estrella & Gaventa, 1998). Utilization of the evaluation report would identify areas of weakness and facilitate corrective action.

Aarts (2012) found out that in Upper Ewaso Ng'iro river basin in Kenya, WRUAs were supported to monitor availability and temporal fluctuation of river water. Such monitoring result was used to provide vital information for formulating by- laws and abstraction regulations and provided early warning system to water users' anticipated water strategies. Information when shared in time could be used to coordinate activities for protection of water point sources, planting of water friendly trees, and making short term plans of water rationing and allocation to avert conflicts. Coordination and building awareness campaigns designed for various stakeholders could gradually introduce activities aimed at building a platform for holding legitimate, structured discussions on water sharing and distribution during the dry periods when there was water scarcity. Thus engaging WRUAs in continuous

monitoring and evaluation would provide information requires for building sustainable water projects.

Holvoet and Renard, (2007) and UNDP, (2006) showed that when WRUAs were supported and trained, capacity could be enhanced to conduct monitoring and evaluation processes. Further, M&E capacity would enhance efforts for enforcement of regulations as well as plans for fair sharing of water resources. When users' capacity for M&E is enhanced, effective stakeholder participation would be prompted. This study sought to establish WRA support offered to WRUAs to build institutional capacity in enforcement of regulations, utilization of evaluation results in the management of water resources.

2.10 Challenges Faced by WRUAs in strategy implementation

User involvement is recognized as a crucial process in which stakeholders genuinely participate in the planning and conservation of their resources. A study on decentralization of water resources management in Zimbabwe, found that effective participation does not automatically occur (Chikozho & Latham, 2005). Participation may be affected by divergent socio-economic backgrounds of participants who may be spread over a large area and have different priorities and competing interests over the water resources in a hydrological system. Competing interests for water use within a catchment area could present challenges of equitable water sharing where users do not effectively participate in developing processes and procedures for water sharing.

Water sharing in WRUA projects was usually organized by the WRUA committee members by incorporating users in decision making processes. A study carried out by Mogaka *et al*., (2005) assessed performance of 100 water projects on water sharing practices and found that 59 percent of them had defects in design of water distribution and faced maintenance challenges. Management of water distribution may also be affected by mismanagement of project resources which could lead to matters affecting transparency and accountability. Lack of financial controls may cause disharmony and could lead to revenues being spent on matters that were not a priority in regard to water resource management. Jennings, (2007) observed that catchment management groups consisting of upstream and downstream stakeholders, had to be assisted by

government agency staff to form a fundamental group to manage many of the causes of financial challenges.

Catchment management groups form routine monitoring teams in the catchment areas. Such routine monitoring activity would require finances without which committees would find it difficult to identify specific operational challenges in water infrastructure around the river beds that house intakes such as water leaks due to blockages, over abstraction and wastage leading to deterioration of water quality and quantity due to contamination at the source and on the riparian plane. From the discussion in this section, participation, competing interests, water distribution, transparency among committee members and monitoring practices were isolated among others and used for this study.

Water catchments face environmental degradation due to destruction of wetlands, swamps, springs, encroachment of river banks and planting of non-water friendly trees near the river banks (WRMA, 2005, 2006). Encroachment of river banks could occur during the prolonged droughts when farmers need water to irrigate food crops, feed the cattle and for domestic purposes. This usually led to over-abstraction of the water from the rivers to meet the needs of the users. At times users can abstract the water leaving the river without any flow downstream, affecting water users downstream. Such abstractions and vegetation destruction could be responsible for decline and drying up of rivers as well as the destruction of ecosystem diversity. The concern of this study was to establish stakeholder participations in reducing abstraction upstream and maintaining water flow downstream as well as encouraging environmental management at all levels.

The change in the environmental management and decision-making was gradually developed with strategies in which planning, policy formulation, and regulation was conducted through involvement of local communities (Merkhofer, Conway & Anderson, 1997 and Crosgrove & Loucks, 2015). Local communities have common interests and were often viewed as having the greatest stakes and responsibility in the sustainability of resources and institutions that manage them. However, such sustainability of resources would need to be carried out by dynamic leaders whose

credibility and capacity need to be established. This study identified leaders' capacity to restore and rehabilitate local water resources in the interests of all stakeholders.

2.11 Theoretical Framework of the Study

This section presents the theoretical perspectives that were used in this study. In assessing the strategies used by WRUAs in promoting sustainable water projects, the theory of Common Pool Resource Management (Ostrom, 1990) and the Institutional Analysis and Development Framework (Ostrom, 2010) were linked to sustainable water management. The theories were linked to the variables of study to provide an appropriate guide on the relationship between the variables.

2.11.1 Theory of Common Pool Resource Management

In order to assess strategies used by WRUAs in the promotion of sustainable water projects, the theory of Common Pool Resources (CPR) Management was used to offer analytical advantage. The Common Pool Resource Management theory as proposed by (Ostrom, 1990, 1997) states that users have the potential to find ways to manage common resources in order to meet needs required for survival and those of future generations. In the common pool resource management theory, the users design and use principles that are locally acceptable to make rules that aim at creating norms of compliance and cooperation in order to meet the desired resource goals. The theory postulates that common resources should be protected and nurtured so that their benefits can be continuously exploited. The theory recognizes that common pool resources can be over-exploited, polluted and can be destroyed unless limits for acceptable use are devised and enforced.

In line with this theory, a water project is taken as a CPR since there are assets to be managed, especially the physical infrastructure for water distribution. This is because use of a particular amount of water by one user could deplete the resources available for others (Bromley & Cernea, 1989; Ostrom, 1990). The theory holds that WRUAs have the potential for improving user welfare. WRUAs have potential to manage water delivery services to make distribution and sharing of water possible to all users. The users have the necessary information regarding local water use and the needs which could be analyzed in order to reduce cost.

Further, the theory holds that water infrastructure maintenance could improve under WRUA management since users are likely to take care of water distribution systems by bearing the costs of repairs, rehabilitation or expansion. When users plan for the water system, formulate rules for equitable sharing and apply water distribution, the welfare of users improves, which leads to sustainable projects (Yercan, Dorsan, & Maulana, 2004). The theory further posits that WRUAs would be able to manage, control and prevent opportunistic behavior and improve fee collection from users to improve financial sustainability of water systems (Svendesen & Murray-Rust, 2001; Yercan, *et al.,* 2004). If this assumption were to be implemented, the results would reduce dependence on the state and lead to sustainable projects. Despite the theoretical benefits of WRUAs that manage natural resources, sustainable water projects often fail to emerge in practice (Svendesen, *et al.,* 2001). If the WRUAs do not control the use of the resource or contribute to common resource management, the results may often lead to depletion or degradation of the resource.

The theory was linked to infrastructure management, resource mobilization, conflict management and catchment management which are strategies used by WRUAs in promoting sustainable water projects. However, the theory did not provide operational guidelines to guide users on implementation of the assumptions. Users were left with unclear directions on how to meaningfully incorporate local interests and carry out practical and effective management of the water resources, calling for the need to consider the theory of Institutional Analysis and Development Framework as an alternative framework in assessing WRUA strategies in the promotion of sustainable water projects.

2.11.2 Institutional Analysis and Development Framework

The Institutional Analysis and Development Framework (IAD) was postulated by Ostrom (2010). The Framework incorporates collective works of scholars such as Ostrom and Elinor, (1983); Poteete, Amy, Jassen and Elinor Ostrom (2010) thus improving the framework to show how institutions improve and change over time. The framework incorporates all relevant variables and classifies them into categories which are put into a structure to show logical relations as illustrated by **Figure 2.1**

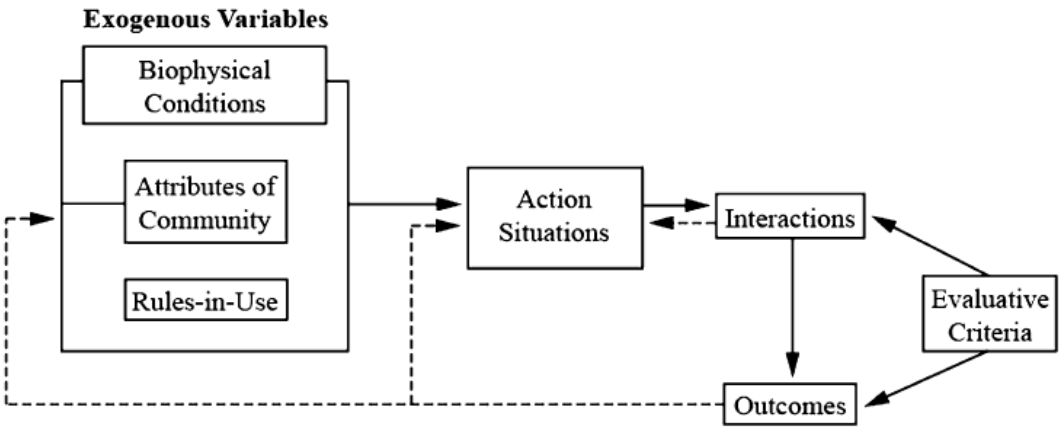


Figure 2.1: Basic Components of the IAD Framework

Source: E. Ostrom (2010, p.646)

The (IAD) framework gave guidance on analyzing vital aspects regarding institutions that implementing strategies to alleviate problems of managing common resources. At the centre of the framework is the action component made up of actors and action situations. The action component indicate where the actors interact to solve common problems and share ideas. Interaction could take the form of consultation, active participation in decision making, provision of resources for running the projects or involvement in carrying out common activities to improve the projects. The actors are perceived as those who take part in the situations to formulate interventions to solve common challenges (Ostrom, 2007). In the Tana Catchment area, the action component was perceived to have water users, water committee members as well as Water Resources Authority Officers as the participants putting efforts to formulate and implement strategies aimed at promoting sustainable water projects.

In line with the steps in (IAD) framework (Figure 2.1) and using the action component as the unit of analysis, the process follows the path of decision making from formulation to implementation of strategies of WRUA strategies in promoting sustainable water projects. The action component thus explores who participates, how the committee offices are filled and what responsibilities was assigned to the respective offices. Further, the mobilization of resources for implementation and expected outcomes are examined to show the relationship with sustainable water projects. When the action component and all the associated rules are evaluated, in

term of management and performance, the results can provide a guide on areas for improvement.

The framework identifies the need for formulation and implementation of project rules and regulations which are regularized in project operations. Thus, the participants formulate rules that direct day to day decisions for running WRUA operations so that collectively the outcomes can improve the projects. The study will examine rules made and used in the projects to establish whether the rules just exist on paper or they are in operation in the actual setting on the ground. The action component in the framework provides a linkage between the interactions of participants through actions expected form them and the expected outcomes.

The region chosen for investigation and use of the framework was the Tana Catchment area, where WRUA strategies have been implemented for more than a decade by use of short term five year plans as was indicated in the sub-catchment plans (WRMA 2007). The study explored the planning, design and implementation of WRUA strategies. The purpose was to examine whether WRUAs have strategies in place, and investigate how they are implemented to promote sustainability of water projects. Implementation of strategies require constant review and continuous feedback as indicated in the framework in order to identifies areas for collective action and address specific and emerging situations. The study further established that participants' actions were in line with action situation and were regularized in the set rules to resolve possible conflicts. However, having rules alone was not sufficient to deter actions of participants in lateness to provide resources, participate in project activities and violation of abstraction rules. Thus the implementation of the rules and regulations in water management require strict enforcement and evaluation to reach the expected outcomes of sustainable water projects. The framework recommends for provision of feedback to enable correction which has been provided in current study.

The theory shows the external variables stated as biophysical situations, attributes of community and rules in use by the participants. The framework explains how the external aspects affect the action situation. However, the IAD framework fails to determine the vital questions to be answered before determining the action situation to

operationalize the framework. The framework could be useful in the institutional analysis of water projects, however, the actors must be empowered to carry out complete activities of situational analysis. Situational analysis would identify the project status and allow formulation of the necessary strategies. The project analysis would further require support of a policy analyst to assist the participants in the clarification and definition of the challenges. Understanding the project status would lead the decision makers in identifying appropriate goals, objectives and values to achieve in the project cycle.

Basic to the two theories used in this study was that if the WRUAs did not control the use of the water resource or contribute to common water resource management, the results may often lead to depletion or degradation of the resource. Hence this study aimed at assessing the strategies used by WRUAs in the promotion of sustainable water projects.

2.12 Summary of Literature Review

Reviewed literature shows that promotion of sustainable water projects was positively related to the strategies used by WRUAs in water management (Chikozho & Latham, 2005; Ganesh, 2007; Regner, 2006; Aarts, 2012). Literature also presents WRUAs as water institutions that are able to set targets, budget, plan activities, identify priorities in order to improve water resource management with support from Water Resources Authority (WRMA, 2013). While it is recognized that WRUAs are relatively new institutions in water management, their existence is justified by water users who participate in the formulation and implementation of water management plans and strategies. Such participants are more likely to understand formulated strategies and rules, own them and comply with them. Mansuri & Rao, (2004) argue that those who participate in formulation of water management strategies use their local knowledge to address persistent water management issues. However, effective participation does not just spontaneously occur (Chikozho & Latham, 2005). The missing link between the theory and practice could be on the effectiveness of the strategies used by WRUAs to address water management.

Literature further acknowledges that although WRUAs are in place, water catchments face environmental degradation due to destruction of wetlands, swamps, springs, encroachment of river banks and planting of non-water-friendly trees near the river banks or over abstraction which led to reduced water flows in rivers (WRMA, 2005). Reduction in water flow in rivers despite existing structures led to renewed interests in the water management conflicts.

Conflicts in water resource management were shown in the reviewed studies to arise due to intense competition for water, lack of adequate administrative capacity, lack of transparency, ambiguous jurisdictions, overlapping functions and lack of necessary infrastructures (Matiru, 2000). Studied literature also points out that rules and regulations on infrastructure maintenance, when not effectively implemented, created disagreements in water allocation among users (Abdelhadi, *et al.*, 2004).

The conclusion that may be drawn from studied literature is that there is variance in performance of how WRUAs implement the strategies in order to promote sustainable water projects. Hence, there is need to continue with research endeavors especially in developing countries in order to find evidence of effective strategies used by WRUAs in the promotion of sustainable water projects. The studies reviewed gave findings that indicated the gaps which informed this study. The study thus focused on the gaps with a view of making a contribution to arguments of strategies used by WRUAs in the promotion of sustainable water projects.

2.13 Conceptual Framework

The objective of the study was to assess the effectiveness of the strategies used by Water Resource Users Associations in the promotion of sustainable water projects in the Tana Catchment Area, Kenya. The basic assumption was that a sustainable water project was dependent on effectiveness of WRUAs strategies in promoting sustainable water projects.

The conceptual framework helped the researcher to clarify research questions and purpose, based on the literature reviewed. Hence it formed the basis on which research questions were formulated and assessed. On the basis of the conclusions

from literature reviewed, it can be argued that all factors held constant, it would be expected that variations in effectiveness of WRUAs strategies will probably cause a difference in the promotion of sustainable water projects. Accordingly, it was conceptualized that promotion of sustainable water projects was dependent on unique combinations of strategies used by WRUAs in water management. Institutional support was thought to have a moderating effect and moderates the relationship between the WRUA strategies and promotion of sustainable water projects as shown in Figure 2.2

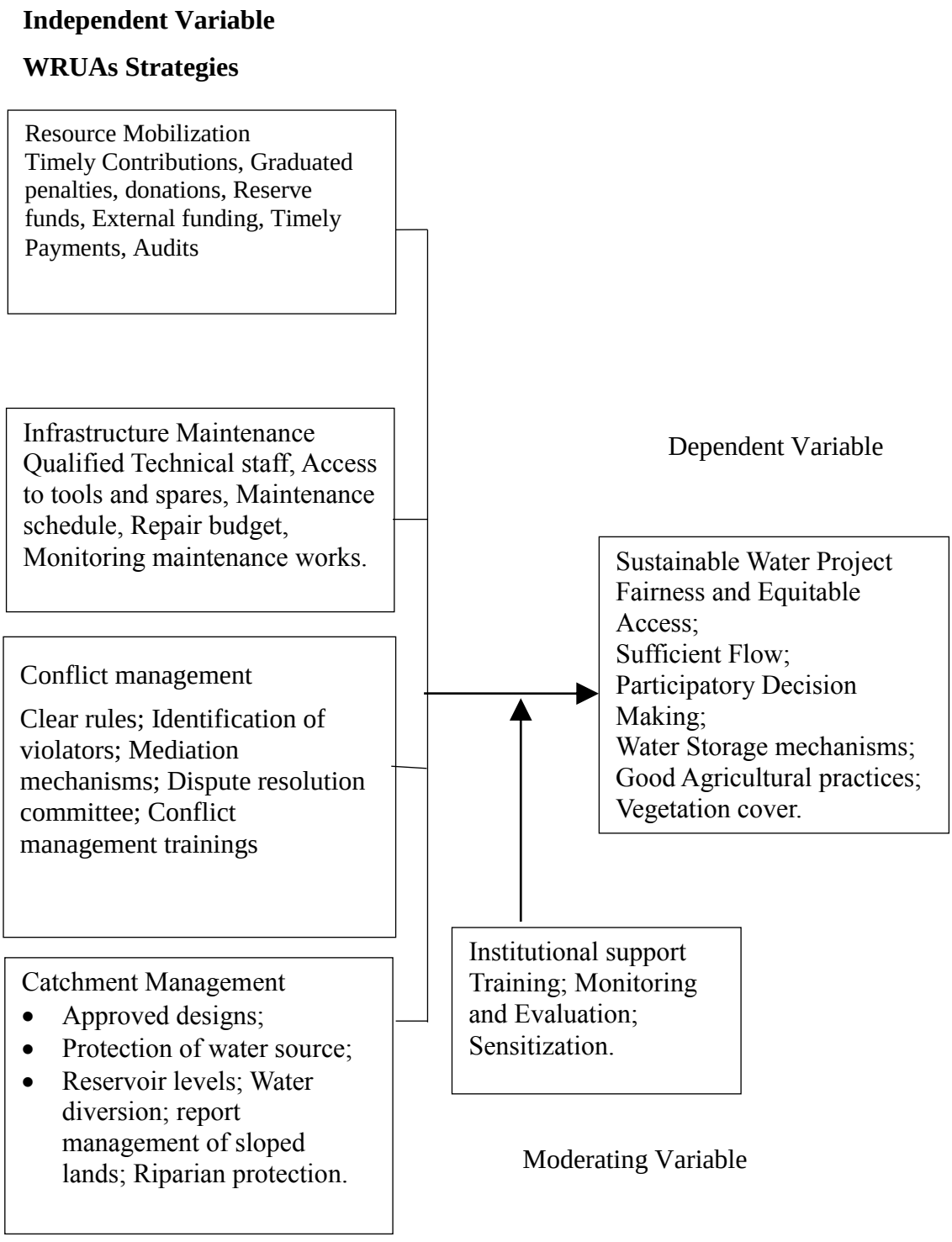


Figure 2.2: Conceptual Framework on variables in the study

The independent variables in the study were as follows: resource mobilization which was measured on WRUA timely contributions, donations, reserve funds, external funding, timely payments and audit; infrastructure maintenance which is conceptualized as availability of qualified technical staff, access to tools and spares,

maintenance schedule, repair budget and monitoring of maintenance works; catchment management which is conceptualized as availability of approved designs, protection of water point sources, reservoir levels, water diversion, management of sloped lands M&E reports on water abstraction in river basin and riparian protection; conflict management which is conceptualized as formation of rules, identification of violators, mediation mechanisms, formulation of dispute resolution committee and participation in the enforcement of rules.

The Moderating variable was institutional support. In this case, institutional support of WRUAs through WRA officers could be provided in the form of training in water management, as well as support in monitoring and evaluation of WRUA strategies in the promotion of sustainable water projects. The dependent variable was a sustainable water process which was measured in terms of fairness and equitability, access to water, and sufficient flow of water, participation in decision-making and water storage mechanisms in place. The concept of sustainable water management is achieved when a project produces continuous output and benefits throughout their intended life cycle (Kaliba & Norman, 2004). Likewise, WRUAs invested time in formulating strategies that aimed at attaining equitable distribution and allocation of water resources among users and governing the sharing of limited water resources to meet user needs (Cleaver & Franks, 2003). Mansuri & Rao (2004) noted that WRUAs that formulated rules and implemented water management plans were more likely to understand, own and comply with rules to address persistent water management problems.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods and procedures that were used in carrying out the study. The main sections include research design, location of the study, and population of the study, sampling techniques and size, and the validity and reliability of data collection instruments. The chapter further describes the data collection procedures and the techniques that were used to analyze the data.

3.2 The Location of the Study

The Tana Catchment Area is one of the Regions created under the Water Resource Authority as enactment of GoK, 2016. This catchment area covers 5 Sub-regions spread in various counties covering an area of 19,169 Km^2 with a population of 4,238,469 (GoK, 2009). The estimated figure for 2015 is 4,537,000 people, projected from the 2009 population census with 16% of them in urban and 84% in the rural areas (GoK, 2009). The catchment covers two of Kenya's water towers - the Aberdare Mountains and Mt. Kenya. The area sustains aquatic biodiversity, supports agricultural activities and livestock rearing that sustains the population in the catchment area. Approximately 40 % of the population receives their water from water supply schemes that were inherited from the Ministry of Water and Irrigation by Water Resources Authority and other get water from organized community groups (WASREB, 2013).

The mandate of WRA was derived from Water Act 2016, which was to increase access to safe, adequate and sustainable water and sewerage services to both the rural and urban populations within the area of its jurisdiction. The enactment of the GoK (2002) and its subsequent revision in GoK (2016), introduced the involvement of Water Resource Users Associations (WRUAs) in water resource management at the grass root, the Tana Catchment Area included. The area has 56 WRUAs that have developed sub-catchment plans for more than three years and were funded by government of Kenya through KSTF. This implies that the WRUAs have the structures in place to manage water resources in the catchment area since their plans were evaluated and funded.

3.3 Research Design

The study adopted a convergent research design that allows use of the mixed methods approach. This approach allows the researcher to use both qualitative and quantitative data from different sets of respondents (Creswell, 2015). This research design allows the researcher to gather data from all stakeholders and explore in-depth opinion of the stakeholders. According to Kerlinger & Rint (1986) this design may be used in a systematic inquiry to explain a consequence based on antecedent conditions. In addition, it determines the link between variables and tests a claim by use of statistical techniques. Kerlinger & Rint (1986) asserted that convergent design *seeks* to reveal possible relationships by interrogating different conditions and referring back in time for possible contributing factors. Cohen, Manion, & Morison, (2011) noted that instead of studying two groups that are equivalent and subjecting them to different treatments to identify the differences in the dependent variables, the design begins with groups that are already different. Ary, Jacobs & Sorensen (2010) states that the research design is useful when one wants to investigate the relationship between variables when manipulation of the independent variable is not possible.

The design was appropriate for this study because the researcher collected and analyzed data as it existed in the field without manipulating the variables. The research sought to assess the effectiveness of Water Resource Users Associations (WRUAs) in the promotion of sustainable water projects. In this approach, the study made knowledge claims and perspectives that claim multiple meanings in individual experiences that were socially and historically constructed (Creswell, 2015). The independent variables under investigation included resource mobilization strategies, maintenance of water infrastructure strategies, conflict management strategies and water catchment management strategies which have already occurred and cannot be manipulated. This study therefore retrospectively examined the effectiveness of WRUAs strategies in the promotion of sustainable water projects.

3.4 Target Population

This study targeted WRUA committee members, water users and Sub-Region Water officers who were the officials supervising the WRUAs in the Tana Catchment Area Kenya. The GoK (2016) showed that the Tana Catchment Area was a region with five

sub-regions (namely Lower Tana, Muranga, Keroguya, Meru and Kitui). The region has 56 registered Water Resource Users Associations who have been in operation for more than three years (Appendix X). The WRUAs in operation for three years were preferred because they had existing management structures and were likely to exhibit elaborate relationships among the variables of study. A WRUA serves a membership of between 350 to 400 members with a total of more than 23,000 members in the catchment area. The sampled members were requested to fill a questionnaire that provided information on the strategies their WRUA uses to promote sustainable water projects. In total, the study targeted 168 committee members (three from each WRUA) who provided information on the strategies the WRUAs used to promote sustainable water projects. Five (5) Water Resource Authority officers were interviewed to provide information on the support offered to the WRUAs and also provide more information on WRUA strategies that promoted sustainable water projects. One WRA officer in each region was sampled to participate in the study. The total population target population was 22,888 These WRUAs cut across sections of Tana Catchment Area as shown in Table 3.1

Table 3.1: Target Population

Sub-regions	WRUAs funded by WSFT 2017/2018	Committee Members	Users	Sub-regional Officers
Lower Tana	6	18	2,400	1
Muranga	14	42	5,624	1
Kerugoya	15	45	6,194	1
Meru	13	39	5,232	1
Kitui	8	24	3,214	1
Total	56	168	22,664	5

Source: Water Resource Authority 2017

3.5 Sampling Techniques, Sample Size and Sampling Procedure

This section describes the sampling technique that was applied to obtain the required sample size. Sampling refers to selecting objects or individuals of a population or the universe whose characteristics are representative of the whole population (Kathuri & Pals, 1993; Kumar, 2011). The main purpose of selection was to secure a representative group which would enable the researcher to gain information about the entire population (Cohen, Morrison & Manion, 2011). The subjects of this study were drawn from the WRA office, WRUA committee members, and water users in the five

sub regions of Tana Catchment Area. To ensure that the sample was adequately representative, the study used both probability and non-probability methods when selecting the respondents. Probability procedures refer to a choice of respondents made in such a way that each unit of the target population has an equal chance of being selected (Kombo & Tromp, 2006). In this case, cluster techniques and simple random techniques were used. In non-probability sampling procedures, the researcher targets a population where the members of the larger group has no equal chance of being chosen as a participants (Cohen, Morrison & Manion, 2007). For the purpose of this study, census and purposive sampling techniques were used. Description of sampling techniques for various categories of the population is provided in 3.5.1, 3.5.2 and 3.5.3.

3.5.1 Water Users Associations

The 56 WRUAs that were operational in Tana Catchment Area for at least 3 years in the second level of the development cycle and funded by WSTF in 2017/2018 were grouped into clusters based on the five sub-regions. According to Kathuri & Pals, (1993), when a target number is 56, then a sample of 48 is appropriate. In this case, 48 WRUAs were selected from each (cluster) sub region proportionately. The 48 WRUAs were assumed to have the necessary strategies for promoting sustainable water projects because they had reached the appropriate level of the development cycle and were funded by the WSTF during the 2017/2018 financial year. Then one committee member was purposively chosen to participate in the study. The executive committee members were directly involved in the day-to-day management of the WRUAs and had directly participated in the formulation of strategies and development of operation management plans for water resource management at their level.

Table 3.2: WRUAs funded in Tana Catchment Area

Sub-regions	WRUAs Funded by WSFT 2017/2018	WRUAs Proportionately Selected
Lower Tana	6	5
Muranga	14	12
Kerugoya	15	13
Meru	13	11
Kitui	8	7
Total	56	48

Source: Water Resource Authority

3.5.2 Water Resource Authority officers

To provide more information, a census of (5) Sub -Region water officers from each Tana catchment area were selected purposively to participate in the study. The sub-region officers were selected to participate in the study because they were directly involved in the supervision of WRUAs in their respective sub regions. The WRA officers interacted directly with WRUAs and supported them in the formulation and implementation of their management plans.

3.5.3 Water Users

The 48 WRUAs selected in this study had a total membership of 22,888. According to Kathuri & Pals, (1993), when the target population is more than 20,000, a sample of 377 is appropriate for the study. For the purpose of this study, an executive committee member was purposively selected from each WRUA. This gave a total of 48 respondents from WRUA committee members. In addition, the 5 WRA officers were included in the sample. The remaining 324 respondents were proportionately selected from among the water users of each WRUA as depicted in Table 3.3. Users from each WRUA were randomly selected to participate in the study. Water users were selected to participate in the study because they were members of WRUAs who land touches the riparian land and directly use the water from the catchment and are directly affected by strategies used by the WRUAs in the promotion of sustainable water projects. The water users sampling matrix is distributed as shown in Table 3.3

Table 3.3: Water Users Sampling Matrix

Sub-regions	Sample	WRUAs Proportionately Selected	Water Users	Water Users Sample in Proportions
Lower Tana	6	5	2,400	34
Muranga	14	12	5,624	82
Kerugoya	15	13	6,194	87
Meru	13	11	5,232	74
Kitui	8	7	3,214	47
Total	56	48	22,664	324

Source: Water Resource Authority

3.6 Data Collection Instruments

Data collection instruments used in the study included face-to-face interviews with WRA officers in the sub region offices, observation schedule, and questionnaires for water executive committee members and water users. The questionnaire was used as a tool for collecting data to offer an objective means of collecting information about the respondent's knowledge, education level, attitudes, behavior and concerns (Boynton & Greenhalgh, 2004). Besides being an instrument that could collect a lot of data, questionnaires were considered easier to administer and analyze and were economical to use in terms of time and money (Kothari, 2009; Miller & Salkind, 2002).

Two sets of questionnaires were used in this study to collect data from executive committee members and water users. They contained closed-ended questions and open-ended questions. The open-ended questions were included in the study, thus avoiding the bias that would have resulted from any suggested responses. In order to cover all the objectives of the study, the questionnaire had eight sections. Section A contained questions aimed at collecting bio data like gender, age, level of education and general information of the respondents. Data collected in sections B, C, D, E and F of the questionnaire responded to objectives 1, 2, 3 and 4 respectively. To assess water infrastructure maintenance strategy a questionnaire was customized and adopted from a study carried out by Katz, Jenifer, Mario, & Kihoon, (1997).

An Interview schedule was also used to collect information from WRA officers who were charged with the mandate of overseeing WRUA activities. The Interview schedules were appropriate for this study because they gave supplementary

information obtained from questionnaires through probing. The interview schedule sought more information on strategies used by WRUAs and how they promoted sustainable water projects. The interview schedule had eight sections for providing data on the research objectives of study. The interview schedule was also used to explore the type of support WRA offices offer to the sampled WRUAs. Besides oral interviews, WRA responses were recorded in order to preserve the information while awaiting data analysis processes.

The observation guide was used to collect data on observable aspects that were considered important for the study. This ensured that data collected was necessary for the study. The aspects observed were, type of vegetation cover along the river bank, observable effects of soil erosion, encroachment of river banks, position of water abstraction points. The observation guide verified claims of actions by the participants.

3.7 Piloting of Research Instruments

A pilot study was conducted before rolling out the main study. Cohen, *et al.,* (2011) posit that it is necessary to pilot the research instruments to refine their content and appropriateness for their use to the target sample. Kumar, (2011) argues that ten cases are appropriate for a pilot of research instruments. Therefore, one WRUA (Nithi WRUA) was sampled to test research instruments since it had the same characteristic with other WRUAs in Tana catchment area. The WRUA was excluded from the main study. Purposive sampling was used to sample water users, committee member and one WRA Officer from Tana Catchment Area to participate in the piloting of the instruments. The pilot of the research instruments included 8 water users, one WRUA committee member and one WRA officer in order to pre-test instruments that were used in the study. The total number of participants in the piloting of research instruments were 10. The three categories of respondents used in the pilot of research instruments had knowledge on WRUA operations and water resource management.

Research questions were modified to suit the research objectives of the study. The observation guide was validated by the supervisors and peers.

The observation guide was used to collect data on observable aspects that were considered important for the study. This ensured that data collected was necessary for the study. The aspects observed were, type of vegetation cover along the river bank, observable effects of soil erosion, encroachment of river banks, position of water abstraction points. The observation guide verified claims of actions by the participants. The observable aspects were determined before use to verify the situation on the ground. Based on the results, the instruments were reviewed by rephrasing the questions that were not well understood, while all irrelevant questions were removed. The pilot study enabled the researcher to determine the reliability and validity of research instruments.

3.8 Instrument Validity

Validity refers to the appropriateness, meaningfulness, correctness and usefulness of the inferences a researcher makes. Results obtained from the data analysis represented the phenomenon under study to a degree. On validity, Mugenda & Mugenda, (2008) argues that it is not possible to estimate validity from the instrument but from the data that is collected using the instrument. In this study, content validity was used to determine the validity of data collection instruments. According to Kothari, (2009) content validity was the extent to which a measuring instrument provides adequate coverage of the topic under study. This was achieved through use of questionnaires for the committee members, an interview schedule for WRA officers in the sub-counties and an observation guide for the purpose of triangulation. A panel of experts made up of the researcher's supervisors from Chuka University verified the instruments.

3.9 Reliability of the Instruments

This refers to the accuracy and precision of a measuring procedure. A measure will be reliable to the degree that it produces consistent results. According to Mugenda & Mugenda, (2003) a questionnaire would be, in most cases, a reliable tool to collect data when there is uniformity in the questions. The researcher administered questionnaires to ten Water Resource Users Association members and committee members who were not in the sample before commencement of data collection from the sampled respondents. The reliability was ascertained by determining the internal

consistency of the tools which was computed using Cronbach's Alpha Co-efficient. This technique requires only a single administration and provides a unique, quantitative estimate of the internal consistency of a scale. This generated an inter-item correlation matrix first, and then summed up all the correlations to estimate the mean correlation. A high coefficient implied that items in the scale correlated highly among themselves and consistently measured the construct of interest. The results in Table 3.4 and Table 3.5 indicate that the Cronbach's Alpha coefficient for the variables of study ranged from 0.621 to 0.901. According to the rule of the thumb provided by George and Mallery, (2003) coefficients greater than @>0.6 are acceptable while @>0.7 are good and @>0.8 is very good.

Table 3.4: Reliability Coefficient Summary (users)

Variable	Number of items	Cronbach's Alpha	Conclusion	Reference (Appendix)
Resource Mobilization Strategy	7	0.730	Reliable	Table A.1
Infrastructure Maintenance Strategy	7	0.869	Reliable	Table A.2
Conflict Management Strategy	7	0.722	Reliable	Table A.3
Water Catchment management Strategy	7	0.708	Reliable	Table A.4
Institutional Support	6	0.756	Reliable	Table A.5
Sustainable Water Projects	7	0.727	Reliable	Table A.6
Composite Cronbach's Alpha Reliability Coefficient	37	0.892	Reliable	

Table 3.5: Reliability Coefficient Summary (executive committee members)

Variable	Number of items	Cronbach's Alpha	Conclusion	Reference (Appendix)
Resource Mobilization Strategy	7	0.646	Reliable	Table A.7
Infrastructure Maintenance Strategy	7	0.822	Reliable	Table A.8
Conflict Management Strategy	7	0.818	Reliable	Table A.9
Water Catchment management Strategy	7	0.704	Reliable	Table A.10
Institutional Support	6	0.621	Reliable	Table A.11
Sustainable Water Projects	7	0.754	Reliable	Table A.12
Composite Cronbach's Alpha Reliability Coefficient	37	0.901	Reliable	

3.10 Data Collection Procedure

In order to carry out the research, the researcher first obtained an introduction letter from Chuka University and a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). After obtaining the research permit from NACOSTI, the researcher then presented these documents to the Tana Water Service Board administrator in charge of the regions under study, to be allowed to conduct the study. Thereafter, the researcher presented introduction letters to various WRA officials in the sub-regions under study. After this, the researcher visited the selected WRUAs and sought permission from the chairperson to administer questionnaires to respondents. The researcher also made appointments with the WRA officers for the purposes of data collection from them.

Prior to undertaking the actual fieldwork, research assistants were recruited and trained. The Researcher recruited five Research Assistants undertaking Bachelor of Sciences in Project Management. Conditions that were considered during recruitment were that they must have studied and passed a research methods course or courses and demonstrated interest in social research. The Research Assistants who were residents from the region of study were preferred because they were familiar with the area of study. The Research Assistants recruited were then trained on data collection methods and also taken through each questionnaire before going to the field. Research Assistants were then assisted in administering questionnaires and filling the observation checklist.

Telephone calls were made to the respondents in advance to arrange for administration of questionnaires. A letter of introduction explaining the purpose of data collection and an assurance of confidentiality was attached to the questionnaires. As a control measure to ensure Research Assistants engaged the respondents, follow up calls were made randomly to the respondents. The researcher also regularly accompanied the Research Assistants in order to monitor progress of data collection. The main researcher conducted the interviews with the WRA offers in the sub-regions.

3.11 Data Analysis

The collected data was taken through data analysis phase which involved data clean-up, and classification. Data clean up involved editing, coding and tabulation in order to detect any anomalies in the responses. Descriptive analysis was conducted on the data using the Statistical Package for Social Sciences (SPSS) Version 19.0 in order to obtain the statistics of the sample. Inferential statistical analysis was conducted using Chi-square statistics to test the hypotheses of the study in order to establish the degree of association between the WRUA strategies and sustainability of water projects. Logistic regression was also used to test the moderation effect of institutional support on the relationship between WRUA strategies and sustainability of water projects. Table 3.6 shows the model of testing the hypotheses. The summary of the descriptive analysis was presented in graphical and tabular form.

Table 3.6: Hypotheses Testing Models

Hypothesis	Variables and Method of Analysis
H_0: There is no relationship between resource mobilization and sustainability of water projects in the Tana Catchment Area, Kenya	X_1: Resource mobilization Y: Sustainability of water projects - Chi – square test
H_0: :There is no relationship between infrastructure maintenance strategy and sustainability of water projects in the Tana Catchment Area,	X_2: Infrastructure Maintenance Y: Sustainability of water projects - Chi – square test
H_0: There is no relationship between conflicts management strategy and sustainability of water projects in the Tana Catchment Area, Kenya	X_3: Conflict management Y: Sustainability of water projects - Chi – square test
H_0: There is no relationship between water catchment management strategy and sustainability of water projects in the Tana Catchment Area,	X_4: Water catchment management Y: Sustainability of water projects - Chi – square test
H_0: There is no moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.	Ln $\left(\frac{p(y)}{1-p(y)}\right) = \beta_0 + \beta_1 X_i + \beta_2 M + \beta_3 X_i * M + e$ Y – Sustainability of water projects P(Y) – Probability of sustaining water projects X_i – WRUA strategies for i = 1,2,3,4 X_1 – Resource Mobilization Strategy X_2 – Infrastructure Maintenance Strategy X_3 – Conflict Management Strategy X_4 – Water Catchment Management Strategy M – Institutional Support X_i*M - interaction of strategies and institutional support β_1 – Regression coefficient for sustainability of water projects β_2 – Regression coefficient for institutional support β_3 – Regression coefficient for interaction of WRUA strategies and institutional support e – Error term

To analyze qualitative data generated through the open ended questionnaire, the data was transformed to quantitative data and analyzed by use of descriptive statistics (Ritchie & Lewis, 2003). The data was classified and organized based on key themes and concepts. The qualitative data generated from the in-depth interview was coded and analyzed in thematic forms. Themes were arrived at after identifying codes that recurred from the interview. Content comparison analysis revealed the underlying trends. The responses were reported in direct verbatim.

The observation schedule used revealed observable aspects that were determined beforehand to verify the situation on the ground. The observed aspects were analyzed using thematic and content analysis. The main content that emerged from the observations were identified and integrated to the qualitative data.

3.12 Ethical and Logistical Considerations

Ethics was an integral part of this research study right from the planning stage to the actual conduct of the study. Logistics in research refers to all those processes, activities or actions that a researcher must address or carry out to ensure successful completion of a research project (Mugenda & Mugenda, 1999). The respondents were provided with adequate information about the aims of the study, the procedures to be followed, and the possible benefits for them and the way in which the results would be used. This enabled the respondents to make informed decisions on whether to participate in the study or not. No form of deception or coercion was used on the respondents. The researcher observed confidentiality, especially with the information given in the questionnaires. The respondents' information was not passed on to a third party. The respondents' names were not written on the questionnaires.

In order to meet the requirements, the researcher sought permission from relevant authorities to ensure that the work was not discontinued midway. The researcher visited the WRA sub- regional offices in Tana Catchment Area to seek permission to carry out research in their areas of jurisdiction. In order to ensure the study was free from plagiarism, all sources of information referenced were cited to give credit to the original author as proposed by Creswell, (2014). The results of the research were disseminated to relevant authorities and also published in referred journals

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results of the statistical analysis of the data and their interpretations. The descriptive statistics of each independent variable is presented using graphics and tables. The effect of institutional support as the moderating variable on each independent variable was tested using binary logistic regression. The effect of each strategy in the promotion of sustainable water projects was tested using Chi-square test. Discussions were done for each objective in reference to the analysis and interpretation of the inferential statistics.

4.2 Descriptive Analysis

4.2.1 Response Rate

Questionnaires were administered to a sample of 48 WRUA committee officers of which 31 questionnaires were returned. A total of 324 questionnaires were administered to the users out of which 257 user's questionnaires were returned giving a response rate of 77.8 %. Face to face interviews were conducted to 5 WRA Sub-region Officers. According to Babbie, (2011), a return rate of 50% is adequate, 60% is good and 70% is very good, for analysis. This implies that 77.8% response rate was very good for data analysis. The response rate was attributed to the questionnaires which were dropped and picked by the research assistant or the researcher. Some questionnaires were dropped but not returned even after follow up and were classified as non-returned.

Table 4.1 Response Rate

Respondents	Sample Size	Return size	Response rate (%)
Water Users	324	257	76.2
Executive committee members	48	31	64.6
WRA officers	5	5	100.0
Overall	377	293	77.8

4.2.2 Gender Distribution of Respondents

The data comprised of 257 user respondents of which 155 were males and 102 females. The data also comprised of 31 executive committee members of which 25

were male and 6 were female. The WRA officers comprised of 5 respondents of which one was the only male.

Figure 4.1 shows the gender distribution of respondents in the survey. Male respondents were approximately 20% more than female respondents.

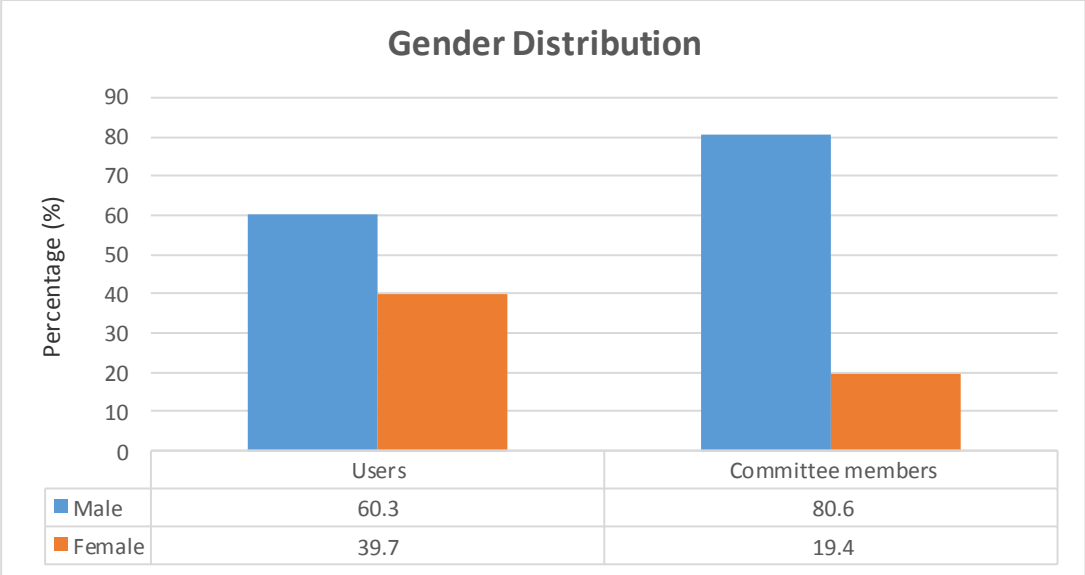


Figure 4.1: Gender Distribution of Users and Executive Committee Members

The findings show that women's participation in water management was low compared to that of men. This can be attributed to the patriarchal society which does not allow women's participation in public matters, especially management of natural resources which are culturally bestowed on men. Secondly, due to male dominance, women are not allowed to take decisions in the presence of men, yet women are direct water users who suffer most when there is scarcity of water or when conflict occurs over water issues. Gender parity is an important aspect of water management because it is the whole community's concerted effort that is required to conserve and watch over water resources. Water Resource Users Associations have a gender mainstreaming strategy and have activities that bring about gender mainstreaming at management committee level and in all stakeholder activities (GoK, 2016).

4.2.3 Age Distribution of Respondents

In order to establish their age, WRUA Committee members and users were requested to identify their age brackets. The age brackets were provided as below 20 years, 26-30 years, 31-40 years, 36-40 years, and 41-45 years, 46-50 years and above 51 years.

The findings are summarized in Table 4.2 and 4.3 for water users and executive committees respectively.

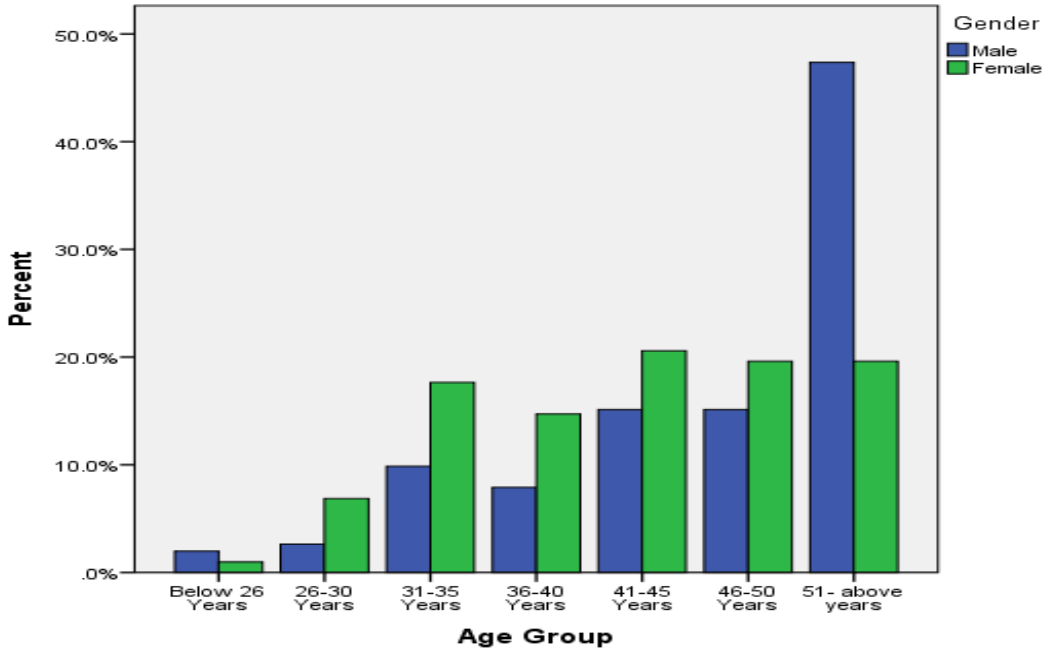


Figure 4.2: Clustered Age Distribution for Users

From the Age distribution shown in Figure 4.2 from which it was evident that other than the 51years and above age category which had significantly more males than females, all other age categories had approximately equal gender representation. The age group with majority of water users was 51years old. This indicated that the elder population participated more in water management and have acquired knowledge on water management.

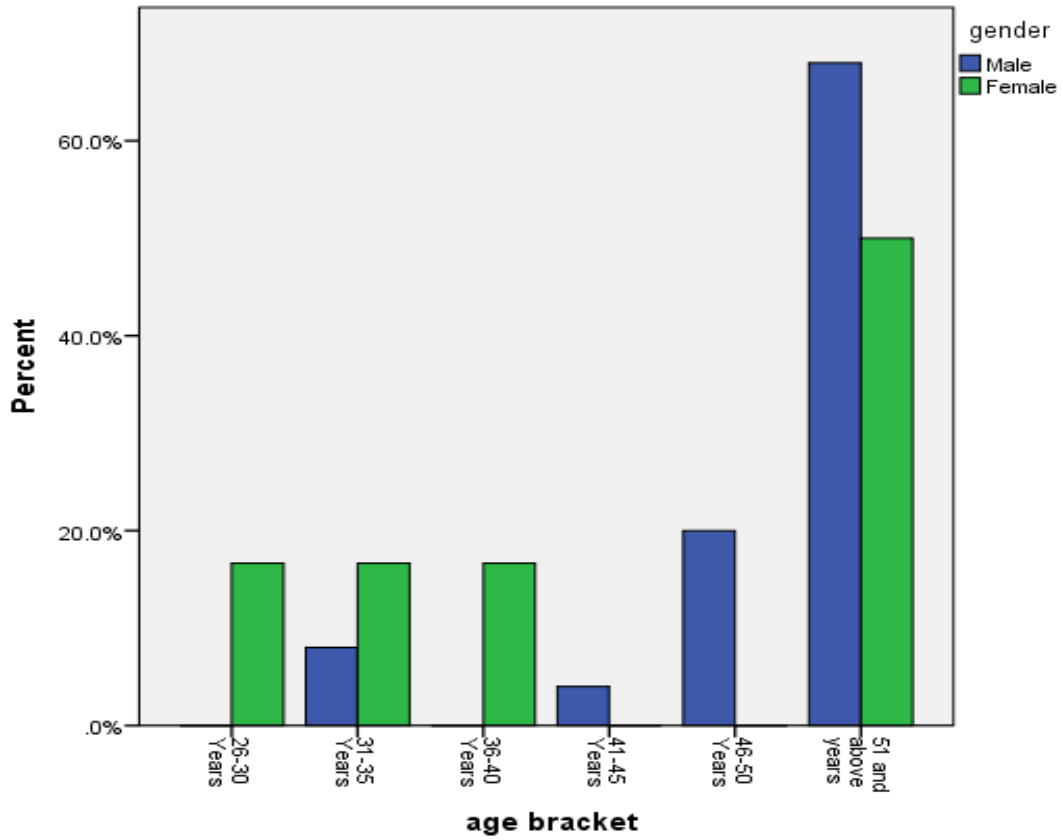


Figure 4.3: Clustered Age Distribution for Committees Members

The category of age 26 to 30 years representing the younger respondents recorded the least participants. The results reveal that the young people do not take part in water resource management. This observation agrees with the FAO (2011) report in North Africa which argued that women and youth participation in decision making on water resource management was limited and a deliberate effort to create an enabling environment for participation was required. In addition, the findings show that the elderly were more involved in WRUA executive committees, compared to the youth. Introducing the youth to water resource management would create awareness on the fragility of water resources and would enhance continuity of sustainable water management, engaging the youth would require formulation of platforms and implementation of new techniques by use of technology that would spark their interest in water resource management. Further, engaging the youth in promoting environmental management would trigger change because the youth would live with the consequences of mismanagement of water resources longer than the elders.

4.2.4 Education Distribution of Respondents

The study sought to establish the education level of the committee members and users who were engaged in WRUA activities. The education level ranged from PhD, Masters, Degree, Diploma, Certificate and Secondary School education levels. As shown in Figure 4.5, the education level of the water users and committee respectively was presented. Although most respondents had a post-secondary education qualification, there was no female respondent with a Master's degree.

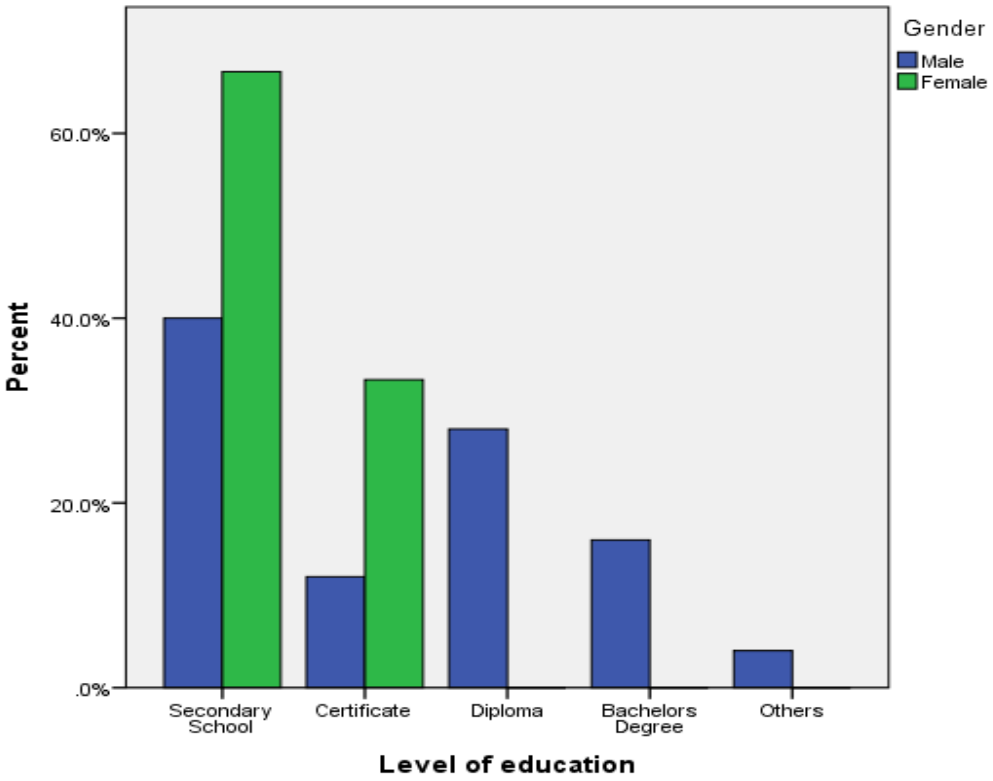


Figure 4.4: Gender – Clustered Education Distribution for Committee Members

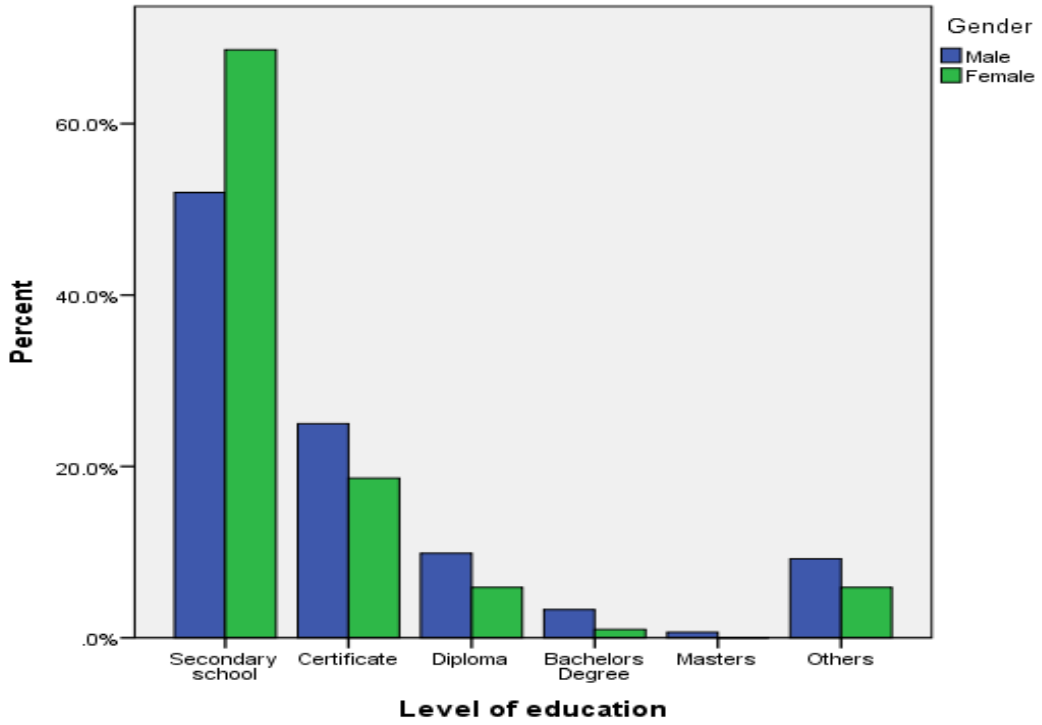


Figure 4.5: Gender – Clustered Education Distribution for Users

Figure 4.4 and 4.5 present the level of education distribution for committee members and water users respectively. On examining the education level of the water users and executive committee members, the study revealed that on average, the education level of executive committee members and users was post-secondary level. This finding implies that WRUAs are managed by executive members mainly at diploma level of education and below. Only approximately (10 %) had education level at masters or Ph.D. level. Education is an integral process that develops a participant's capacity for decision making in WRUA activities. Educated committee members have the ability to interpret legal and environmental matters which can be very complicated for lay observers to comprehend.

The findings reveal that WRUA managers have inadequate knowledge and technical skills on water management. This concurs with World Bank, (2002) findings that WRUAs in Kenya are managed by committee members who have limited formal skills in management, monitoring or evaluation practices. The small percentage of WRUA Executive Officers and users with high education level implies that interpretation of water policies, and formulation of innovative strategies would be

inadequate. This implies that there is need for WRA Officers to train WRUAs committee and users on water resource management in order to build capacity to enhance effectiveness of local water resource management.

4.2.5 Distribution of the WRUAs along the River Basin

The study sought to establish where the WRUAs were distributed along the river basin. Location of WRUAs along the river basin can ensure activities to protect the water resource are well spread. The results revealed that approximately 50% of WRUAs were located in the middle of the river basin as shown in figure 4.6 with the remaining WRUAs being at the head (upstream) or tail (downstream).

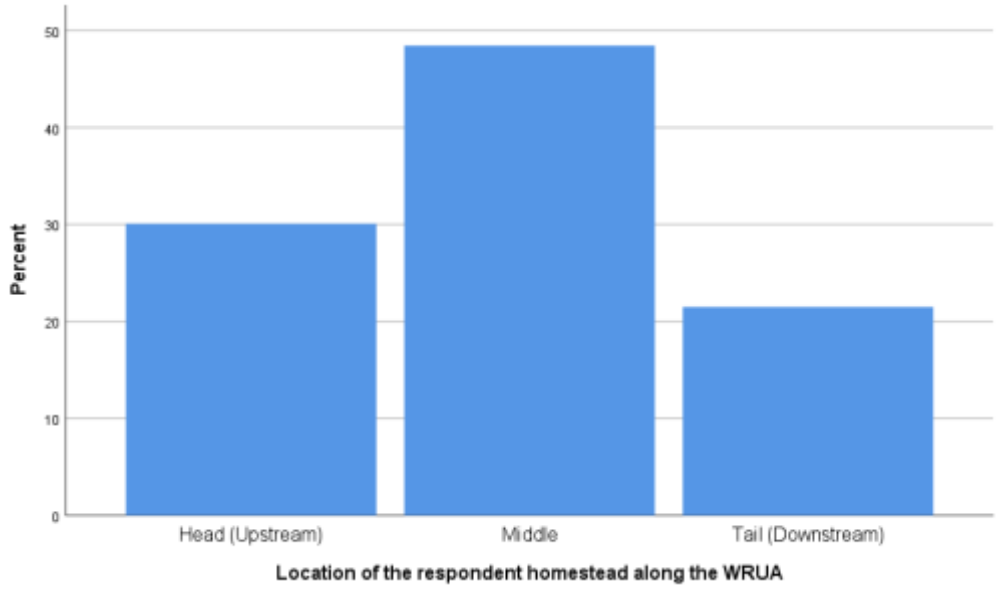


Figure 4.6: Distribution of the WRUAs along the River Basin.

Figure 4.6 shows the distribution of WRUAs along the river basin. The findings show that fewer WRUAs were located at the upstream yet WRUA activities upstream would ensure water point sources are protected and agricultural practices that promote soil conservation on sloped grounds implemented to reduce surface run-off upstream and siltation downstream.

4.2.6 WRUA Age Distribution

The study sought to establish the age of the WRUA by establishing the number of years they have been in operation. The respondents were requested to tick (√) the ages of WRUA formation and age was provided as follows: less than 1 year, 2 years, 3

years or over 5 years old. The study established that both executive committee members and users indicated that (58%) were 3 years old, while (42%) were over 5 years old.

Table 4.2: WRUA Age Distribution

Age	Frequency	Percent
Less than 1 year ago	0	0.0
2 years ago	0	0.0
3 years ago	18	58.0
over 5 years ago	13	42.0
Total	31	100.0

The findings imply that WRUAs that have operated for three years and above have undergone formation and development structures and met all requirements provided in the WRUA development cycle guidelines. It also means that the WRUAs have the structures in place for WRUA managements and have adequate management experience to promote sustainable projects. This findings agree with the documents reviewed which indicate that WRUAs are registered with the Registrar of Societies of Kenya and have memorandums of understanding with WRA which clearly show level of collaboration and responsibilities .4.2.7 Activities of WRUAs

All the respondents (100%) identified the activities their WRUAs engaged in and confirmed that they had noted changes in the river basins since the WRUAs became operational. The identified activities are shown in Table 4.3

Table 4.3: Activities of WRUAs

Activities		F	%
Riparian land protection	Yes	30	96.8
	No	1	3.2
Monitoring land use practices and infrastructure	Yes	22	71.0
	No	9	29.0
Awareness creation on conservation practices	Yes	29	93.5
	No	2	6.5
Reporting illegal loggers	Yes	31	100.0
	No	0	0.0
Planting trees	Yes	25	80.6
	No	6	19.4
Management of water conflicts	Yes	31	100.0
	No	0	0.0
Spring protection	Yes	27	87.1
	No	4	12.9
Abstraction survey	Yes	25	80.6
	No	6	19.4

From Table 4.3, activities of the WRUAs including riparian land protection, abstraction survey, reporting illegal loggers and reporting illegal abstractors, were quite visible in the sub-basin. Respondents reported that there was an increase in tree planting, a reduction in illegal abstraction and reduced soil erosion. The results show that committee members and water users had an understanding of their activities and they actually carried them out as planned using the available resources.

4.3 Strategies of WRUAs in Promoting Sustainable Water Projects

In responding to the first objective, the researcher sought to examine WRUA resource mobilization strategy in promoting sustainable water projects. Questionnaires for committee members and water users were administered. Data collected was analyzed using frequencies, percentages and means where Strongly agree (5); Agree (4); Undecided (3); Disagree (2); Strongly Disagree (1)' were used. Any score below three was considered to be disagreement while scores above 3 were considered to be agreement.

4.3.1 Committee Members' Responses on Resource Mobilization Strategy

The committee members were asked to indicate their level of agreement on whether they mobilized resources for their WRUAs. The statements and committee members' responses are presented in Table 4.4.

Table 4.4: Responses from Committee Members on Resource Mobilization Strategy

Questions		1	2	3	4	5	Mean
Members agreed to contribute labor, materials or time towards WRUA activities	F	0	6	0	18	7	3.84
	%	0.0	19.4	0.0	58.1	22.6	
Members contribute labor and finances on time as required	F	7	15	2	5	2	2.35
	%	22.6	48.4	6.5	16.1	6.5	
There are graduated penalties for non-payments of user contributions	F	1	8	2	16	4	3.45
	%	3.2	25.8	6.5	51.6	12.9	
There is availability of reserve fund for our WRUAs	F	5	21	1	3	1	2.16
	%	16.1	67.7	3.2	9.7	3.2	
WRUAs have a reserve fund for repairs and rehabilitation.	F	3	17	4	7	0	2.48
	%	9.7	54.8	12.9	22.6	0.0	
Resources collected from users are adequate to run the activities of WRUAs	F	11	18	0	1	1	1.80
	%	35.5	58.1	0.0	3.2	3.2	
Our WRUA has an internal audit team in place	F	2	11	1	12	5	3.23
	%	6.5	35.5	3.2	38.7	16.1	
Average (%)		11.5	45.2	5.5	29.5	8.3	2.76
Summary			62.2 (Disagreement)		37.8 (Agreement)		

From the findings presented in table 4.4, it was established that committee members (mean of 3.84) involved users in setting contributions to support WRUA activities. Involvement of users in setting contributions to be provided by each member could raise satisfaction levels of members and enhance project ownership. However, inadequate participation by water users in financial planning could cause mistrust and affect resource mobilization.

Majority, 22 (71%) of the committee members confirmed that water users had agreed to contribute between Ksh. 4000 and Kshs.6, 000 per year in support of WRUA activities. Five (16.1) indicated that water users contributed above Ksh. 6000 while 4 (12.9) reported that water users contributed between Ksh. 2000 and 4000. This means that consultation of users on the amount of contribution required to run the activities of WRUAs was an important aspect in the management of water resources .Adequate funding provided a base for planning and implementing set project activities.

However, data analyzed from the open ended questions indicated that in 2017/2018 financial year, the committee members had received from the water users and the government financial support for WRUA operations. Majority of committee members

26 (83%) indicated that they had received between Ksh 2,000,000 and 5,000,000 in support of WRUA activities. While none of the WRUAs had received below Ksh. 2000000.5 (17%) had received above Ksh.6, 000,000 in support of WRUA activities.

This implies that the WRUAs were all in level two of funding and a few of them were already in level three of funding. Although WRUA committee members indicated that they had received contributions for the financial year, the budgeted finances for all WRUAs ranged from Ksh. 5,000,000 to Ksh. 10,000,000 .This shows a variance between the average of finances received and the budget targets to finance planned activities during the 2017/2018 financial year. All committee members at 31 (100%) confirmed that the resources were inadequate. Mobilization of inadequate resources implies that when the contributions collected were less than the required contributions, implementation of planned activities may not be effectively carried out.

When the contributions made supports partial implementation of activities the overall performance of project can be affected.

The finding was confirmed by all the WRA officers interviewed who reported that;

> *"WRUAs had signed Level 11 funding contracts and they had received funding from Water Services Trust Fund (WSTF). WRUAs had presented many activities for funding however due to limited resources, all needs identified could not be met. Instead, WRUAs rationalized the activities for funding in order of priorities. Therefore, the released funds were for the implementation of approved activities as per the contracts signed".*

Further, the committee members were asked whether the WRUAs had a reserve fund for repairs and rehabilitation. Majority (a mean of 2.48) disagreed that WRUAs had a reserve fund. Lack of reserve funds could be attributed to inability of users to provide the required resources or inability to collect the agreed contributions. Without a reserve fund WRUAs would not be able to respond to emerging matters that could affect the water users.

When the committee members were asked whether the mobilized resources were adequate (a mean of 1.80) agreed that the resources raised were inadequate to run the

project activities. Inadequate budget restricted WRUAs from establishing a reserve fund in 2017/2018.The study findings agree with the study carried out in Ghana by Braimah, (2011) which observed that although WRUAs raised resources, levies and finances provided were inadequate to ensure effective operation and maintenance of water projects. Although WRUAs set resources required to run activities, inadequate resources could negatively impact on the implementation of the set strategies. However, study by Barakat, (2007) stated that when WRUA members were involved in annual inspections, cleaning works, rehabilitation of canals, and government subsidy given, the users rated their projects as 70 to 100 percent successful. Government subsidy when combined with member's contribution can alleviate the challenges associated with inadequate resources.

In addition, committee members were asked whether they had graduated penalties for nonpayment of user contributions. A mean of (3.45) agreed that WRUAs had graduated penalties to deter members from defaulting on their contribution obligations. Although WRUAs agree on penalties that should be paid for nonpayment or delayed contributions, implementation of penalties could be difficult to enforce given that the WRUAs comprise of voluntary members. Continuous sensitization, creation of alternative income generating activities, and recruitment of more members could lower the costs incurred by members hence encouraging them to make their contributions in time.

Committee members were asked whether they had an audit team in place, at a mean of (3.23) it was established that WRUAs did not have an audit team in place. However, when WRUAs were asked whether they announced financial audit reports to the members every year 31 (100 %) agreed that they announced financial audit report to members. For users who willingly contribute resources to support WRUA activities, financial audit reports were very vital. When financial reports are not shared with contributors, their morale for further contributions could be affected. Financial controls could create harmony and lead to revenues being spent on prioritized activities of water resource management (Hirji, 2006).

Water users' Statements and responses on resource mobilization strategy were provided as shown in table 4.5

Table 4.5: Responses from Users on Resource Mobilization Strategy

Questions		1	2	3	4	5	Mean
I contribute (labor and finances) as set out by our WRUA towards construction of water intake points, infrastructure and rehabilitation	F	10	20	13	125	89	4.02
	%	3.9	7.8	5.1	48.6	34.6	
I make my contribution in labor or finances to the WRUAs on time as required by our WRUA	F	6	15	10	124	102	4.17
	%	2.3	5.8	3.9	48.2	39.7	
I am willing to give additional resources to the WRUA	F	5	13	11	136	92	4.16
	%	1.9	5.1	4.3	52.9	35.8	
There are graduated penalties for non-payment of fees or other contributions set by our WRUA	F	21	25	40	118	53	3.61
	%	8.2	9.7	15.6	45.9	20.6	
Financial audit results of our WRUA are announced to members every year	F	64	92	52	27	22	2.42
	%	24.9	35.8	20.2	10.5	8.6	
The finances paid to WRUA are frequently used to repair leaking pipes tanks repair water source put bullets	F	61	51	60	61	24	2.75
	%	23.7	19.8	23.3	23.7	9.5	
Fees and resources collected from users are adequate to run the activities of WRUA	F	86	54	20	54	43	2.67
	%	33.5	21.0	7.8	21.0	16.7	
Average (%)		14.1	15.0	11.5	35.8	23.6	3.40
Summary			40.5 (Disagreement)		59.5 (Agreement)		

Table 4.5 indicates responses from water users on resource mobilization strategy. From the findings, it was established that the majority of water users (mean of 4.02) agreed that members should contribute towards construction of water intake points, infrastructure and rehabilitation of the river basin. When users were asked how they made their contributions, 71 (27.6%) agreed that they made monthly contributions while 94 (36.6%) made contributions yearly and 92 (35.8%) gave contributions when the need arose. Water users' mode of contribution on monthly, yearly or on-need basis may arise due to user income generation patterns.

Although 92 (35.8%) of water users made the contributions when need arose, such mode of payments could cause a challenge to resource planning and budgeting because of the uncertainties associated with unscheduled payments. The results differ

with those of Abdelgail, (2018) in Sudan, where 20% of the members got water without payment of agreed amounts and another 15% interfered with gate valves to access water illegally. Harvey & Reed (2004) argued without a comprehensive project Cost Benefit Analysis determination, and a financial plan, it would not be possible to inform water users of the true cost of service required and how such resources could be raised. Contribution in terms of labor and material resources could supplement the financial contributions and reduce project costs.

The study established that on average, 59 (23%) of water users contributed between Ksh, 2,000 and Ksh. 4,000, 154 (60%) contributed between Ksh, 4,001 and Ksh. 6,000 and 44(17.0) contributed Ksh, 6,001 and above to the WRUAs in 2017/2018 financial year. Confirmation of users' contributions in support of WRUA activities was an indication that users were involved in decisions making regarding resource mobilization. Although WRUA members could have limited finances, little contribution made to WRUAs many times in a span of time can demonstrate commitment to water management. Participation can take the form of attending planning meetings to identifying the challenges and making decisions on resources for water management processes.

The findings of the study are in line with recommendations of Harvey and Reads, (2004) that stakeholders should be engaged in financial planning, determining sources of funding for direct operation costs, maintenance, and cost of resource mobilization. In Kenya, water management structure was reformed to include WRUAs in the management of water at the grassroots root level, a task which would be impossible to perform without resources. User participation in planning of activities of resource mobilization can generate a sense of ownership, break dependency patterns and give decision making power to the contributors (Gunchinmea and Yakubar, 2010).

Water users were further asked whether they contributed labor and finances in time to WRUAs towards construction of water intake points, infrastructure and rehabilitation. The study established that the majority of users (a mean of 4.7) disagreed with the statement. The negative indication on timely contribution could be attributed to the level of income or other factors that affected availability of resources. Timely

contribution could also be hindered by the raised mistrust especially when the project resources were not prudently used or accounted for publically. When water users are involved in resource planning, they make informed choices and they understand the implications of delayed payments on the expected project outcomes.

The study's findings agree with the study in Sudan by Adam, (2003) which reported that in the Gezira irrigation scheme it was difficult to mobilize cash in time from farmers and they were allowed to pay the dues in kind which were sold to raise money for maintenance of water supply systems. These findings, however, differ with the results of Reis, (2009) who established that in Vietnam users were unwilling to contribute to water management because they felt that a monthly income of 500,000-5,000,000 VND was low earnings for the rural community. Involvement of users in determining the source of required resources creates a sense of ownership and reduces reliance on external sources. The findings imply that it is necessary for users to provide timely payment of agreed resources whether in kind or in cash. This will enable the WRUA management to implement strategies on schedule.

The respondents were asked whether their WRUA observed graduated penalties for non-payment of user contributions as a resource mobilization strategy. The study established that the majority of users (a mean of 3.61) agreed that WRUAs did have graduated penalties. Although WRUAs had penalties, the IAD theory postulated by (Ostrom, 2010) argued that institutions should ensure that rules do not only appear on paper but also be effectively implemented on the ground to guide user behavior. The findings agree with study by Kolaralli and Brewer, (1999) in Sudan, which reported that users had rules and regulations but they did not have sufficient punitive punishments for defaulters. However, for WRUAs to raise required resources, reduce conflicts and operate their activities, internal structures needed to be established, regulated and implemented (Asante, 2010). The findings imply that WRUAs had the capacity to manage, control and prevent noncompliance, improve fee collection, and financial sustainability of water projects if the regulations were adhered to.

The users were further asked whether the finances raised were used to repair leaking pipes and rehabilitate water point sources. A majority (a mean of 2.75) agreed that

repair and rehabilitation works were frequently done by the WRUAs. However, when they were asked whether there were visible pipes leaking (77%) of the users agreed that there were burst pipes from time to time. Although WRUAs do not supply water to households, they monitor abstraction points and assess the condition of the intakes. However, an inadequate funding base to cater for repairs and maintenance of old infrastructure can delay repairs. The study's finding concurs with the case study in Morocco, Tunisia and Turkey by Gunchinmea and Yakubar, (2010) which revealed that although members made contributions, some projects had faced financial shortfalls because decisions to charge user fees were set too low to cover actual costs.

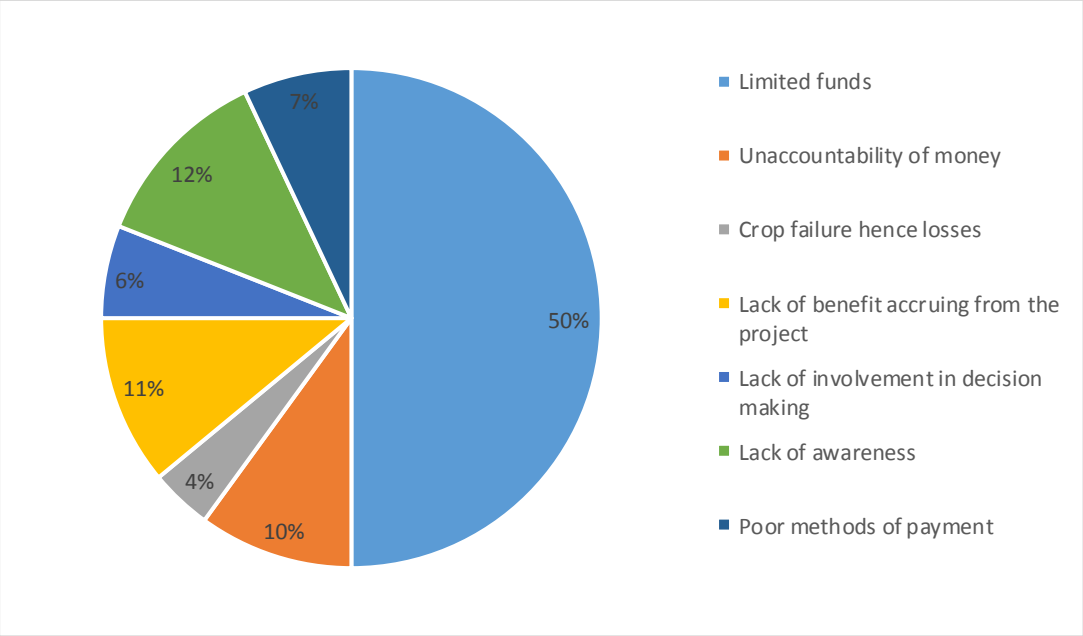


Figure 4.7: Challenges Experienced by WRUAs in Resource Mobilization

Figure 4.7 presents the challenges experienced by the water users and committee members in meeting WRUA contributions. Majority of the water users 129 (50%) indicated limited finances, 26 (10%) indicated that WRUA officers failed to account for the contributions hence discouraging them form contributing, 28 (11 %) indicted lack of benefits accrued from the projects, and 18 (7%) indicated poor method of payments made it difficult to remit the contributions. From the findings majority of WRUAs showed that limited finances made them not meet their contribution obligations while 11% indicated lack of accrued benefits from the project. The study findings were in line with the study by Ifejika, (2018) which established that 65% of

water users who contributed labor and finances, had not received the intended benefits from the projects. Thus, continuous monitoring and evaluation as well as sharing evaluation results with the water users, could enhance continuous improvement of project outcomes to build water user satisfaction on accrued benefits.

Table 4.6: Methods of Improving Water Users Contributions

Methods	Frequencies(F)	Percentages (%)
Involving users in decision making	92	32
Encourage users to income generating activities	49	17
Transparency of committee members to gain user confidence	23	8
Promote equitable sharing and good management practices	43	15
Enforce contribution rules	81	28
Total	288	100

Table 4.6 presents methods that can be used to improve user contributions. Majority of the users 71 (28%) indicated that enforcement of WRUA rules could be used as a method to improve user contributions. While 82 (32%) indicated that involvement of water users in decision making could improve water user contributions. While 21 (8%) indicated transparency of committee members could improve water user contributions. Further, 44 (17%) indicated that diversification of water user income generation activities could increase user income making it easy to provide contributions. Another 39 (15%) indicated that promotion of good water management practices could encourage users to provide required contributions. Continuous involvement of participants in finding solutions to the emerging challenges, and training of committee members on resource mobilization skills can enhance mobilization of resources.

From the study findings, both committee members and water users agreed on the required contributions to run WRUAs through discussions and consensus building. However, both committee members and water users also agreed that the amount of resources contributed were inadequate to run WRUA activities. WRUAs lacked reserve funds for repairs and rehabilitation as confirmed by water users and committee members' responses. A reserve fund could be used to carry out emergency infrastructure repairs to maintain the water system. Availability of resources to run

WRUA activities whether in cash or kind could be used to implement set activities as scheduled. The findings further confirm that the IAD framework of Ostrom, (2007) could be applied in water resource mobilization strategies. The framework presented the action component that indicated where the actors could interact to solve common problems and share ideas on the implementation of strategies.

4.3.2 Infrastructure Maintenance Strategy

The second objective sought to examine infrastructure maintenance strategy on sustainable water projects. Questionnaires for executive members and users were administered in order to examine infrastructure maintenance strategy on sustainable water projects. Data collected was analyzed using frequencies, percentages and means where 'Strongly Agree (5), Agree (4), Undecided (3), Disagree (2), and Strongly Disagree (1) were used. Any score below three was considered to be disagreement while scores above 3 were considered to be agreement. The statements and members' responses for committee members are presented in Table 4.7.

Table 4.7: Responses from Committee Members on Infrastructure Maintenance Strategy

Questions	1		2	3	4	5	Mean
WRUA water projects have designated well trained and qualified technical staff	F	7	13	1	6	4	2.58
	%	22.6	41.9	3.2	19.4	12.9	
WRUA water projects have easy access to tools and spare parts for water maintenance	F	3	17	2	7	2	2.61
	%	9.7	54.8	6.5	22.6	6.5	
WRUAs have maintenance schedules and rehabilitation plans	F	2	10	8	7	4	3.03
	%	6.5	32.3	25.8	22.6	12.9	
WRUAs have a quarterly infrastructure serving schedule for water intakes	F	2	20	1	6	2	2.54
	%	6.5	64.5	3.2	19.4	6.5	
There is adequate budgetary allocation for repairs, maintenance and rehabilitation of water intakes in WRUA Projects	F	8	16	2	4	1	2.16
	%	25.8	51.6	6.5	12.9	3.2	
There are no pipe leakages in the water along the river banks	F	7	15	2	5	2	2.35
	%	22.6	48.4	6.5	16.1	6.5	
There is always planning and preparation for M&E data collection, analysis and sharing of information	F	7	10	3	5	6	2.77
	%	22.6	32.3	9.7	16.1	19.4	
Average (%)		16.6	46.5	8.8	18.4	9.7	2.58
Summary		71.9 (Disagreement)			28.1 (Agreement)		

Table 4.7 presents the responses from committee members on infrastructure maintenance strategy. The findings indicate that the majority of the committee members (mean of 2.58) disagree that the WRUAs had designated, trained and qualified technical staff. This implied that WRUAs did not have reliable trained and qualified technical staff to attend to their water intakes, repairs or rehabilitation schedules. Qualified technical staff at the grass root level could carry out repairs and maintenance works as often as was necessary. The finding was in line with Kerr, Pangare, & Pangare, (2002) which found that communities required external technical capacity for repair works and rehabilitation of the water systems.

Lack of trained technical staff with appropriate skills in water maintenance could lead to poor construction of intakes and obstruction of river flows from materials carried by floodwater during the rainy season, causing water shortage downstream. Trained technical staff at the grass root level, could be involved in planning, participation in appraisal of work done and identification of needs. The trained personnel could also analyze complex interaction between human and the environment to ensure timely infrastructure repairs. Thus, WRUAs require continuous training to build skills for water infrastructure maintenance to reduce water wastage and over-dependence on external technical support.

WRUA committee members were asked whether they had easy access to tools and spare parts for water maintenance. Majority of committee members (mean of 2.61) disagreed that they had easy access to tools and spare parts. Tools and spare parts, which include; spanners, hoes, spades and machinery to repair pipes, when readily available could be used by local technicians to repair broken or blocked water pipes. The study findings agree with study of Kerre et al., (2002) which established that in order to enhance water flows and ease maintenance problems, external technical to supplement available skills was required to ensure continuous water flows in rivers. This implied that for WRUAs to maintain, repair and rehabilitate water intakes, water users would not only need training on operation of equipment but also provide easy access to tools and spare parts. An interview with one WRA officer revealed that;

> "*At the grassroots level, there exists only a few trained technical staff. The WRUAs were supported by WRA technical staff at the sub catchment level when the need arose. Although WRUAs do not supply water to households they monitor abstraction of water at the river basin level where the intakes are constructed. WRUAs at times consolidate many small intakes into one big intake to control abstraction and reduce water conflicts due to low volume of water in rivers. However, the investment has not kept pace with the need and resource levels to train adequate technicians at the grass root level are yet to be met".*

Further, committee members were asked whether WRUAs had maintenance schedules and rehabilitation plans. Majority (mean of 3.03) agreed that they had maintenance

and rehabilitation plans. Schedules are short term plans that indicate timelines for specific activities on water management to be implemented at specified time. These findings agree with those of Adbelhadi et al., (2004) who established that in the Gezira scheme, WRUAs had rehabilitation and maintenance plans that prescribed standards of allocation, cleaning of water canals and maintenance of irrigation infrastructure, with allowable time for servicing broken pipes or equipment. However, in Sudan study by Avelliono, (2012) established that maintenance practices by WRUAs were not coordinated in a systematic manner, leaving members to suffer water shortages due to broken pipes. Timely repairs of infrastructure and continuous implementation of rehabilitation plans can lead to efficiency of water systems and raise user satisfaction. Hence it is necessary for water managers to establish continuous oversight, monitoring, maintenance and asset replacement plans in order to enhance optimal infrastructure use during its useful cycle.

Committee members were asked whether they had a quarterly infrastructure servicing schedule for water intakes and a mean of (2.54) disagreed with the statement. Scheduled infrastructure servicing plans can ensure regular inspection and identification of weak points for repairs as well as enable planning for major rehabilitation works. The findings agree with Braham, (2016) that in Ghana, planned schedules were not available but members were called upon to provide voluntary services to repair broken infrastructure. However, the study established that local managers were unable to mobilize adequate user support to cover operation, rehabilitation and management of the projects leaving burst pipes and water intakes with leakages. However, Barakat, (2019) established that users expressed willingness to volunteer services for removing material deposited on river beds that obstructed river flow and planting creepers to reduce soil erosion. Water projects require annual maintenance schedules, monitoring plans and rehabilitation plans formulated prior to implementation of the planned activities (Braham, 2016). The observation implies that when users are not successfully involved in drawing maintenance and rehabilitation plans of their infrastructure, the projects can remain dysfunctional or hinder intervention by backing up institutions.

Committee members were asked whether there was adequate budget allocation for repairs and maintenance. Majority of the members (mean of 2.16) disagreed that they had adequate budget allocation for repairs and rehabilitation. The respondents indicated that results imply that WRUAs did not have adequate budget allocation to implement planned repair activities. The findings agree with Mollinga, (2008) who established that in Tanzania, WRUA budgeting and managerial skills hindered effective mobilization and utilization of funds received from either government or other funding agencies. This implies that water projects require adequate budget to maintain an efficient infrastructure at a viable cost (Abdelhadi, et al. 2004). Adequate budget allocation is needed to achieve timely repairs and rehabilitation plans as well as enhance catchment renewal strategies.

Executive members were further asked whether there were leaking pipes in their water systems among the projects. A majority of executive members (a mean of 2.35) disagreed that there were no pipe leakages in water systems among their projects. This finding differs with Adam, (2003) who reported that in Sudan, the transfer of the Abdul Hakam pilot project to farmers improved quality of maintenance and reduced water leakages and waste because farmers gave support in labor, finance and time. Water users' statements and responses on infrastructure maintenance strategy is indicated in Table 4.8

Table 4.8: Responses from Users on Infrastructure Maintenance Strategy

Questions		1	2	3	4	5	Mean
Our WRUA has designated, well trained and qualified water technical staff	F	51	98	27	47	34	2.67
	%	19.8	38.1	10.5	18.3	13.2	
Our WRUA has easy access to water tools and water spare parts for water maintenance	F	35	74	50	63	35	2.57
	%	13.6	28.8	19.5	24.5	13.6	
Our WRUA has maintenance schedules and rehabilitation plans	F	51	100	36	35	35	2.96
	%	19.8	38.9	14.0	13.6	13.6	
There is budgetary allocation for repairs and maintenances our water system	F	55	84	51	38	29	2.61
	%	21.4	32.7	19.8	14.8	11.3	
There are no noticeable pipe leakages in our water system	F	51	100	36	35	35	2.62
	%	19.8	38.9	14.0	13.6	13.6	
There is always logistical planning and preparation for M&E data collection, analysis, and sharing of information in our WRUA	F	28	67	16	92	54	3.30
	%	10.9	26.1	6.2	35.8	21.0	
WRUAs have a quarterly infrastructure serving schedule for water intakes	F	33	82	45	50	47	2.98
	%	12.8	31.9	17.5	19.5	18.3	
Average (%)		16.9	33.6	14.5	20.0	14.9	2.82
Summary			65.0 (Disagreement)		35.0 (Agreement)		

Table 4.8 presents the responses from users on infrastructure maintenance strategy. The water users were asked whether WRUAs had designated, well trained and qualified water technical staff. Majority of respondents (a mean of 2.67) disagreed. The findings show that WRUAs do not have trained and designated staff to handle their maintenance issues. The study implies that users are involved in water infrastructure maintenance but have not received any support from the designated staff except occasional visits by WRA technical staff when an emergency occurs.

This finding differs with studies by Abdelhadi, et al., (2004), Rusfandi, (2001) and Avellino, (2012) in Ghana, which found that the spirit of voluntarism in maintenance practices which was expected to drive the local managers to effective management of the projects was fading away. The study observation is that voluntarily labor in the critical work of infrastructure maintenance cannot produce the desired results. Despite the need for use of spare parts for repairs and rehabilitation of water systems, majority (a mean of 2.57) disagreed that they had easy access to spare parts. When the users were asked how many days it took to repair breakdown system, majority 70% of the uses indicated a range of 5 to 10 days to repair broken down systems at the intake level. The level of time taken to carry out a major repair like an intake can be

attributed to limited resources and inadequate resources. The findings are in line with Barakat, (2007) which found that when full responsibility of maintenance was handed over to users, they lacked spare parts and tools to repair the equipment, repair broken pipes or replace old ones since revenue collected only covered light repairs. This means that users can go for long periods without water due to inadequate skills for repairs and rehabilitating broken down infrastructure.

Users were further asked whether they had maintenance schedules and rehabilitation plans. The majority (a mean of 2.96) disagreed that they had plans. Preparation and implementation of schedules can be attributed to availability of resources, spare parts and technical skills. The study findings are in line with study by Dasaser-cerlik et al., (2008) in Turkey which found out that scheduling of maintenance and rehabilitation activities depended on fees collected from users. Fees collected from users can be used to buy materials to carry out scheduled activities plans in line with approved standards of operation and maintenance however, the resources may be inadequate for routine monitoring.

Further, users were asked whether their WRUAs had budgetary allocation for repairs and maintenances of water system. At mean of (2.61) users disagreed that their WRUAs had budgetary allocation for repairs. From the analysis of open ended questions water users 81(31%) of users confirmed that there were noticeable pipe leakages in water system leading to water wastage. Water wastage from broken and leaking pipes can cause water shortage downstream. These findings are in line with a study by Mollinga, (2008) in Tanzania which revealed that institutional incapacity in terms of technical, budgeting and managerial skills, hindered effective mobilization and utilization of funds received from the government and other funding agencies. The findings imply that even when users had the required finances to carry out activities, technical and managerial skills can hamper implementation of their activities. From the finding users should be trained on needs assessment, prioritizing of activities, provision of labor and materials and budgetary skills in order to improve the resource base and enhance institutional capacity.

Further, users were asked whether the WRUAs engaged in logistical planning and preparation for M&E data collection, analysis, and sharing of information amongst themselves. A majority (a mean of 3.30) strongly disagreed that they were involved in logistical planning for M&E data collection. Engaging in monitoring and evaluation, improving assessment and appraisal activities and forecasting resources required cash and kind. Earlier studies in the area reported that WRUAs in Kenya are managed by committee members who may not have formal skills in either monitoring or evaluation practices (World Bank, 2002; JICA, 2013; Njonjo, 2002).

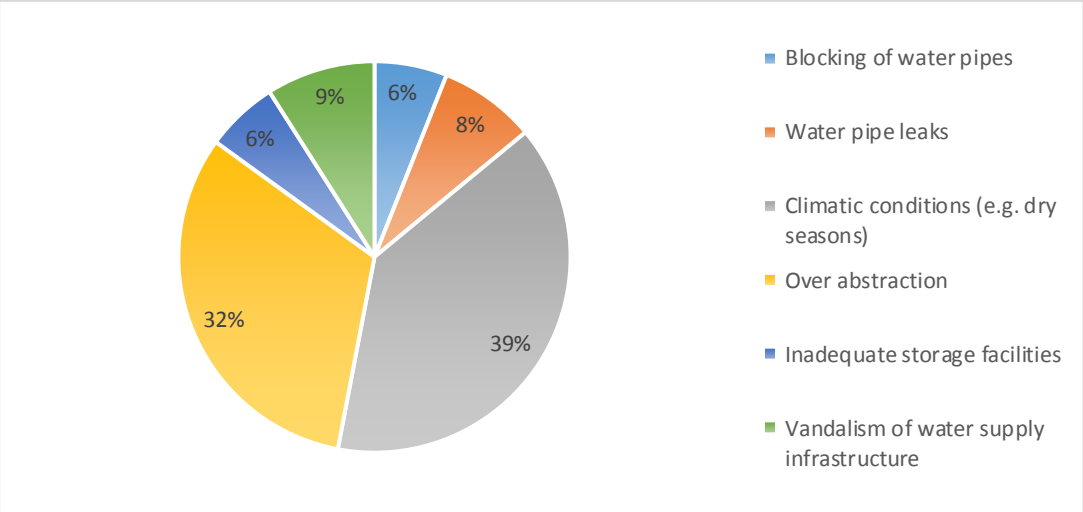


Figure 4.8: Causes of Water Shortages

Figure 4.7 presents the responses of water users on the causes of water shortage. The results revealed that causes of water shortage were as follows; 15 (6%) of respondents indicated the cause as blocked pipes at the intakes, 20 (8%) indicated water pipe leakages, 101 (39%) indicated the cause as adverse climatic conditions especially prolonged dry seasons, over abstraction was indicated by 81 (32%), while 16 (6%) indicated inadequate storage facilities and 24 (9%) indicated the cause as vandalism of water infrastructure. From the findings, only 16 (6%) indicated the causes of water shortage as inadequate storage facilities yet users can use appropriate methods to store water during the rainy season(surface run-off) for use during the dry season when there was water shortage. The findings thus imply that water users have not embraced water saving mechanisms as methods to address water shortage challenges.

Table 4.9: Steps Taken to Improve Water Infrastructure

Measures	Frequencies (F)	Percentages (%)
Creation of awareness	58	20
Improvement of maintenance budget allocation	35	12
Coordinated support	17	6
Consolidation of intakes for water control	6	2
Enhancement of storage facilities	23	8
Erosion control (e.g. terracing, planting vegetation)	63	22
Planting water friendly trees	86	30
Total	288	100

Table 4.9 shows the responses of water users on the steps that could be taken to address the water infrastructure challenges. Majority 71(20%) indicated creation of awareness among members as a step that could improve water infrastructure maintenance. Another 31(12%) indicated an increase of budget for infrastructure maintenance could improve maintenance activities, 5 (2%) of the respondents indicated the need for coordinated support, 77(30%) indicated control of soil erosion, while 62 (30%) indicted the need to plant water friendly trees as a necessary step to improve water infrastructure maintenance. All the indicated methods when appropriately implemented could improve water infrastructure maintenance. The finding were in line with study by Barakat, (2009) which established that when users participated willingly in maintenance activities was associated with promises of continuous water flows in rivers to meet water user's needs.

While there were significant benefits to the installation of water infrastructure, the cost of construction, maintenance and repair could be high. From the findings, both users and committee members require training on water infrastructure maintenance and sensitization of water saving methods to address water shortage.

4.3.3 Conflict Management Strategy

In responding to the third objective, the researcher sought to establish the effectiveness of conflict management strategy on promotion of sustainable water projects. Data collected was analyzed using frequencies, percentages and means where 'Strongly Agree (5); Agree (4); Undecided (3); Disagree (2); Strongly Disagree (1)' were used. Any score below three was considered to be disagreement while

scores above 3 were considered to be agreement. The statements and committee members' responses are presented in Table 4.10

Table 4.10: Responses from Committee Members on Conflict Management Strategy

Questions	1		2	3	4	5	Mean
Our WRUA has clear rules on who has a right to water	F	3	1	0	10	17	4.19
	%	9.7	3.2	0.0	32.3	54.8	
Our WRUA has clear rules that ensure member contributions are in balance	F	0	3	1	13	14	4.22
	%	0.0	9.7	3.2	41.9	45.2	
Our WRUA has faced difficulties from users when enforcing rules	F	1	3	2	12	13	4.06
	%	3.2	9.7	6.5	38.7	41.9	
Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the members	F	1	4	4	16	6	3.71
	%	3.2	12.9	12.9	51.6	19.4	
Our WRUA has structures in place for reporting when they do not receive allocated amount of water in a time	F	2	7	3	14	5	3.41
	%	6.5	22.6	9.7	45.2	16.1	
Our WRUA has in place mechanisms to mediate water disputes and resolve conflicts	F	1	4	0	10	16	4.16
	%	3.2	12.9	0.0	32.3	51.6	
There exists a Dispute Resolution Committee in our WRUA	F	2	8	0	13	8	3.55
	%	6.5	25.8	0.0	41.9	25.8	
Average (%)		4.6	13.8	4.6	40.6	36.4	3.90
Summary		23.1 (Disagreement)			76.9 (Agreement)		

Table 4.10 presents responses from committee members on conflict management. The committee members were asked whether WRUAs had clear rules on who had right to use of water. From the findings it was established that the majority (a mean of 4.19) strongly agreed that WRUAs had clear rules on how water was shared. Having water rules is a measure to ensure that order is maintained in the use of the resource. Further, committee members were asked whether WRUAs had clear rules that ensured each member contribution was in balance. A majority (mean of 4.22) strongly agreed that the rules that existed ensured that each member contributed the same amount and they had equal access to water. The study findings imply that formulation and enforcement of self-created rules, sets a fair platform for water sharing. The findings agree with study by Tang, (2001) and Genesh and Jennifer, (2007) in India

which established that WRUAs were successful in formulating and enforcing rules regarding who had right to water use but faced challenges with regard to water sharing and distribution.

In addition, the committee members were asked whether WRUAs had faced difficulties from users when enforcing rules. A majority (a mean of 4.06) strongly agreed that they had faced difficulties when enforcing rules. Enforcement of rules when strictly implemented can avoid unfair use of natural resources and promote equitable sharing. Difficulties in enforcing water rules can stem from disagreements caused by facts or lack of adequate information on perceived facts (Matiru, 2000) When asked whether a mechanism was in place to identify violators and if punishments were in place to discipline them, the majority (mean of 3.71) agreed that mechanisms were in place to identify and punish violators. Identification and punishment of violators assists in controlling, unfair use of a common resource. In addition, the committee members were asked whether users had been involved in deciding on measures to be imposed on violators. Majority (a mean of 3.41) agreed that members had been involved in deciding what punishments should be imposed on violators depending on the rules violated. Involvement of users in solving water cases can reduce the costs associated with litigation and reduce tensions among water users. In the past, water conflicts were regarded as technical but as populations grow, complexities in water management unfold and scarcity of water and associated costs increase, WRUAs mainly turn to homegrown solutions to solve water conflicts (Regner, 2006)

The study findings differ with Garces-Restrepo, (2001) in Kyrgyzstan which established that rules governing water distribution were weakly instituted and upstream users unfairly used more water than downstream users and wealthy users bribed WRUA staff to allocate them more water. The study findings imply that when rules are not effectively enforced, members are unfairly served and can lead to loss of integrity in managing water resources and provoke disputes among users. Thus, WRUAs need to ensure that conflicts are not ignored so that they don’t grow into greater conflicts in future. Strict enforcement of rules can decrease illegal abstractions and deter violators.

Committee members (mean of 3.55) strongly agreed that WRUAs had mechanisms in place to mediate water disputes and resolve conflicts. This observation implies that WRUA committee members listen to each other when there is disagreement, finding common ground to address competing interests or involving mediators to help solve water related conflicts. Further, the committee members were asked whether they had a dispute resolution committee to resolve conflicts between members in the same WRUA as well as solve conflicts between distinct WRUAs. A majority (a mean of 4.16) strongly agreed that a dispute committee was in place. Dispute committee when constituted engages members in formulating valuable solutions in resolving conflicts and setting long term answers to water issues. The observation implied that when cases were heard by an impartial committee, fair decisions were made and disputes were resolved accordingly. Users' statements and responses on conflict management strategy are indicated in Table 4.11.

Table 4.11: Responses from Users on Conflict Management Strategy

Questions		1	2	3	4	5	Mean
Our WRUA has clear rules on who has right to water	F	4	3	5	113	132	4.42
	%	1.6	1.2	1.9	44.0	51.4	
Our WRUA has clear rules that ensure members contributions are in balance	F	4	8	17	111	117	4.28
	%	1.6	3.1	6.6	43.2	45.5	
Our WRUA has faced difficulties from users when enforcing rules	F	85	143	11	14	4	2.87
	%	33.1	55.6	4.3	5.4	1.6	
Our WRUA has structures in place for reporting when users do not receive allocated amount of water in a time	F	13	24	26	114	80	3.87
	%	5.1	9.3	10.1	44.4	31.1	
Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the members	F	13	24	26	114	80	3.90
	%	5.1	9.3	10.1	44.4	31.1	
Our WRUA has in place a mechanism to mediate water disputes and resolve conflicts	F	11	16	15	112	103	4.10
	%	4.3	6.2	5.8	43.6	40.1	
There exists a Dispute Resolution Committee in our WRUA	F	25	44	17	79	92	4.66
	%	9.7	17.1	6.6	30.7	35.8	
Average (%)		8.6	14.5	6.5	36.5	33.8	4.01
Summary		29.7 (Disagreement)			70.3 (Agreement)		

Table 4.11 shows responses from users on conflict management strategy. The water users were asked whether they had clear rules on who had rights to use water. Majority (a mean of 4.42) strongly agreed that they had clear rules to be adhered to. Further, a mean of (4.28) strongly agreed that the WRUA had clear rules that ensured each member contributed equal amounts. Agreeing on what amounts should be contributed by members sets a very firm foundation of communication when disagreements arise between members. Knowledge of who had a right to water and how much members were expected to contribute can reduce disputes arising from water distribution and utilization and reduce mistrust between members. Although users confirmed that they had clear rules, majority (63%) agreed that they had been involved in water conflicts in the previous year. The causes of conflicts were identified as unfair sharing of water during the dry season and delayed repairs.

The finding agrees with a study by (Matiru, 2000) which posited that conflicts in water resource management arise due to intense competition for water, lack of adequate administrative capacity, lack of transparency, ambiguous jurisdictions, overlapping functions and lack of necessary infrastructure. The findings indicate the need to explore alternative ways of water harvesting and storage, appropriate farming methods to conserve water, as well as train committee members and users on importance of water conservation to curb water shortage challenges.

Majority of users (a mean of 2.87) agreed that WRUAs faced difficulties from users when enforcing rules on water sharing. Difficulties in enforcing rules on water sharing can arise during the dry season when water levels reduce. Upstream users can abstract more water leaving little water to flow downstream to serve other users. Study findings agree with Regner, (2006) who established that in Jordan Valley, WRUAs took ten years of effort to restore trust between upstream and downstream WRUAs over water abstraction and allocation. Mistrust among WRUAs can raise frequency of water disputes and complicated water cases due to hidden power struggles. WRUAs, therefore, should be encouraged to engage in dialogue in the WRUA forums on abstraction and allocation challenges during the meetings and make strategies for abstraction more effective.

Further, a majority of users (a mean of 3.87) agreed that WRUAs had structures in place for reporting when users did not receive allocated amount of water in time. A majority (mean of 3.90) strongly agreed that WRUAs had a mechanism in place to identify violators of rules and measures to punish them as decided by the members. The findings agree with study by Abdulla, (2009) which established that WRUAs in Uzbekistan had rules and regulations for water allocation but the administration and enforcement of regulations were too weak to control distribution of water to all users. Continuous flow of water can be affected by broken water pipes, blockage of pipes from siltation or vandalism of pipes. Such challenges can be addressed by strong administration that monitors condition of water infrastructure for quick repairs and control of vandalism. In addition, majority (a mean of 4.0) strongly agreed that there existed a dispute resolution committee in WRUAs to address conflicts arising from users. Majority (a mean of 4.66) strongly agreed that WRUAs had mechanisms to mediate water disputes and resolve conflicts.

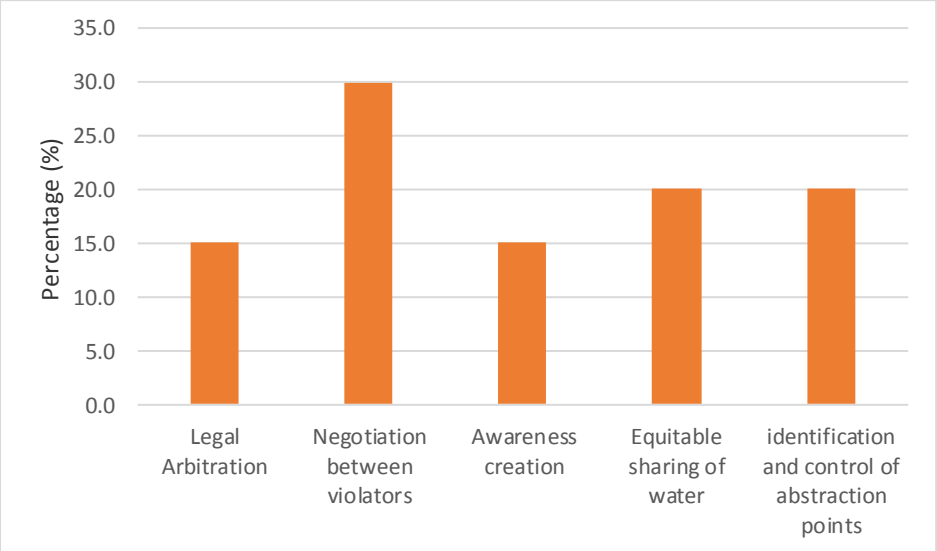


Figure 4.9: Approaches for Mitigation of Conflicts in WRUAs

Analysis of open ended questions shown in Figure 4.7 revealed that water users identified approaches that were used in the management of water conflicts: litigation when arbitration failed 39 (15%); negotiation with parties in disputes 77 (30%); equitable distribution of resources 51 (20%); fixing of water gauging and regulating devices 51 (20%) and use of mechanical staff to identify and control abstraction points 51 (15%).The results implied that the water users have approaches in place to manage water conflicts. The findings agree with a study by Aarts, (2012) in the Upper

Ewaso Nyiro that established approaches for conflict resolution such as: creation of platform for discussion when water disputes between users arose; arrangement for dialogue and awareness creation among the upstream and downstream members; awareness on creation of water use and control between the upstream and downstream users within the river basin can reduce occurrence of conflicts. The findings imply that even when the negotiation process is not effective, it restores communication and provides the parties with problem solving skills.

One of the WRA officer interviewed said that;

> *"Among the WRUAs, conflicts mainly originate from competition for water allocation needed for irrigation, domestic or livestock use. In many cases, the committee members resolve conflicts especially if they were minor and could be resolved at that level. The cases that i precede over, are the ones that that are difficult and have the potential to cause bigger conflicts among the water users. In such cases, I call the complainants who present the case to the regional office. If the case is difficult and can't be resolved it is referred for a ligation process. However, when the committee members report the cases, the conflicts are usually based on non- compliance of rules especially regarding abstraction and appropriate sanctions are provided."*

The results of conflict management strategy, showed that both committee members and the water users agreed that they had clear rules on water sharing. However 145 (56.4 %) of water users agreed that they had been involved in water conflicts in the previous year while 112 (43.6 %) reported that they had not been involved in water conflicts in the previous year. From the results the Committee members agreed that they had faced difficulties in implementing the rules of water sharing during the dry season. The difficulty in sharing water resources could be caused by increased water needs for irrigation and livestock by water users both in the upstream and downstream of the river yet water flow in rivers had reduced. Sharing of water from a spring or the river could be controlled to avoid over abstraction. Over abstraction could lead to conflicts due to sharing of scarce water from rivers between upstream and downstream users.

4.3.4 Water Catchment Management Strategy

In responding to the fourth objective, the researcher sought to examine the effect of water catchment management strategy on promotion of sustainable water projects. The respondents were asked to identify the water catchment strategies they engaged in. The respondents' choices were rated on a five point Likert scale ranging from 'Strongly agree (5); Agree (4); Undecided (3) Disagree (2); Strongly Disagree (1). Any score below three was considered to be disagreement while scores above 3 were considered to be agreement .The statements and responses are presented in Table 4.10

Table 4.12: Responses from Committee Members on Water Catchment Management Strategy

Questions		1	2	3	4	5	Mean
There are no serious defects in the construction of the water intakes along the rivers , wells or springs	F	3	7	4	15	2	3.19
	%	9.7	22.6	12.9	48.4	6.5	
Design and construction of the water intakes was done to the acceptable standards set by the government	F	0	5	1	18	7	3.87
	%	0.0	16.1	3.2	58.1	22.6	
The water point sources are well protected (from animal contamination and human destruction)	F	4	9	4	9	5	3.06
	%	12.9	29.0	12.9	29.0	16.1	
There is low level of water in the reservoirs and river basin	F	4	0	2	16	9	3.84
	%	12.9	0.0	6.5	51.6	29.0	
The WRUAs share water fairly	F	2	5	1	13	10	3.77
	%	6.5	16.1	3.2	41.9	32.3	
Upstream WRUAs in the river basin divert more water than the downstream WRUAs	F	4	4	4	11	8	3.48
	%	12.9	12.9	12.9	35.5	25.8	
WRUAs engage in good agricultural practices that reduce soil erosion, and degradation of river basin	F	5	6	2	12	6	3.26
	%	16.1	19.4	6.5	38.7	19.4	
Average (%)		10.1	16.6	8.3	43.3	21.7	3.50
Summary		35.0 (Disagreement)			65.0 (Agreement)		

Table 4.12 presents responses from committee members on water catchment management strategy. From the findings, it was established that majority of the committee members (a mean 3.19) agreed that there were no serious defects in the

construction of water intakes in rivers, wells and springs. Further, a majority (a mean of 3.87) agreed that design and construction of the water intakes was done to the acceptable standards set by the government. This implies that use of approved design to construct abstraction points on the rivers, wells or springs is an approach to control water flow downstream. The findings agree with Kabogo et al., (2017) who posited that water abstraction control can protect water point sources from drying due to over abstraction. Abstraction control of water from sources when strictly enforced can lead to increase in surface water flows downstream.

The executive members were asked whether water point sources and springs were well protected from possible animal contamination and human destruction. Majority (a mean of 3.06) of respondents disagreed that the water point sources and springs were not protected from animal contamination and human destruction. During the rainy seasons surface run off covers the spring heads with silts. Although WRUAs engaged in spring protection, *in situ* training can be conducted on how to control surface run off. In training of committee members, care should be taken to avoid what is already in practice. The emphasis should be on training technical staff to reinforce what users do on their own. However, a study by Olajuyigbe et al., (2010) established that 60% of respondents reported learning little from trainings on water source protection, environmental issues or law and regulations of the riparian protection. Implementation of protection measures to change land use practices can be tedious and time consuming. Thus, taking training to the grassroots level should involve direct users of the product. Due to differing learner needs, local language and local examples should be used. This implies that methodologies for training on catchment protection should be practically oriented and synchronized with demonstration and effective participation targeted at learner needs. Training should also include passing on vital information so that skills could be understood and utilized. Interviewed WRA officers confirmed that;

> *"To control surface run-off from sloped grounds, WRUAs collaborate with WRA Office in pegging and marking the river banks. Marking the river banks identifies the area for restoration and rehabilitation. Users are encouraged to plant vegetation cover. For example, grass that they can cut and carry to feed*

their animals, planting of indigenous bamboo tress which can be harvested without uprooting, practice farm ponds harvesting techniques. The vegetation covers and the indigenous trees hold the soil firmly and controls surface run-off during the rainy seasons and therefore maintains the river banks from erosion. However, there is need to monitor the activities when implementing the strategy so as to entrench the practice".

Executive members were asked whether there was low level of water in their reservoirs and river basins. A majority (mean of 3.84) of the respondents agreed that there was low level of water in the rivers. A majority (mean of 3.48) of respondents agreed that upstream WRUAs over obstructed water more than downstream users. Low level of water in rivers can be noted during the dry seasons when evaporation rates are high due to deforestation around water catchment areas and reduced vegetation cover along the river banks which cause soil erosion. Gathering information to understand spring and well sources, water flows and landscape could be necessary in the identification of mitigating measures.

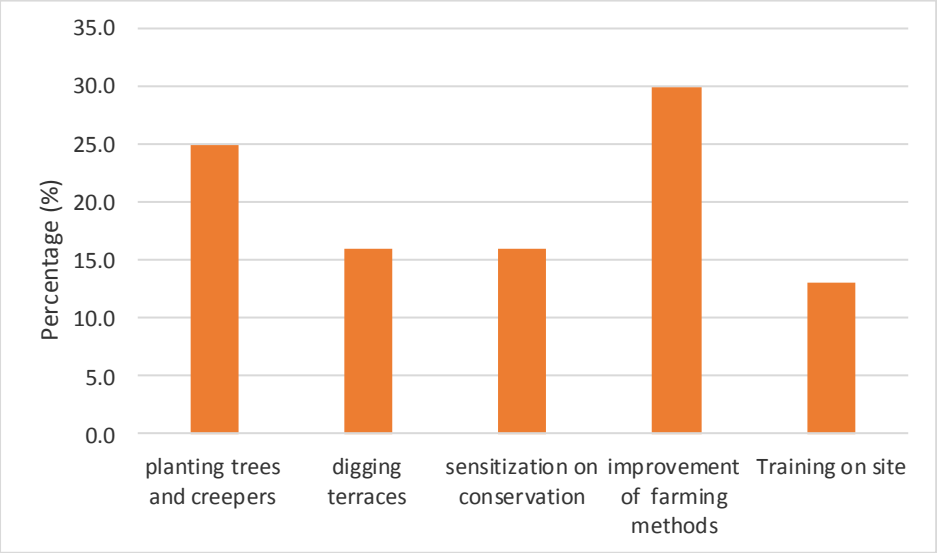


Figure 4.10: WRUA Activities towards river basin conservation

Figure 4.8 showed that all the water users identified activities that were used to conserve the water sources such as; planting trees and creepers 64 (25%), digging terraces 44 (16%), sensitization of users on the need to conserve the environment 13 (5%), improvement of farming methods 77 (30%) and conducting training on site 39 (13%) .The results implied that water users have variety of activities that could be

implemented to conserve the environment. Although the activities for conservation were identified by the water users, the implementation of such activities were partially carried out. Other activities that could be more effective could be explored to protect the water catchment. From the analysis of the observation schedule, effects of soil erosion, unprotected river banks and encroachment on the river banks were observed. The finding implied that the water users had not adopted good farming methods to conserve the catchment.

When the water users were asked to identify challenges that they faced in the management of catchment areas, 15 (6%) identified cutting down of tress, 21 (8%) poor farming methods on sloped lands 87 (33%) encroachment of riparian land, 81 (32%) planting of unfriendly water trees,16(6.7%) lack of cooperation from land owners where springs originates in private land, 37 (14.3%) laxity in law enforcement, sand harvesting and destruction of planted trees along the river banks. The findings agree with Jowuora et al., (2017) who stated that encroachment on riparian land, tree cutting and over-abstraction as reasons for low water flow in rivers. The findings imply that although the catchments meet agricultural, livestock and human needs, they can be affected by human encroachment and high demand for ecosystem services. Accordingly, protection of river banks through planting water friendly trees, vegetation and use of appropriate farming methods can reduce surface runoff, improve natural water recharge points and enhance natural infiltration.

One WRA officer had the following to say on support given to WRUAs on catchment management:

WRA Officers train WRUAs on various strategies for water catchment protection such as good agricultural practices, riparian protection, water harvesting as well as spring protection. However, WRUAs face challenges on climate variability. For example, WRUAs may plan to plant trees and creepers on the degraded land during the long rainy season and then there is little or no rain to water the planted seedling trees. Or perhaps ground cover vegetation dries up during the anticipated short rain season and too much rain is received and the river banks are eroded and their gains are lost.

WRUAs committee members were asked whether they engaged in good agricultural practices that reduce soil erosion, and degradation of river basin. A majority (mean of 3.26) agreed that they used appropriate agricultural practices. Use of appropriate agricultural practices on sloped land can enhance control of soil erosion and reduce surface run-off and siltation during the rainy season. Good farming methods along the river banks can enhance growth of vegetation cover to protect rivers from extreme evaporation. Catchment conservation measures ensure natural regeneration of water infiltration systems and enhance water flow in sources. The findings agree with a study by Alufa, (2012) in Kiserian that established WRUA members participated in tree planting, pegging of the riparian land, planting of creepers on river beds as well as fencing of water point sources. Participation, sensitization and training of users on conservation measures can enable users to acquire knowledge and skills for checking on surface run-off, water harvesting mechanisms and rehabilitation of riverbanks that can increase water flow in rivers.

The committee members identified challenges in the implementation of their planned activities as follows: lack of funding, which adversely affects the efforts in the implementation of WRUA activities, thus some of the activities are partly done; the WRUA management committee carries out activities on a voluntarily basis with no allowances which demoralizes them; WRUA members and non -members are uncooperative towards implementation of proposed WRUA activities and as such, planting of water unfriendly trees still goes on despite sanitization on their effects on water conservation. These challenges agree with the WRMA (2005) report which established that water catchments face environmental degradation due to destruction of wetlands, swamps, springs, encroachment of river banks and planting of non-water friendly trees near the river banks. User responses on water catchment management strategy is presented in Table 4.13

Table 4.13: Responses from Users on Water Catchment Management Strategy

Questions		1	2	3	4	5	Mean
There are no serious defects in the construction of our water intake along the river basin	F	32	44	50	81	50	3.28
	%	12.5	17.1	19.5	31.5	19.5	
Design and construction of our water system was done to the acceptable standards set by the government	F	9	39	23	113	73	3.77
	%	3.5	15.2	8.9	44.0	28.4	
Our water sources are well protected (animal contamination and human destruction)	F	33	82	45	50	47	2.98
	%	12.8	31.9	17.5	19.5	18.3	
There is low water level in our water reservoirs and rivers	F	16	32	17	145	47	3.64
	%	6.2	12.3	6.6	56.6	18.3	
Upstream WRUAs divert more water than the downstream WRUAs	F	23	55	17	95	67	3.44
	%	8.9	21.4	6.6	36.9	26.1	
WRUAs divert much water that make less water available for end-tail users	F	26	67	16	86	62	3.29
	%	10.1	26.1	6.2	33.4	24.1	
WRUAs engages in good agricultural practices that reduce soil erosion, and degradation of river basin	F	51	98	27	47	34	2.67
	%	19.8	38.1	10.5	18.3	13.2	
Average (%)		10.5	23.2	10.8	34.3	21.1	3.30
Summary		44.5 (Disagreement)			54.5 (Agreement)		

Table 4.13 presents responses from users on water catchment management strategy. From the findings, it was established that the majority of users (mean of 3.28) agreed that there were no serious defects in the construction of water intakes in rivers, wells and springs. This observation implies that the WRUAs are supported by WRA technical team to put up most of the intakes. However, findings differ with the study by Mogaka et al., (2005) that assessed performance of 100 water projects on water sharing practices and found out that 59 percent of them had defects in design of water distribution and faced maintenance challenge.

The members were asked whether water point sources and springs were well protected from possible animal contamination and human destruction respondents (mean of 3.77) disagreed with the statement. Further, users were asked whether there

was low level of water in their reservoirs and river basins. A majority (mean of 2.98) of the respondents agreed that there was low level of water in the rivers especially during the dry seasons. When users were asked whether they cut down trees and encroached on river basins (mean of 3.64) of the respondents agreed with the statement. Cutting of trees and encroachment loosen the soil along the river banks making it vulnerable to erosion. The users further identified that uncooperative members encroached on the riparian land despite the effort to protect it. This implies that better farming methods should be applied to curb soil erosion and regulation on encroachment enforced.

Users were asked whether they took part in activities that protected water sources. The majority (mean of 3.44) strongly agreed on participating in protection of water sources. Seventy-eight percent agreed that they took part in tree planting, digging terraces on sloped land as well as planting creepers along the river banks.

River embankment to restore vulnerable areas can be done by use of locally available materials and labor. A majority (mean of 2.67) agreed that they engaged in good agricultural practices that reduce soil erosion, and degradation of river basins. This implies that there is effort to check conservation of the catchment areas. However, adoption of appropriate measures to ensure that activities have a significance impact can enhance water management.

From the finding, both committee members and users agreed that WRUAs engaged in various activities for water protection. However, committee members and water users agreed that there was low water level in rivers and springs. Though users and committee members engage in water conservation measures, low water levels in rivers implies that there was need to explore alternative measures to water conservation. In addition, the findings indicate that there was need to combine scientific and local knowledge to forecast climatic variations with precision and make use of crucial information to build local capacity to deal with anticipated impacts. Local knowledge can also be adopted to improve water conservation practices. Further, they confirmed that there was encroachment and cutting down of trees along

river banks. The eyes of springs can be protected by planting vegetation cover and fencing, as well as conserving the catchment to provide sustainable water sources.

4.3.5 Institutional Support

In responding to the moderating effects of institutional support, the researcher sought to examine the support given to WRUA strategies in the promotion of sustainable water projects. The respondents were asked to identify the support given by WRA office. The respondents' choices were rated on a five point Likert scale ranging from 'Strongly agree (5); Agree 4); Undecided (3) Disagree (2); Strongly Disagree (1). Any score below three was considered to be disagreement while scores above 3 were considered to be agreement. The statements and responses are presented in Table 4.14

Table 4.14: Responses from Committee Members on Institutional Support

Questions		1	2	3	4	5	Mean
WRUAs management are supported to source for financial resources from other financial agencies/institutions	F	0	1	0	16	14	4.39
	%	0.0	3.2	0.0	51.6	45.2	
WRUAs are supported by WRA water officers in training, drawing plans (legal and regulatory support)	F	3	0	0	11	17	4.26
	%	9.7	0.0	0.0	35.5	54.8	
WRUAs get support from the WRA office on good agricultural activities for water catchment maintenance	F	0	3	3	13	12	4.10
	%	0.0	9.7	9.7	41.9	38.7	
WRA Officers train users on water conflict resolution	F	1	2	1	18	9	4.03
	%	3.2	6.5	3.2	58.1	29.0	
WRUAs have information about follow-up support by WRA office in case of major water system repairs	F	3	10	5	8	5	4.06
	%	9.7	32.3	16.1	25.8	16.1	
Financial audit results of WRUA are submitted to members every year	F	4	3	1	12	11	3.74
	%	12.9	9.7	3.2	38.7	35.5	
Average (%)		5.9	10.2	5.4	41.9	36.6	4.10
Summary		21.5 (Disagreement)			78.5 (Agreement)		

Table 4.14 shows responses from committee members on institutional support WRUAs committees were asked whether they were supported in sourcing for finances

from other financial agencies/institutions to support their projects. A majority (mean of 4.39) strongly agreed that they were supported to source for financial resources. The financial resources are required for implementation of WRUA activities as guided by the plans. This finding is supported by WSTF, (2017) report that published the funding of WRUAs in 2017/2018 financial year that had met the qualification criteria for funding. For WRUAs to be funded by external sources like the government or other agencies, they are required to write viable proposals with specific objectives, budgets and timelines in a given criteria which would be evaluated from time to time to ensure implementation progress. The findings agree with studies by Parker Oates, (2016) that recommended WRUAs be supported through training on governance and financial management in order to formulate viable budgets, prioritize activities and formulate objectives with measurable outputs. Participants have different learning paths during trainings and require use of different methods to explore practical alternatives to address challenges.

The results of the interviews from the WRAs officers indicated that WRUAs were supported in planning, training and mobilization of resources. The interviewed officers agreed that support to WRUAs for resource mobilization was very crucial and one officer said that:

> "*WRUAs are supported in planning, identification of priories, proposal writing for funding as well as technical support in the implementation of the activities. Support takes the form of training to build capacity to mobilize resources for soil conservation on sloped areas, planting of grass and water friendly trees along the riparian land, preparation of tree nurseries for rehabilitation of degraded areas as well as protecting springs. Methodology for training takes the form of focused group discussions, transect walks to monitor implementation process of planned activities preparation of practical lessons on writing proposals for funding as well as preparation of progress reports on their activities".*

Committee members were asked whether they were supported by WRA water officers in training on legal and regulatory matters concerning operation of WRUAs .Majority (mean of 4.6) strongly agreed that they had been trained on legal and regulatory

matter in water management. Training on legal matters can enforce rules, reduce illegal abstraction, encroachment of riparian land and reduce conflicts among members. The findings agree with (Ostrom, 2000)who recommended that enforcement mechanisms can take the form of graduated sanctions, and setting aside control teams to oversee the implementation of agreed activities, legal training on by laws, land agreements and penalties for noncompliance . Adequate knowledge on environmental law requires gathering of scientific verification as evidence for use against violators in courts of law to avoid weak cases. Committee acquisition of legal knowledge can help them check violators of water resource management laws, and take appropriate deterrent measures. The results of the interviews from the WRAs officers indicated that WRUAs were trained in legal matters and in setting up by laws and regulations which members were required to abide with in the WRUAs. The interviewed WRA officer said that;

> *WRUAs are mandated institutions that manage water at the local level by the Water Act (GoK, 2016). Further they are registered associations by the Registrar of Societies that requires legal compliance for incorporation. As such WRA officers supports WRUAs to formulate by laws to guide their operations training on gathering evidence for violation of laws governing natural resource management. WRA office provides quality assurance support to WRUAs in activity implementation or when services specializes are required. The WRA office also links the WRUAs with other institutions that deal with legal affairs on environmental matters, NEMA as well as Kenya Forestry Services.*

Committee members were further asked whether they got support from the WRA office on good agricultural activities for water catchment maintenance. Majority (mean of 4.10) strongly agreed that were they supported in improving agricultural activities to conserve the catchment areas (99%) of the committee members identified support in pegging of riparian land to avoid river bank encroachment, terracing techniques to reduce surface run off in sloped areas, planting of nippier grass and fodder creepers on the river banks to hold the soils, removing silt from dams and water pans so that they can hold more during the rainy seasons. Further, majority of committee members agreed (mean of 4.06) that they have information about follow-

up support by WRA office. Support would assist the WRUAs solve unanticipated challenges in water management. Interview with WRA office revealed that;

> *"WRUAs are supported in training members on various agricultural farming methods that encourage soil conservation to reduce surface run off. Such methods includes making of contours Sloped land where grass is planted to hold the soils together. Other methods include making of contour bunds which divide sloped land into terraces which slow down speed of run off and preserve the shape of the slopes. Strips of grass planted on such areas provide fodder for animals as a benefit of such practices. They are also trained on making of bench terraces which improve water storage and protect soils against erosion. Further they are trained on double digging to break hard pans which allow soils to store water among other practices depending on the terrain of the land".*

In addition, WRA officers confirmed that WRUAs are given guidelines to enhance sustainable catchment management depending on their location in the river basin through:

> *Apprehending violators of water regulations, marking the riparian land, monitoring water levels, as well as rehabilitation of degraded areas. Assessment and identification of threatened areas allow formulation of desirable improvements options.*

The committee members were asked whether WRA Officers trained users on water conflict resolution. A majority (mean of 4.03) strongly agreed that they had been trained in conflict management. The committee members reported that conflicts arising on water were resolved by the committee or reported to WRA office. Skills acquired on conflict resolution can be applied to solve cases as well as deter occurrence of conflicts. Further committee members agreed (mean of 3.74) that they shared financial audit results of the WRUAs with members every year. Audit reports can provide information on the resources provided during the year and how they were used. Audit findings can create harmony and indicate transparency on use of mobilized resources in the implementation of agreed targets. The findings imply that sharing of audit results can improve participation in decision making and enforce

financial contribution rules and collection of fees for project resources. The study findings are in line with studies by Rolston et al., (2017) who established that involvement of stakeholders in monitoring of the activities and involvement in decision making processes can lead to trust building and better communication and increase project success. The findings agree with Mumma, et al., (2011) which pointed out that for intervention plans to be implemented and yield desired results, regular monitoring of intervention activities has to be carried out, evaluation done and practical solutions sought until the desired objectives are achieved. Hence, support of WRUAs should encourage collaboration with all agencies concerned to exchange of ideas. User statements and responses from users on Institutional Support are presented in Table 4.15

Table 4.15: Responses from users on Institutional Support

Questions		1	2	3	4	5	Mean
WRUAs are supported by WRA water officers in training, drawing plans (legal and regulatory support)	F	54	37	25	62	79	3.29
	%	21.0	14.4	9.7	24.1	30.7	
Financial audit results of WRUA are submitted to members every year	F	31	20	9	91	106	3.85
	%	12.1	7.8	3.5	35.4	41.2	
WRUAs have information about follow-up support by WRA office in case of major water system repairs	F	30	76	44	55	52	3.08
	%	11.7	29.6	17.1	21.4	20.2	
WRA Officers train users on water conflict resolution	F	17	33	5	117	85	3.86
	%	6.6	12.8	1.9	45.5	33.1	
Financial audit results of WRUA are submitted to members every year	F	33	82	45	50	47	2.98
	%	12.8	31.9	17.5	19.5	18.3	
WRUAs get support from the WRA office on good agricultural activities for water catchment maintenance	F	51	100	36	35	35	2.96
	%	19.8	38.9	14.0	13.6	13.6	
Average (%)		14.0	22.6	10.6	26.6	26.2	3.34
Summary		47.2 (Disagreement)			52.8 (Agreement)		

Table 4.15 shows that responses from users on institutional support. A majority (mean of 3.29) agreed that the WRUAs sourced for financial resources from other agencies

and institutions to support their projects. However, when asked whether the committee shared financial audit results of WRUA with members every year majority (mean 3.85) disagreed with the statement. The mixed reaction on shared financial audit results can be attributed to low participation of members in meetings. Lack of information sharing on financial audit results can raise questions on transparency on use of resources mobilized from the users. The observation agrees with findings of Mogaka et al., (2005) who posited that management of water distribution can be affected by mismanagement of project resources which could lead to matters surrounding transparency and accountability. Uncontrolled use of revenues can lead to finances being spent on matters that were not a priority in regard to water resource management. The findings imply that involvement of users on financial controls can enhance decision making processes that ensure opinions of stakeholders are taken into account in setting and enforcing financial reporting procedures of their project. Inadequate information on financial management can cause scarcity of resources due to raised suspicion on use of available resources.

Users were asked whether they had information about follow-up support by WRA office in case of major water system repair. Majority (mean 3.08) agreed that they had information on where to get follow up support in case of need. Follow up support can take the form of training to fill identified gaps or sensitization of local water users on benefits of sub catchment protection. Thus follow up on afforestation, construction of terraces and planting of water friendly trees. Follow up support on water friendly planted trees can ensure their preservation by cutting braches instead of uprooting the trees that take over thirty years to grow. When provided with credible support, WRUAs can use historical experiences to implement their activities and preserve their environment. At a (mean of 2.96) users agreed that they got support from the WRA office on good agricultural activities to check on soil erosion, and excessive sand harvesting to ensure water catchment maintenance. Follow up support can build capacity and confidence of individuals to undertake essential activities, and promote capable autonomous associations that value contribution of ideas from members at every stage.

From the findings both users and committee members agreed that WRUAs were supported by WRA office in implanting activities in the catchment areas. Nevertheless, they reported low water levels in rivers, encroachment on the riparian land, cutting of tress along the river banks and degradation of wetlands. The finding revealed that support provided to WRUAs is inadequate in the promotion of sustainable catchment area. The finding is line with other studies which revealed that water management required concerted effort from all stakeholders to support WRUAs in planning, decision making, technical assistance and training to carry out sound river basin protection (UNDP, 2006)

4.3.6 Sustainability of Water Projects

In responding to the dependent variable the researcher sought to examine the effect of WRUA strategies in the promotion of sustainable water projects. The respondents were asked to identify the strategies they engaged in to make the water projects sustainable. The respondents' choices were rated on a five point Likert scale ranging from 'Strongly agree (5); Agree (4); Undecided (3) Disagree (2); Strongly Disagree (1)'. The statements and responses are presented in Table 4.16

Table 4.16: Responses from Committee Members on Sustainability of Water Projects

Questions		1	2	3	4	5	Mean
All community users in our WRUA have equitable access to water throughout the year (fairness and equal access to all users)	F	0	9	1	15	6	3.58
	%	0.0	29.0	3.2	48.4	19.4	
There is continuous flow of water to meet user demand throughout the year (sufficient flow of water, no regular dry ups in parts of the year)	F	2	12	3	10	4	3.06
	%	6.4	38.7	9.7	32.3	12.9	
All members participate regularly in decision making meetings of the WRUAs (Participation)	F	0	2	0	13	16	4.39
	%	0.0	6.5	0.0	41.9	51.6	
There are water saving mechanisms in place e.g. water storage tanks and taps for members (water storage)	F	3	6	7	12	3	3.19
	%	9.7	19.4	22.6	38.7	9.7	
Our members are trained on how to identify and report any challenges experienced in water management	F	0	4	0	18	9	4.03
	%	0.0	12.9	0.0	58.1	29.0	
The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external Financial assistance	F	0	6	1	14	10	3.90
	%	0.0	19.4	3.2	45.2	32.3	
I consider our WRUA as a self-managed organization governing its financial, organizational, and administrative issues independently from the water agency or any other government agency	F	5	4	0	11	11	3.61
	%	16.1	12.9	0.0	35.5	35.5	
Average (%)		4..6	19.8	5.5	42.9	27.2	3.68
Summary		30.0 (Disagreement)			70.0 (Agreement)		

From the findings in Table 4.16, committee members (mean of 3.58) strongly disagreed that WRUA had equitable access to water throughout the year. The functions of water are diverse and do only cover domestic but also agricultural functions (Hutton & Batram, 2008) .The observation implies that some water users did not receive water when it was needed due over abstraction and reduced water flows. Crosswell, (2015) observed that many rivers of the world have reduced water

flows, had dried up or were in the verge of dying up and their flows no longer reach the ocean .Although WRUA committee members agree that they share water equitably, access to water could mean the little water availably was equitably shared. This was indicated by committee members (mean of 3.06) that disagreed that there was continuous flow of water to meet user demand throughout the year. This obersrvation is collaborated by Cleaver & Franks, (2003) who observed that conservation of water reserves and development of long term management interventions would be required to ensure optimum benefits of shared water to all users.

Majority of committee members (a mean of 4.39) strongly disagreed that all members participated regularly in decision making meetings of the WRUAs. Members may fail to attend meetings because they do not see a genuine opportunity to better their own lives or that of the community. Participation motivates people work together when they realize the benefits of their participation. There exists a significant relationship between participation and sustainability of water and recommended participation of members on regular bases to share ideas, take decisions, and raise funds for their WRUAs Mogaka et al., (2005).

A majority of committee members (mean of 3.19) agreed that there were water saving mechanisms in place e.g. water storage tanks and taps for members .The storage tanks can be constructed to store water for distribution, and also store water in homesteads during the rains for use during the dry seasons. Due to the cost involved in construction of tanks, availability of storage tanks in homesteads could be inadequate. Indeed the finding was collaborated by interviewed WRA who started that:

> *"WRUAs did not have adequate water storage facilities in place and committee members were sensitized on water harvesting techniques during the rainy seasons to ease off pressure of water need during the dry seasons. Storage mechanisms take the form of building pans and dams that hold water during the rainy season, use of storage tanks by public institutions for roof water harvesting during the rainy seasons. Households are also encouraged to practice roof water harvesting. Stored water in dams, pans and tanks hence can be used during the dry season to support user livelihood activities."*

Further, committee members (mean of 4.03) agreed that users were trained on how to identify and report any challenges experienced in water management. Regular reports on challenges experienced can be reference point in meetings and build confidence of members when their matters are listened to. Sharing of experiences enriches regular monitoring reports and thus improves water sharing and solve challenges arising from distribution.

When committee members were asked whether they considered their WRUAs a self-managed organization governing financial, organizational, and administrative issues independently from the water agency or any other government agency majority (mean of 3.61) agreed that they considered their WRUAs self-managed. The opinion of self-managed WRUAs is an indicator autonomous associations. Although challenges were experienced, WRUA committee members considered carrying on with the implementation of planned activities to achieve their strategies. Upgrading of physical works by use of professional technicians who would in turn train the local users can assist the WRUA committee rehabilitee their water infrastructure and make it more effective. Sustainable water maintenance may require annual maintenance schedules, monitoring plans, rehabilitation plans formulated prior to implementation of the planned activities to mobilization of participants (Braham, 2016). Water users' statements and responses on sustainability of water projects were presented in Table 4.17

Table 4.17: Responses from Users on Sustainability of Water Projects

Questions		1	2	3	4	5	Mean
Our WRUA shares water equitably to all projects throughout the year (fairness and equal access to all users)	F	21	31	13	114	78	3.76
	%	8.2	12.1	5.1	44.4	30.4	
I receive continuous flow of water to meet my demand throughout the year (sufficient flow of water, no regular dry ups in parts of the year)	F	27	83	28	76	43	3.13
	%	10.5	32.3	10.9	29.6	16.7	
I participate regularly in decision making meetings of our WRUA	F	6	8	8	99	136	4.38
	%	2.3	3.1	3.1	38.5	52.9	
Our WRUA is supported by WRA water officers in training, drawing plans and legal and regulatory issues	F	54	37	25	62	79	3.30
	%	21.0	14.4	9.7	24.1	30.7	
My household has water saving mechanisms in place e.g. water storage tanks, taps	F	30	45	17	77	88	3.60
	%	11.7	17.5	6.6	30.0	34.2	
I consider our WRUA as a self-managed organization governing its financial, organizational, and administrative issues	F	17	23	12	94	111	4.00
	%	6.6	8.9	4.7	36.6	43.2	
The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external Financial assistance	F	51	100	36	35	35	2.96
	%	19.8	38.9	14.0	13.6	13.6	
Average (%)		11.4	18.2	7.7	31.0		3.59
Summary		37.3 (Disagreement)			62.6 (Agreement)		

Table 4.17 present responses from users on sustainability of water projects. Water users were asked whether WRUAs shared water equitably throughout the year.A majority (mean 3.76) agree that their WRUAs shared their water equally. However, at a (mean 3.13) users disagreed that they got continuous flow of water to meet my demand throughout the year. Lack of continuous flow can be caused by little water flows in rivers making it difficult to equitably share little amounts. The findings agree with the findings of Rusfendi, (2001) who established that in Indonesia, users suffered shortage during the dry seasons because upstream users abstracted more water leaving the downstream users prolonged shortage. Although water can be equally shared,

shortages can be experienced in the dry season when rivers have of low water volumes. This implies that alternative ways of conserving water like water harvesting, good agricultural practices can reduce water pressure and enhance equitable sharing in the dry seasons.

In examining regular participation in decision making meetings of WRUAs, a majority (mean of 4.38) members agreed they participated regularly in decision making. User participation can take the form of sharing ideas, taking decisions on pertinent matters, provision of finances or material as well as monitoring of project progress. Users' participation can gather comments, perceptions as well as experiences which can be taken into account before making decisions. A majority (mean of 3.60) agreed that they had attended training in legal and regulatory issues.The finding differs with study by Rolston et al, (2017) that established that 81% of respondents did not feel included in decision making that concerned their water environment management and only 31% were willing to attend such meetings. In meetings information is shared to make the audience conversant with the proposed plans and anticipated challenging matters. Low participation in decision making can be affected by users with differing backgrounds spread over a large geographical areas and lack funds to facilitate their travel to meetings. Such can further be affected by varying user interests in utilization of water resources. Participation can empower stakeholders and foster a feeling of responsibility and create winners interested in the protection and management of water resource. It's significant that institutions have inadequate resources to cover effective capacity building of members to allow inclusivity in decision making (Biswas, 2005).

Further, a mean of (4.00) disagreed that household had water saving mechanisms in place e.g. water storage tanks and taps. Construction of individual storage tanks can have costs implications that many users can not afford. However appropriate technology of water saving mechanisms can be explored to enhance water saving. Further, at (mean of 2.96) majority of the water users agreed that they undertook water rehabilitation works. Engagement in rehabilitation work can be provision of material for construction, provision of finances or offering ones time during the process. A low level of respondents agree with the statement that users have not fully

embraced water saving mechanisms and may require enhanced training on water storage as strategy for water management. The findings agree with study in Nigeria by Olajuyigbe et al, (2010), which established that 60% of respondents learnt little in trainings on water saving mechanisms on water conservation. Interview with WRA officer confirmed that:

> "*Water saving mechanisms are an important aspect which can be used to store water during the rainy seasons and control surface run-off which can be used during the dry seasons when there is water shortage due to reduced water flows in rivers. Rain water harvesting and storage tanks are encouraged for households".*

It was evident from the results that there was low water flows in rivers to sustain equitable sharing to meet the required needs. Further, the study established that WRUAs experience inadequate finances to run WRUA activities, ineffective water sharing and water saving mechanisms which can affect sustainability of water projects. Further, the results revealed that WRUAs experienced water conflicts especially during the dry seasons.

4.4 Inferential Statistics

This section presents empirical results on the factors affecting sustainable relationship between WRUA strategies and sustainability of water projects. WRUA strategies included resource mobilization strategy, infrastructure maintenance strategy, conflict management strategy and water-catchment management strategy. The study also investigated the moderating effect of institutional support on the relationship of each WRUA strategy and sustainability of water projects. The study tested the following hypotheses. The researcher sought to test the acceptance of the following hypotheses;

H_0: There is no relationship between resource mobilization strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_a: There is a statistically significant relationship between resource mobilization strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between infrastructure maintenance strategy and sustainability of water projects

H_a: There is a statistically significant relationship between infrastructure maintenance strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between conflicts management strategy and sustainability of water projects

H_a: There is a statistically significant relationship between conflicts management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no relationship between water catchment management strategy and sustainability of water projects

H_a: There is a statistically significant relationship between water catchment management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

H_0: There is no moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.

H_a: There is a statistically significant moderation effect of institutional support on resource mobilization, infrastructure maintenance, conflict management and catchment management strategies in the promotion of sustainable water projects.

The study used Chi square statistics (χ^2) to make inference on the relationship between sustainability of water projects in WRUAs in Tana Catchment area and the WRUA strategies hence forming the basis of concluding the research hypotheses. In this case, where the p-value as computed in Chi square statistical test was less than five per cent significance level (0.05), the null hypothesis was rejected. Conversely, where the p-value was more than five per cent significance level (0.05), the null hypothesis (H_0) failed to be rejected. This means that the alternate hypothesis (H_a) was adopted. Moderation effect of institutional support on the relationship between the WRUA strategies (resource mobilization strategy, infrastructure maintenance strategy, conflict management strategy and water-catchment management strategy) and sustainability of water projects in WRUAs in Tana Catchment area was operationalized through their interactions. The significance of these interactions (institutional support and each WRUA strategies) was tested in binary logistic regression to show the moderation effect as hypothesized.

The binary logistic regression model for testing moderation was as follows:

$$\text{Ln}\left(\frac{p(y)}{1-p(y)}\right) = \beta_0 + \beta_1 X_i + \beta_2 M + \beta_3 X_i * M + e \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where;

Y – Sustainability of water projects in WRUAs in Tana Catchment area

P(Y) – Probability of sustaining water projects

X_i – WRUA strategies for i = 1,2,3,4 hence, X_1, X_2, X_3, X_4

X_1 – Resource Mobilization Strategy

X_2 – Infrastructure Maintenance Strategy

X_3 – Conflict Management Strategy

X_4 – Water Catchment Management Strategy

M – Institutional Support

X_i*M - interaction of strategies and institutional support

β_1 – Regression coefficient for sustainability of water projects

β_2 – Regression coefficient for institutional support

β_3 – Regression coefficient for interaction of WRUA strategies and institutional support

e – Regression error term

The first model involves each strategy as a sole main effect. The second model involves adding the moderator (institutional support) as a second main effect. At this point, there is no moderation as institutional support is added here as an additional predictor, hence, two main effects. The third model involves adding the interaction of the strategies and institutional support. This interaction form the basis of establishing moderation effect as postulated in the study. According to Hsu, Wang, and Hsu, (2012); Baron & Kenny, (1986) the absence of the interaction term can lead to incorrect specification of the regression model because main effects of the independent variables *per se* do not explain how the independent variables interact (moderate) each other. It is only an empirical determination of insignificance in interaction that can justify ignoring of the product term thereby concluding the absence of interaction (moderation).

Likert scale questions were coded in SPSS as ‘strongly agree = 5’, ‘agree = 4’, ‘neutral = 3’, ‘disagree = 2’ and ‘strongly disagree = 1’. Structured questionnaire

items were further coded into dichotomous outcomes, that is, ‘yes = 1’ and ‘no = 0’. For the 5 point Likert scale questions, ’agree’ and ‘strongly agree’ were collectively coded as 1 while, ‘neutral’, ‘disagree’ and ‘strongly disagree’ were collectively coded as 0. Any score below three was considered to be disagreement while scores above 3 were considered to be agreement.

4.4.1 Effect of Resource Mobilization Strategy on Sustainability Water Projects

The first hypothesis of the study postulated a relationship between Sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy. The null hypothesis stated that there was no significant relationship between resource mobilization strategy and Sustainability of water projects in WRUAs in Tana Catchment area while the alternate hypothesis stated that there was a statistically significant relationship between resource mobilization strategy and Sustainability of water projects in WRUAs in Tana Catchment area. Chi – square test was used to test the research hypothesis. The results include cross-tabulation results to show that the minimum expected count was not violated (minimum count is five) and chi-square statistic with the corresponding p-value to show the significance of the relationships.

Table 4.18: Cross-tabulation Resource Mobilization Strategy and Sustainability of Water Projects

			Sustainability of water projects in WRUAs in Tana Catchment area		Total
			No	Yes	
Resource Mobilization Strategy	No	Count	53	42	95
		Expected Count	39.6	55.4	95.0
	Yes	Count	67	126	193
		Expected Count	80.4	112.6	193.0
Total		Count	120	168	288
		Expected Count	120.0	168.0	288.0

Table 4.18 also shows that cross tabulation between sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy met the threshold of Chi-square analysis such that none of the cells had expected count of less than five given that the minimum count was 39.6 (row ‘No’ of Resource Mobilization strategy

and column 'No' of sustainability of water projects in WRUAs in Tana Catchment area).

Table 4.19: Chi-Square test for Resource Mobilization Strategy and Sustainability of Water Projects

	Value	df	p-value
Pearson Chi-Square	11.633	1	0.001
Symmetric Measures:			
Pearson's Correlation Coefficient, R (interval by interval) = 0.201, t=3.47, p=0.001			
Spearman Correlation (ordinal by ordinal) = 0.201, t = 3.47, p = 0.001			
N of Valid Cases 288			

Table 4.19 shows Chi-square results which includes: Pearson's Chi-square statistic, Pearson's correlation coefficient and Spearman's correlation coefficient. Each of the three latter statistics were accompanied by their corresponding p-values. The Chi square result was, χ^2 (1) = 11.633, p = 0.001 (p-value less than 0.05). Since the p-value was less than five per cent, this implies that there is a statistical evidence of a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy.

The Pearson's correlation coefficient (R) and Spearman's correlation coefficient were both found to be 0.201, (that is, 20.1 per cent), p = 0.001 (p-value less than 0.05). This shows significant correlation between sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy. Therefore, the study rejected the null hypothesis which postulated an absence of a relationship between sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy. Therefore, the alternate hypothesis was adopted meaning that there was a statistically significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and resource mobilization strategy.

Based on respondent's opinion, there was a relationship between resource mobilization and sustainability of water project. The results implied that when resources were adequately mobilized, sustainability of water project would be enhanced. The findings agree with studies carried out by Hutton & Bartram, (2008) and Baker, (2000) which argue that determination of the real costs of projects affects

accounting and financial administration of project finances, financial management skills among WRUAs was not well developed in the developed world (Mumma, 2005).

The interviewed WRA officers confirmed that WRUAs had faced challenges in mobilizing adequate resources required for implementation of set strategies. One of the WRA officers that;

"Unless effort is put to recruit more members to join WRUAs the WRUA committee members and indeed all WRUAs would be unwilling to contribute more resources than they were doing currently"

4.4.2 Effect of Infrastructure Maintenance Strategy on Sustainability of Water Projects

The second hypothesis of the study postulated a relationship between Sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy. The null hypothesis stated that there was no significant relationship between infrastructure maintenance strategy and Sustainability of water projects in WRUAs in Tana Catchment area while the alternate hypothesis stated that there was a statistically significant relationship between infrastructure maintenance strategy and Sustainability of water projects in WRUAs in Tana Catchment area. Chi – square test was used to test the research hypothesis. The results include cross-tabulation results to show that the minimum expected count was not violated (minimum count is five) and chi-square statistic with the corresponding p-value to show the significance of the relationships.

Table 4.20: Cross-tabulation of Infrastructure Maintenance Strategy and Sustainability of Water Projects

			Sustainability of water projects in WRUAs in Tana Catchment area		Total
			No	Yes	
Infrastructure Maintenance Strategy	No	Count	110	130	240
		Expected Count	100.0	140.0	240.0
	Yes	Count	10	38	48
		Expected Count	20.0	28.0	48.0
Total		Count	120	168	288
		Expected Count	120.0	168.0	288.0

Table 4.20 also shows that cross tabulation between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy met the threshold of Chi-square analysis such that none of the cells had expected count of less than five given that the minimum count was 20 (row 'Yes' of Infrastructure maintenance strategy and column 'No' of sustainability of water projects in WRUAs in Tana Catchment area).

Table 4.21: Chi-Square test for Infrastructure Maintenance Strategy and Sustainability of Water Projects

	Value	df	p-value
Pearson Chi-Square	10.286	1	0.001
Symmetric Measures:			
Pearson's Correlation Coefficient, R (interval by interval) = 0.189, t=3.255, p=0.001			
Spearman Correlation (ordinal by ordinal) = 0.189, t = 3.255, p = 0.001			
N of Valid Cases 288			

Table 4.21 shows Chi-square results which includes: Pearson's Chi-square statistic, Pearson's correlation coefficient and Spearman's correlation coefficient. Each of the three latter statistics were accompanied by their corresponding p-values. The Chi square result was, χ^2 (1) = 10.286, p = 0.001 (p-value less than 0.05). Since the p-value was less than five per cent, this implies that there is a statistical evidence of a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy.

The Pearson's correlation coefficient (R) and Spearman's correlation coefficient were both found to be 0.189, (that is, 18.9 per cent), p = 0.001 (p-value less than 0.05). This shows significant correlation between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy. Therefore, the study rejected the null hypothesis which postulated an absence of a relationship between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy. Therefore, the alternate hypothesis was adopted meaning that there was a statistically significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy.

Based on the findings, there was relationship between infrastructure maintenance strategy and sustainability of water project. The results implied that when water infrastructure was repaired, rehabilitated and catchment maintained, there would be an increase of water volume in rivers. Downstream water users would not be disadvantaged instead, all water users would be able to share the limited resources. Adequately implemented maintenance strategies would ensure timely repairs and reduction of water wastage lost through broken or blocked water pipes. However, WRUAs faced challenges in accessing spare parts and tools for repair of water infrastructure. The study agrees with studies by Bergh, (2007) which established that in Morocco, lack of involvement of local stakeholders in the design of infrastructure technical design lead to installation of expensive water pumps which required spare parts that users could not afford all the times. Other studies found out that at times, funds to carry out required maintenance activities were sometimes lacking or inadequate decisions were taken on infrastructure maintenace (Al-Mohannad, 2003; Fadul Bashir, 2012).

One interviewed WRA officer reported that;

"WRUAs really try to maintain their water systems through repairs. However they lack skilled labor to effectively maintain the water infrastructure during the rainy seasons when flash floods destroy the water intakes, fill the sedimentation tanks with silt or debris or block pipes all together. However when the repairs were major, the WRUAs lack the technical capacity to carry our repairs until they get support from the WRA technical staff"

Results from the observation schedule revealed that visible low water base levels in rivers indicating reduced water levels in rivers that were previously indicating higher levels. There were visible marks of repaired water pipes, construction of new intakes and rehabilitation of intakes along the river banks. Such observations confirmed implementation of WARUA activities on the ground.

The study findings agree with Abdelhadi, *et al.,* (2004) who argued that ownership of projects lead to greater care of infrastructure by members who protect the resources against waste, destruction and reduce conflicts. However, Ifejika, (2018) found out that in Laikipia, inadequate capacity to mobilize resources was associated with human capital (education, knowledge, skills and experience) of the committee members. When such skills were limited among the WARUA members, maintenance of infrastructure would not be effectively maintained.

4.4.3 Effect of Conflict Management Strategy on Sustainability of Water Projects

The third hypothesis of the study postulated a relationship between Sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy. The null hypothesis stated that there was no significant relationship between conflict management strategy and Sustainability of water projects in WRUAs in Tana Catchment area while the alternate hypothesis stated that there was a statistically significant relationship between conflict management strategy and Sustainability of water projects in WRUAs in Tana Catchment area. Chi – square test was used to test the research hypothesis. The results include cross-tabulation results to show that the minimum expected count was not violated (minimum count is five) and chi-square statistic with the corresponding p-value to show the significance of the relationships.

Table 4.22: Cross-tabulation of Conflict Management Strategy and Sustainability of Water Projects

			Sustainability of water projects in WRUAs in Tana Catchment area		Total
			No	Yes	
Conflict Management Strategy	No	Count	31	13	44
		Expected Count	18.3	25.7	44.0
	Yes	Count	89	155	244
		Expected Count	101.7	142.3	244.0
Total		Count	120	168	288
		Expected Count	120.0	168.0	288.0

Table 4.22 also shows that cross tabulation between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy met the threshold of Chi-square analysis such that none of the cells had expected count of less than five given that the minimum count was 18.3 (row 'No' of conflict management strategy and column 'No' of sustainability of water projects in WRUAs in Tana Catchment area).

Table 4.23: Chi-Square test for Conflict Management Strategy and Sustainability of Water Projects

	Value	df	p-value
Pearson Chi-Square	17.708	1	0.000
Symmetric Measures:			
Pearson's Correlation Coefficient, R (interval by interval) =0.248, t=4.329, p=0.000			
Spearman Correlation (ordinal by ordinal) = 0.248, t = 4.329, p = 0.000			
N of Valid Cases 288			

Table 4.23 shows Chi-square results which include: Pearson's Chi-square statistic, Pearson's correlation coefficient and Spearman's correlation coefficient. Each of the three latter statistics were accompanied by their corresponding p-values. The Chi square result was, χ^2 (1) = 17.708, p = 0.000 (p-value less than 0.05). Since the p-

value was less than five per cent, this implies that there is a statistical evidence of a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy.

The Pearson's correlation coefficient (R) and Spearman's correlation coefficient were both found to be 0.248, (that is, 24.8 per cent), p = 0.000 (p-value less than 0.05). This shows significant correlation between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy. Therefore, the study rejected the null hypothesis which postulated an absence of a relationship between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy. Therefore, the alternate hypothesis was adopted meaning that there was a statistically significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy.

The results from the study implied that there was a relationship between conflict management strategy and sustainability of water project. The results implied that conflict management was an important aspects in the promotion of sustainable water project. Further, the results implied that when participants were involved in the formulation and enforcement of rules, conflicts would be minimized. Use of various conflicts resolutions mechanisms would reduce the time spent to resolve case leaving the participants to put more efforts in other projects activities. The findings agree with Aarts (2012) who found out three reasons why WRUAs in the Upper Ewaso Ng'iro river basin in Kenya were able to reduce water-related conflicts. The reasons established were that WRUAs were platforms for discussion when water disputes between users arose, WRUA officials were able to arrange for discussions and solve conflicts through dialogue and that WRUAs created awareness among the upstream and downstream members of their interconnectedness within the river basin to ensure water use control.

4.4.4 Effect of Water Catchment Management Strategy on Sustainability of Water Projects

The fourth hypothesis of the study postulated a relationship between Sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management

strategy. The null hypothesis stated that there was no significant relationship between water-catchment management strategy and Sustainability of water projects in WRUAs in Tana Catchment area while the alternate hypothesis stated that there was a statistically significant relationship between water-catchment management strategy and Sustainability of water projects in WRUAs in Tana Catchment area. Chi – square test was used to test the research hypothesis. The results include cross-tabulation results to show that the minimum expected count was not violated (minimum count is five) and chi-square statistic with the corresponding p-value to show the significance of the relationships.

Table 4.24: Cross-tabulation of Water Catchment Management Strategy and Sustainability of Water Projects

			Sustainability of water projects in WRUAs in Tana Catchment area		Total
			No	Yes	
Water Catchment Management Strategy	No	Count	95	127	222
		Expected Count	92.5	129.5	222.0
	Yes	Count	25	41	66
		Expected Count	27.5	38.5	66.0
Total		Count	120	168	288
		Expected Count	120.0	168.0	288.0

Table 4.24 also shows that cross tabulation between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy met the threshold of Chi-square analysis such that none of the cells had expected count of less than five given that the minimum count was 27.5 (row ‘Yes’ of water-catchment management strategy and column ‘No’ of sustainability of water projects in WRUAs in Tana Catchment area).

Table 4.25: Chi-Square test for Water Catchment Management Strategy and Sustainability of Water Projects

	Value	df	p-value
Pearson Chi-Square	0.505	1	0.477
Symmetric Measures:			
Pearson's Correlation Coefficient, R (interval by interval)=0.042, t=0.709, p=0.479			
Spearman Correlation (ordinal by ordinal) = 0.042, t = 0.709, p = 0.479			
N of Valid Cases 288			

Table 4.25 shows Chi-square results which includes: Pearson's Chi-square statistic, Pearson's correlation coefficient and Spearman's correlation coefficient. Each of the three latter statistics were accompanied by their corresponding p-values. The Chi square result was, χ^2 (1) = 0.505, p = 0.477 (p-value more than 0.05). Since the p-value was more than five per cent, this implies that there is no statistical evidence of a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy.

The Pearson's correlation coefficient (R) and Spearman's correlation coefficient were both found to be 0.042, (that is, 4.2 per cent), p = 0.479 (p-value more than 0.05). This shows no significant correlation between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy. Therefore, the study rejected the null hypothesis which postulated an absence of a relationship between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy. Therefore, the alternate hypothesis was adopted meaning that there was a statistically significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy.

The results implied that when the catchment management strategies were implemented, water flow in rivers would increase. Catchment protection by digging terraces and appropriate farming methods would reduce the surface run off and allow river natural recharge system. Results from the observation schedule reviewed that there were river banks with no vegetation cover having been cut for cattle feeds.

Land along the riparian land had been cleared to give way to agricultural activities. Vegetable gardens along the river banks were visible evidence of riparian encroachment. There were visible tree stumps indicating that trees had been felled to provide either timber or firewood. Such observations indicated that conservation measures were partially implemented However, there were visible tree nurseries and young trees planted along the river banks.

The study findings agree with NEMA, (2003) and Agwata, (2005) who found that in Kenya, catchment areas were vulnerable to degradation due to destruction of swamps, springs and planting of tree species that use lots of water, and over-abstraction as well as encroachment of river basin. Encroachment and over-withdrawal of water could lead to reduced water flow downstream in the dry seasons, resulting in severe water shortage (Aarts, 2012).

4.4.5 Moderation Effect of Institutional Support on the relationship between WRUA strategies and Sustainability of water projects

The study tested the moderation effect of institutional support by checking the significance of its interaction with each WRUA strategy. Binary logistic regression was employed as the statistical model to check for the effect of the interactions between the moderator and the independent variables (resource mobilization strategy, infrastructure maintenance strategy, conflict management strategy and water-catchment management strategy).

Table 4.26: Logistic Regression Results for Moderation Effect of Institutional support on relationship between Sustainable Water Projects against Resource Mobilization

Variables	B	S.E.	Wald	df	P-Value	Odds
RM	0.089	0.034	6.988	1	0.008	1.093
IS	0.216	0.039	30.129	1	0.000	1.241
RM*IS	-0.012	0.008	2.416	1	0.120	0.988
Constant	-5.583	0.942	35.167	1	0.000	0.004

Dependent variable: Sustainability of water projects in WRUAs in Tana Catchment area

RM: Resource mobilization strategy

IS: Institutional support

RM*IS: Interaction of resource mobilization strategy and institution support

Binary logistic regression model in Table 4.26 shows the main effects of resource mobilization strategy, institutional support and their interaction. The p-value corresponding to resource mobilization strategy is less than 5% significance level ($p=0.008 < 0.05$) which shows that it remains significant in the presence of the moderator. Institutional support is also seen to have positive significant main effect on sustainability of water projects in WRUAs in Tana Catchment area ($p=0.000 < 0.05$) while controlling for the other variables. The interaction between institutional support and resource mobilization strategy was however not significant in influencing sustainability of water projects in WRUAs in Tana Catchment area ($p=0.120 > 0.05$). Furthermore, the interaction term had negative influence on the overall sustainability of water projects (beta = - 0.012). Hence, institutional support negatively moderated the relationship between resource mobilization strategy and sustainability of water projects in WRUAs in Tana Catchment area albeit insignificantly.

The results implied that there was no moderation effect between institutional support and results mobilization strategy. The findings implied that WRUA resource mobilization strategy required more support from all agencies to mobilize adequate resources to promote sustainable water project.

Table 4.27: Logistic Regression Results for Moderation Effect of Institutional support on relationship between Sustainable Water Projects against Infrastructure Maintenance

Variables	B	S.E.	Wald	df	P value	Odds
IM	0.076	0.032	5.525	1	0.019	1.079
IS	0.211	0.041	26.136	1	0.000	1.234
IM*IS	0.001	0.007	0.037	1	0.847	1.001
Constant	-4.693	0.739	40.364	1	0.000	0.009

Dependent variable: sustainability of water projects in WRUAs in Tana Catchment area

IM: Infrastructure maintenance strategy

IS: Institutional support

IM*IS: Interaction of infrastructure maintenance strategy and institution support

Binary logistic regression model in Table 4.27 shows the main effects of infrastructure maintenance strategy, institutional support and their interaction. The p-value corresponding to infrastructure maintenance strategy is less than 5% significance level ($p=0.019 < 0.05$) which shows that it remains significant in the presence of the moderator. Institutional support is also seen to have positive significant main effect on sustainability of water projects in WRUAs in Tana Catchment area ($p=0.000 < 0.05$) while controlling for the other variables.

The interaction between institutional support and infrastructure maintenance strategy was however not significant in influencing sustainability of water projects in WRUAs in Tana Catchment area ($p=0.847 > 0.05$). Furthermore, the interaction term had positive influence on the overall sustainability of water projects in WRUAs in Tana Catchment area (beta = 0.001). Hence, institutional support positively moderated the relationship between infrastructure maintenance strategy and sustainability of water projects in WRUAs in Tana Catchment area albeit insignificantly.

The results implied that the institutional support had a significant moderation effect on infrastructure maintenance. The institutions support and control water abstraction to ensure water flowing rivers. The institutions also controlled designs used in the construction of water intakes and the location of water abstraction as a way of insuring continues flow during the dry seasons.

Table 4.28: Logistic Regression Results for Moderation Effect of Institutional support on relationship between Sustainable Water Projects against Conflict Management Strategy

Variables	B	S.E.	Wald	df	p-value	Odds
CM	0.030	0.039	0.578	1	0.447	1.030
IS	0.233	0.044	28.200	1	0.000	1.263
CM*IS	0.002	0.007	0.116	1	0.734	1.002
Constant	-4.679	0.918	25.960	1	0.000	0.009

Dependent variable: sustainability of water projects in WRUAs in Tana Catchment area

CM: Conflict management strategy

IS: Institutional support

CM*IS: Interaction of conflict management strategy and institution support

Binary logistic regression model in Table 4.28 shows the main effects of conflict management strategy, institutional support and their interaction. The p-value corresponding to conflict management strategy is more than 5% significance level ($p=0.447 > 0.05$) which shows that it loses significance in the presence of the moderator. Institutional support is also seen to have positive significant main effect on sustainability of water projects in WRUAs in Tana Catchment area ($p=0.000 < 0.05$) while controlling for the other variables.

The interaction between institutional support and conflict management strategy was not significant in influencing sustainability of water projects in WRUAs in Tana Catchment area ($p=0.743 > 0.05$). Furthermore, the interaction term had positive influence on the overall sustainability of water projects in WRUAs in Tana Catchment area (beta = 0.002). Hence, institutional support positively moderated the relationship between conflict management strategy and sustainability of water projects in WRUAs in Tana Catchment area albeit insignificantly.

Table 4.29: Logistic Regression Results for Moderation Effect of Institutional Support on relationship between Sustainable Water Projects against Water Catchment Management Strategy

Variables	B	S.E.	Wald	df	P value	Odds
WCM	-0.006	0.036	0.031	1	0.861	0.994
IS	0.287	0.044	43.262	1	0.000	1.333
WCM*IS	0.032	0.010	9.608	1	0.002	1.033
Constant	-4.900	0.909	29.062	1	0.000	0.007

Dependent variable: sustainability of water projects in WRUAs in Tana Catchment area

WCM: Water catchment management strategy

IS: Institutional support

RM*IS: Interaction of water catchment management strategy and institution support

Binary logistic regression model in Table 4.29 shows the main effects of water-catchment management strategy, institutional support and their interaction. The p-value corresponding to water-catchment management strategy is more than 5% significance level ($p=0.861 > 0.05$) which shows that it loses significance in the presence of the moderator (institutional support). Institutional support is also seen to have positive significant main effect on sustainability of water projects in WRUAs in Tana Catchment area ($p=0.000 < 0.05$) while controlling for the other variables. The interaction between institutional support and water catchment management strategy was significant in influencing sustainability of water projects in WRUAs in Tana Catchment area ($p=0.002 < 0.05$). Furthermore, the interaction term had positive influence on the overall sustainability of water projects in WRUAs in Tana Catchment area (beta = 0.032). Hence, institutional support positively and significantly moderated the relationship between water-catchment management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

CHAPTER FIVE
SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings, conclusions and recommendations. The presentation is organized in order of research objectives and hypotheses of the study. The study sought to assess WRUA strategies in the promotion of sustainable water projects in Tana Catchment Area, Kenya. This study sought to assess the strategies used by WRUAs in promoting sustainable water projects. Specific objectives of the study examined the relationship between resource mobilization strategies, infrastructure maintenance strategies, conflict management strategies, and catchment management strategies in promoting sustainable water projects. The study also examined the moderating effect of institutional support on the relationship between WRUA strategies and the sustainability of water projects. Five hypotheses in line with the five specific objectives were tested to determine the relation between the variables. The theoretical framework to guide the study were: the theory of common pool resource management and institutional analytical framework

The Kenya Water Act (2016) recognizes WRUAs as institutions that manage water at the grass root level. In water management, WRUAs formulate strategies and draw water sub-catchment management plans that guide their implementation of water management activities within a set period. The effectiveness of the strategies used by WRUAs in promoting sustainable water projects therefore needed to be assessed.

Studies have investigated many aspects of water management around the world, there was renewed interest in water management due to climatic changes and increased competition for utilization of water to satisfy various needs. WRUAs have provided a platform for stakeholder participation in the water management. Reviewed literature showed that studies carried out locally in the subject assessed diverse issues in water management. Most of the studies, however, focused on water governance and community participation in water management. Little information was available on the effectiveness of WRUAs in promoting sustainable water projects. The study was guided by the common pool theory by Ostrom, (2000).

The study used convergent research design and applied mixed methods approach to investigate the phenomenon. The target population was 48 WRUAs, 254 users, 48 executive committee members and 5 WRA Officers sampled in Tana Catchment Area. WRUA members were sampled using cluster and purposive methods, while purposive sampling was used to sample the committee members. Data from the WRUA executive committee members and users was collected using questionnaires while in-depth interview guide was used to gather data from the WRA Officers, observation schedule was used as an observation checklists to access some aspects along the river basin. Collected data was analyzed using SPSS. Quantitative data was analyzed using descriptive statistics. Inferential statistics was used to the test the acceptance hypotheses. Qualitative data was analyzed using thematic and content analysis. Information gathered was presented using tables, charts and narrative statements. The findings from the study formed a platform on which conclusions were drawn and recommendations made. Recommendations can be applied by the water resource users associations and the government of Kenya through the water resources authority. The findings revealed possible areas for further research.

5.2 Summary of the Findings

This section contains the summary of the main findings of the study. Summary of demographic data which includes findings of respondent's age, gender and education background was presented. Similarly, summaries of findings per research objectives were presented.

5.2.1 Demographic Characteristics

The findings indicated that most water users and committee members (60%) were involved in WRUA activities were above 50 years old while only (19%) of the younger respondents involved in water management are aged 26 to 30 years. This indicated that although the elder group represented had experiences in water management, the younger population was also an important resource in water management because they would experience the consequences of water management longer than the elder members. The introduction of the younger generation in to the water resource management would create awareness on the fragility of water

resources. Their involvement in the management of natural resources would enhance continuity of WRUA activities to promote sustainable water management.

Engaging the youth in activities of water management would require formulation of platforms to discuss, negotiate and implement new techniques of resource mobilization, catchment protection activities by use of technology that would spark their interest in water resource management. Besides raising their interest, Training of the younger generation on matters of water management would require a practical oriented approach for them to learn useful and applicable skills. Therefore efforts to involve the younger generation in water management should always be explored.

Majority of the water users and committee members were male and were (20%) more than the females. The higher percentage of male representative may be explained by cultural factors that consult for opinion of males while women become passive participants in community meetings. For women to participate actively in water resource management, their participation in project could be in the design of project and decision making process that determine member contributions towards project activities.Involving the women in setting the required resources could promote ownership and protection of projects from wastage and destruction. Due to increased resources. Such ownership could promote and maintain high levels of project care because the women would be most affected by un functional water projects hence promoting project sustainability.

Water Resource Users Associations have a gender mainstreaming strategy and have activities that bring about gender mainstreaming at management committee level and in all stakeholder activities (GoK, 2016).Thus sensitization and encouragement of women to participate in water activities could build and promote project sustainability. The study agreed with the study by Bergh, (2007) which established that in Morocco, lack of involvement of local stakeholders in the design of infrastructure technical design lead to installation of expensive water pumps which required spare parts that water users could not afford to pay for.

The study established that regarding education, more water users and committee members were in the category of diploma education and below. The study findings agreed with studies by the World Bank, 2002; JICA, 2013; Njonjo & Lane, 2002 which established that Water Resource Users Associations in Kenya were managed by committee members who may not have formal education. Through education, skills of resource mobilization, water management, monitoring or evaluation practices could be learnt. Insufficient skills in mobilization, monitoring and evaluation could lead to failure to implement planned intervention activities. WRUAs with unskilled managers would require training in monitoring and evaluation of water projects. Other managerial skills for water resource management would require skills of financial management in order to constantly evaluate the effectiveness of the water management strategies. Such training could thus be carried out by WRA officers who have technical and managerial skills.

The study established that there were few water users and committee members (19%) at Masters or PhD level yet water management was a complicated phenomenon requiring concerted effort, experience and knowledge in order to formulate and implement possible strategies to promote sustainable water management. Highly educated individuals such as WRUA executive committee members could interpret policies, offer leadership and build trust and support from other members. Water resource management thus required water managers with formal skills to interpret water policies, water management trends, climatic changes and thus formulate effective strategies.

The study established that Water Resource Users Associations have operated for three years and above in the Tana Catchment Area. The WRUAs have undergone formation and involved water users in the development of structures of operations. Thus the operational structures could be used to formulate strategies that could be required for use in the development WRUAs as guided by the water development cycle .It was also established that WRUAs have the structures in place to enable WRUA committees members manage the water projects. WRUA committee members therefore require to be equipped with adequate water management skills in order to promote sustainable projects.

The study found out that WRUAs were able to identify activities that they were involved in so as to promote sustainable water projects. The activities established regarded riparian land protection, carrying out abstraction surveys which also included mapping of the riparian land, reporting illegal loggers to the authorities and reporting illegal abstractors and ensuring compliance with WRA abstraction requirements. From the observation schedule,and confirmation by the WRA officers interviewed it was confirmed that quite a number of WRUA activities were visible in the along the river basins. However, some of the river banks were still bear and required more activities if the WRUA strategies were to show remarkable results. The respondents reported that there was an increase in tree planting activities, a reduction in illegal abstraction and reduced soil erosion. Thus the results showed that committee members and water users had an understanding of their activities, although the impact of such activities would be gradual.

5.2.2 Resource Mobilization Strategy and Promotion of Sustainable Water Projects

From the findings, it was established that water users were consulted by WRUA committee members in order to determine the contributions water users would be required to contribute for the implementation of WRUA activities. Water user participation in decision making on resource mobilization indicated the willingness of Water users to support the implementation of WRUA activities. Water users' perceived benefits of a well-established WRUA could offer a big motivation for members to participate in the implementation of the activities. When water users participated in decisions regarding their WRUAs, there could be project ownership. The study findings agreed with Mansuri & Rao, (2004*)* who argued that when water users were involved in decision making process and participated in the formulation and implementation of water management plans they were more likely to understand it, own and comply with the rules. The ownership of such water projects would trigger more user participation and encourage the members to put more effort because and use their local knowledge to address persistent water management issues.

Inability to collect water user's fees and the inability of the committee members to enforce regulations for participating could hinder effective water user participation. Effective user participation could influence the making of popular decisions that

could be embraced by all water users, resolve all disturbing matter hence promoting ownership of projects hence project sustainability. The study findings differed with study by Ifejika, (2018) which established that in Laikipia, inadequate capacity to mobilize resources and account for them impacted negatively in project management. Thus although members could be willing to participate other factors like accountability, knowledge of record keeping, shared experiences could affect implementation of planned strategies.

Despite user participation in resource mobilization, it was established that WRUAs had inadequate resources to run their activities as indicated by a (mean of 1.80). Inadequate resources could affect timely implementation of planned activities and delay the accomplishment of project activities. Thus water users required constant sensitization to engage in diverse income generating activities so that resources to operate water projects could be availed by water users. Increase in income generating activities could build on accrued projects benefits thus encouraging more participation by members. Perception of accrued project benefits would make users contribute to project investment by providing labor, land, and local materials. Such resources would require proper computing and record keeping to enhance decision making that promote project sustainability (Tickner, Parker, Moncrieff, Oates, Ludi & Acreman, 2017).

The study found out that WRUAs were supported by the government through WSTF Office with an average of 5 million Kenya shillings in the year 2017/2018. However, most WRUAs had a budget ranging between 5 million to 10 million to fund implementation of their activities. Although a strong policy was in place on resource mobilization, resources to meet performance targets were inadequate. Financial sustainability of WRUAs was therefore inadequate. Hence affecting sustainability of water project. WRUAs therefore, need to explore alternative ways of engaging in income generating activities to fund the implementation of project activities. The findings agreed with the study by Mollinga, (2008) which established that in Tanzania, institutional capacity in terms of technical, budgeting and managerial skills hindered effective mobilization and utilization of funds received from the government and other funding agencies. Thus limited capacity for management and utilization of

resources could increase the challenges of operating and managing functional WRUAs projects that promote sustainability.

Well as most water users (mean of 2.42) indicated that WRUAs did not discuss audit reports with them, committee members (mean of 2.48) indicate that audit reports were presented to water users every year. The differing opinion between the water users and the committee members implied some level of dishonesty between the water users and the committee members. When the committee members present project income and expenditure of resources to members, a notice of the meeting and the intended matters of discussion should be communicated in time to enable all members avail themselves. Lack of participation in such meetings could cause unnecessary disharmony and mistrust between members on matters of project resources. Dishonesty and mistrust could be a fact which could cause mistrust between water users and committee members and thus hindering implementation effective of resource mobilization strategy. Thus, Contributors require adequate information on amount of resources raised and costs incurred in implementing set activities in order to promote sustainable water projects. Therefore to operate and maintain accessible adequately functional water projects would require trust building. WRUAs as established institutions at the local level required to be grounded in cultural values, procedures, rules for operation as well as, capable leaders with water management skills to ensure project sustainability.

5.2.3 Infrastructure Maintenance Strategy and Promotion of Sustainable Water Projects

Both users and committee members were requested to indicate their level of agreement or disagreement with their WRUA infrastructure maintenance strategy. At (a mean of 2.62) water users and committee members (mean of 2.16) indicated that resources were inadequate to effectively maintain the infrastructure. The study findings agree with study by Cornish *et al.,* (2004) which found out that in Turkey, scheduling of maintenance and rehabilitation activities depended on fee collected from users because the water fees collection rate was insufficient to cater for operation and maintenance expenses. The results implied that water users would require to seek alternative strategies to mobilize resources necessary for infrastructure maintenance. When resources for infrastructure were inadequate, there would be old,

burst or leaking pipes in some water projects from time to time due to lack of resources to repair them.

The study further revealed that WRUAs (89%) did not have trained, skilled and designated technical staff to repair the infrastructure and they relied on volunteers and external technicians to carry out major repairs and rehabilitation works. However, study by Tickner *et al.,* (2017) established that maintenance practices by WRUAs were not coordinated in a systematic manner thus rules and regulations on infrastructure maintenance were not effectively implemented which created disagreements in water allocation among users due to delayed repair.

Over-reliance on external technicians to carry out infrastructure repair and rehabilitation works for WRUAs would limits growth and use of local technical capacity among the members. However, finding skilled technicians to provide good labor at fair prices at the local level could be a challenge for WRUAs. Technical capacity to carry out major repairs on distribution tanks, laying down water pipes deep in the ground at the recommended depth could be beyond the capacity of most WRUA. Study by Barakat, (2007) established that in Egypt, when full responsibility of maintenance was handed over to water users, they lacked skills, spare parts and tools to repair the equipment, repair broken pipes or replace old water pipes, and they often would switch to their individual pumps. Thus, poorly timed repairs could make water users go for long periods without water due to inadequate infrastructure repairs hence affecting sustainable water projects.

5.2.4 Conflict Management Strategy on Promotion of Sustainable Water Projects

The findings showed that majority of WRUA committee members and water users strongly agreed that they had clear rules and regulations in their WRUA. Despite having clear rules, users agreed that they had been involved in water conflicts in the previous year. The findings could imply that rules that were formulated by WRUAs could not be effectively enforced on the ground. Study by Abdulla et al., (2009) established that although WRUAs in Uzbekistan had rules and regulations, the implementation was weak and the rules only existed on paper but which in practice they did not work and most powerful water users gained better access to water

resources. When water rules and regulation were strictly enforced, water resources could be equitably shared among water users without powerful users disadvantaging other users.

The committee members agreed that they had faced challenges when enforcing the rules managing water resources. The committee members reported that WRUAs experience water conflicts during the dry seasons when water flow in rivers was low. During the dry seasons the members require water to irrigate their farms and feed the livestock as well as water for domestic use. The water users compete to get the most of the scarce water resources due to prolonged dry seasons. The sharing of the scarce resource that lead to conflicts were mainly caused by weak enforcement of rules. However, even when water supplies were not severely limited, allocation of water among different uses and users could be highly contested and could be a source of potentially violent disputes (Ohlsson, 2000). Thus the study established that conflicts increase in the dry seasons. However, even when the there was no shortage some water users required a lot more water than was available thus causing conflicts.

When rules were strictly enforced, they would provide an essential platform through which requests and demands of users could be interpreted and resolved. Water rules when strictly enforced outline terms of member engagement to ensure service provision to meet water user's needs while respecting the needs of other users. The findings agree with Gleitsmann, (2007) who argued that building friendship scenarios among water users would encourage in-depth discussions that weaken positions taken by different parties and encourage the focus of stakeholders on the underlying matters of water sharing. However, without effective formulation and enforcement of the self-created rules based on knowledge of the locally available resource, attempts at conflict management would fail and more water users would be dissatisfied with WRUA services.

The study established that to the WRUAs, disobeying the agreed rules was interpreted as causing conflict among the water users. In cases where enforcement of water rules were weak, unequal sharing of water resources could lead to favoritism and misuse of resources. Water users and committee members participated in the formulation of the

rules governing their activities, but any attempt to find acceptable solutions to water sharing resulted in mixed reactions Since water management was a multi-objective resource, balancing water needs to satisfy competing interests of the water users was a necessary aspect for promotion of sustainable water projects. Besides the understanding of user interests, involvement of water users in the resource conservation could increase water flow in rivers hence creating more water resources for sharing among users.

5.2.5 Catchment Management Strategy on Promotion of Sustainable Water Projects

The findings revealed that both committee members and water users were involved in activities of water conservation. Majority of water users and committee members agreed that they had participated in pegging of the riparian land, planting trees, digging terraces and engaging in appropriate farming practices. However majority of the users and committee members agreed that there was encroachment on river banks and cutting of trees in the catchment area leading to soil erosion. Cutting of trees along the river banks and removing vegetation cover exposes the river to extreme evaporation reducing the flow of water in rivers. According to Chowdhury, (2010) catchment generative capacity occurs when small streams merge continuously into big rivers supported by sound land protection mechanisms such as tress planting along riparian land, spring protection, wetland, land protection, terracing and gabion building on sloped grounds, as well as, building silt traps building along the rivers. Such conservation activities require training of water users to adopt and apply conservation techniques that hold the soils together to prevent soil erosion that causes silting and blockage of water infrastructure.

However, study by Olajuyigbe & Fasakin, (2010) in South Western Nigeria, established that training for WRUAs often reached only a select group of people which did not include all water users. In the study, 60% of respondents reported that they learnt little in the trainings on water source protection. The study thus established that for WRUAs to implement sound conservation techniques and protect the catchment areas, training of members would require practical oriented training on site that could promote uptake and application of learnt skills.

The study established the need for adaptation of scientific methods for the establishment and monitoring of accurate water flows before conservation of water resources was carried out. Such knowledge could be used to convince illegal abstractors to seek permit for legal abstraction and comply with conservation rules. The Water Act (2016) dictates a riparian land of between six metres and thirty metres on either side of the river depending on the size should be observed to reduce encroachment. Regular meeting with riparian land owners could thus be embraced for discussion of conservation measures of the riparian land and discourage encroachment river banks.

The (IAD) framework offered the guidance on the analyses of important aspects regarding WRUAs as institutions implementing strategies to alleviate problems of managing common water resources. At the centre of the WRUAs were the committee members and water users and the WRA officers who were the actors at the action component and took actions depending on the situations in the implementation of WRUA strategies. As postulated in the theory the actors interacted to solve common problems and shared ideas and resources to implement the strategies. The interaction between the actors took the form of consultation, active participation in decision making, provision of resources for running the projects or involvement in carrying out common activities to improve the WRUAs. The theory of IAD was applicable for improvement of water resources in Tana catchment area.

5.2.6 Summary of Hypotheses Testing

Each variable was considered separately and its significance in the promotion of sustainable water projects tested at 5% level of significance using chi-square test of independence. Further, the significance of each variable and institutional support on sustainability of water projects was tested. The moderating effect of institutional support on each variable was also tested. The Chi square result for resource mobilization strategy was χ^2 (1) = 11.633, p = 0.001 (p-value less than 0.05). Since the p-value was less than five per cent, this indicated that there was a statistical of a significant relationship between sustainability of water projects in WRUAs in Tana The Chi square result for infrastructure management strategy was χ^2 (1) = 10.286, p = 0.001 (p-value less than 0.05). Since the p-value was less than five per cent, the

results showed that there was a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and infrastructure maintenance strategy. Further the study established that the Chi square result for conflict management strategy was χ^2 (1) = 17.708, p = 0.000 (p-value less than 0.05). Since the p-value was less than five per cent, this implied that there was a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy.

The assessment of the water management strategy showed that the Chi square result for water catchment management strategy was χ^2 (1) = 0.505, p = 0.477 (p-value more than 0.05). Since the p-value was more than five per cent, the results showed that there was a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and water-catchment management strategy.

In addition, conflict management strategy showed that the Chi square result was, χ^2 (1) = 17.708, p = 0.000 (p-value less than 0.05). Since the p-value was less than five per cent, this implies that there is a statistical evidence of a significant relationship between sustainability of water projects in WRUAs in Tana Catchment area and conflict management strategy.

Institutional support was also seen to have positive significant main effect on sustainability of water projects in WRUAs in Tana Catchment area ($p=0.000 < 0.05$) while controlling for the other variables. The interaction between institutional support and water catchment management strategy was significant in influencing sustainability of water projects in WRUAs in Tana Catchment area ($p=0.002 < 0.05$). Furthermore, the interaction term had positive influence on the overall sustainability of water projects in WRUAs in Tana Catchment area (beta = 0.032). Hence, institutional support positively and significantly moderated the relationship between water-catchment management strategy and sustainability of water projects in WRUAs in Tana Catchment area.

5.3 Conclusions

The study focused on the assessment of WRUA strategies in promoting sustainable water projects in Tana Catchment Area, Kenya. This was in realization that Kenya water sector had embraced WRUAs as institutions managing water resources at the grass root level. Four research objectives guided the study. Institutional support was used as a moderating valuable in the study.

The findings indicated that WRUAs formulate and implement strategies in water management to create an advantage in promoting sustainable water projects. Continuous user participation and engagement in WRUA implementing planned activities were instrumental in the water resource . Despite use of WRUA strategies to promote sustainable water projects, water resources which were required by most living things to survive, were on the decline and there was low water flow in rivers. The study was in line with United Nations, (2009); Ifejike, (2018); Klug, (2019) which concluded that the amount and quality of water has been decreasing over time hence require conservation.

This study found out that WRUAs had inadequate resources to enable implementation of their strategies to promote water conservation activities that ensure water flow in rivers. Adequate water flow in rivers would provide adequate water for both upstream and downstream users to support livelihood activities. It was concluded that all stakeholders should make concerted effort to raise the resource base of WRUAs to enable the implementation of planned strategies.

There was an agreement from all respondents that effective resource mobilization strategy requires continuous sensitization of all stakeholders to raise awareness of the benefits of catchment. WRUA members would be encouraged to willingly provide resources, labor, material, knowledge and time required to promote sustainable projects. Further, mobilized resources from donors and development partners would be combined with those received locally and used to implement planned strategies, hence breaking dependency on external sources and promoting sustainable water projects. A low financial base in WRUAs was considered to lead to unsustainability of WRUAs. Therefore, there was need to train WRUA committees on book keeping

skills, financial management and audit processes to enhance accountability. There was need to enhance mobilization of resources to support WRUA activities since resources significantly impacts on the sustainability of water projects The strategies used by WRUAs were aimed at bringing all stakeholders together to address water management at the grass root level, hence enhancing decision-making processes on water management activities. Effective participation of all stakeholders in formulating or reviewing WRUA strategies pave way for ownership of projects and promote sustainable water projects. However, it was established that WRUAs were struggling with human resource matters because some committee leaders had little education and therefore their ability to mobilize and steer WRUA strategic vision was limited. Competent leadership and member participation in decision-making processes regarding WRUA strategies was key to promoting sustainable water projects.

The study established that WRUA committee members provided voluntary service with no allowances. Given that WRUAs were spread over a large geographical area and given the time spent and costs incurred in influencing members to participate in WRUA activities, an allowance to motivate the committee members was deemed necessary to facilitate movement along the river basin.

.

On infrastructure maintenance, the findings indicated the need to train local water users and the committee members on infrastructure maintenance and the need to set aside a budgetary allocation for infrastructure maintenance and rehabilitation. Budget provision would ensure availability of tools and spare parts to repair broken water infrastructure. Training and equipping technicians with appropriate skills for infrastructure maintenance would ensure continuous monitoring of the infrastructure's physical conditions to ensure its long life.

The study established that although some water users got water for domestic, irrigation, and livestock use, they failed to provide their contributions to support WRUA activities. While other water users interfered with gate valves at the intake points to illegally abstract more water and take advantage of proximity to the waters sources. From the analysis of the responses gathered from the observations schedule,

there were too many intakes constructed too close to each other in some rivers hence the need to consolidate intakes and control water sharing.

Water catchment management strategy was significant in the promotion of sustainable water projects. It was concluded that WRUAs should be strengthened to allow user participation in formulating and implementing strategies that favor their catchment terrain. Identification of strategies as guided by catchment terrain would enhance implementation of strategies that work best for sloped areas, middle level or low lying areas. All stakeholders needed to be sensitized to the fact that the activities of upstream users would affect the activities of down-stream users. Thus enforcing the rules would enable sharing of the resources between upstream and downstream water users and allow continuous water flow in the rivers.

Effective strategies in each level of catchment would ensure natural water infiltration and reduce surface run-off and enhance water storage during the rainy seasons. Water-saving mechanisms that encourage water harvesting could reduce competition for scarce water resources during the dry seasons. For users to engage in protection of springs from contamination, reduce water pollution, and restore degraded catchment areas, motivating benefits to users need to be visible. Sensitization of users on the benefits that could be achieved from conserved catchment can draw a large proportion of public to join WRUAs in implementing activities of catchment management.

The study concluded that there was need to empower users to adopt sustainable livelihood diversification strategies. Diversification of WRUAs economic activities needed to focus on applying appropriate agricultural methods to produce alternative products along the river banks to increase their revenue base. Besides engagement in agricultural activities, WRUAs could write proposals that could attract funding in natural resource management. The fund could be utilized for implementation of activities that promote sustainable projects

The study findings revealed the need to enforce the implementation of documented rules of water management both the statutes and the WRUA by-laws in order to reduce conflicts in water management. Further WRUAs required legal support in

order to build capacity for gathering evidence required in the prosecution of violators of water regulations. Concerted efforts to conserve water flow could lead to equity water sharing between downstream and upstream water users. While conserving the resources.

The findings established that WRUAs perform a set of activities in order to achieve their strategies and as such it was necessary to train WRUA managers, technical teams and users to build skills required in the implementation of their strategies. Enhanced training of WRUA committee and users with relevant skills on financial management, monitoring and evaluation of their activities would enhance infrastructure maintenance, soil protection, spring protection, river bank protection and promote natural river recharge processes leading to more water in rivers. Exchange programs and benchmark learning, as provided in water development cycle manuals needed to be conducted so that WRUAs could learn valuable lessons from successful WRUAs.

5.4 Recommendations of the Research Findings

This study provided answers to some of the issues that were associated with the effectiveness of WRUA strategies in promoting sustainable water projects. With high population growth that adds to competition for water resources to satisfy diverse needs, effective water management strategies cannot be avoided. Therefore WRUAs, WRA office, policy makers and Government of Kenya through the water sector should put mechanisms in place to promote sustainable water management. It is for this reason that recommendations were made to stakeholders based on the findings of the study.

5.4.1 Recommendation based on Resource Mobilization Strategy

The study recommended that WRUAs should leverage on available support from all stakeholders to mobilize resources to implement the formulated strategies. Mobilized resources should include finances, labor, material, skills and time. Proposals for funding should be written to explore collaborations and mobilize support from donors and industrialists who rely on water resource for production. Further, users can be

trained on modern methods of farming that require minimum water use in turn get money to finance WRUA activities.

The study recommended that water users should be involved in the financial planning to determine the required resources needed for the implementation of WRUA activities for each year. The study established that there was a variance between finances received by WRUAs and the finances planned for the implementation of WRUA activities. Thus the study recommended that WRUAs engage all the stakeholders in mobilizing finances necessary for the implementation of set activities. The riparian land owners and water users who share water sources should be sensitized to join WRUAs by explaining to them the benefits of a conserved catchment area.

The government through the relevant agencies should provide more resources to enable the implementation of WRUA activities as planned in the sub catchment plans. Additional resources could be used to train WRUAs on appropriate farming and conservation methods to support intense agricultural activities while conserving the water catchment. The mobilized resources could further be used to control water abstraction, check encroachment of protected riparian land, monitor infrastructure conditions, increase afforestation on wetlands and protect spring heads from pollution.

The study recommended that WRUAs required to establish a reserve fund which could be used to implement WRUA activities that could emerge either as result of floods or prolonged drought. The adverse climatic conditions require intervention which could be behold the ability of the WRUAs to handle hence need for support. Further, Project reserve fund could form a base for consolidating finances for expansion of resources to improve services offered to the stakeholders. In addition, WRUA committee members should be encouraged to provide information to water users regarding mobilized income and expenses as a way of accounting for projects resources. This could improve the relationship between the water users and the committee member's hence building trust and project ownership and promote sustainability.

WRUAs were struggling with human resource matters because some committee leaders had little education since the educated water users did not volunteer to join or participate in WRUA activities. Educated stakeholders at Diploma level of education or above in community should be encouraged to take interest in the management of water resources and offer knowledge, share experiences and promote active participation in WRUA decision making processes.

Given the time spent and costs incurred in the management of WRUA affairs, and influencing members to participate in WRUA activities, committee members should be given allowances to facilitate travel across the WRUA jurisdiction while coordinating other tedious activities. Hence consolidated work plans would guide the implementation of WRUA activities systematically and ensure close monitoring of the implementation process

It was established that water users were willing to provide resources to run the activities of the WRUAs although they preferred to provide the resources when need arose. As such, modern methods of money transfer like the use of M-pesa facility could be explored as a mode through which users could submit their contribution. Electronic payment on a structured basis could reduce the burden of looking for officers to receive member contributions hence saving time to engage in other activities.

The study recommended WRUA members be encouraged to make timely contributions as opposed to raising resources when need arose to enable planning and implementation of WRUA activities. Such plans could be to calculate and evaluate costs of plans which could be incorporated into a strategic plan in line with sub-catchment management plans to enable continuous sourcing of the required resources.

5.4.2 Recommendation based on Infrastructure Maintenance Strategy

Findings from the study indicated that WRUAs require skilled technicians at the grass roots level to repair broken or blocked infrastructure as well as rehabilitate old infrastructure. WRUAs needed to be supported in order to build capacity to embrace new technology for water abstraction. On-site training should therefore be carried out

regularly taking into consideration of literacy levels of participants. Education level of trainees should be considered so that training methodology could be simple and practical oriented to ensure adaption and use of skills learnt.

The study recommended that water intakes along a river or spring be consolidated into one water intake to serve several water users in order to enhance water control and ensure the flow of water downstream. In addition, there was needed need to formulate schedules to enable members offer labor and material resources to supplement financial requirement which could lower the costs of project operations..

To mitigate against the challenges experienced by WRUAs in repairs and maintenance of the infrastructure, water users should be sensitized to comply with scheduled maintenance activities of monitoring in order to participate in the making of informed decision making.

The study recommended that qualified technical staff be trained and engaged to support WRUA activities. The trainees should be got from the local areas who understand the challenges associated with their WRUAs. The training on conservation or maintenance work should be carried out in the areas affected by degradation so that the water users could pick the practical skills and replicate them to rehabilitate the environment in other affected areas. Uptake of practical skills by all the water users and practices by all stakeholders could lead to better implementation of conservation activities and promote project sustainability.

To improve participation of all stakeholders in WRUA activities of infrastructure maintenance, participants needed to perceive the benefits of engaging in WRUA activities which could directly change their lively hold. Benefits should be short term and long term, such as continued rehabilitation of degraded buffer strips through planting of appropriate vegetation along river banks which could provide fodder for animals and conserve the river banks.

The study recommended participatory monitoring and evaluation of WRUA activities in order to identify areas that required correction and thus enable planning of corrective actions. Reports should be prepared after analysis of data collected using

monitoring tools .The information gathered should be disseminated and findings utilized for continuous improvement of WRUA strategies. Provision of monitoring and evaluation technical skills to WRUAs would not only be a back stopping measure but also a buildup of local water user's skills.

The study recommended collaboration between WRUA committee members, water users and stakeholders address water management issues and share knowledge on the mitigation of floods and droughts which have been caused by climatic changes. Such collaboration could build more capacity and preparedness to handle effects of climate change by identifying early warning signs.

5.4.3 Recommendation based on Conflict Management Strategy

The study recommend that WRUA committee members and water users be sensitized on the need to enforce water rules and regulations. When water rules were strictly enforced, conflicts between the upstream and downstream WRUAs could be reduced. However, in some cases conflicts could not be eliminated but could be resolved through negotiations, arbitration and mediation by use of committee members and WRA officers.

The WRUAs members should be encouraged to engage in dialogue and in-depth discussion on matters of water abstraction and allocation which from time to time due to reduced water for use. The committee members at all times should exercise fairness to avoid the perception favoritism or unfairness when hearing water related conflicts.

The study recommended that graduated penalties should be imposed on members who failed or delayed to submit their contributions to support WRUA activities at the agreed time. The WRUAs should enforce sanctions on water users who intentionally violated the set rules to stop recurrent noncompliance. Such penalties could deter defaulters and ensure compliance to the set regulations to reduce conflicts among the water users. Where sanctions could not deter noncompliance, litigation processes could be preferred after consultation with the WRA officers.

5.4.4 Recommendation based on Catchment Management Strategy

The study recommended identification of critical water point sources and formulation of specific protection measures to guard them by fencing and marking to enable continuous specialized care. Continuous monitoring of planted water friendly trees, vegetation cover, marking of the riparian land and control of water abstraction could allow natural regeneration of catchment areas.

The water committee members should formulate strategies to mobilize stakeholders support to provide contribution in terms of labor and time to dig trenches, gabions, benches to protect areas prone to soil erosion thus reducing surface -run off and silting. Protection and prevention of soil erosion would reduce silting and blockage of water pipes and water intakes hence ensuring the infrastructure served its intended purpose for a long period of time.

The study recommended investigative monitoring of the catchment areas which could include transect walks with the aim of identifying areas that required critical attention, analyze trends and formulate short and long term mitigation measures for corrective action to conserve the environment.

Continuous sensitization of water users should include integration of local and scientific knowledge needed for exploitation and utilization of benefits associated with well conserved catchment areas for posterity. The study recommended that WRUAs members be trained on the effects of climatic change with the view of aligning all WRUA activities building resilience of to adapt mitigating measures to address the emerging climatic change issues. The training of the water users could also include sensitization and adoption of early warning systems for use as an effort to protect the catchment areas.

5.5 Suggestions for Further Research

The study had hypothesized that WRUA strategies were mediated by institutional support in promoting sustainable water projects. The findings revealed that institutional support insignificantly moderates resource mobilization, infrastructure maintenance, conflict management and catchment management in the promotion of

sustainable water projects. However, there could be other variables that moderate the relationship between WRUA strategies and promotion of sustainable water projects. Further, the variable of institutional factors can be investigated and used as a mediating variable.

Further, the study only looked at the strategies used by WRUAs in promoting sustainable water projects. The study did not look at the factors that influence implementation of WRUA strategies and other possible variables that may promote sustainable water projects. Probably there could be other factors namely: gender, user empowerment, governance and climate influence, which could have greater effect on the relationship with WRUA strategies and promotion of sustainable water projects.

REFERENCES

Aarts, J. (2012). *Will community-based water management solve africa's water Problem.The performance of Water Resource User Associations in the Upper Ewaso Ng'iro river basin, Kenya.* Radboud University.Retrieved from https://www.google.com/search?client=firefox-b-d&q=Will+community-based+water+managemen

Abdelgalil, E., & Bushara, A. I. (2018). Participation of water users associations in Gash spate system management, Sudan. *Water Science, 32*(1), 171-177.Retrieved from https://www.sciencedirect.com/science/article/pii/S1110492917300115

Abdelhadi, A. W.(2004). Participatory management: Would it be a turning point in the history of the Gezira scheme. *Irrigation and Drainage, 53*(4), 429 - 436. doi:10.1002/ird.139

Abdulla, I. (2009). Participatory water management at the main canal: A case from South Ferghana canal in Uzbekistan. *Agricultural Water Management*, 317-329. Doi: 10.1016/j.agwat.2008.08.013

Adams, H. S. (2003). *IMT profile for: Sudan – Pilot project Level Gezira Irrigation Scheme.* Retrieved 01 01, 2016, from FAO.Retrieved from http://www.fao.org/nr/ water/ topics_irrig _countries

Agwata, J. F. (2005). Water Resources Utilization, Conflicts and Interventions in the Tana Basin of Kenya. *In: G. Förch, R. Winnegge and S. Thiemann (eds):Topics of Integrated Watershed Management, Water Resources Publications(3),* 13-22.Retrieved from https://www.oceandocs.org/bitstream/handle/1834/6995/ktf0061.pdf?sequence=1&isAllowed=y

Alison, M. (2010). *No water no life Mara River Basin 2009 Expedition FLAG Report,* Nairobi. Retrieved from http://www.nowater-nolife.org

Al-Mohannad, H. I. (2003). Controlling water demand in qatar: An assessment. *In: AMBIO, (32),* 362-366.Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/14571967

Allouche, J. (2016) The birth and spread of IWRM –A case study of global policy diffusion and translation, Water Alternatives, 9(3), 412-433.Retrieved from https://www.researchgate.net › publication › 322030468_The_birth_and_spr...

Ary, D., Jacobs, L. C., & Sorensen, C. K. (2010). *Introduction to research in education* (8 ed.). Belmont, CA: Wadsworth.

Asante, K. (2010). *Opportunities and challenges of community-based rural drinking water supplies -an analysis of water and sanitation committees in Ghana.* Accra: International Food Policy Research Institute.

Babbie, E. R. (2011). *The basics of social research, (5th Ed.).* Belmonte: Cengage Learning.

Baker, J. L. (2000). *Evaluating the impact of development projects on poverty: A handbook for practitioners.* Washington (D. C.): World Bank.

Baker, T., Kiptala, J., Olaka, L., Oates, N., Hussain, A., & McCartney, M. (2015). *Baseline review and ecosystem services assessment of the Tana River Basin, Kenya* (Vol. 165). International Water Management Institute (IWMI).

Barakat, E. (2009). *IWRM I branch canal water user association Assessment Report no. 5.* Integrated Water Resource Management I.

Bayer, W., & Waters-Bayer, A. (2002). *Participatory monitoring and evaluation (PM&E) with pastoralists: a review of experiences and annotated bibliography.* Eschborn : GTZ.

Binder, D. (2008). *Sustainability of water service delivery in rural environment: Past approaches and the way forward.* Emerging Markets Group, Ltd.

Boynton , P. M., & Greenhalgh, T. (2004). *Hands-on guide to questionnaire research: Selecting, designing, and developing your questionnaire.* BMJ.

Braimah I. F. N. (2011). Community ownership and management of water and sanitation facilities: issues and prospects in the Nadowli district of the of the upper west region of Ghana. *Journal of Sustainable Development in Africa, 13*(2), 74–87.Retrieved from https://pdfs.semanticscholar.org

Bromley, D. B., & Cernea, M. M. (1989). *The management of common property natural resources. Some conceptual and operational fallacies.* Washington, (DC): World Bank.

Bryman, A. (2012). *Social research methods*. OUP Oxford.

Butler, C. A. (2015). Empowering marginalized communities in water resources management: addressing inequitable practices in participatory model building. *Journal of Environmental Management (153).* doi:http://dx.doi.org/10.1016/j.jenvman.2015.02.010

Chowdhury, N. T. (2010). Water management in Bangladesh: an analytical review. *Water Policy,*12(1), 32 - 51. doi:10.2166/wp.2009.112

Lagat, D. K. (2019). *Christian faith and environmental stewardship: Theological foundations for creation care*.Retrieved from https://www.amazon.com/Christian-Faith-Environmental-Stewardship-Theological/dp/1532670001

Chepyegon, C., & Kamiya, D. (2018). Challenges faced by theKenya water sector management in improving water supply coverage. *Journal of Water Resource and Protection*, *10*(01), 85.Retrieved from https://m.scirp.org/papers/82153

Cleaver, F., & Franks, T. (2003). How institutions elude design: River basin management and sustainable livelihoods. *The Alternative Water Forum.* Bradford: Bradford Centre International Development, University of Bradford.

Cohen, L., Manion, L., & Morison, K. (2000). *Research methods in education.* London: Routledge Falmer.

Cornish, G., Bosworth, B., Perry, C. J., Burke, J. J., & Nations, F. and A. O. of the U. (2004). *Water Charging in Irrigated Agriculture: An Analysis of International Experience*. Retrieved from http://www.fao.org/3/y5690e/y5690e00.htm

Cosgrove, W.J., & Louks, D.P. (2015). Water mangement: Current and future challenges and research directions. *Water Resouce*.51, 4823-4839.Doi: 10.1002(20144WR016869.

Cotulla L., & Mayers, J. (2009). *Tenure in REDD – Start-point or after thought.* London: International Institute for Environment and Development.

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approach* (3rd ed.). London: Sage Publication Ltd.

Creswell, J. (2015). *Educational research: Planning, conducting and evaluation quantitative and qualitative research,* (5th ed.). Boston, MA: Pearson.

Ediriweera, I. V. (2005). Strategies adopted for sustained water supply and sanitation through community participation in Sri Lanka. *31st WEDC International Conference.* Kampala: WEDC.

Estrella, M., & Gaventa, J. (1998). *Who counts reality. Participatory monitoring and evaluation: A literature review. IDS Working Paper no. 70.* Sussex: IDS.

Fadul Bashir, E. M. (2012). *Sharing the experiences among water users associations in spate irrigated schemes* . Kassala: Hydraulics Research Centre.

FAO. (2011a). Multiple uses of water services for men and women in large irrigation systems: Engendering the MASSMUS approach. MASSMUS Gender Module (draft). By Esther Wiegers and Robina Wahaj. Rome.

Garces-Restrepo, C., Vermillion, D., & Muñoz, G. (2007). *Irrigation management transfer: Worldwide efforts and results. FAO water reports.* Rome: FAO.

Gleitsmann, B. A. (2007). Analysis of a rural water supply project in three communities in Mali: Participation and sustainability. *Natural Resources Forum, 31*(2), 142-150.Retrieved from https://onlinelibrary.wiley.com › doi

Government of Kenya (2002). *Water Act 2002.* Retrieved 04 01, 2016, from Water Services Regulatory Board: https://wasreb.go.ke/downloads/Water Act 2002.pdf

Government of Kenya. (2016). *Water Act 2016.* Retrieved 04 01, 2016, from Water Services Regulatory Board: https://wasreb.go.ke/downloads/Water Act 2016.pdf

Guijt, I. (1998). *Participatory monitoring and impact assessment of sustainable agriculture initiatives: An introduction to the KeSARL Discussion Paper No.1 Elements.* London: International Institute for Environment and Development.

Habtamu Addis, B. (2012). *Factors affecting the sustainability of rural water supply systems. The case of mecha Woreda amhara region, Ethiopia.* Ithaca: Cornell University.

Hagen, J. M. (2002). *Causes and consequences of food retailing innovation in developing countries: Supermarkets in Vietnam.* New York: Cornell University.

Harvey, P., & Reed, R. (2004). *Rural water supply in africa: Building blocks for sustainability.* Loughborough: Water, Engineering, and Development Centre (WEDC).

Harvey, P., & Reed, R. (2007). Community-managed water supplies in Africa: Sustainable or dispensable. *Community Development Journal, 42*(3).Retrieved from https://academic.oup.com › cdj › article

Hirji, R., & Grey, D. (1997). Managing international waters in Africa: Process and progress. *5th Nile Conference on Comprehensive Water Resources Development of the Nile Basin: Basis for Cooperation.* Addis Ababa, Ethiopia.

Holvoet, N., & Renard, R. (2007). Monitoring and evaluation under the PRSP: Solid rock or quicksand. *Evaluation and programme planning, 30*, 66 -81.Retrieved frrom https://www.ncbi.nlm.nih.gov/pubmed/17689314

Huggins, C. (2002). *Water policy and law in a water-scarce country, in Murray-Rust and blank (eds). The Changing Face of Irrigation in Kenya*. Colombo: International Water Management Institute.

Hutton, G., & Batram, J. (2008). *Regional and global costs of attaining the water supply and sanitation target (Target 10) of the Millennium Development Goals.* Geneva:

World Health Organization (2006). *Improved land management in the Lake Victoria basin: Final report on the TransVic Project.* . World Agroforestry Centre.

Ifejika Speranza, C., Kiteme, B., Wiesmann, U., & Jörin, J. (2018). Community-based water development projects, their effectiveness, and options for improvement: lessons from Laikipia, Kenya. *African geographical review, 37*(3), 192-208.Retrieved from https://www.tandfonline.com › doi › abs

IWMI. (2003). *IWMI Annual report 2002-2003.* Colombo: International Water Management Institute. doi:http://dx.doi.org/10.5337/2011.0022

JICA. (2013). *Annual report 2013.* Tokyo: Japan International Cooperation Agency.

Kabogo, J., Anderson, E. P., Hyera, P., & Kajanja, G. (2017). Facilitating public participation in water resources management:reflections from Tanzania. *Ecology and Society, 22*(4), 26.Retrieved from https://www.researchgate.net › publication › 321235912

Kaliba, A., & Norman, D. (2004). Assessing sustainability of community based water utility projects in central Tanzania with the help of canonical correlation analysis. *Journal of Environmental Assessment Policy Management, 6*(1), 73.Retrieved from https://www.worldscientific.com › doi

Kangur, K. (2008). *Deliberative water policy-making in Kazakhstan and Kyrgyzstan: Focus groups in the Talas and Chu River Basins.* Tartu: Peipsi Centre for Transboundary Cooperation.

Kathuri, J. N., & Pals, D. A. (1993). *Introduction to education research.* Njoro: Educational Media Centre, Egerton University.

Katz, T. (1998). *Making rural water Supply Sustainable: Recommendations from a Global Study.* Washington D.C: UNDP-World Bank Water and Sanitation Program. Retrieved from http://www.its.caltech.edu/~e105/readings/rural_water.pdf

Katz, T., Jenifer, S., Mario, N., & Kihoon, L. (1997). *The Impact of institutional rules on the sustainability of rural water supply systems Honduras Country Report.* Washington, DC: UNDP-World Bank Water.

Kelly, E., Shields, K. F., Cronk, R., Lee, K., Behnke, N., Klug, T., & Bartram, J. (2018). Seasonality, water use and community management of water systems in rural settings: Qualitative evidence from Ghana, Kenya, and Zambia. *Science of the Total Environment, 628,* 715-721.Retrieved from https://www.ncbi.nlm.nih.gov › pubmed

Kelvin, J., & Ward, E. A. (2018). *Rain water harvesting : Texas water development Board.* Retrieved from http://www.tx.us/homeindex.asp

Kerlinger, F. N., & Rint, N. (1986). *Foundations of behaviour research.* London: Winston Inc.

Kerr, J., Pangare, G., & Pangare, L. (2002). *Watershed development projects in India: an evaluation. IFPRI Research Report No. 127.* Washington, DC: International Food Policy Research Institute (IFPRI).

Khalifa, M. A., & Connelly, S. (2009). Monitoring and guiding development in rural Egypt: local sustainable development indicators and local human development indices. *Environment, Development and Sustainability, 11*(6), 1175 - 1196. Doi: 10.1007/s10668-008-9173-0

Kithiia, S. M. (2012). *Water quality degradation trends in Kenya over the last decade, water quality monitoring and assessment.* (Dr. Voudouris ed.). InTech. Retrieved from http://www.intechopen.com/books/water-quality-monitoring-and-assessment/water-quality-degradation-trends-in-kenya-over-the-last-decade

Kloezen, W. H. (2002). *Accounting for water: institutional viability and impacts of market-oriented irrigation interventions in Central Mexico.* Wageningen: Wageningen University.

Klug, T., Shields, K. F., Cronk, R., Kelly, E., Behnke, N., Lee, K., & Bartram, J. (2017). Water system hardware and management rehabilitation: Qualitative evidence from Ghana, Kenya, and Zambia. *International journal of hygiene and environmental health*, *220*(3), 531-538. Doi: 10.1016/j.ijheh.2017.02.009

Klug, T., Cronk, R., Shields, K. F., & Bartram, J. (2018). A categorization of water system breakdowns: Evidence from Liberia, Nigeria, Tanzania, and Uganda. *Science of the Total Environment*, *619*, 1126-1132. Doi: 10.1016/j.scitotenv.2017.11.183

Kolavalli, S., & Brewer, J. D. (1999). Facilitating user participation in irrigation management. *Irrigation and Drainage Systems 13(3)*, 249–273. Doi:10.1023/A:1006211725291

Kombo, D. K., & Tromp, D. L. (2006). *Proposal and thesis writing.* Nairobi: Pauline Publications.

Komives, K.(2007). Community management of rural water systems in Ghana: Post-construction Support and Water and Sanitation Committees in Brong Ahafo and Volta Regions. *Water Resources and Sustainability*.Retrieved from https://www.accessengineeringlibrary.com/content

Kothari, C. (2009). *Research methodology: Methods and techniques.* New Delhi: New Age International Ltd.

Kumar, R. (2010). *Research methodology: A step-by-step guide for beginners*. Australia: Sage.

Langat, P. K., Kumar, L., & Koech, R. (2018). Understanding water and land use within tana and athi river basins in kenya: Opportunities for improvement. *Sustainable Water Resources Management*, *7*(2) 1-11. doi: 10.1007/s40899-018-0274-0

Leech, N. (2007). An array of qualitative data analysis tools: A call for data analysis triangulation. *School Psychology Quarterly*, *22*(4), 557.Retrieved from https://pdfs.semanticscholar.org

Leeuwis, C. (2004). *Communication for Rural Innovation. Rethinking Agricultural Extension (with Contributions of Anne van den Ban).* Oxford: Blackwell Science.

Lelo, F. K. (2005). Managing the River Njoro Watershed, Kenya: Conflicting laws, policies, and community priorities. *In: Republic of South Africa (Eds), African Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa*.

Lockwood, H., Alex, B., & Wendy, W. (2003). *Assessing sustainability in rural water supply: the role of follow-up support to communities.* Retrieved from http://www.worldbank.org/watsan/bnwp

Mansuri, G., & Rao, V. (2004). *Community-based and driven development: A critical review. Policy Research Working Paper; No.3209.* Washington, D.C: World Bank.

Matiru, V. (2000). *Conflict & natural resource management.* Rome: Conflict & Natural Resource Management.

McCartney, M., Foudi, S., Muthuwatta, L., Sood, A., Simons, G., Hunink, J., ... & Omuombo, C. (2019). *Quantifying the services of natural and built infrastructure in the context of climate change: the case of the Tana River Basin, Kenya* (Vol. 174). International Water Management Institute (IWMI).

Mehta, M., et al., (2005). Financing the millennium development goals for water and sanitation: what will it take. *International Journal of Water Resource Development, 21*, 239 -252. https://doi.org/10.1080/07900620500108445

Merkhofer, M. W., et al. (1997). Multiattribute utility analysis as a framework for public participation in siting a hazardous waste management facility. *Environmental Management, 21*, 831–839. Retrieved from https://link.springer.com/article/10.1007/s002679900070

Miller, D. C., & Salkind, N. J. (2002). *Handbook of research design & social measurement* (6 ed.). London: SAGE Publications.

Mollinga, P. (2008). Water, politics, and development: framing a political sociology of water resources management. *Water Alternatives, 1*(1), 7-23.Retrieved from http://www.water-alternatives.org/index.php/allabs/15-a-1-1-2/file

Mugenda, O.M., & Mugenda, A.G. (2003). *Research methods: Quantitative and qualitative approaches.* Nairobi: Acts Press.

Mukherji, A., Fuleki, B., Shah, T., Suhardiman, D., Giordano, M., & Weligamage, P. (2009). *Irrigation reform in Asia: A review of 108 cases of irrigation management transfer.* Asian Development Bank. Colombo, Sri Lanka: International Water Management.

Mumma, A. (2005). *New water law: An analysis of the implications for the rural poor* . London: African Centre for Technology Studies.

Mumma, A., Lane, M., Kairu, E., Tuinhof, A., & Hirji, R. (2011, 06). *World Bank: Water and Sanitation Program (WSP).* Retrieved 01 01, 2016, from Kenya Groundwater Governance Case Study. Water Papers: http://www.worldbank.org/water

Mureithi, P. M., Luwesi, C. N., Mutiso, M. N., Förch, N., & Nkpeebo, A. Y. (2018). Legal and market requirements for water finance in Africa: The kenya water sector reforms case. *IN AFRICA*, 83.Retrived from https://www.diva-portal.org/smash/get/diva2:1193386/FULLTEXT01.pdf#page=85

Mutiga, J. K., et al., (2010). Faculty of geo-information science and earth observation (ITC), University of Twente, 7500 AA, Enschede.

Munyua, P. K., & Mbugua, J. (2019). Factors influencing performance of water resource users associations in water resources management in Laikipia County, Kenya. *International Academic Journal of Information Sciences and Project Management*, *3*(4), 233-255.Retrieved from http://www.iajournals.org/articles/iajispm_v3_i4_233_255.pdf

Murusuri, N., Brown, J., & Hay-Edie, T. (2018). Engaging communities in conservation and sustainable development of African World Heritage: lessons learned from COMPACT. *World Heritage for Sustainable Development in Africa/Le Patrimoine mondial pour UN développement durable en Afrique*, 69.Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000261283

Muthuwatta, L., Sood, A., McCartney, M., Silva, N. S., & Opere, A. (2018). Understanding the impacts of climate change in the Tana River Basin, Kenya. *Proceedings of the International Association of Hydrological Sciences*, *379*, 37-42.Retrieved from https://profiles.uonbi.ac.ke/aopere/publications/

Ndirangu, W., Luwesi, C. N., Beyeneand, A., & Akudugu, M. A. (2018). Africa's Water Sector Development and Financing Outlook. *IN AFRICA*, 43.Retrieved from https://www.icafrica.org › knowledge-hub › water

Ngetich, R. C. (2009). *Assessment of factors influencing projects sustainability, the case of community water projects in Keekonyokie Central Location of Kajiado North District, Kenya.* Nairobi: University of Nairobi.

Nishimoto, S. (2003). *Mainstreaming gender in water management: A practical journey to sustainability. A resource guide. Environmentally sustainable development group. Bureau for development policy.* New York: UNDP.

Njonjo, A., & Lane, J. (2002). *Rural piped water supplies in Ethiopia, Malawi and Kenya: Community management and sustainability.* Retrieved 01 01, 2016, from Water and Sanitation Program: http://www.wsp.org/filez/pubs/328200711859_RuralPipedWater.pdf

Obando, J. A., Luwesi, C. N., Förch, N., Opiyo, A. O., Shisanya, C., & Förch, G. (2018). Kenya success story in water resources management: Participatory capacity building in integrated watershed management. In *Hydrology and Best Practices for Managing Water Resources in Arid and Semi-Arid Lands* (pp. 185-208). IGI Global.Retrieved from https://www.igi-global.com/chapter/

Odonkor, E., Hamasi, L., Muthoni, F., Khau, M., & Mutiso, M. (2018). Gender in water finance: Perspectives for a paradigm shift in water finance management. *IN AFRICA*, 141.Retrived from http://repository.seku.ac.ke/handle/ 123456789/4429

Ogendi, G. M., & Ong'oa, I. M. (2009). Water Policy, Accessibility and Water Ethics in Kenya. *Santa Clara Journal of International Law, 7*(3), 177 - 196.Retrieved from https://digitalcommons.law.scu.edu › cgi ›

Ohlsson, L. (2000). *Livelihood conflicts: Linking poverty and environment as causes of conflict.* Department of Natural Resources and the Environment. Stock holm: Swedish International Development Agency.

Olajuyigbe, A. E., & Fasakin, J. O. (2010). Citizens' willingness to pay for improved sustainable water supply in a medium sized city in South Western Nigeria. *Current Research Journal of Social Science, 2*, 41-50.Retrieved from https://www.researchgate.net › publication

Olorunfemi, F. B., & Gbadegesin, A. S. (2011). Sustainable technological policy options for rural water supply management in selected rural areas of Oyo State, Nigeria. *Management of Environmental Quality: An International Journal, 22*(4), 486 - 501. doi:10.1108/14777831111136081

Orodho, J. A. (2009). *Elements of education and social science research methods* (2 ed.). Maseno: Kanezja.

Ostrom, E. (1990). *Governing the commons: the evolution of institutions for collective action.* Cambridge: Cambridge University Press.

Ostrom, E. (1997). A behavioral approach to the rational choice theory of collective action: Presidential address, american political science association, 1997. *The American Political Science Review*,8(1), 1 - 22. doi:10.2307/2585925

Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economic Perspectives, 14*(3), 137 - 158. doi:10.1257/jep.14.3.137

Palmer, M. A. (1999). *The ecological consequences of changing land use for running waters, with a case study of urbanizing watersheds in Maryland. Journal of Environmental Quality.*Retrieved from https://www.researchgate.net › publication ›

Postel, S. L., & H., T. B. (2005). Watershed protection: Capturing the benefits of nature's water supply services. *Natural Resources Forum, 29*(2), 98-108.Retrieved from https://onlinelibrary.wiley.com › doi › abs

Radosevich, G. E., & Olson, D. (1999). Existing and emerging basin arrangements in Asia: Mekong river commission case study. *Third Workshop on River Basin Institution Development June 24, 1999.* Washington D.C.: World Bank.

Regner, H. J. (2006). Approaches and impacts of participatory irrigation management (PIM) in complex, centralized irrigation systems – Experiences and results from the Jordan Valley. *Conference on International Agricultural Research for Development.* Retrieved from https://www.researchgate.net › publication ›

Reis, N., & Mollinga, P. (2009). *Microcredit for rural water supply and sanitation in the mekong Delta; ZEF Working Paper Series.* Bonn: Department of Political and Cultural Change Center for Development Research, University of Bonn.

Resources, M. A., Information (2019). Urban Agriculture and Food Systems: Breakthroughs in Research and Practice: Breakthroughs in Research and Practice. IGI Global.

Richards, N., & Syallow, D. (2018). Water resources users associations in the Mara Basin, Kenya: Pitfalls and opportunities for community based natural resources management. *Frontiers in Environmental Science*, *6*, 138.Retrieved from https://www.frontiersin.org › articles › fenvs.2018.00138

Ritchie, J., & Lewis, J. (2003). *Qualitative research practice: A guide for social science students and researchers.* London: Sage Publications.

Rondinelli, D. A. (2003). *Partnering for development: Government-Private sector cooperation in service provision.* Retrieved 01 01, 2016, from United Nations Public Administration Network http://unpan1.un.org/intradoc/groups/public/documents/un/unpan006231.

Scoones, I. (2010). Sustainability . *Develeopment in Practice, 17*(4), 589-596.Retrieved from https://onlinelibrary.wiley.com › doi › book

Shivoga, W. A. (2007). Influences of land use/cover on water quality in the upper and middle reaches of River Njoro, Kenya. *Lakes & Reservoirs: Research and Management*(12), 97 - 105.Retrieved from https://doi.org/10.1111/j.1440-1770.2007.00325.

Svendsen, M., & Murray-Rust, D. H. (2001). Creating and consolidating locally managed irrigation in Turkey: The national perspective. *Irrigation and Drainage Systems*, 355 - 371. Retrieved from http://hdl.handle.net/10568/41304

Svendsen, M., & Nott, G. (2000). *Irrigation management transfer in Turkey: Process and outcomes In D Groenfeldt, M Svendsen (Eds.) Case studies in participatory irrigation management.* Washington, D.C.: World Bank Institute.

Tang, S. Y. (1999). *Institutions and collective action: Self-governance in irrigation.* San Francisco: ICS Press.

Tickner, D., Parker, H., Moncrieff, C. R., Oates, N. E. M., Ludi, E., & Acreman, M. (2017). Managing rivers for multiple benefits–a coherent approach to research, policy and planning. *Frontiers in Environmental Science, 5*. Retrieved from https://doi.org/10.3389/fenvs.2017.00004

Ul Hassan, M. (2007). *A proposed framework for irrigation management transfer in Iran: Lessons from Asia and Iran. Working Paper 118.* Colombo: International Water Management Institute (IWMI).

UNDP (2006). *Beyond scarcity: Power, poverty and the global water crisis.* New York: United Nations Development Programme.

UNICEF (2008). *Water, sanitation and hygiene annual report.* UNICEF.

United Nations. (2003). *Interim report of the secretary-general on the prevention of armed conflict(Report of the Secretary-General on the work of the Organization, A/58/365–S/2003/888).* New York: United Nations.

United Nations (2009). *UN Children's Fund Report.* New York: United Nations.

Uysal, O. K., & Atis, E. (2010). Assessing the performance of participatory irrigation management over time: A case study from Turkey. Agricultural Water Management. *Agricultural Water Management*, 1017 - 1025. doi:10.1016/j.agwat.2010.02.007

WASREB (2010). *Annual water sector review 2009.* Nairobi: Government of Kenya.

WASREB (2013). *A performance report of Kenya"s water services sub-sector 2011-2012.* Nairobi: Water Services Regulatory Board.

Water Resources Management Authority (2005). *Workshop on the formation of Buathonaro water users association (Workshop Report).* Nairobi: WRMA.

WCED. (1987). *Our common future.* Oxford: Oxford University Press.

Whittington, D. J., Davis, L. P., Komives, L., Thorsten, R., Lukacs, H., Bakalian, A., & Wakeman, W. (2008). *How well is the demand-driven, community management model for rural water supply systems doing. Evidence from Bolivia, Peru, and Ghana* (Vol. 22). Manchester, UK: Brooks World Poverty Institute, University of Manchester.

World Bank (2002). *Water services in small towns in Africa: The role of small and medium Sized organizations. Field note 12.* Nairobi: Water and Sanitation Program - Africa Region.

World Bank (2008). *The world bank annual report 2008 : Year in Review.* Washington: World Bank.

WRMA (2010). *Enforcement of water use charges and water quality thresholds in Kenya, Training Works.* Nairobi: Government of Kenya.

WRMA (2013). *National water master plan 2013.* Nairobi: Government of Kenya.

Yakubov, M. (2011). Assesing irrigation performance from the farmers perspectives: A qualitative study: Irrrigation and drainage (Published online) doi:10.1002/ird.649

Yercan, M., Dorsan, F., & Maulana, U. (2004). Comparative analysis of performance criteria in irrigation schemes: a case study of Gediz River Basin in Turkey. *Agricultural Water Management*,22(2), 259 - 266. doi:10.1016/j.agwat.2003.10.008

APPENDICES

Appendix I: Introductory Letter to Respondents

Letter of Introduction

20th December, 2018

Department of Social Sciences,

Chuka University

Tel: +254724920173

Email: lmworia@must.ac.ke

Dear Sir/Madam

RE: ACADEMIC RESEARCH

My name is Kirimi Lilian Mworia, a Ph.D. student in Community Development in the Faculty of Humanities and Social Sciences of Chuka University. I am collecting data for my study on: **"Strategies of Water Resources Users Associations in Promoting Sustainable Water Projects: The Case of Tana Catchment Area, Kenya" in order to improve and sustain equitable distribution and management of water resources among the WRUAs in Tana Catchment Area.**

I humbly request if you could kindly fill the attached questionnaire. The information given will be treated with strict confidentiality and will only be used for this study.

Your participation and contribution will be highly valued and appreciated. Please respond to all questions.

Thanking you in advance.

Yours faithfully,

Lilian Mukiri Mworia

Appendix II: NACOSTI Permit

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/99054/29594**

Date: **24th April, 2019**

Lilian Mukiri Mworia
Chuka University,
P.O. Box 109-60400,
CHUKA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Effectiveness of water resources users associations in promoting sustainable water projects: The case of Tana Catchment Area"*** I am pleased to inform you that you have been authorized to undertake research in **all Counties** for the period ending **23rd April, 2020.**

You are advised to report to **the County Commissioners and the County Directors of Education, all Counties** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioners
All Counties.

The County Directors of Education
All Counties.

THIS IS TO CERTIFY THAT:
MS. LILIAN MUKIRI MWORIA
of CHUKA UNIVERSITY, 109-60400
CHUKA,has been permitted to conduct
research in *All Counties*

on the topic: ***EFFECTIVENESS OF WATER RESOURCES USERS ASSOCIATIONS IN PROMOTING SUSTAINABLE WATER PROJECTS: THE CASE OF TANA CATCHMENT AREA***

for the period ending:
23rd April,2020

.....
Applicant's
Signature

Permit No : NACOSTI/P/19/99054/29594
Date Of Issue : 24th April,2019
Fee Recieved :Ksh 2000

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

Appendix III: Questionnaire for WRUA Executive Committee Members

Section A: Personal Details and General Information

I. Please give the name of your WRUA?

.....

II. Please indicate your gender.

Male	[]
Female	[]

III. What is your age bracket?

Below 26 years	[]	26-30 years	[]
31-35 years	[]	36-40 years	[]
41-45 years	[]	46-50 years	[]
51-above years	[]		

IV. What is your highest level of education?

Secondary school	[]	Bachelor's degree	[]
Certificate	[]	Masters	[]
Diploma	[]	PhD	[]
Other (specify	……..		

V. Where is your WRUA located along the river basin?

i. Upper part of the river [ ]
ii. Middle part of the river [ ]
iii. Lower part of the river [ ]
iv. I don't know in which part it is [ ]

VI. When was your WRUA formed?

Less than 1 year ago	[ ]
2 years ago	[ ]
3 years ago	[ ]
Over 5 years ago	[ ]

VII. Please identify the main activities that you think your WRUA deals with in regard to your water project

i. .....
ii. .....
iii. .....
iv. .....

SECTION B: Resource Mobilisation strategy

The statements below assess the resource mobilization in WRUAs as a strategy for sustainability. The statements are rated on a Five Point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	Members of WRUA agreed to contribute labor, materials and time towards construction of water intake points, infrastructure and rehabilitation of the river basin.					
2	Members of our WRUA contribute labor and finances in time as required.					
3	There are graduated penalties for non-payments of user contributions					
4	There is availability of reserve fund for repairs and rehabilitation					
5	Resources/payments from users are contributed to WRUAs in time					
6	Resources collected from users are adequate to run the activities of WRUAs					
7	Our WRUA has an internal audit team in place					

8. Please indicate the amount of money in grant by government and contribution by users for operations of the WRUA activities
   a. Below Ksh2000 [ ]
   b. Ksh. 2001-4000 [ ]
   c. Ksh. 4001-6000 [ ]
   d. Above Ksh.6000 [ ]
9. Please indicate the amount of money to be contributed by each member per year
   a. Ksh Below 2000 [ ]
   b. Ksh. 2001-4000 [ ]
   c. Ksh. 4001-6000 [ ]
   d. Above Ksh.6000 [ ]

10. Kindly indicate the amount required for operations of the WRUA activities as per your budget Ksh. .....

11. Does your WRUA require money for any other activities?

Yes [ ] No [ ]

12. What challenges do you experience in mobilizing resources for your WRUA?

i. .....

ii. .....

iii. .....

13. If your answer in No. 15 above is no, how can resource mobilization as a strategy be improved?

i. .....

ii. .....

iii. .....

SECTION C: Maintenance of Water Infrastructure strategy

The statements below assess the maintenance of water infrastructure in WRUAs. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	WRUA water projects have designated well trained and qualified technical staff					
2	WRUA water projects have easy access to tools and spare parts for water maintenance					
3	WRUAs have maintenance schedules and rehabilitation plans					
4	WRUAs have a quarterly infrastructure serving schedule for water intakes					
5	There is adequate budgetary allocation for repairs and maintenance and rehabilitation of water intakes in					

	WRUA Projects.					
6	There are no pipe leakages in the water along the river banks					
7	There is always planning and preparation for M&E data collection, analysis, and sharing of information					

8. How much money is allocated for maintenance of water intakes by your WRUA per quarter?
   i. Kshs.10,000-Kshs 20,000 ☐
   ii. Kshs.20,000-Kshs 30,000 ☐
   iii. Kshs.30,000-Kshs 50,000 ☐

9. How many times have WRUA Projects failed to supply water to users in the last four months? .....

10. What causes the shortages experienced in your water project?
    i. .....
    ii. .....
    iii. .....

11. What does your WRUA do to improve maintenance of the water abstraction points along the river?
    i. .....
    ii. .....
    iii. .....

SECTION D : Conflict Management strategy

The statements below seek to assess conflict management strategies in WRUAs. The statements are rated on a Five Point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**

1	Our WRUA has clear rules on who has a right to water					
2	Our WRUA has clear rules that ensure each members contributions are in balance					
3	Our WRUA has faced difficulties from users when enforcing rules					
4	Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the members					
5	Our WRUA has structures in place for reporting when they do not receive allocated amount of water in a time					
6	Our WRUA has in place mechanism to mediate water disputes and resolve conflicts					
7	There exists a Dispute Resolution Committee in our WRUA					

8. What approaches do you think could have positive influence on management of conflicts in our WRUA?

   i. .....

   ii. .....

   iii. .....

SECTION E: Water Catchment Management

The statements below assess the management of water catchment areas in WRUAs. The statements are rated on a Five Point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	There are no serious defects in the construction of the water intakes along the rivers , wells or springs					
2	Design and construction of the water intakes was done to the acceptable standards set by the government					
3	The water point sources are well protected (from animal contamination and human destruction)					

4	There is low level of water in the reservoirs and river basin					
5	Upstream WRUAs divert more water than downstream WRUAs (water sharing).					
6	Upstream WRUAs in the river basin divert more water than the downstream WRUAs					
7	WRUAs engages in good agricultural practices that reduce soil erosion, and degradation of river basin					

8. Which of the following activities does your WRUA undertake to protect the water sources (please tick as appropriate)
    i. Plant trees: ☐
    ii. Plant creepers ☐
    iii. Digging terraces ☐
    iv. None of the above ☐
9. What challenges does your WRUA face in the management of the catchment area?
    i. .....
    ii. .....
    iii. .....
10. What can be done to solve the challenges faced by our WRUA in the management of our catchment area?
    i. .....
    ii. .....
    iii. .....

SECTION F: Institutional support

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	WRUAs management source for financial resources from other financial agencies/institutions to support the project					
2	WRUAs are supported by WRA water officers in					

	training, drawing plans (legal and regulatory support)					
3	WRUAs get support from the WRA office on good agricultural activities for water catchment maintenance					
4	WRA Officers train users on water conflict resolution					
5	WRUAs have information about follow-up support by WRA office in case of major water system repairs					
6	Financial audit results of WRUA are submitted to members every year					

SECTION G: Sustainability of Water Projects

The statements below refer to the components of sustainability of the water project in your WRUA. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	All community users in our WRUA have equitable access to water throughout the year (fairness and equal access to all users)					
2	There is continuous flow of water to meet user demand throughout the year (sufficient flow of water, no regular dry ups in parts of the year)					
3	All members participate regularly in decision making meetings of the WRUAs (Participation)					
4	There are water saving mechanisms in place e.g. water storage tanks and taps for members (Water storage)					
5	Our members are trained on how to identify and report any challenges experienced in water management support)					
6	The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external financial assistance					
7	I consider our WRUA as a self-managed organization governing its financial, organizational, and administrative issues independently from the water agency or any other government agency					

Thank you for your participation

Appendix IV: Questionnaire for WRUA members

Section A: Personal Details and General Information

1. Give the name of your WRUA?

   .....

2. Please indicate your gender

Male	[ ]
Female	[ ]

3. What is your age bracket?

Below 26 years	[ ]	26-30 years	[ ]
31-35 years	[ ]	36-40 years	[ ]
41-45 years	[ ]	46-50 years	[ ]
51-above year	[ ]		

4. What is your highest level of education?

Secondary school	[ ]	Bachelor's degree	[ ]
Certificate	[ ]	Masters	[ ]
Diploma	[ ]	PhD	[ ]
Other (specify	……..		

5. Where your homestead is geographically located along the WRUA?

Head (Upstream)	[ ]
Middle	[ ]
Tail (Downstream)	[ ]

6. Please identify the main activities that you think your WRUA deal with in regard to your water project

   i. .....

   ii. .....

   iii. .....

SECTION B: Resource Mobilisation strategy

The statements below determine resource mobilization in WRUAs for specific activities. The statements are rated on a Five Point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	I contribute (labor and finances) as set by our WRUA towards construction of water intake points, infrastructure and rehabilitation					
2	I make my contribution in labor or finances to the WRUAs in a time as required by our WRUA					
3	I am willing to give additional resources to the WRUA if there is need					
4	There are graduated penalties for non-payments of fees or other contributions set by our WRUA					
5	The finances paid to WRUA are frequently used to repair leaking pipes tanks repair water source put bullets					
6	Fees and resources collected from users are adequate to run the activities of WRUA					
7	Financial audit results of our WRUA are announced to members every year					

8. How do you make your contributions to the WRUA?

Monthly [ ]

Yearly [ ]

When need arises [ ]

9. How much money did you pay last year to the WRUA Kshs…….

10. What challenges do you experience in meeting contribution obligation to your WRUA?

i. ….....

ii. ….....

iii. ….....

C: Maintenance of Water Infrastructure strategy

The statements below seek to assess the maintenance of water infrastructure in WRUAs. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	Our WRUA has designated well trained and qualified water technical staff					
2	Our WRUA has easy access to water tools and water spare parts for water maintenance					
3	Our WRUA has maintenance schedules and rehabilitation plans					
4	There is budgetary allocation for repairs and maintenances our water system					
5	There are no noticeable pipe leakages in our water system					
6	There is always logistical planning and preparation for M&E data collection, analysis, and sharing of information in our WRUA					
7	WRUAs have a quarterly infrastructure serving schedule for water intakes					

8. How many times has water supply from your project failed in the last year?

.....

9. What causes the shortages experienced in your water project?

i. .....

ii. .....

iii. .....

10. What useful skills do you have for water maintenance?

    i. .....
    ii. .....
    iii. .....

11. What challenges does your WRUA face in the maintenance of the water intakes?

    i. .....
    ii. .....
    iii. .....

12. What can your WRUA do to improve maintenance of the water supply in your project?

    i. .....
    ii. .....
    iii. .....

SECTION D: Conflict Management strategy

The statements below seek to assess conflict management in WRUAs. The statements are rated on a Five Point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	Our WRUA has clear rules on who has right to water					
2	Our WRUA has clear rules that ensure each members contribution are in balance					
3	Our WRUA has faced difficulties from users when enforcing rules					
4	Our WRUA has structures in place for reporting when users do not receive allocated amount of water in a time					
5	Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the					

	members					
6	Our WRUA has in place mechanism to mediate water disputes and resolve conflicts					
7	There exists a Dispute Resolution Committee in our WRUA					

8. What causes conflicts in your WRUA?
   i. .....
   ii. .....
   iii. .....

9. Have you been involved in any water conflict in the last year?
   Yes [ ]
   No [ ]

10. If the answer to no 9 above is yes, what conflict was it?
    i. .....
    ii. .....
    iii. .....

11. What approaches do you think could have positive influence on management of conflicts in our WRUA?
    i. .....
    ii. .....
    iii. .....

SECTION E :Water Catchment Area Management strategy

The statements below seek to assess the management of water catchment area in WUAs. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	There are no serious defects in the construction of our					

	water intake along the river basin					
2	Design and construction of our water system was done to the acceptable standards set by the government					
3	Our water sources are well protected (animal contamination and human destruction)					
4	There is low water level in our water reservoirs and rivers					
5	WRUAs engages in good agricultural practices that reduce soil erosion, and degradation of river basin					
6	Upstream WRUAs in the sub-county divert more water than the downstream WRUAs					
7	WRUAs divert much water that make less water available for end-tail users					

8. Which activities does your WRUA carry out towards river basin conservation?
   i. .....
   ii. .....
   iii. .....
9. Our WRUA trained members on activities for riparian plane protection?
   Yes [ ]
   No [ ]

10. If answer above is yes, list any activities that you participated in towards riparian plane protection?
    i. .....
    ii. .....
    iii. .....

11. What can be done to improve conservation in your catchment area?
    i. .....
    ii. .....
    iii. .....

SECTION F: Institutional support

The statements below refer to the components of Institutional Support by WRA office. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	WRUAs management source for financial resources from other financial agencies/institutions to support the project					
2	WRUAs are supported by WRA water officers in training, drawing plans (legal and regulatory support)					
3	WRUAs get support from the WRA office on good agricultural activities for water catchment maintenance					
4	WRA Officers train users on water conflict resolution					
5	WRUAs have information about follow-up support by WRA office in case of major water system repairs					
6	Financial audit results of WRUA are submitted to members every year					

SECTION G: Sustainability of Water Projects.

The statements below refer to the components of sustainability of the water project in your WRUA. The statements are rated on a five point Likert scale ranging from: Strongly Agree (SA); Agree (A); Undecided (UD); Disagree (D); Strongly Disagree (SD). Please tick ONLY the most appropriate response to your WRUA.

	Statement	**SA**	**A**	**UD**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	Our WRUA shares water equitably to all projects throughout the year (fairness and equal access to all users)					
2	I receive continuous flow of water to meet my demand throughout the year (sufficient flow of water, no regular					

	dry ups in parts of the year)					
3	I participate regularly in decision making meetings of our WRUA					
4	Our WRUA is supported by sub county water officers in training, drawing plans and legal and regulatory issues					
5	My household has water saving mechanisms in place eg water storage tanks, taps					
6	I consider our WRUA as a self-managed organization governing its financial, organizational, and administrative issues independently from the water agency or any other government agency					
7	The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external Financial assistance					

Thank you for your participation

Appendix V: Interview Schedule for WRA Officers

SECTION A: OFFICE DETAILS

1. In which department is water management hosted?
2. Why were the Water Resources Users Associations formed?
3. What kind of support do you offer to WRUAs?
4. What challenges do WRUAs face in implementing resource mobilization strategy?
5. Do WRUAs engage in the following for resource mobilization?
   a. Source for financial resources from other financial agencies/institutions
   b. Have graduated penalties for non-compliance of water rules by WRUAs
   c. WRUA audited accounts records reflect availability of reserve fund
   d. WRA trains WRUAs on resource mobilization strategies
   e. Fees collected from users are adequate to run the activities of WRUAs
   f. WRUAs account for grants and contributions given to them every year
   g. Financial audit results of WRUAs are submitted to our office every year
6. What strategies can be used to improve maintenance of WRUA projects?
7. In which period of the year do water use conflicts occur?
8. To what extent does your support to WRUAs conflict management strategies promote sustainability of water projects?
9. What types of conflicts have been reported to your office in the last one year?
10. What approaches does your office have for identifying conflicts related to water management other than those reported by members?
11. What methods does your office use to prevent future water use conflicts?
12. What additional activities can WRUAs use to conserve the water catchment areas and promote of sustainable water projects?
13. To what extent do water catchment management strategies used by WRUAs promote sustainable water projects?
14. What guidelines does your office offer WRUAs to enhance sustainable catchment management?

Thank you for your participation

Appendix VI: Observation Schedule

Observation Check list

ITEM	REMARKS
Describe the vegetation cover found on the river banks	
Identify position of water intake along the river bank	
Are there visible signs of soil erosion near the river banks	
Describe the land use activities taking place along the riparian land	
Are there visible farming activities on the riparian land	
Appropriate native species used for vegetation along the river banks	
Dominant land use activity	
Marks to map the riparian land, to show riparian land for protection	
Visible conservation activities eg terraces, gabions to control erosion	

Appendix VII: Sampling Table

The Size of a Randomly Chosen Sample

The table for determining the size of a randomly chosen sample for a given population of N cases such that the sample proportion is within + 0.05 of the population within a 95% level of confidence.

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	241	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377

Source: Kathuri and Pals (1993), Introduction to Educational Research, Njoro: Egerton University Press.

Appendix VIII: Reliability Tables

Table A.1: Reliability Analysis for Resource Mobilization for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I Contribute (labor and finance) as set by our WRUA towards construction of water intake points, infrastructure and rehabilitation.	19.7743	20.550	0.404	0.707
I make my contribution in labor or finance to the WRUA in a time as required by our WRUA	19.6265	20.383	0.498	0.690
I am willing to give additional resources to the WRUAs if there is need	19.6420	21.957	0.328	0.722
There are graduated penalties for non-payments of fees set by our WRUA	20.1868	19.856	0.406	0.706
Financial audit results of our WRUA are announced to members every year	21.3774	18.400	0.530	0.676
The finances paid to WRUA are frequently used to repair leaking pipe tanks repair water source put bullets	21.0467	17.287	0.590	0.658
Fees collected from users are adequate to run the activities of WRUA	21.1323	18.021	0.389	0.721
Resource mobilization reliability statistic				0.730

Table A.2: Reliability Analysis for Infrastructure Maintenance for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Our WRUA has designated well trained and qualified water technical staff	16.9770	39.115	.659	.848

Our WRUA has easy access to water tools and water spare parts for water maintenance	17.0553	37.830	.743	.836
WRUAs have a quarterly infrastructure serving schedule for water intakes	16.4793	37.779	.729	.838
Our WRUA has maintenance schedules and rehabilitation plans	16.6406	38.926	.682	.845
There is budgetary allocation for repairs and maintenance our water system	16.9816	38.916	.686	.844
There are no noticeable pipe leakages in our water system	17.0230	41.430	.501	.869
There is always logistical planning and preparation for M&E data collection, analysis, and sharing of information in our WRUA	16.3825	41.200	.512	.867
		Infrastructure Maintenance reliability score		0.869

Table A.3: Reliability Analysis for Conflict Management for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Our WRUA has clear rules on who has rights to water	21.6654	15.770	0.530	0.678
Our WRUA has clear rules that ensure members contributions are in balance	21.8093	15.842	0.426	0.693
Our WRUA has structures in place for reporting when users do not receive allocated amount of water in a time	22.2179	12.984	0.650	0.629
Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the members	22.1907	12.866	0.664	0.625
Our WRUA has in place mechanisms to mediate water disputes and resolve conflicts	22.0000	13.687	0.600	0.647

There exists a dispute resolution committee in our WRUA	22.4319	11.239	0.686	0.610
Our WRUA has faced difficulties from users when enforcing rules	24.2218	22.064	-0.424	0.836
		Conflict Management reliability analysis		0.722

Table A.4: Reliability Analysis for Water Catchment Management for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
There are no serious defects in the construction of our water catchment area or wells	20.9624	22.310	0.466	0.661
Design and construction of our water system was done to the acceptable standards set by the government	20.5211	22.477	0.571	0.638
Our water catchment area is well protected (from possibility of animal contamination and human destruction)	21.2676	25.291	0.229	0.724
There is low water level in our water reservoirs	20.6291	24.895	0.353	0.690
Upstream WRUAs in the sub-county divert more water than the downstream WRUAs	20.8826	22.736	0.441	0.668
Upper households divert much water which makes less water available for end-tail users	21.0704	23.320	0.384	0.684
Our WRUA trained me on good agricultural practices for catchment protection.	20.3005	23.372	0.530	0.651
		Water Catchment Management reliability analysis		0.708

Table A.5: Reliability Analysis for Institutional Support for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Our WRUA is supported by sub-county water officers in training, drawing plans and legal and regulatory issues	17.3146	21.660	.389	.756
Financial audit results of our WRUA are announced to members every year	16.7887	21.696	.486	.723
Our WRUA has information about follow-up support in case of major water system repairs	17.6479	20.116	.619	.685
I have been trained by our WRUA water conflict management	16.8638	20.901	.618	.689
Our WRUA trained me on good agricultural practices for catchment protection.	16.6808	23.728	.443	.735
WRUAs management source for financial resources from other financial agencies/institutions to support the project	18.1315	22.134	.456	.731
			Institutional Support Reliability	0.756

Table A.6: Reliability Analysis for Sustainability for Users

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Our WRUA shares water equitably to all households throughout the year (Fairness and equal access to all users)	21.4118	24.043	.487	.684
I receive continuous flow of water to meet my demand throughout the year (sufficient flow of water, no regular dry ups in parts of the year)	22.0452	23.343	.518	.675
I participate regularly in decision making meetings of our WRUA	20.7919	27.356	.378	.711

Our WRUA is supported by sub-county water officers in training, drawing plans and legal and regulatory issues	21.8597	22.967	.416	.705
My WRUA has water saving mechanisms in place e.g. water storage tanks, taps.	21.5158	22.860	.494	.681
I consider our WRUA as a self-managed organization governing its financial, organizational and administrative issues independently from the water agency or any other government agency.	21.1810	24.613	.446	.693
The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external Financial assistance	22.2262	25.058	.361	.714
		Sustainability reliability		0.727

Table A.7: Reliability Analysis for Resource Mobilization for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Members of WRUA agreed to contribute towards construction of water intake points, infrastructure and rehabilitation of the river basin	17.5161	11.658	.414	.592
Members of our WRUA contribute labor and finances in time as required	16.9677	13.832	.247	.639
There are graduated penalties for non-payments of user contribution	17.9032	10.490	.518	.553
There is availability of reserve fund for our WRUAs	19.1935	12.028	.401	.597
I am willing to give additional resources to the WRUA if there is need	18.8710	12.316	.335	.616

Fees collected from users are adequate to run the activities of WRUAs.	19.5484	14.389	.053	.687
Our WRUA has an internal audit team in place	18.1290	9.716	.517	.550
	Resource mobilization reliability score			0.646

Table A.8: Reliability Analysis for Infrastructure Maintenance for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
WRUA water projects have designated well trained and qualified technical staff	15.4839	25.858	0.560	0.800
WRUA water projects have easy access to tools and spare parts for water maintenance	15.4516	28.589	0.470	0.813
WRUAs have maintenance schedules and rehabilitation plans	15.0323	27.899	0.518	0.805
WRUAs have a quarterly infrastructure serving schedule for water intakes	15.5161	26.058	0.756	0.769
There is adequate budgetary allocation for repairs and maintenance and rehabilitation of water intakes in WRUA projects.	15.9032	26.890	0.689	0.780
There are no pipe leakages in the water system among WRUA projects	15.7097	25.080	0.762	0.764
There is always planning and preparation for M&E data collection, analysis and sharing of information	15.2903	28.480	0.317	0.848
	Infrastructure maintenance reliability score			0.822

Table A.9: Reliability Analysis for Conflict Management for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Our WRUA has clear rules on who has a right to water	23.1290	20.716	0.746	0.758
Our WRUA has clear rules that ensure each members contribution are in balance	23.0968	24.290	0.620	0.787
Our WRUA has faced difficulties from users when enforcing rules	23.2581	28.865	0.059	0.867
Our WRUA has a mechanism to identify violators of rules and measures to punish them as decided by the members.	23.6129	24.312	0.524	0.799
Our WRUA has structures in place for reporting when they do not receive allocated amount of water in a time.	23.9032	21.557	0.693	0.769
Our WRUA has in place mechanism to mediate water disputes and resolve conflicts	23.1613	22.406	0.640	0.779
There exists a dispute resolution committee in our WRUA	23.7742	20.847	0.683	0.770
	Conflict Management Reliability Score			0.818

Table A.10: Reliability Analysis for Water Catchment Management for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
There are no serious defects in the construction of the water intakes in catchment area, wells or springs	22.0323	15.566	.624	.606

Design and construction of the water system was done to the acceptable standards set by the government	21.0000	19.467	.432	.669
The water point sources are well protected (from possibility of animal contamination and human destruction)	21.9032	21.024	.147	.736
The WRUA controls water supply fairly i.e. The WRUAs share water fairly	21.6774	16.892	.567	.628
Upstream WRUAs in the river basin divert more water than the downstream WRUAs	21.5484	15.189	.689	.586
WRUAs engages in good agricultural practices that reduce soil erosion, and degradation of river basin	21.0323	22.432	.032	.756
There is low level of water in the reservoirs and river basin	21.3871	18.712	.463	.660
Water catchment management reliability score				0.704

Table A.11: Reliability Analysis for Institutional Support for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
WRUAs management source for financial resources from other financial agencies/institutions to support the project	19.1935	11.561	.656	.517
Financial audit results of our WRUA are announced to members every year	19.8387	8.540	.556	.475
WRUAs have information about follow-up support in case of major water system repairs	20.5161	11.325	.230	.636
Our WRUA trains users on conflict resolution	19.5484	11.189	.457	.543

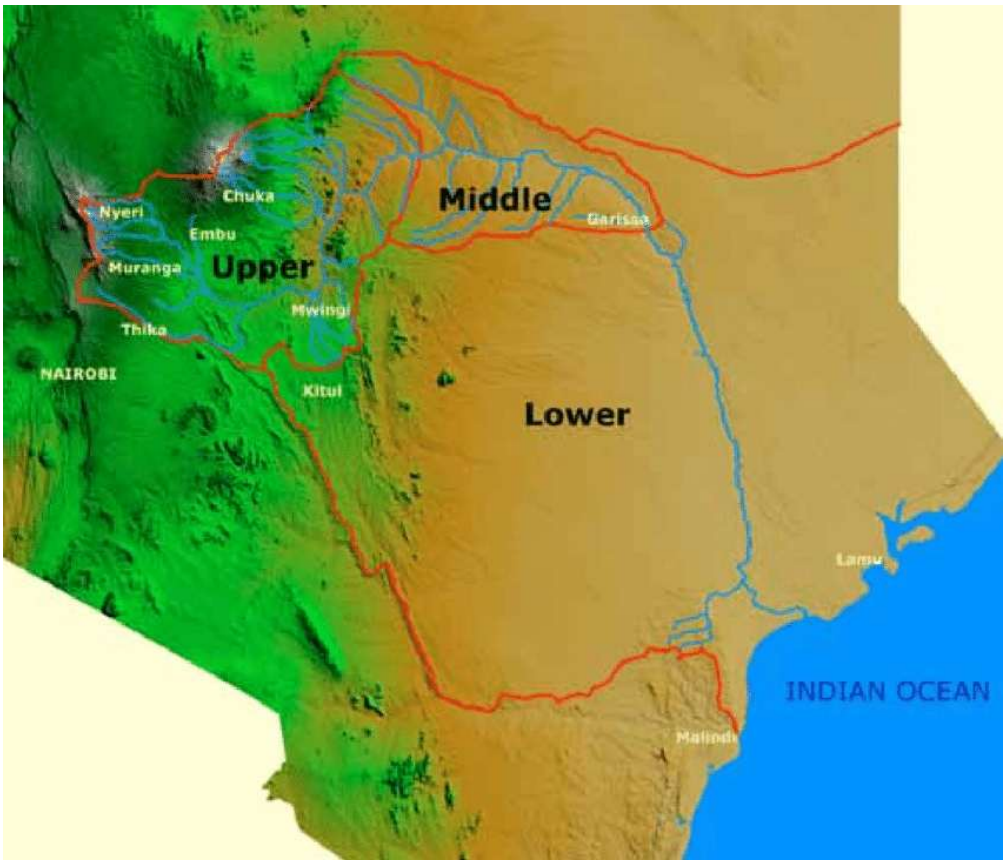
Our WRUA gets support from the WRA office on good agricultural activities for water catchment maintenance	19.4839	12.058	.311	.593
WRUAs are supported by WRA water officers in training, drawing plans (legal and regulatory support)	19.3226	12.492	.131	.667
	Institutional support reliability score			0.621

Table A.12: Reliability Analysis for Sustainability for Executive Committee Members

Item-Total Statistics				
Questionnaire Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
All community users in our WRUA have equitable access to water throughout the year (fairness and equal access to all users)	22.1935	20.695	0.351	0.749
There is continuous flow of water to meet user demand throughout the year (sufficient flow of water, no regular dry ups in parts of the year)	22.7097	19.346	0.426	0.735
All members participate regularly in decision making meetings of the WRUAs (sufficient flow of water, no regular dry ups in parts of the year)	21.3871	19.912	0.692	0.695
There are water saving mechanisms in place e.g. water storage tanks and taps for members (water storage)	22.5806	20.718	0.323	0.756
Our members are trained on how to identify and report any challenges experienced in water management	21.7419	18.665	0.763	0.673

The WRUA undertook rehabilitation works in previous years at shared expenses of WRUA and external financial assistance	21.8710	18.049	0.690	0.677
I consider our WRUA as a self-managed organization governing its financial, organizational, and administrative issues independently from the water agency or any other government agency.	22.1613	19.206	0.309	0.777
		Sustainability reliability score		0.754

Appendix IX: Map of Tana Catchment Area



Appendix X: List of Sampled WRUAs

Table A.13: List of WRUAs

Number	Name of WRUA
1	Bwathanaro
2	Ngakinya
3	Gangara
4	Iraru
5	Mutonga Kiamuga
6	Lower Kathita
7	Upper Kathita
8	Lower Rupingazi
9	Mariara
10	Upper Thingithu
11	North Mathioya
12	Rwaamuthambi
13	South Mathioya
14	Tungu
15	Upper Maragua
16	Kithino
17	Upper Thangatha
18	Kiwe
19	Kirwara
20	Gachiege-Kanyuango
21	Upper Thuci
22	Lower Thananthu
23	Lower Thuci
24	Rwanjoga
25	Kirwara
26	Upper Thiba
27	Lower Thananthu
28	Upper Thuci
29	Lower Thuci
30	Muringato
31	Middle Kathita