ASSESSMENT OF COMMUNITY PARTICIPATION IN MANAGEMENT OF WATER RESOURCES IN MOSHI RURAL DISTRICT, KILIMANJARO TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN PROJECT MANAGEMENT AND EVALUATION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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EXTENDED ABSTRACT

Community's participation in the water resources management is of paramount importance as it contributes to improve the efficiency and effectiveness of water projects and also improving the family's economy since family members will focus on production more than wasting time on fetching water. However, there is lack of enough information on local community's participation in management of water resources (MWR) in poor resource countries such as Tanzania. The study on which this dissertation is based assessed local community's participation in management of domestic water in East Old Moshi and Kimochi Wards in Moshi Rural District in Tanzania. The wards were purposively selected due to a number of water sources from slopes of Mount Kilimanjaro, but still community members suffer from water shortage. Specifically, the study sought to: (i) determine the extent of participation of local communities in water resources management, (ii) assess water conservation measures applied by the local communities and (iii) assess institutional and socio-economic factors affecting community members' choice of types of water conservation technologies. Structured interviews were applied as the main method of data collection whereby 150 respondents who were randomly selected from the two wards were interviewed. Collected data were analysed using quantitative and qualitative approaches. Chi-Square test was used to assess the association between respondents' characteristics and participation in project activities (manual works and project meetings). In inferential analysis, Ordinal Logistic Regression and binary logistic regression was used to assess the factors associated with respondents' participation in Water Resources Management (WRM) in general and factors influencing the households' choice of Water Conservation Measures (WCMs) respectively. The ordinal logistic regression analysis results revealed a significant association between overall participation in WRM and respondents' years of schooling and the days

respondents had received water. Binary logistic regression revealed that choice of WCMs was significantly associated with the respondents' age, marital status and distance to the household's alternative sources of water. Based on the study findings, it is concluded that education is a major solution to many problems facing community members. Also WCMs applied in the study area depend on status of water availability of the particular place and season. From the findings and conclusions, the study recommends that, in order to improve application of WCMs to local communities, education should be provided especially to elders, people who reside in the upper parts of the community.

DECLARATION

I, John M. Lyatuu, do hereby declare to the Senate of the Sokoine University of Agriculture that this dissertation is my original work, done within the period of registration and that it has neither been submitted nor been concurrently submitted for a higher degree award in any other Institution.

_____ _____

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MA (Project Management and Evaluation) Candidate

The above declaration is confirmed by:

_____ _____

Dr. C. J. Kilawe Date

(Supervisor)

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ABBREVIATIONS AND ACRONYMS

AMCOW	African Ministers' Council on Water
FGD	Focus Group Discussion
GWP	Global Water Partnership
IWRM	Integrated Water Resources Management
MDG	Millennium Development Goals
MoW	Ministry of Water
MUWSA	Moshi Urban Water Supply and Sewage Authority
MWR	Management of Water Resources
NPES	National Poverty Eradication Strategy
PRSP	Poverty Reduction Strategy Paper
SDGs	Sustainable Development Goals
UK	United Kingdom
UNCED	United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
URT	United Republic of Tanzania
WCMs	Water Conservation Measures
WHO	World Health Organization
WRM	Water Resources Management
WSSD	World Summit on Sustainable Development

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Water is an essential resource for assuring socio-economic development and for maintaining healthy ecosystems (WSSD, 2002). There have been some important efforts towards bridging the gap between the demand for and supply of water worldwide (Tong *et al.*, 2017). Despite these efforts, a recent Joint Monitoring Programme (JMP) reported that over 844 million people (11%) in the world are still without access to improved and safely managed drinking water (WHO/UNICEF, 2017). Globally, the Sustainable Development Goals' (SDGs') targets regarding of access to safe drinking water show that 7 out of 8 regions including Sub-Saharan Africa are currently off track to achieve universal coverage by 2030 (UN-Water, 2020). In Sub-Saharan Africa, the number of people lacking safely managed drinking water has increased by more than 40% since 2000 (United Nations, 2018).

Considering the importance of this limited resource, one of the targets of the Tanzania Development Vision 2025 is to achieve universal access (100%) to water supply in urban areas and 90% of water supply coverage in rural areas by 2025 (URT, 1999). Studies show that to attain the Tanzania Development Vision 2025's targets on water, partnership-based model involving community members has a huge potential to bridge water supply gaps, especially in underserved locations where state-based public utilities, market-based solutions and public-private partnerships have failed to improve people's access to safe water (Seluhinga, 2013; Mokiwa, 2015 and Daluwatte *et al.*, 2020).

On the slopes of Mt. Kilimanjaro which is recognized as an important water tower in East Africa and Africa in general and which is one of the UNESCO's world heritage sites due

to its high biodiversity (Zech *et al.,* 2014), the increase in human population, climatic change and unsustainable land management practices have increased causing pressure on water resources leading to its scarcity for domestic and agricultural use (Meta *et al.,* 2016). The northern parts of Moshi Rural District (in Kilimanjaro Region) have their socio-economic activities, which are strongly dependent on water through old infrastructure and catchment points (Kimaro *et al.,* 2019). In Tanzania, studies show that community participation is among the major interventions that simplify the management of domestic water projects at different stages from designing, planning, implementation, as well as monitoring and evaluation (Dungumaro and Madulu, 2002 and Kirenga *et al.,* 2018), but studies on community participation in the management of water resources have not been adequately explored in Moshi Rural District, particularly in Kimochi and East Old Moshi Wards.

Meta *et al.* (2016), who assessed economic efficiency of domestic water allocation in north-eastern Tanzania, recommended that the emphasis should be on management by participation through formulation of village water committees that oversee utilities on behalf of community members. Daluwatte *et al.* (2020), who assessed community empowerment with community based water socio-elites in Kenya, argued that community participation is an essential factor for continuous operations and sustainability of projects, but there are different factors affecting community participation like nature of community, nature of the leadership and sense of ownership of the project.

However, a study on communities' participation in the management of water resources was needed in Moshi Rural District to identify processes which could eliminate struggle for water among the communities surrounding the important water tower in Tanzania. Therefore, the study on which this dissertation is based aimed at assessing the extent of

local communities' participation in water resources management in Moshi Rural District, Kilimanjaro Region.

1.2 Problem Statement

The southern slopes of Mt. Kilimanjaro have their socio-economic activities which are strongly dependent on water through old infrastructure and catchment areas (Said *et al.*, 2019). The increase in human population, climatic change and unsustainable land management practices have increasingly been exerting pressure on water resources leading to its scarcity for domestic and agricultural uses (Kimaro, 2019). Domestic water supply in Kimochi and East Old Moshi Wards is currently vulnerable to the climatic change, increase in the human population, old infrastructures and unsustainable water management practices which increased pressure on water resources leading to its scarcity for domestic and agricultural use (de Haas and Borst, 2012; Mokiwa, 2015). Villages in the study area have a centralized piped water system which is captured from several springs and streams in the higher parts of the area and flow by gravity to lower parts of villages. Water in the villages is freely accessed (Mokiwa, 2015). Payment is only made during the installation of private water connection. Since water use isn't charged, there is no incentive to save water. Water fund collected is inadequate to cover operation and maintenance costs due to extremely low tariff levels, users' preference of service level, weak water consumption control measures and power relations between upstream and downstream users (Kirenga *et al.*, 2018). Another problem is that the water infrastructure system is poorly maintained. There is no regular maintenance; repairs are done in case there is a problem. Repairs are also difficult to do since community water committees have no funds to buy necessary parts or hire people (de Haas and Borst, 2012; Mokiwa, 2015).

Several studies have been conducted in the study area relating to WRM. Mokiwa (2015) found that few people, especially leaders, participated in the management of water sources

in Hai District and community members did not clearly understand the laws and regulations governing water spring. Meta *et al.* (2016) found that water scarcity, average distance to a water source, average time spent on water collection, and average hours of daily availability of water were significant predictors of daily average water usage in Kirua-Kahe (Moshi Rural District). Some studies suggest that personal experiences with drought issues provide the best lesson to adopt WCMs since these individuals already feel a moral obligation to conserve water (Garcia *et al.,* 2013; Tong *et al.,* 2017). Also Suresh *et al.* (2017), who assessed water efficiency and conservation in urban India, saw the need to design more service delivery models and technical innovations that would support efficiency in domestic water conservation. Also, Koop *et al.* (2019), who conducted a review of empirical studies on influencing tactics that enhance domestic water conservation, concluded that the current body of literature is promising and provides a useful body of evidence on the range and effectiveness of individual water conservation mechanisms, especially how to initiate specific water serving habits.

Another strand of literature focuses on the socio-psychology of water conservation, identifying the key factors that drive water-saving behaviour, such as attitudes, beliefs and habits (Fan *et al*., 2014; Aprile and Fiorillo, 2017 and Xue *et al*., 2017). Dungumaro and Madulu (2002), who assessed public participation in WRM in Tanzania, argue that local communities in various areas of Tanzania have developed coping strategies to ensure the conservation of water resources, although some of the traditional strategies have been eroded by modernization factors and population pressure. However, little is known from the studies about factors affecting the community's choice of WCMs in Moshi Rural District, Tanzania. Hence, the study sought to assess water use strategies and conservation measures applied by the local communities, and to assess institutional and socio-economic factors affecting community's choice of types of water conservation technologies.

The study is in line with Water Resources Management Act of 2009; the Act provides for an institutional and legal framework for sustainable management and development of water resources.

1.3 Study Justification

The study conforms with Tanzania Vision 2025 which aims at achieving a high quality of livelihood for its people by 2025. This target specifically addresses the issue of universal access to safe water. It is also envisaged that fast growth will be pursued while effectively reversing current adverse trends in the loss and degradation of environmental resources (such as forests, fisheries, fresh water, climate, soils, biodiversity) and in the accumulation of hazardous substances (URT, 1999). Also, among the objectives of the 2009's Water Resources Management Act were to ensure that the nation's water resources are protected, developed, managed and controlled in ways which take into account the principle that water is essential for life and that safe drinking water is a basic human right (URT, 2009). On the other hand, the 2002 National Water Policy provides for stakeholders' participation in water resources management within a decentralized framework. It states that "communities in general play a major role in the water sector because they are the primary users, guardians and managers of water sources" (URT, 2002). Participation of both men and women in decision-making, planning, management and implementation of water resources management and development should be enhanced. Youth and children as the future's managers of water resources have to be involved from the early stages for better management and future sustainability.

The study is also in line with the National Forestry Policy of 2008 which aimed at ensuring ecosystem stability through conservation of forest biodiversity, water catchments and soil fertility and enhanced national capacity to manage and develop the forest sector in

collaboration with other stakeholders (URT, 2008). Internationally, this work is in line with goal number six of Sustainable Development Goals (SDGs) which is about ensuring availability and sustainable management of water and sanitation for all (UN-Water, 2020). The goal has the following targets to be achieved by 2030; Safe and affordable drinking water, end open defecation and provide access to sanitation and hygiene, improve water quality, wastewater treatment and safe reuse, increase water-use efficiency, ensure freshwater supplies, implement Integrated Water Resources Management (IWRM) and to protect and restore water-related ecosystems. Therefore, the findings of the study will help to determine alternative measures to be taken by all other stakeholders to solve the challenges brought about by improper water management and conservation.

1.4 Research Objectives

1.4.1 Overall objectives

The general study objective was to assess local communities' participation in water resource management.

1.4.2 Specific objectives

The specific objectives of the study were:

i. To determine the extent of local communities' participation in water resources management,
ii. To assess water conservation measures applied by the local communities and
iii. To assess factors affecting community members' choice of types of water conservation technologies.

1.5 Research Questions

i. To what extent local communities' participating in water resources management?

ii. What are the water conservation measures applied by the local communities?

iii. How institutional and socio-economic factors affect community's choice on types of water conservation technology?

1.6 Theoretical Framework

The most common participation theory is the Collective Action Theory by Mancur Olson of 1971. The author challenges a generally held view that groups of individuals with common interests usually work together to achieve their interests. The author argues that "unless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, the rational and self-interested individuals will not act to achieve their group interests" (Olson, 1971).

However, the study followed the Power-Load-Margin theory by Howard McClusky of 1970, who defines margin as "a function of the relationship of load to the power." The author defines Load as the "self and social demands by a person to maintain a minimum level of autonomy" and power is described as resources such as abilities, possessions, position, allies and the like, which a person can use in coping with the load. The author provides a formula states that, "the higher the margin between load and power, the lesser the participation in development activities." McClusky used the formula for margin, (M = L/P).

The Power-Load-Margin theory suggests that the greater the power (P) in relationship to the load (L), the more margins would be available. Thus, if the hypothesis is true, a logical conclusion is that the efforts of mobilizing such marginal masses to participate in development activities must consider reduction of load or raising their power or both. In other words, the more the margin one has, the greater the chances of dealing with the load.

The less the margin one has, the lower the chances of dealing with the load (McClusky, 1970). In general, theories of participation in development programmes are stating conditions under which people do or do not participate in a collective action.

1.7 Gaps in Literature

The approach of community participation views decision-making as a dialogue and negotiation which involves stakeholders from government, profits/non-profit sectors, private sector and the general public (Kirenga *et al.*, 2018). In WRM, this is collaborative or combined approach, which has been used to address complex water problems and integrate diverse government and non-government perspectives. Mokiwa (2015) proposes that, in addressing water management challenges, it is important to deliver sustainable water management approaches. It is also important to review particular levels at which partnership operates, can focus on projects, programmes, or policies use (Kimaro *et al.*, 2019). In the water sector, equal participation between men and women shall be well organized and well empowering because these factors work in collaboration (Meta *et al.*, 2016). Women's contribution, for instance in terms of ideas to water supplies, is believed to be helpful because such kind of empowering creates a sense of ownership and the related perceptions of responsibility which then efficiently result in proper maintenance of water facilities (Suresh *et al.*, 2017). However, little is known on communities' participation in WRM in Moshi Rural District.

Many of the adoption studies (Koutiva and Makropoulos, 2017; Koop *et al*., 2019) try to group the factors affecting community's adoption of technologies into four categories namely technology, biophysical, institutional/government contribution and respondent characteristics. Together with technology characteristics, adoption is also influenced by biophysical factors, which include climate and distance to the sources of water, and all the

costs incurred to make water available (Aprile and Fiorillo, 2017). Institutions and or government support include policies, rules, trainings and types of leadership of a particular area are also the determining factors being mentioned (de Haas and Borst, 2012). The respondents' characteristics include age, sex, education level, income and the size of the household (Meta *et al.,* 2016 and Kirenga *et al.,* 2018). All of these can influence communities positively or negatively towards adoption of conservation technology. Hence, the study focuses on determining socio-economic factors affecting community on type of WCMs due to inadequate previous studies on this topic, particularly in Moshi Rural District.

1.8 Conceptual Framework

A conceptual framework is a narrative outline presentation of variables to be studied and the relationship between them (Fig. 1.1). The variables shown in the conceptual framework are contextual factors, which include socio-economic factors, political and institutional factors; independent variables which include household characteristics of community members, methods and approaches used to communicate with community members, learning environments and attitudes of local communities towards natural resources which eventually influence effective and good organization of water resources management (dependent variable).

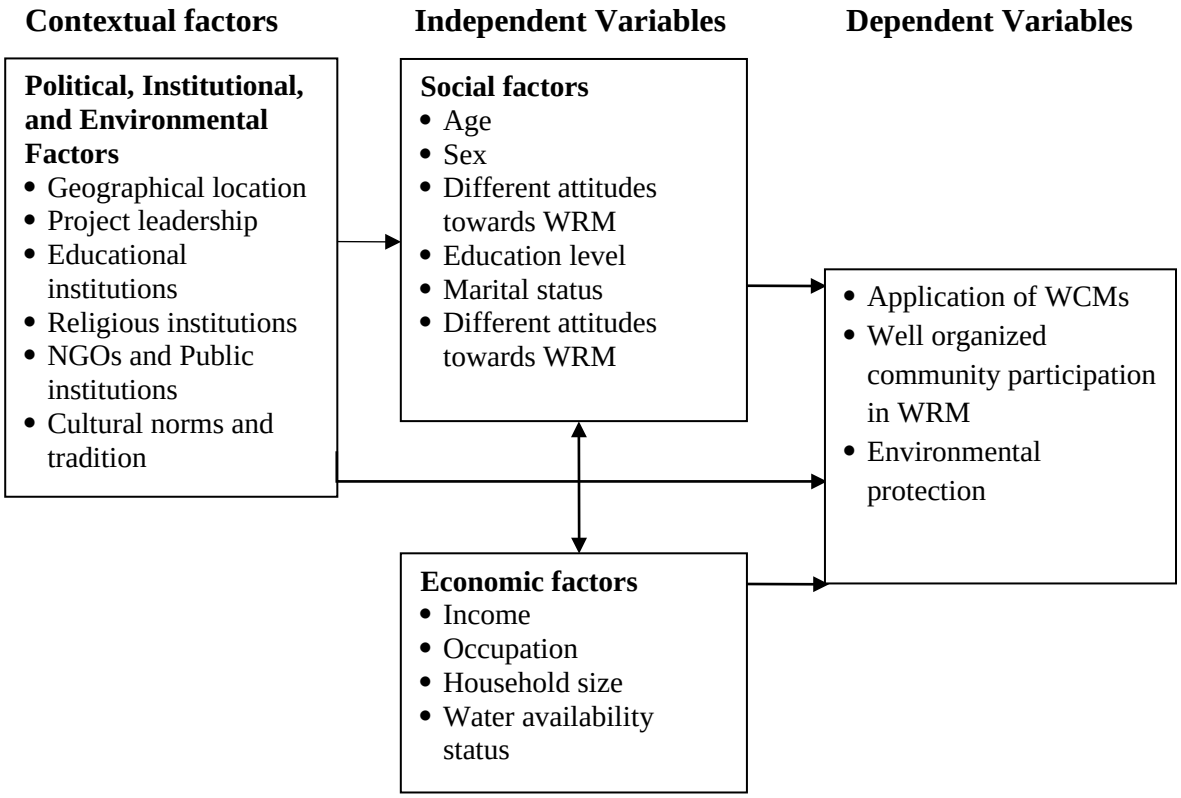

Figure 1.1: Conceptual framework on factors affecting local community's participation in Water Resources Management

1.9 Limitation of the Study

Record keeping was a challenge that faced data collection. Community members rarely kept written records of their activities including transactions. Their responses were based on the latest memories they had. Therefore, it was difficult for some respondents to provide correct data to some of the questions. The researcher had to probe by asking the respondents additional questions in order to get as good information as possible based on the basic questions were in the questionnaire.

During focus group discussions, some participants were reluctant to provide information without first being paid. This was caused by previous experience whereby community members were given money in exchange for participation in interviews. To overcome this challenge, the researcher convinced them by clarifying the objectives and importance of the study until they were aware and willing to participate.

1.10 General Methodology

1.10.1 Description of the study area

The study was conducted in six villages found in East Old-Moshi and Kimochi Wards located in Moshi Rural District (Fig. 1.2). The district is found at the base of Mt. Kilimanjaro in the Northern part of Tanzania. Two different rainy seasons occur in the study area: the long rains that start from mid-March to the end of May and the short rains that extend from October to December. The driest period is July through the end of September. The mean annual rainfall increases from 1000 to 1200 mm in lower and mid areas, and from 1800 to 2000 mm in upper areas (Misana *et al.*, 2012).

According to the Tanzania National Population and Housing Census of 2012 (NBS, 2013), Moshi Rural District population was 466 737 people with an average household size of 4.2 mostly composed of the Chagga ethnic group. Moshi Rural District is divided into 4 divisions, 31 wards, and 145 villages. The communities are engaged in agroforestry that involves production of crops in a mixture of trees and zero-grazing. Some of the tree crops widely cultivated are: Avocado (*Persea americana*), Jackfruit (*Artocarpus heterophyllus*), Mango (*Mangifera indica*) and Java Plum (*syzygium cumini*). A map showing the study area is shown in Figure 1.2.

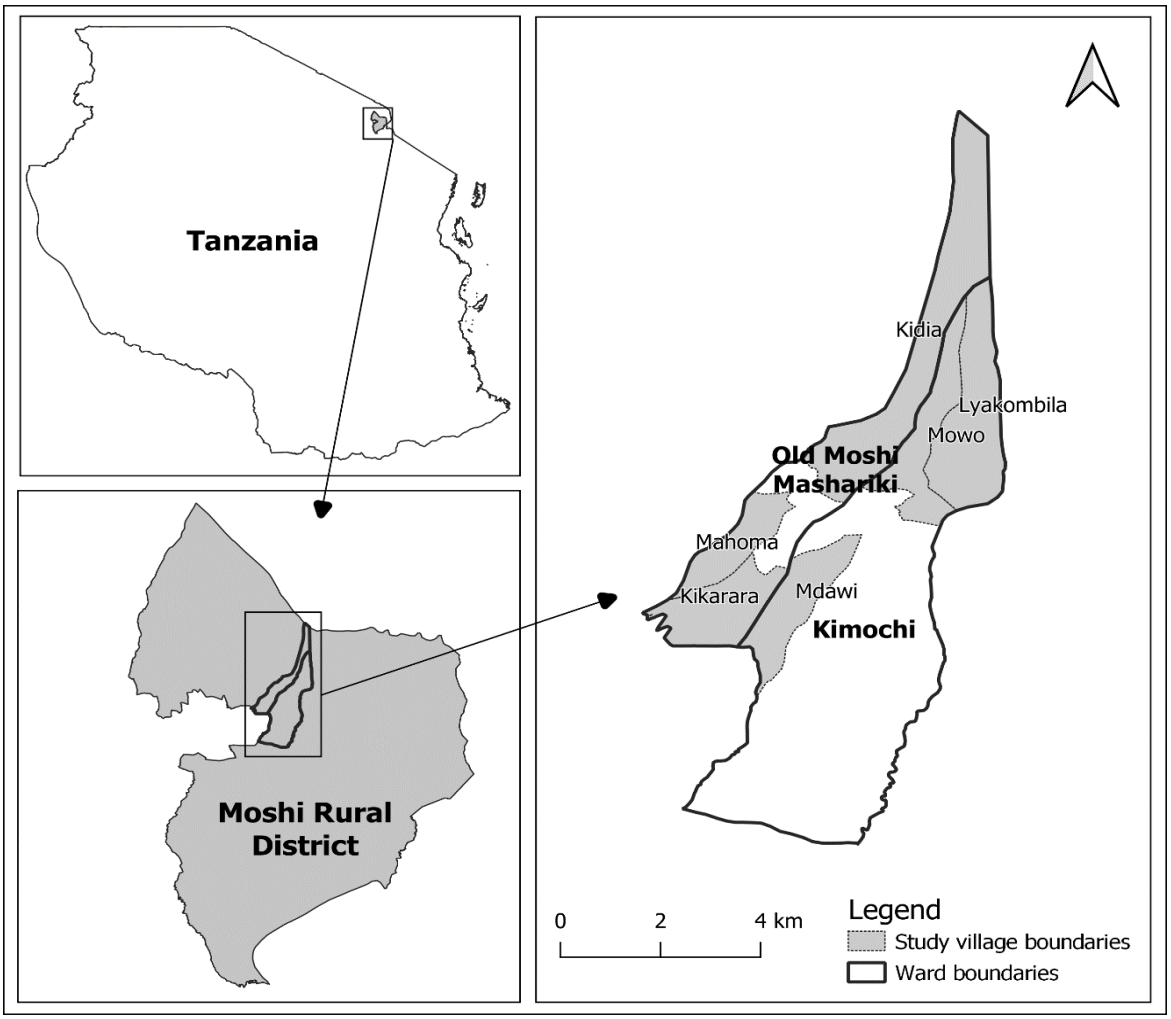

Figure 1.2: Map of Tanzania showing the location of study villages

Socio-economic activities include small scale crop production, especially banana (*Musa acuminata*), yams (*Dioscorea spp*), taro plants (*Colocasia esculeta*) and sweet potatoes (*Ipomea batatas*). Also, they grow cereal crops especially maize (*Zea mays*) and leguminous plants (*Fabaceae*) and keep animals by zero grazing farming, especially dairy cattle, goats, pigs and poultry including chickens, ducks and pigeons. Cattle are kept for milk, while goats and pigs are reared for meat, either for sale or for home consumption (Kimaro *et al.,* 2019). The major land uses in this area are influenced by the altitudinal gradient. Lower areas are dominated by maize mono-cropping and pastoralism (Misana *et al*., 2012).

In the mid areas (1200 to 1350m above sea level) the dominant farming systems are coffee-banana agroforestry and increasingly also maize fields. In upper areas (1350 to 1600 m above sea level), Chagga home gardens, a traditional form of agroforestry with banana and coffee are dominant crops, which have been cultivated for centuries by local inhabitants.

East Old Moshi and Kimochi water projects were inaugurated in 1965 and 1967 respectively when the villages were struck by drought and people suffered from measles and worms especially in lower part villages where the problems were severe (de Haas and Borst, 2012). To tackle this problem, a pipeline was laid from Kirua Dam on the Cholo River. Currently, after maintenance and addition of another 7 new springs (Kipure, Mbonga, Msaranga, Machoneni in East Old Moshi and Kinyaha Juu, Kinyaha Chini, Kimarare in Kimochi ward) into the system, the projects are approximated to serve the population of more than 9 528 and 13 562 people respectively who live in the villages where these springs serve (Kimaro *et al.*, 2019).

East Old Moshi Domestic water project serve people who live in the villages, namely Kidia, Mahoma, Tsudunyi and Kikarara while Kimochi Domestic water project serves people who live in Mowo, Lyakombila and Mdawi Villages Therefore, Meta *et al.* (2016) argue that, in combination with the poor technical state of the system, in many parts of the villages (especially in the lower areas) there is no or only very little water available in the system. Especially since water supply in most parts of the villages is not available all days of the week, everybody tries to extract and use or store as much water as they can. Moshi Rural District and the wards were purposely selected due to the existence of information on unsustainable water use and conservation measures (Misana *et al.*, 2012; Kimaro *et al.*, 2019).

1.10.2 Sampling techniques

The study employed purposive and simple random sampling. Within the district, two wards of East Old-Moshi and Kimochi were purposively selected out of 31 wards in the district. Within each ward, three villages were randomly selected because they both have similar water status. The villages were Kidia, Kikarara and Mahoma from East Old Moshi Ward and Mdawi, Lyakombila and Mowo from Kimochi Ward (Fig.1.2). In each village, 25 households were randomly selected (in order to avoid biasness) making a total of 150 households.

1.10.3 Data collection

Data collection was conducted between October 2019 and March 2020. Questionnaire were administered to 150 households in six villages. The questionnaire comprised information about respondents' characteristics, livelihood strategies, domestic water use, and WCMs. The questionnaire was prepared in Kiswahili to avoid language barriers, as most of the community members do not understand English. One Focus Group Discussion (FGD) was held in each village. A FGD was composed of one village chairman, one domestic water project committee member, and six community members who were beneficiaries of the domestic water project selected on the basis of balancing equality on age, sex and education level. Moreover, four key informants were interviewed from district to village level including District Water Engineer, Operational Officers, Ward Executive Officers (WEO), and Village Executive Officers (VEO) to obtain general information on administrative activities, ward water project, and community members' application to WCMs.

1.10.4 Data analysis and interpretation

Data processing involved coding, summarizing, recoding, analysis, and interpretation. The IBM SPSS Statistics and Microsoft Excel were used to analyse quantitative data. For descriptive analysis, ratios, rates, percentages and frequencies were used. Moreover, cross-tabulation with Chi-Square Test was used to test association between livelihood characteristics and patterns of water use and conservation measures by the local communities. In addition, an index scale (as seen in Appendix 1) was used to determine community members' extent of participation in domestic water projects at the village level. The scale had nine (5) items to each of which the respondents were asked to respond Very low (1 point), Low (2 points), Moderate (3 points), High (4 points) or Very high (5 points). The results from quantitative analysis were presented in the form of charts and tables. Also, qualitative data were analysed and interpreted through narrative and thematic analysis and then presented in detailed narratives.

For inferential analysis, an Ordinal Logistic Regression model was used to assess factors related with community's participation in WRM. Moreover, a binary logistic regression model was used to assess factors affecting community's choice of WCMs.

The ordinal logistic regression model was specified as follows:

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_5 x_5 + \varepsilon$ ……..…… (1)

where:

y = the extent of participation in water resources management [0 = Low (1.16 to 2.47), 1 = Moderate (2.48 to 2.83), 2 = High (2.49 to 4.00)]

$\beta_1, \beta_2, \ldots, \beta_5$ = Coefficients of the independent variables showing how they influence y

x_1 to x_5 = Independent variables and

ε = Random error term showing the influence of other factors not explained by the model

x_1 = Actual income

x_2 = Presence of tap

x_3 = Actual age

x_4 = Household size

x_5 = Distance to main source of water point

x_6 = Days receiving water

x_7 = Years of schooling

x_8 = Ward of respondent.

The binary logistic regression model was used to determine the factors influencing community choice of water conservation techniques. The probability that a water conservation measure would be adopted was defined as:

Logit (Y) = $\alpha + \Sigma\beta 1\ X1 + \Sigma\beta 2\ X2 \ldots + \Sigma\beta n\ Xn + \varepsilon i.$ …… (2)

Where: Y = dependent variable (choice of WCMs), with 1 = adopters of WCMs and 0 = non-adopters; α = intercept; $\beta 1$, βn = coefficients of the independent variables indicating the influence of these variables on the likelihood of choice; $X_1, \ldots, X_{11}$ = the independent variables.

KII and FGD findings (Qualitative data) analyzed and interpreted through narrative and thematic analysis then presented in detailed shorts narratives.

1.11 Organization of the Dissertation

This dissertation consists of two publishable manuscripts which are presented in chapters 2 and 3. The whole dissertation is organized in four chapters: the first chapter consists of the introduction of the overall theme studied. And offers a description of the key concepts presented in the separate manuscripts. Chapter two contains publishable manuscript

Number 1 which covers the first and second specific objectives and answers the first and second research questions of the study. Chapter three contains publishable manuscript Number 2 which covers the third objective and answers to the third research question of the study. Lastly, chapter four presents the study general conclusions and recommendations.

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CHAPTER TWO

2.0 THE EXTENT OF LOCAL COMMUNITIES' PARTICIPATION IN WATER RESOURCES MANAGEMENT IN MOSHI RURAL DISTRICT, TANZANIA

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Abstract

In Tanzania, studies show that the partnership-based model involving community members has a huge potential to bridge water supply gaps especially in underserved locations where state-based public utilities, market-based solutions and public-private partnerships have failed to improve people's access to safe water. However, there is a lack of enough information on the extent of community's participation in water resources management in Moshi Rural District. The study aimed at assessing the extent of local communities' participation in water resources management. Structured interviews were used to collect data from 150 respondents who were randomly selected from two wards (East Old Moshi and Kimochi). A Chi-Square test showed that participation in project meetings was associated with sex of the respondent, sex of the household head and

marital status of the household head. Ordinal logistic regression analysis results revealed a significant association between overall participation in WRM and respondents' wards, respondents' years of schooling and the days' respondents received water. The study findings show that the poor participation in WRM in the study area are contributed by different factors such as poor leadership, Lack of education and poor water services. The study recommends improving awareness to community members on the power of unity and effective involvement in the water project and regular maintenance of project infrastructure in order to improve the water availability in the study area.

Key words: Community participation, Socio-economic factors and WRM

2.1 Introduction

The Sustainable Development Goals' (SDGs') target regarding access to safe drinking water show that 7 out of 8 regions including Sub-Saharan Africa are currently off track to achieve universal coverage by 2030 (UN-Water, 2020). In Sub-Saharan Africa, the number of people lacking safely managed drinking water has increased by more than 40% since 2000 (United Nations, 2018). Considering the importance of this limited resource, the Tanzania Development Vision 2025 was formed and one of its targets is to achieve universal access (100%) to water supply in urban areas and 90% of water supply coverage in rural areas by 2025 (URT, 1999).

Studies show that, to attain the Tanzania Development Vision 2025's targets on water, partnership-based model involving community members has a huge potential to bridge water supply gaps especially in underserved locations where state-based public utilities, market-based solutions, and public-private partnerships have failed to improve people's access to safe water (Seluhinga, 2013; Mokiwa, 2015 and Daluwatte *et al.,* 2020). On the slopes of Mt. Kilimanjaro which is recognized as an important water tower in East Africa

and Africa in general, and which is one of the UNESCO's world heritage sites due to its high biodiversity (Zech *et al.,* 2014), human population, climatic change and unsustainable land management practices have increased causing pressure on water resources leading to its scarcity for domestic and agricultural uses (Meta *et al.,* 2016). The northern parts of Moshi Rural District (in Kilimanjaro Region) have their social economic activities, which are strongly dependent on water through old infrastructure and catchment points (Kimaro *et al.,* 2019). In Tanzania, studies show that community participation is among the major means that simplify management of domestic water projects at different stages from designing, planning, implementation, as well as monitoring and evaluation (Dungumaro and Madulu, 2002 and Kirenga *et al.,* 2018), but studies on community participation in management of water resources has not adequately been explored in Moshi Rural District particularly Kimochi and East Old Moshi wards.

Several studies have been conducted on community participation in management of water resources in Kilimanjaro such as Meta *et al.* (2016) who assessed economic efficiency of domestic water allocation in north-eastern Tanzania and recommended that the emphasis should be on management by participation through formulation of village water committees that oversee utilities on behalf of community members. Mokiwa (2015) found that few people specifically leaders participated in management of Saaki spring in Hai District and community members do not clearly understand the laws and regulations governing water springs. According to Daluwatte *et al.* (2020), who assessed community empowerment with community based water socio-elites in Kenya, community participation is an essential factor for continuous operations and sustainability of projects but there are different factors affecting community participation, like nature of community, nature of leadership and sense of ownership of the project. However, studies are needed on communities' participation in management of water resources in Moshi Rural District to

show the process which can eliminate the water competitions among the communities surround this important water tower in Tanzania. Therefore, this study aimed at assessing the extent of local community's participation in water resources management in Moshi Rural District, Kilimanjaro.

2.2 Methodology

The study was conducted in six villages found in East Old-Moshi and Kimochi Wards located in Moshi Rural District (Fig. 1.2). The district is found at the base of Mt. Kilimanjaro in the northern part of Tanzania. Two different rainy seasons occur in the study area: the long rains that start from mid-March to the end of May and the short rains that start in October and end in December. The driest period is July through the end of September. The mean annual rainfall increases from 1000 to 1200 mm in the lower areas and from 1800 to 2000 mm in the upper areas (Misana *et al.,* 2012).

According to the Tanzania National Population and Housing Census of 2012 (NBS, 2013), Moshi Rural population was 466 737 people with an average household size of 4.2, mostly composed of the Chagga ethnic group. Moshi Rural District is divided into 4 divisions, 31 wards, and 145 villages. The communities are engaged in agroforestry that involves the cultivation of crops in a mixture of trees and zero-grazing. Some of the tree crops widely grown are: Avocado (*Persea americana*), Jackfruit (*Artocarpus heterophyllus*), Mango (*Mangifera indica*) and Java Plum (*Syzygium cumini*).

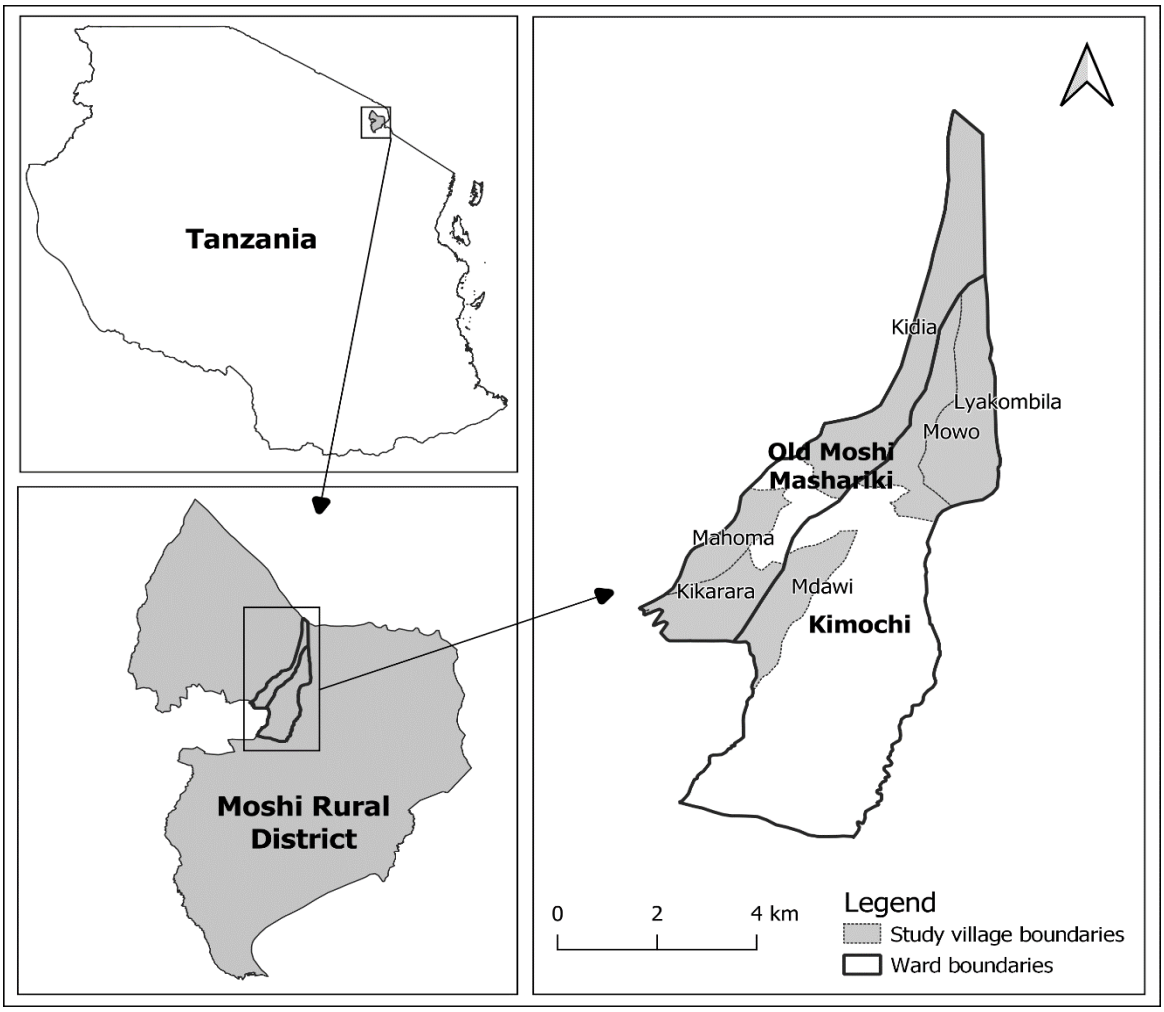

Figure 2.1: Map of Tanzania showing the location of study villages

The socio-economic activities include small scale crop production, especially banana (*Musa acuminata*), yams (*Dioscorea spp*), taro plants (*Colocasia esculeta*) and sweet potatoes (*Ipomea batatas*). Also, they grow cereal crops especially maize (*Zea mays*) and leguminous plants (*Fabaceae spp*) and keep animals by zero grazing farming especially cattle, goats, pigs and poultry like chickens, ducks and pigeons. Cattle are kept for milk, while goats and pigs are reared for meat, either for sale or for home consumption (Kimaro *et al.*, 2019). The major land uses in this area are influenced by the altitudinal gradient. The lower areas are dominated by maize mono-cropping and pastoralism (Misana *et al.*, 2012).

In the mid areas (1200 to 1350 m above sea level) the dominant farming systems are coffee-banana agroforestry and increasingly also maize fields. In the upper area (1350 to 1600 m above sea level), Chagga home gardens, a traditional form of agroforestry with banana and coffee as the dominant crops, have been cultivated for centuries by local inhabitants.

East Old Moshi and Kimochi water projects were inaugurated in 1965 and 1967 respectively when the villages were struck by drought and people suffered from measles and worms especially in villages of the lower parts where the problems were severe (de Haas and Borst, 2012). To tackle this problem, a pipeline was laid from Kirua Dam on the Cholo River. Currently, after maintenance and addition of another 7 new springs (Kipure, Mbonga, Msaranga , Machoneni in East Old Moshi and Kinyaha Juu, Kinyaha Chini, Kimarare in Kimochi ward) into the system, the projects approximately serve the population of more than 9 528 and 13 562 people respectively who live in the villages where these springs pass (Kimaro *et al.*, 2019).

East Old Moshi Domestic water project serves people who live in the villages namely Kidia, Mahoma, Tsudunyi, and Kikarara while Kimochi Domestic water project serves people who live in the villages namely Mowo, Lyakombila and Mdawi. Therefore, Meta *et al.* (2016) argues that, in combination with the poor technical state of the system, many parts of the villages (especially in the lower areas) there is no or there is only very little water available in the system. Especially since water supply in most parts of the villages is not available all days of the week, everybody tries to obtain extract and use or store as much water as they can.

2.2.1 Sampling design

The study employed two sampling techniques, which were purposive and simple random sampling. Moshi Rural District and the wards were purposely selected due to the existence of information on unsustainable water use and conservation measures (Misana *et al.*, 2012; Kimaro *et al.*, 2019). Within the district, two wards East Old-Moshi and Kimochi were purposively selected out of 31 wards in the district. Within each ward, three villages were randomly selected. The villages were Kidia, Kikarara and Mahoma from East Old Moshi Ward and Mdawi, Lyakombila, and Mowo from Kimochi Ward (Fig. 2.1). In each village, 25 households were randomly selected making a total of 150 households.

2.2.2 Data collection

Data collection was conducted between October 2019 and March 2020. Questionnaire copies were administered to 150 households in six villages. The questionnaire comprised information about respondents' characteristics, livelihood strategies, domestic water use, and WCMs. The questionnaire was prepared in Kiswahili to avoid language barriers, as most of the community members do not understand English. One Focus Group Discussions (FGD) was held in each village. The FGD was composed of one village chairman, one domestic water project committee member and six community members who were beneficiaries of the domestic water project selected on the basis of balancing equality on age, sex and educational level to elaborate information obtained from questionnaires. Four key informants were interviewed from district to village level including the District Water Engineer, Operational Officers, Ward Executive Officers (WEO) and Village Executive Officers (VEO) to obtain general information on administration activities, ward water project, and community members' application to WCMs.

2.2.3 Data analysis and interpretation

Data processing involved coding, summarizing, recoding, analysis, and interpretation. The IBM SPSS Statistics and Microsoft Excel were used to analyse quantitative data. Ratios, rate, percentages and frequency distributions were used. Cross-tabulation with Chi-Square was used to measure the association between livelihood characteristics and the pattern of water use and conservation measures by the local communities. In addition, an index scale (as seen in Appendix 1) was used to determine community members' extent of participation in domestic water projects at the village level. The scale had nine (9) items to each of which the respondents were asked to respond Very low (1 point), Low (2 points), Moderate (3 points), High (4 points) or Very high (5 points). Frequency analysis was done to determine the proportion of each code. The results from quantitative analysis were presented in the form of charts and tables. Qualitative data were analysed and interpreted through narrative and thematic analysis and then presented in detailed narratives. In inferential statistics, Ordinal Logistic Regression model was used.

2.3 Results and Discussion

2.3.1 Socio-demographic characteristic of the respondents

2.3.2 Age

The age distribution of the respondents from the study ranged from 20 to 83 years old (Table 2.1). The distribution was grouped into three categories. First, was the youths group with 18 years to young adults of 35 years (13%); second was 36 years to 60 years (33%), and last was above 61 years of age (33%). Most of the respondents (33%) were within the 36 to 60 years' age category. This was caused by young adults' mobility to urban areas in search for part-time jobs and employment. From the demographic data, the mean age of the respondents was 51 years, with a median age of 52 years, a mode age of 57 years and a range of 20 – 83 years.

Table 2.1: Respondent's socio-demographic characteristics (n=120)

	East Old Moshi		Kimochi		All wards	
Sex of respondents		%		%		%
Males	33	44	35	47	68	45
Females	42	56	40	53	82	55
Age Group (Years) of both males and females						
18 – 35	12	16	8	10	20	13
36 – 60	45	60	35	46	80	33
61 and above	18	24	32	43	50	33
Marital Status of both males and females						
Married	57	76	59	79	116	77
Single	3	4	5	7	8	5
Divorced	2	3	3	4	5	3
Widowed	13	17	8	11	21	14
Education level						
No formal Education	3	4	2	3	5	3
Primary	58	77	58	77	11	77
Ordinary	13	17	14	19	27	18
University	1	1	1	1	2	1

2.3.3 Sex of the respondents

Of the 150 respondents interviewed, 45.7% were males and 53.6% were females (Table 2.1). Although the majority of the households interviewed were male-headed households, women were also interviewed because the study was conducted during working hours of the weekdays when males were at work while women were at home proceeding with domestic chores. However, in most cases where men were at home, they took the leading role in the interviews.

2.3.4 Marital status

Of the 150 respondents who were beneficiaries of ward's domestic water project, either directly or indirectly, 77% were married, 5% were single, 14% were widows/widowers

and 3% were divorced/separated (Table 2.1). The per cent of divorce in the study area was lower than the national average of 5.8%, as reported by the National Bureau of Statistics (NBS, 2014b). The per cent of widowhood was higher in this study than the national average of 3% in 2012 as reported by National Bureau of Statistics (NBS, 2014a). This caused by many respondents to belong to advanced age group.

2.3.5 Education level of the respondents

Findings on respondents' levels of education showed that about 77% of the respondents had attained primary education (Table 2.1). This level was higher than the 72% of the heads of agricultural households who had formal education in 2012 (NBS, 2013; 2014b). In addition, 3% of the respondents had no formal education. This per cent was lower than the one reported at the national level which stood at 24% for those who had never attended school in 2007/08 and 18.8% for those who had never attended school in 2012 (NBS, 2013).

2.3.6 Extent of participation of local communities in WRM

The findings regarding respondents' participation show that only 45% and 39% of the respondents had participated in project meetings and project's field works respectively within the past five years (Table 2.2). There was no statistically significant association between level of participation and villages of residence. However, Mahoma and Kidia Villages had the highest levels of participation in meetings, both having 52% of their respondents participating in project meetings. Kikarara Village had the lowest participation level with only 24% of its respondents participating in meetings. Results further revealed that only 39.3% of the respondents were participating in the project's field works. Lyakombila Village had the highest level (68% of respondents) participation in project field works. On the other hand, more than 60% of the respondents in the study area

were not participating in the projects' field works. The majority (72%) of non-participating respondents were found in Kikarara and Mahoma Villages (Table 2.2). Out of the notable differences in participation in project's field works, the Chi-Square test (χ^2 = 5.637, p > 0.05), showing that there was no statistically significant association between the six villages and participation in project meetings and field works.

Table 2.2: Respondents' participation in project meetings and field works, n = 150

	East Old Moshi Ward				**Kimochi Ward**									
Respondents' commitment	Kikarara (n=25)	Mahoma (n=25)	Kidia (n=25)	**Average (n=75)**	Mdawi (n=25)	Mowo (n=25)	Lyakombila (n=25)	**Average (n=75)**	**Average (n=150**	Villages χ^2	df	P-value	Wards χ^2	df	p-value
Participating in meetings	24	52	52	**42.7**	44	48	48	**46.7**	**44.7**	6.510	5	0.260	0.243	1	0.622
Participating in field works	28	28	48	**34.7**	48	32	52	**44.0**	**39.3**	5.637	5	0.343	1.369	1	0.242

The findings in the study as seen in Table 2.2 revealed that the majority of the respondents (more than 55%) were not participating in project meetings. One of the key informants argued that there were different limiting factors against community participation in project meetings including poor leadership which was associated with the use of bad language, lack of commitment, lack of transparency and accountability and corruption. According to Chi-Square test results, as seen in Table 2.2, participation in project meetings was significantly associated ($p \leq 0.05$) with sex of the respondent, sex and marital status of the household head. These findings support those reported in earlier studies by Mokiwa (2015) who reported that only 1.2% of the respondents participated in Saaki spring management in Hai District, in accordance with sex and marital status of the respondents.

In a focus group discussion held at Kidia Village, it was found that, in order for community members to participate willingly, there should be commitment, transparency, and accountability among the leaders in the implementation process of all project activities. The group concluded that villages committee and LGA leaders should have a proper ruling system, which makes every community member feel that their leaders are committed to making the project achieve its aims. Further findings from key informant interviews revealed that the main task then in the project was to modify the system to cope with socio-economic and environmental changes; a key informant argued:

> "*The domestic water project, which was initiated more than half-a century ago in the 1960s and became functioning in 1974, is currently running its activities through regeneration of plans to cope with the socio-economic and environmental changes. So, nowadays here in our area, each meeting is organised through making announcement and displaying posters in open platforms to enable all community members be informed of the day, time and place of the next meeting*".

Respondents' participation in the project field works, as seen in Table 2.2, was very poor as only 39.3% of the respondents were participating. The project committees were organising a special day for cleaning water catchment areas using turn taking system whereby every village participated in the activity by taking turns, and project leaders were accountable to the whole schedule. Moreover, during key informant interviews, some weaknesses associated with little knowledge on the roles and responsibilities among community members were reported. One of the key informants at Mowo Village reported:

> "*The schedule for project manual works provides for each beneficiary village to participate in a turn taking. Each village is allocated a specific day for clearing water intake and sources. Those who are not able to participate are required to contribute TZS 10,000/- as a labour charge. Those who fail to contribute money or labour power are fined. However, the problem now is poor enforcement of these by-laws.*"

These findings are in contrast with the findings reported in earlier studies by Meta *et al.*, (2016) in Kirua Kahe Ward in Moshi Rural District which indicated that most (85.2%) of the respondents contributed their labour in water project activities. It was revealed that the East Old-Moshi Ward had 42.7% of the respondents participating in meetings (Table 2.2). This was lower than that in Kimochi Ward, which had 46.7% of the respondents participating. The Chi-Square test showed statistically significant association between participation in project meetings and sex of the respondents ($\chi^2 = 10.087$, $p \leq 0.01$). Sex of the household head ($\chi^2 = 4.244$, $p \leq 0.05$) and marital status of the household head ($\chi^2 = 11.857$, $p \leq 0.01$) (Table 2.3) were significantly associated with participation in project meetings. The East Old-Moshi Ward had 34.7% of the respondents participating in field works.

This per cent was lower than that in Kimochi Ward, which was 44% of the respondents participating in such activities. The Chi-Square test ($\chi^2 = 1.369$, $p > 0.05$) showed no

statistically significant association between wards of residence and participation in field works. However, Chi-Square test results revealed that participation in project field works was significantly associated with the respondents' sex (χ^2 =11.852, $p \leq 0.01$) and education level (χ^2 = 18.755, $p \leq 0.01$) (Table 2.3).

Table 2.3: A summary of Chi-Square test results showing factors associated with respondents' participation in meetings and field works (n = 150)

Variables	Meetings			Field works		
	χ^2	df	p-value	χ^2	df	p-value
Sex of household head	4.244	1	0.039	2.079	1	0.149
Sex	10.087	1	0.001	11.852	1	0.001
Education level	8.152	5	0.148	18.755	5	0.002
Marital status	11.857	3	0.008	4.116	3	0.249
Presence of public tap at household	0.315	1	0.575	3.117	1	0.077
Occupation	2.358	4	0.670	9.639	4	0.047
Ward	0.243	1	0.622	1.369	1	0.242
Village	5.637	5	0.343	6.510	5	0.260

In parametric analysis, t-test results showed that there was no significant difference ($p = 0.199$) in level of participating in project meetings by age of respondents (Table 2.4). On the other hand, Age did not differ significantly between respondents who participated in field works and those who did not participate the p-value for level of participation in project field works was 5.217.

In non-parametric analysis, Mann-Whitney U test showed that there was a significant difference in level of participation in field works between respondents with different weekly incomes (U = 3,389.500, z = 2.737, p = 0.006, r = 0.0182. However, the Mann-Whitney test showed that the participating and non-participating in meetings did not differ

significantly between respondents' weekly income (U = 3,055.500, z = 1.049, p = 0.294, r = 0.086.

Table 2.4: T-test showing factors affecting respondent's participation to meetings and field works (n = 150)

	Grouping variable Participating	n	Test variable (Mean age of respondents)	F-value	p-value
Meetings	No	83	52.51		
	Yes	67	52.85	0.199	0.656
Field works	No	91	55.58		
	Yes	59	48.15	5.217	0.024

2.3.7 Challenges that hinder respondents' participation to project meetings and field works

Several factors were found to limit respondents' participation in meetings and field works. The multiple response analysis results showed six main challenges, which were further grouped into three categories as follows: (a) Lack of education [being busy with domestic chores(23%)], (b) Kind of leadership [poor leadership (26), opinions are not taken into account (19%), corruption (13%), lack of transparency and accountability (7%)] and (c) Type of services provided [poor water services (12%)]. Almost two-thirds (65.50%) of the respondents cited problems related to leadership constraints.

Problems like poor leadership, opinions are not taken into account, corruption, lack of transparency and accountability show that there is a need to formulate the project leadership in a way that each community member will have power in it and will feel happy to cooperate with their leaders to develop the project. In a group discussion, participants from Mdawi Village exposed that poor water services were the major problem. This was

reported to discourage community members from participating in project activities since they felt as being neglected by the project. A focus group discussion held at Kikarara Village cited corruption and misappropriation of project assets as their major challenge. The participants in a group discussion argued as follows:

> *"We received aid of pipelines and cash from the wife of the former president Mr. Benjamin William Mkapa, but the aid has not been used to convey water to the lower parts of the ward as targeted. Both the money and pipelines have disappeared in the hands of our leaders. We tried to seek solution through the court but those whom we sent have failed".*

The findings relate to those reported earlier by Julio (2001) in Lima, Peru who argues that one of the major challenges in water resources management was inadequate water policy as well as weak and ineffective water authority and institutional arrangements.

2.3.8 Possible solutions to solve participation problems

Multiple responses analysis was used to obtain respondents' views solutions to participation problems. The results revealed that more than a quarter of the respondents (26%) suggested that education should be improved to community members. Other mentioned suggestions were: Listening and taking into account the opinions (23%), changing leadership (17%), improving water services (16%), forming new laws and enforcing the existing laws (12%) and greater transparency and accountability among leaders (7%). The findings revealed that education is still a major solution to many problems facing community members. More than a quarter of respondents (26%) mentioned it as a possible measure. In clarification of the point "provision of education", one of the participants contended that education to women should be given priority; he said:

"Women should be given first priority in education because they have left the project issues to their husbands and brothers. This can be revealed in the meetings; there are more men than women. It seems that they don't know that their opinions can make better changes to develop the project".

In the study area there were many possible solutions mentioned by the respondents, but they were grouped into 6 categories. However, they were further grouped into 3 major groups: kind of leadership (59%), education (26%) and service provided (16%). The findings related to possible solutions reported earlier by Mjema (2017) who recommends for enforcement of by-laws, ensuring regular monitoring, accountability of sub-project committees to increase actors' awareness of their roles for sustainability of the sub-projects as possible solution.

2.3.9 Community member' awareness on their roles and responsibilities to the project

It was revealed that the problem causing poor commitment to the project participation in the meetings and field works was not so much caused by the respondent's awareness of roles and responsibilities. This is because more than 58% of the respondents said that they well understood their roles to the project, 28% were not aware and about 12% were aware at to a moderate level. In addition, 84% of the respondents were able to mention their two basic roles while 52% were able to mention their three basic roles. Therefore, the majority of the respondents had problems neither with awareness nor with understanding their roles. The results imply that the community members lacked proper knowledge on the effects of their irresponsible behaviour to project matters.

2.3.10 Community involvement in different levels of the project implementation

The results showed that most of the respondents scored 2.52 out of 5.00 on involvement in different project implementation activities, which means they were generally poorly involved in all six different activities of project implementation (Table 2.5). The majority of Mdawi Village's respondents was rated as having high level of community participation (score 2.87). Mahoma's respondents had the lowest community participation in the study (score 2.23). At the wards level, East Old Moshi Ward had the lowest score than Kimochi Ward; their mean scores were 2.28 and 2.68 respectively.

The general results in Table 2.5 showed that most (64%) of the respondents admitted that there was poor involvement in project development matters which should include community participation at different stages of project development from planning, implementation of plans, decision making process within the project, control over resources, information sharing as well as monitoring and evaluation. In particular, community participation in the implementation of plans was rated high (83.3%) compared to participation in all other project activities as seen in Table 2.5. However, a focus group discussion held at Kidia Village revealed that there was a risk of engaging community members in implementing things which they did not take part in planning. One of the members argued as follows:

> *"Community members may lack a sense of ownership and may be unwilling to implement unless coercion is exercised. As a result, community members may not consider the process as their own responsibility; they may only implement it for fear of being penalised, but not because they want better results"*.

On the other hand, community participation in decision-making was rated low (77.3%) on all other management activities. In the domestic water project, decision-making was

regarded as the reasoning process, which resulted to selection of a course of action among several possible options. Members of a focus group discussion in Mdawi Village said:

> *"There is a risk of selecting a wrong decision where community members are not properly included in the process because always alternatives are chosen based on the value, preference and the beliefs of the decision makers".*

Attitude towards participation was also determined by the project committee members who could influence community members to participate either highly or poorly in project implementation. These findings relate to those reported in Morogoro by Seluhinga (2013) which revealed that community members were not involved in planning and decision making in WRM although they were the first to note whenever water problems occurred in the study area.

In particular, the findings show that community participation in implementation of plans was rated high compared to participation in all other project activities. The findings indicate that most of the respondents said that there was good participation of community members in the implementation process (score = 4.17). On the other hand, community participation in decision-making was rated low (score 1.85) of all other management activities. However, Mdawi Village had high percentage of members reporting that decision-making was properly inclusive (score 2.40). On the other hand, Kikarara Village was rated the lowest on involvement in decision-making (score 1.60).

Chi-Square test between two wards shows statistically significant association between wards and control over resources ($\chi^2 = 13.771$; $p \leq 0.010$), as well as monitoring and evaluation ($\chi^2 = 11.038$; $p \leq 0.05$). At the village level, Chi-Square test results showed statistically significant association between levels of involvement in different project

implementation and planning ($\chi^2 = 32.232$; $p \leq 0.05$), control over resources ($\chi^2 = 35.436$; $p \leq 0.05$), as well as monitoring and evaluation ($\chi^2 = 32.710$; $p \leq 0.05$).

Table 2.5: Assessment of respondents' involvements in different levels of the project implementation (n = 150)

1= Very poor, 2= Poor, 3= Moderate, 4= High, 5= Very high	**East Old Moshi Ward**				**Kimochi Ward**										
	Kikarara (n=25)	Mahoma (n=25)	Kidia (n=25)	**Average (n=75)**	Mdawi (n=25)	Mowo (n=25)	Lyakombila (n=25)	**Average (n=75)**	**Average (N=150**	Villages χ^2	df	P-value	Wards χ^2	df	P-value
Planning	1.84	1.84	2.24	**2.0**	2.64	2.12	2.32	**2.4**	**2.17**	**32.232**	**20**	**0.041**	**6.431**	**4**	**0.169**
Implementation of plans	4.20	4.12	3.92	**4.1**	4.44	4.36	3.96	**4.3**	**4.17**	**8.605**	**20**	**0.987**	**1.489**	**4**	**0.829**
Decision making process within the project	1.60	1.64	1.76	**1.7**	2.40	2.08	1.64	**2.0**	**1.85**	**22.006**	**20**	**0.340**	**4.8000**	**4**	**0.308**
Control over resources	2.04	1.24	1.64	**1.6**	2.28	1.92	2.40	**2.2**	**1.92**	**35.436**	**20**	**0.018**	**13.771**	**4**	**0.008**
Information sharing	2.40	2.52	2.12	**2.3**	2.72	2.80	2.16	**2.6**	**2.45**	**28.540**	**20**	**0.097**	**5.502**	**4**	**0.240**
Monitoring and evaluation	1.64	2.00	2.28	**2.0**	2.72	2.44	2.76	**2.6**	**2.30**	**32.710**	**20**	**0.036**	**11.038**	**4**	**0.026**
Average	**2.29**	**2.23**	**2.33**	**2.3**	**2.87**	**2.62**	**2.54**	**2.7**	**2.48**						

2.3.11 Factors associated with community involvement in different levels of the project implementation

The factors associated with community involvement in WRM are presented in Table 2.6. Ordinal logistic regression analysis results revealed a statistically significant association between participation in WRM and years of schooling of respondents and days of receiving water. Also, the model showed non-statistical significance between the following predictor variables and participation in WRM in descending order: Actual income, presence of tap in the household, actual age, household size, distance to main source and sex of respondent.

Table 2.6: Ordinal logistic regression results showing factors associated with respondents' overall involvement in different levels of project implementation (n =150)

Predictors	Estimate	Std. Error	Wald	df	Sig.
Overall participation = 0	0.915	1.121	.666	1	0.414
Overall participation = 1	2.458	1.139	4.656	1	0.031
Actual income	-5.852E-006	8.121E-006	0.519	1	0.471
[Presence of tap = 0]	-0.555	.584	0.903	1	0.342
[Presence of tap = 1]	0	.	.	0	.
Actual age	-0.013	0.013	0.955	1	0.329
Household size	0.100	0.095	1.113	1	0.291
Distance to main source	-0.046	0.043	1.147	1	0.284
[Sex, Male = 1]	0.614	0.400	2.360	1	0.124
[Ward = 0]	-1.611	0.358	20.210	1	0.0121
[Ward = 1]	0[a]	.	.	0	.
[Sex, Female = 0]	0[a]	.	.	0	.
Days receiving water	0.270	0.126	4.619	1	0.032
Years of schooling	0.246	0.079	9.726	1	0.002

Model Fitting Information: Chi-Square = 37.851 (p = 0.000), Goodness-of-Fit Chi-Square = 291.224 (p = 0.419), Cox and Snell R^2 = 0.223, Nagelkerke R^2 = 0.255

Positive coefficients ‘in estimate’ indicate that participation in WRM was influenced by the corresponding variable in the raw (years of schooling, household size, days receiving water, and sex of respondent). The negative coefficients show that participation in WRM was less associated with the predictor variables (actual age, presence of tap at home, actual income, distance to the main source of water and ward). The Chi-Square for Model Fitting Information was significant (p = 0.000), which means that the independent variables entered in the model were good predictors of the outcome. Both Pearson (0.419) and Deviance (0.732) Chi-Square values were not significant, meaning that the model was not a good fit. Nagelkerke R^2 was 0.255, which means that about 25.5% of the chances of the respondents’ being involved in WRM were predicted by the predictor variables entered in the model.

The data in Table 2.6 show significant relation between wards, education levels of respondents as well as numbers of days respondents had received water and respondents’ involvement in different stages of the project development. At the ward level, Kimochi was more characterized by poor community involvement than East Old Moshi Ward. The results show the importance of education to community members, since for a unit increase in schooling (1 year of schooling) the odds of being grouped in the high scores category increased by 0.246 while the other variables in the model were held constant. The results are related to those presented by Nkonjera (2008) in Mbeya District which showed that there was a statistically significant relationship between level of participation and household income, village size and sex.

2.3.12 Satisfaction of community members in relation to involvement in different levels of project implementation

Among other things, data were collected to know the satisfaction levels and their justification. The findings showed that 62% of the respondents were not satisfied with the level of their participation in domestic water projects at the ward level in the study areas. The other satisfaction levels in descending order were: agree (30%), moderate (17%), disagree (13%) and strongly disagree (8%). The multiple responses analysis was used to get respondents' justification for their lack of satisfaction with the way they had been involved in the project implementation. These justifications were grouped into 5 main categories namely, disregard of the people's opinions (27%), late delivery of information and reports (21%), poor participation in decision-making (20%), lack of transparency and accountability among project leaders (17%) and poor participation in planning (15%).

Moreover, the respondents explained the manner in which they would like to be involved in future domestic water projects. The responses were grouped into 5 main categories: participation in planning, participation in decision making, provision of project reports and information in time, training on water resources and environmental conservation and wider opportunities of providing opinions.

Data showed that 62% of the respondents were not satisfied with their involvement in different stages of the project development. The respondents mentioned reasons for dissatisfaction such as, disregard of the people's opinions (27%), late delivered of information and reports (21%), poor participation in decision-making (20%), lack of transparency and accountability among project leaders (17%) and poor participation in planning (15%). Further findings, from focus group discussion revealed that community members were not given development reports transparently on a quarterly basis and

sometimes they were not given anything at all. In this respect, one of the participants recommended the following:

> "*Project leaders together with LGAs should ensure that community members are provided with development reports transparently and on a quarterly basis. The reports should be disseminated through all available platforms in the villages where community members can read and understand each item easily."*

Also, one of the key informant interviewees argued that project leaders together with LGAs should ensure that before implementing or taking any actions they should seek communities' views to avoid grievances, conflicts and misunderstandings from the communities to enable a smooth running of project activities. Implementation of these recommendations will also address corruption and misappropriation of project resources. It would also ensure that better water services are rendered to the public.

The findings are consistent with the findings reported by Mjema (2017) which revealed that the majority of the respondents in irrigation schemes were not satisfied with the condition of sub-project infrastructures. In addition, the study findings are in line with the findings reported by Mokiwa (2015) who revealed that more than 81% of the respondents were not satisfied with the management of Saaki spring while only 18.8% of the respondents were satisfied.

2.3.13 Women involvement

The study also intended to find out the extent to which women participated in planning and implementation of water projects (Table 2.7). The study findings show that there was poor women participation in project matters in general; the general score (1.44) revealed that most of the respondents admitted that there was no special consideration for vulnerable groups and women in terms of engagement in the project implementation.

Table 2.7: Assessment of women's participation in the water projects (n = 150)

1= Very poor, 2= Poor, 3= Moderate, 4= High, 5= Very high	**East Old Moshi ward**						**Kimochi ward**								
	Kikarara (n=25)	Mahoma (n=25)	Kidia (n=25)	**Average (n=75)**	Mdawi (n=25)	Mowo (n=25)	Lyakombila (n=25)	**Average (n=75)**	**Average (N=150**	Villages χ^2	df	P-value	Wards χ^2	df	P-value
There is special consideration for women and vulnerable groups	1.36	1.68	1.48	**1.5**	1.44	1.40	1.28	**1.4**	**1.4**	15.264	20	761	4.35	4	0.294
Project will be more successful if women and vulnerable groups will be included	3.48	3.04	3.44	**3.3**	3.20	4.20	3.20	**3.5**	**3.4**	33.697	20	0.028	6.484	4	0.166

The findings in Table 2.7 showed the average of 1.4 scores in the question of special consideration for women and vulnerable groups. This implies that there is still gender biasness to participation in some of development projects in rural. The study suggests that education should be provided to all community members especially women who seem to be reluctant to participate. During an FGD, it was revealed that women were not well involved since they only used their partners to get information on what was happening and to represent the household. Participants in an FGD agreed as follows:

"In Chagga communities, men have more power and say than women who are considered as subordinate members at the family and at the community level. These cause women to be reluctant of giving their opinions before men in the public".

Data from key informant revealed that one of the key challenges to women participation in water projects was women's involvement in farming and domestic activities, which are the daily routines for most women as opposed to men. A key informant argued that:

"Farming activities and domestic chores are normally done by women; they keep women busier than men even during weekends when village meetings are usually held".

The findings are similar to the findings reported by Seluhinga (2013) who investigated local institutions and water resources management in Morogoro Tanzania. She reported poor women's participation and calls for local communities to be involved at all stages of water management while ensuring full involvement of women because of their crucial roles in the day-to-day supply, management and use of water. Also, the study findings are in line with observations in studies by Guijt and Shah (1998) who found poor women's participation in development projects and hence called for participatory development projects to address gender inequalities through providing means by which women can take part in decision-making processes.

2.3.14 Project committees in relation to community participation

The study findings showed that project committees in villages lacked ability of organizing, supervising, and managing domestic water projects (Table 2.8). In general, committees' score was 1.75. Mdawi Village had the highest score (1.98) while Kidia had the lowest score (1.56) compared to other villages. At the ward level, East Old Moshi Ward had lower average score than Kimochi Ward; their average scores

were 1.25 and 1.38 respectively. Chi-Square tests showed statistically significant association between wards and the perception of committees to serve others ($p \leq 0.001$). Also, at the village level, the Chi-Square test results showed statistically significant association between villages and projects' commitment to serve others ($p < 0.001$).

Table 2.8: Attitudes towards project committees' performances (n =150)

1= Very poor, 2= Poor, 3= Moderate, 4= High, 5= Very high	**East Old Moshi ward**				**Kimochi ward**										
	Kikarara (n=25)	Mahoma (n=25)	Kidia (n=25)	**Average n=75**	Mdawi (n=25)	Mowo (n=25)	Lyakombila (n=25)	**Average n=75**	**Average N=150**	Villages χ^2	df	P-value	Wards χ^2	df	P-value
Possess basic knowledge and skills to run this project	1.72	1.76	1.60	**1.69**	1.96	1.44	1.80	**1.73**	**1.71**	**17.553**	**20**	**0.617**	**5.256**	**4**	**0.262**
Motivating others for valuing of project infrastructures	2.24	2.08	1.92	**2.08**	2.20	2.12	2.32	**2.21**	**2.14**	**11.024**	**20**	**0.946**	**1.088**	**4**	**0.896**
Transparent and accountable	1.60	1.20	1.32	**1.37**	1.36	1.40	1.36	**1.37**	**1.37**	**14.537**	**20**	**0.802**	**1.311**	**4**	**0.859**
Have commitment to serve others	1.56	1.52	1.40	**1.49**	2.40	1.80	1.88	**2.03**	**1.76**	**48.008**	**20**	**0.000**	**36.359**	**4**	**0.000**
Average	**1.78**	**1.64**	**1.56**	**1.66**	**1.98**	**1.69**	**1.84**	**1.84**	**1.75**						

Committees seemed to have been rated poor on all the aspects except on efforts of motivating others to attach value to project infrastructures where the score was 2.14 (Table 2.8). In particular, committees' responsibility to motivate others valuing project infrastructure was rated better than other aspects. Lyakombila Village was the most highly rated (score 2.32) while Kidia Village was rated very poor (score 1.92). The committees' transparency and accountability were rated as the poorest aspects on committees' responsibilities. Mahoma was the village which was rated the poorest (score 1.20) compared to other villages.

The study findings in Table 2.8 show that the project committees in villages lacked ability of organizing, supervising and managing the domestic water project (score was 1.75). It was further revealed during focus group discussions and key informant interviews that the existing village committees did not have formal and workable technical knowledge on maintaining the project's physical infrastructure and managing the project activities in general. For example, in Mdawi Village, the FGD participants complained against irresponsiveness of Village Councils and project committees, which failed to take action of ensuring that water was regularly available to customers for uses, especially at the end points.

Further findings from key informants revealed that the committees lacked regular training and allowances to motivate them to perform their duties. One of the committee members who was also a key informant argued that:

> *"Project committees lack stable sources of income or regular allowances and technical trainings to enable them carry out minor maintenance and rehabilitation of project infrastructures. As a result, the community water committees are not fully functional and do not have technical skills to make informed decisions.*

2.3.15 Environmental protection

Local governments in the study areas have a significant contribution to protect environment and water sources in that 32% of respondents mentioned it as one of the important actors in environmental protection processes. Also, educational institutions such as schools and colleges were mentioned as the second stakeholders in protecting environment, having 25% of respondents who mentioned it. Other actors which were mentioned were as follows in an ascending order: mass media (12%), private institutions (11%), public institutions (8%), cultural norms and traditions (8%) and religious institutions (5%). However, in general, data show that most of the respondents rated the institutional contribution to environmental protection as 'moderate' as the general score was 2.94. In particular, two institutions (education and LGAs) were rated as good at contributing to environmental protection the scores were 3.70 score and 4.16 respectively (Table 2.9). Chi-Square test results showed statistically significant association between wards and mass media's contribution to environmental protection ($\chi^2 = 59.171$; $p \leq 0.001$). Also, at the village level, Chi-Square test results showed statistically significant association between mass media's contribution to environmental protection and villages as well as wards ($\chi^2 = 110.983$, $p \leq 0.001$).

Table 2.9: Institutional supports to environmental protection (n =150)

1= Very poor, 2= Poor, 3= Moderate, 4= High, 5= Very high	**East Old Moshi ward**				**Kimochi ward**										
	Kikarara (n=25)	Mahoma (n=25)	Kidia (n=25)	**Average n=75**	Mdawi (n=25)	Mowo (n=25)	Lyakombila (n=25)	**Average n=75**	**Average N=150**	Villages χ^2	df	P-value	Wards χ^2	df	P-value
Education institutions	4.08	3.60	2.92	**3.53**	3.84	4.12	3.64	**3.87**	**3.70**	24.049	20	0.240	3.945	4	0.413
Religious institutions	1.72	1.64	2.32	**1.89**	2.08	2.16	1.88	**2.04**	**1.96**	23.558	20	0.262	0.688	4	0.953
Private institutions	2.64	2.76	2.44	**2.61**	2.88	2.32	2.28	**2.49**	**2.55**	24.121	20	0.237	3.945	4	0.413
Public institutions	2.52	2.80	2.80	**2.71**	2.88	2.60	2.32	**2.60**	**2.65**	15.152	20	0.768	6.123	4	0.190
Cultural norms and traditions	2.76	2.48	2.76	**2.67**	2.48	2.76	2.40	**2.55**	**2.60**	20.783	20	0.410	4.602	4	0.331
LGA's	4.00	4.68	3.72	**4.13**	4.36	4.00	4.24	**4.20**	**4.16**	27.469	20	0.123	3.934	4	0.415
Mass media	4.24	3.72	2.24	**3.40**	1.68	1.56	1.92	**1.72**	**2.56**	110.983	20	0.000	59.171	4	0.000
Average	**2.95**	**2.99**	**2.83**	**2.92**	**3.09**	**2.99**	**2.79**	**2.96**	**2.94**						

Results showed that different institutions play their part in protecting water sources and environment in general for the better future. Although local government and educational institutions tried their best and succeeded to provide education and the needed apparatus to the community in relation to water sources and environmental protection, most of respondents said that there was a little contribution from the institutions in general as seen in Table 2.9. A key informant interview revealed that the local government authorities played a fundamental part in law making and enforcements to protect environment. One of the key informants said:

> *"A villager who wants to cut his/her tree should write a letter to the Village Executive Officer and to the Village Environmental Committee which should verify if the applicant is eligible to be granted a permit. Then the District Environmental Committee sends its officer to verify if the applicant is eligible to be granted permission. Also, there is a waste disposal by-law which restricts community members from burning or throwing plastic or non-corrosive wastes.*

According to a focus group discussion in East Old-Moshi Ward, there were four catchments namely Kipure, Mbonga, Msaranga and Machoneni. In Kimochi Ward there were three catchments: Kimarare, Kinyaha Juu and Kinyaha Chini. It was revealed that the communities around catchments areas are the ones who carry out socio-economic activities around the catchments areas. Participants in a focus group discussion in Mdawi Village argued that:

> *"Catchments are 'poorly protected because these catchment areas are not enclosed within a fence or hedge for protection against encroachment. For instance, in our village (Mdawi), there are some of catchments, such as Kinyaha Chini, which are found beneath residential areas. This results into contamination of water from domestic activities leading to generation of unsafe and unclean water for human consumption"*.

Although it is believed that effective environmental protection is a source to safe and clean water, the general results from observation showed that different actors have little contribution to environment protection as in the case of protection of spring water sources. The results support those reported earlier by Misana *et al.* (2012) on land-use/cover changes and their drivers on the slopes of Mt. Kilimanjaro which reported that the state mechanism for catchment protection is already established around Mt. Kilimanjaro but cutting of trees can easily be spotted both in Kilimanjaro National Park and in home gardens where local people fail to recognize the importance of maintaining trees.

2.4 Conclusion and Recommendations

From the above findings, it can be concluded that communities' participation in the domestic water project in the study wards is still low. The study findings show that the problems of water competition in the study area is contributed by many factors which can be grouped as lack of community members' commitment to participate in the water project meetings and manual works, poor leadership which causes improper oversight of project resources and lack of transparency and accountability which causes local communities to be discouraged from participating well in the project matters. Also, the study revealed that lack of regular maintenance and repair of reservoirs, break pressure tanks (BPTs), pipes and their valves especially in upper areas cause improper conveyance efficiency and maximize water competition.

However, improvements have to be prioritized where excessive leakages and physical damages are frequent. The public and private institutions have to invest more in awareness creation in order to make sure that all community members are well cooperating with the respective authorities to protect water resources and environment at large. Provision of

awareness will help to improve the situation since there are already strict rules but they are not obeyed by community members due to different reasons mainly because some people do not report their fellow villagers who secretly break the rules.

The study recommends effective community participation to make the project attain its goals to end the water problems for domestic uses. Also, the study recommends that whenever there is a massive transformation in any water system for example from “unpaid water consumptions to paid water consumptions”, community participation should be the first obligation to think about. All groups of community members especially women, elders and the disabled should be included in terms of providing opinions. Also, they have to be given education about how the system will work, how the system is going to benefit them and the government at large. The study also recommends that the costs to be paid by water users should be affordable, reasonable and stable due to the nature of local community in the study area.

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CHAPTER THREE

3.0 FACTORS INFLUENCING COMMUNITY'S CHOICE OF DOMESTIC WATER CONSERVATION MEASURES IN MOSHI RURAL DISTRICT, TANZANIA

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Factors Influencing Community's Choice of Domestic Water Conservation Measures in Moshi Rural District, Tanzania

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Abstract

Domestic water conservation measures are among the fundamental strategies used to overcome water shortages in many homes. The choice of water conservation measures (WCMs) varies among individuals and communities, but there are inadequate studies on this topic in Sub-Saharan Africa. This study analysed socioeconomic factors influencing the choice of domestic WCMs in Northern Tanzania. Structured interviews were administered to 150 randomly selected households from six villages. Binary logistic regression was performed to determine factors associated with the household choice of WCMs. Results revealed that on average 60% of the respondents applied various WCMs. Rainwater harvesting in water tanks was the most preferred water conservation measure followed by the reuse of wastewater and the use of alternative sources of water cleaning. The choice of WCMs was significantly associated with the respondent's age ($p = 0.004$), marital status of the respondent ($p = .006$) and distance to the household's alternative source of water ($p = 0.008$). We recommend water conservation education to elderly people, married couples, and people residing near water sources to improve domestic water conservation among local communities.

Keywords: Water conservation, Water efficiency, Domestic water use, Socio-economic factors.

3.1 Introduction

Water is an essential resource for assuring socio-economic development and for maintaining healthy ecosystems (WSSD, 2002). There have been some important efforts toward bridging the gap between the demand and supply of water worldwide (Tong et al., 2017). Despite these efforts, a recent Joint Monitoring Programme (JMP) reported that over 844 million people (11%) in the world are still without access to improved and safely managed drinking water (WHO/UNICEF, 2017). Globally, the Sustainable Development Goals' (SDGs') targets regarding access to safe drinking water show that seven out of eight regions including Sub-Saharan Africa are currently off track to achieve universal coverage by 2030 (UN-Water, 2020). In Sub-Saharan Africa, the number of people lacking safely managed drinking water has increased by more than 40% since 2000 (United Nations, 2018).

Considering the importance of this limited resource, one of the targets of the Tanzania Development Vision 2025 is to achieve universal access (100%) to water supply in urban areas and 90% of water supply coverage in rural areas by 2025 (URT, 1999). Studies show that to attain the Tanzania Development Vision 2025's targets on water, a partnership-based model involving community members has a huge potential to bridge water supply gaps, especially in underserved locations where state-based public utilities, market-based solutions, and public-private partnerships have failed to improve people's access to safe water (Seluhinga, 2013; Mokiwa, 2015 and Daluwatte et al., 2020).

It has been urged that the community's participation in water conservation is an essential factor for the sustainability of domestic water conservation in Africa (Daluwatte et al. 2020). However, there are various factors affecting the community's participation in water conservation. Meta et al. (2016) found that water scarcity, the average distance to a water

source, the average time spent for water collection, and the average hours of daily availability of water were significant predictors of daily average water usage. Some studies suggest that personal experiences with drought issues provide the best lesson to adopt WCMs since these individuals already feel a moral obligation to conserve water (Tong et al., 2017; Garcia et al., 2013). Another strand of literature identified key factors that drive water-saving behaviour, such as attitudes, beliefs and habits (Fan et al., 2014; Aprile and Fiorillo, 2017; Xue et al., 2017). According to Dungumaro and Madulu (2002), local communities in various areas of Tanzania have developed coping strategies to ensure the conservation of water resources, although some of the traditional strategies have been eroded by modernization factors and population pressure.

The present study sought to assess 1) domestic water conservation measures applied by the local communities, and 2) factors associated with the community's choice of WCMs. The study is in line with the Water Resources Management Act of 2009, an Act that provides for an institutional and legal framework for sustainable management and development of water resources.

3.2 Methodology

3.2.1 Description of the study area

The study was conducted in six villages found in East Old-Moshi and Kimochi Wards located in Moshi Rural District. Moshi Rural District is found at the base of Mt. Kilimanjaro in the Northern part of Tanzania (Fig. 1.). The district is divided into four divisions, 31 wards, and 145 villages. According to the Tanzania National Census (2012), the district has 466,737 people with an average household size of 4.2, mostly composed of the *Chagga* ethnic group. Land use in Moshi Rural District is influenced by the altitudinal gradient. The lower area is dominated by maize mono-cropping and pastoralism (Misana

et al., 2012). The mid-altitude zones are dominated by mixed farming of trees and crops (home garden agroforestry practice). Some of the tree crops cultivated are Coffee (*Coffea arabica*), Avocado (*Persea americana*), Java Plum (*syzygium cumini*), banana (*Musa acuminata*), yams (*Dioscorea spp*), taro plants (*Colocasia esculeta*), and sweet potatoes (*Ipomea batatas*). They also grow cereal crops, especially maize (*Zea mays*) and keep animals by zero grazing farming, especially cattle, goats, pigs and poultry like chickens, ducks and pigeons. Cattle are kept for milk, while goats and pigs are reared for meat, either for sale or for home consumption (Kimaro et al., 2019).

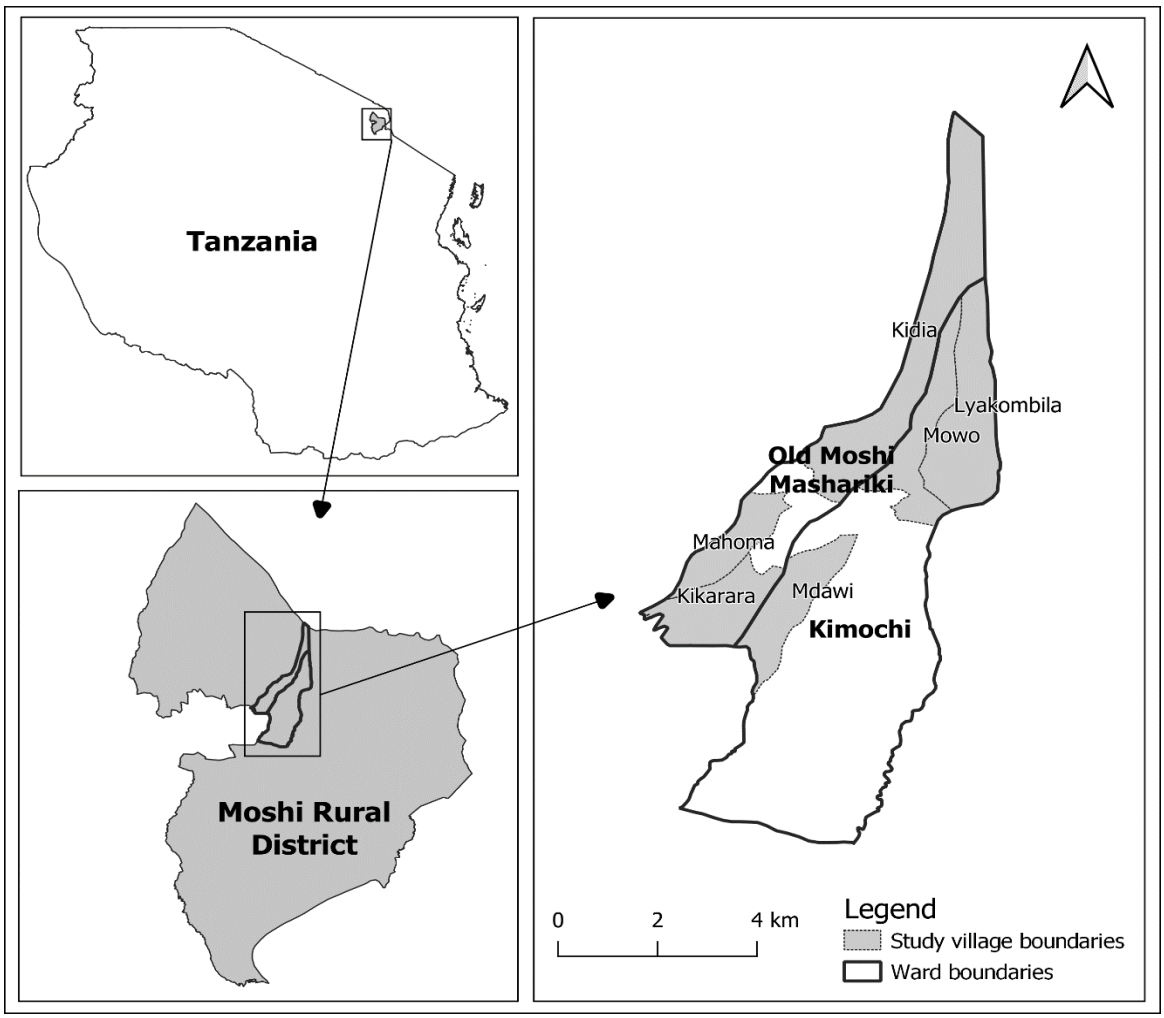

Figure 3.1. Map of Tanzania showing the location of study villages

Two different rainy seasons occur in the study area: the long rains that start from mid-March to the end of May, and the short rains that start in October and end in December. The driest period is July through the end of September. The mean annual rainfall is 1000 to 1200 mm in the lower and mid areas and 1800 to 2000 mm in the upper areas (Misana et al., 2012).

Domestic water supply in Moshi Rural District is currently vulnerable to drought, climatic change, an increase in the human population, old infrastructure and unsustainable water management practices which have increased pressure on water resources leading to its scarcity of domestic water and water for agricultural uses (Kimaro et al., 2019; de Haas and Borst, 2012). Villages in the study area have a centralized piped water system being captured from several springs and streams in the higher parts of the area and flow by gravity to the lower parts of the village but the system is poorly maintained. There is no regular maintenance, only repairs in case there is a problem. Repairs are also difficult due to inadequate funds (Mokiwa, 2015; de Haas and Borst, 2012). In many parts of the district (especially in the lower areas) there is no or there is only very little water available in the system. Water supply to most parts of the villages is not available all day of the week, everybody tries to extract and use or store as much water as they can.

3.3 Sampling Design

The study employed purposive and simple random sampling approaches. Moshi Rural District was purposely selected due to the existence of information on unsustainable water use, and the adoption of water conservation measures (Misana et al., 2012; Kimaro et al., 2019). Within the district, two wards East Old-Moshi and Kimochi were randomly selected out of 31 wards. Within each ward, three villages were randomly selected. The villages are Kidia, Kikarara and Mahoma from East Old Moshi Ward and Mdawi,

Lyakombila, and Mowo from Kimochi Ward. In each village, 25 households were randomly selected making a total of 150 households (Fig. 1).

3.4 Data Collection

Data collection was conducted between October 2019 and March 2020. Questionnaire copies were administered to 150 households in the six villages specified above. The questionnaire comprised information about respondents' characteristics, livelihood strategies, domestic water use and WCMs. The questionnaire was prepared in Kiswahili to avoid language barriers, as most of the community members do not understand English. One Focus Group Discussion (FGD) was held in each ward to supplement the information obtained from the households. The FGD was composed of one village chairman, one domestic water project committee member and six community members selected based on balancing equality on age, sex and educational level to elaborate information collected using the questionnaire.

3.5 Data Analysis

The Statistical Package for Social Sciences (SPSS) for Windows version 12 (SPSS Inc., Chicago, Ill., USA) was used in the analysis. The Binary logistic regression was used to determine the factors influencing the community's choice of water conservation techniques. The probability that a water conservation measure would be adopted was defined as:

$$\text{Logit}(Y) = \alpha + \Sigma\beta_1 x_1 + \Sigma\beta_2 x_2 \ldots + \Sigma\beta_n x_n + \varepsilon i.$$

Where: Y = dependent variable (choice of WCMs), with 1 = adopters of WCMs and 0 = non-adopters; α = intercept; β_1, β_n = coefficients of the independent variables indicating the influence of these variables on the likelihood of choice; $x_1 \ldots x_{11}$ = the independent variables.

Collinearity between independent variables was tested. Independent variables with variance inflation factors (VIF) less than 10 suggested a lack of multi-collinearity. However, O'Brien (2007) suggests consideration of other factors beyond VIF. Such consideration was the justification from theories if the variables that show collinearity measure the same underlying concept.

Following the procedures above, we found and selected eleven independent variables that might affect respondents' decision to adopt WCMs. The variables are described below,

1. *Age of household head*: Elders have traditional knowledge, experience, and a better understanding of the water flow systems, and are better prepared for the choice of WCMs (Grafton et al., 2011; Worthington and Hoffman, 2008). Hence, a positive relationship between age and the choice of WCMs was expected.
2. *Household size*: Individual water consumption decreases with increasing family size (Willis et al., 2013). Hence, a positive relationship between household size and the choice of WCMs was expected.
3. S*ex*: Gender appears to be a determining factor as many observations indicate that women generally consume considerably less water than men (Tong et al., 2017). So men were expected to have poor choices of WCMs compared to women.
4. *Marital status*: Divorced and widowed save less water than single people (Grafton et al., 2011). Hence, marital status was expected to influence the choice of some WCMs.
5. *Income*: The level of income is expected to conform to water conservation since higher income correlates with higher water consumption rates (Willis et al., 2013; Xue et al., 2017). Hence, a positive relationship between income and choice of WCMs was expected.

6. *Distance to the household's source of water*: The further the distance to the source of water, the higher the expected numbers of WCMs applied to avoid many routes/trips to collect water (Garcia et al., 2013). Hence, a positive relation between distance and choice of WCMs was expected.
7. *Education level*: Educated people are expected to be more civilized and use water more efficiently because, as compared to people with less formal education, well-educated people are generally more committed to water conservation (Fan et al., 2014; Aprile and Fiorillo, 2017). Hence, a positive relationship was expected between years of schooling and the choice of WCMs.
8. *Duration of water availability per week*: Respondents receiving tap water are frequently expected to have lower chances to apply WCMs since they have plenty of water without any cost (Meta et al., 2016). Hence, a negative relationship is expected between the duration of water availability and the choice of WCMs.
9. *Awareness of environmental protection laws*: Respondents' awareness of these rules and regulations is expected to increase their choices since WCMs are also environmental friends (Garcia et al., 2013). Hence, a positive relationship was expected between the choice and awareness of these rules and regulations.
10. *Participation in water project meetings:* Respondents' adherence to their roles and responsibilities is expected to facilitate the application of WCMs since meetings are also held to remind them to conserve water.

3.6 Results

3.6.1 Existing WCMs in Moshi rural

Results revealed that on average 90 respondents (60%) used various WCMs whereas 60 respondents (40%) did not use any WCMs (Table 1). The preference of water rain Rainwater harvesting in the tanks was the most preferred water conservation measure in

the study area (41%). Other top three WCMs were the reuse of wastewater (34%), use of alternative sources of cleaning (33%) and performing cleanness for only full loads (32%). A significant different ($p \leq 0.05$) exist between villages and some of the WCMs such as rainwater harvesting in the water tanks, reuse of wastewater, use of alternative sources, performing cleanness for only full loads, and water serving gardens differed significantly among villages.

Table 3.1: Existing WCMs in Moshi Rural District

WCMs	East Old Moshi ward			Kimochi ward			Average (%)	Villages χ^2	df	P-value
	Kikarara	Mahoma	Kidia	Mdawi	Mowo	Lyakombila				
Rain water harvested in tanks	76	60	40	44	12	16	**41.33**	31.562	5	0.000
Application of water serving gardens	60	20	24	36	20	8	**28**	20.238	5	0.001
Start cleanness for only full loads	48	52	20	40	16	16	**32**	15.809	5	0.007
Reuse of wastewater	60	36	36	40	20	12	**34**	15.597	5	0.008
Uses of alternative sources	36	32	36	28	32	32	**33**	15.143	5	0.010
Installation of water efficient devices	20	4	0	12	16	8	**10**	7.778	5	0.169
Rain water harvested in wells	12	12	8	8	4	4	**8**	2.174	5	0.825
Use vessels to tap water when perform cleanness	52	40	12	36	12	28	**30**	0.515	5	0.992
Average	**45.5**	**32**	**22**	**30.5**	**16.5**	**15.5**	**27**			

Results showed that the choice of WCMs was significantly associated with the respondent age (p = 0.004), marital status of the respondent (p=0.006) distance to the alternative source of water (p = 0.008). The odds of adopting WCMs increases by 11 times for every decrease in

household age by 10 years and increases by 3 times if the respondent is single. Furthermore, the odds of adopting WCMs was found to increase by 10 for every increase of the distance to alternative source of energy by 10 km.

Table 2: Factors affecting the community's choice of WCMs

Independent Variables	Estimate (B)	S.E	Wald	df	Sig.	Odds (Exp(B))
Age of respondent (years)	-.051	.018	8.397	1	.004**	1.05
Marital status of respondent (1 married, 0=single)	.919	.538	2.920	1	.006*	3.105
Distance to household's alternative source of water (km)	.037	.014	7.119	1	.008**	1.038
Participation in water project's meetings (1= participate, 0 do not participate)	.629	.417	2.277	1	.131	1.876
Duration of water availability (hours/week)	-.187	.136	1.892	1	.169	.829
Income (TZS/year)	.000	.000	1.075	1	.300	1.000
Sex of respondent (1 Male, 0=Female)	-.490	.514	.908	1	.341	.613
Years of school (years)	.060	.092	.419	1	.517	1.062
Awareness of village's by-laws on water protection (1 Aware, 0=Not aware)	-.275	.432	.404	1	.525	.760
Household size	-.072	.119	.365	1	.546	.931
Constant	1.600	1.568	1.042	1	.307	4.953

Overall Wald statistic = 5.918 (p = 0.015); Omnibus Tests of Model Coefficients Chi-Square = 46.236 (p = 0.000); Hosmer and Lemeshow Test Chi-Square = 5.177 (p = 0.739); Cox & Snell R^2 = 0.265; Nagelkerke R^2 = 0.359

** Significant at P<0.01

* Significant at P<0.05

3.8 Discussion

3.8.1 Existing WCMs in Moshi Rural

The findings in the study revealed that 41% preferred rainwater harvesting as the water conservation measure. It was revealed during FGDs thatthe respondents preferred rainwater harvesting in water tanks because it was inexpensive. Our findings are in line with Suresh et al. (2017) who found that local communities in India preferred *Taankas,* an indigenous traditional rainwater harvesting technique for water storage. Rainwater harvesting through wells was the least preferred due to its high cost of establishment. Respondents cited financial constraints as the main reason for not adopting this water harvesting technique. One participant in an FGD in Kikarara village said: *"We would like to apply water harvesting in well but due to their expensiveness we fail"*.

Kikarara, Mahoma and Mdawi Villages had high choices of water conservation techniques by having average choices of 47%, 39%, and 33% respectively. On contrary, Mowo and Lyakombila Villages were the lowest adopters of WCMs. Mowo and Lyakombila had the mean choices of 16 % and 18 % respectively, followed by Kidia (25%). These findings imply that the respondents in the highland parts practice few or no conservation measures at all due to high water availability in the areas. They had lower choice compared to Kikarara, Mdawi and Mahoma Villages which are located in the lower parts of the study area. The low lands receive little or no water at all especially during dry seasons.

The findings also confirm those reported earlier by Mihayo (2008) in Same District which revealed that different storage facilities have been adopted to store water for those who are living on the low land. East Old Moshi Ward had the highest average in the application of WCMs (33%) compared to Kimochi Ward (21%). A KI from East Old Moshi Ward argued that the water shortage in the area is more severe compared to Kimochi Ward, a fact that made people from East Old Moshi Ward apply different WCMs to solve the problem. Consequently, the presence of fewer water sources influences community members to apply WCMs. A Key Informants from Kimochi Ward reported that, although the ward consists of 3 water sources compared to the 5 in the East Old Moshi Ward, there were various initiatives done in the ward to solve the water problem compared to East Old Moshi Ward. For instance the presence of a donor-funded project known as SamSam water has reduced the water shortage and water problems in Mdawi Village which is located in Kimochi ward.

In water serving gardens, observations revealed that most of the respondents used 100 or 50-kilogram bags which is filled with with soil and manure to grow vegetables for households' uses and commercial purposes. In the FGD which was conducted at Kikarara Village, they agreed that education imparted to the community members by the RIPAT project had positive impact on the choice of water-saving gardens. One of the FGD participant said:

> *"Although it was taught to every group, water-saving gardening is still adopted at a low rate due to the laziness of some members since they see that it is a bit awkward to prepare such gardens rather than the normal gardens.*

It was also revealed from a key informant interview that water-saving gardens do not only include the preparation of gardens but also the act of watering the garden. People can water the gardens in ways that save water, for example, before the RIPAT project community members were not aware that watering gardens in the midday when the sunlight is more severe influence higher evaporation. After knowing this gardeners irrigate gardens in the evening when the temperature is low. These findings support Melbourne by Kneebone et al. (2018) who reported combination of media campaigns, price incentives, water use restrictions and knowledge transfer led to roughly 10 to 25% savings of water in lawns and gardens.

3.8.2 Factors affecting the community's choice of the types of WCMs

Binary logistic regression revealed that the choice of WCMs was significantly associated with the respondent's age, marital status, and distance to the alternative source of water. From the age perspective, the results showed that elders were poor in their choice of WCMs. The results are contrary to those reported earlier by Worthington and Hoffman (2008) who conducted an empirical survey of residential water demand modelling in Australia and found that the elders have traditional knowledge, experience, and a better understanding of the water flow systems, and are better prepared for the application of WCMs. On the distance to the alternative source of water, the results support those reported earlier by Garcia et al. (2013) who conducted a study on attitudes and behaviour towards water conservation on the Mediterranean coast and argued that the farther the distance to the source of water, the higher the expected numbers of WCMs applied to save time and energy.

On the other hand, the duration of water availability seemed to cause the number of WCMs applications. There were differences in WCMs practised between highland and lowland areas. The key informant reported that the highland area received water first from a variety of water sources and used it so inefficiently to the extent the lower parts receives less water for their domestic uses. During the dry seasons, water shortage becomes critical especially in water allocation schedules. During dry seasons when water is not enough water allocation schedules are planned for each village. However, you will find some villages get water for more days and others once per week. The findings are in contrary to Manouseli et al. (2019) who contended that 65% of the people who have been trained on community domestic water conservation) reduced their consumption in domestic water use after the training.

3.9 Conclusions

The study findings show that about 60% of the respondent adopted various WCMs in the study areas with rainwater harvesting in the water tanks to be the most preferred option followed by re-use of wastewater and the use of alternative water sources. The choice of WCMs was associated with the respondent's age, marital status of the respondent and distance to the household's alternative source of water. It is recommended that to improve WCMs in local communities, awareness creation and education should be provided especially to elders and people who reside in the highland areas. Education on water conservation will help users to integrate multiple users and uses.

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CHAPTER FOUR

4.0 SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary of Major Findings

Below is a summary of the study's major findings in a chronological order as per presented manuscripts.

4.1.1 Extent of local communities' participation in water resources management

The findings regarding the extent of respondents' participation in water resources management showed that only 45% and 39% of the respondents had participated in the project meetings and project's field works respectively within the previous five years. There was no statistically significant association between levels of participation among villages. However, Mahoma and Kidia Villages had the highest rates of participation in meetings, both having 52% of their respondents participating in project meetings. Kikarara Village had the lowest participation rate with only 24% of its respondents participating in meetings. Results further revealed that only 39.3% of the respondents were participating in the project's field works. Lyakombila Village had the highest rate (68%) of respondents participating in project field works. On the other hand, more than 60% of the respondents in the study area were not participating in the projects' field works. The majority (72%) of non-participating respondents were found in Kikarara and Mahoma Villages. Ordinal logistic regression analysis results revealed a statistically significant association between participation in WRM and wards, years of schooling of respondents and days receiving water.

4.1.2 Challenges that hinder respondents' participation in project meetings and field works

About two-thirds (65.50%) of the respondents cited problems related to leadership constraints. In particular, 25% of the respondents cited poor services as a factor that hindered their commitment.

4.1.3 Possible solutions to solve participation problems

Slightly above a quarter (26%) of the respondents suggested that education should be improved to community members. Other mentioned suggestions were: Listening and taking into account the opinions (23%), changing leadership (17%), improving water services (16%), formulating new by-laws and enforcing the existing ones (12%) and greater transparency and accountability among leaders (7%).

4.1.4 Community member' awareness on their roles and responsibilities to the project

It was revealed that the problem causing poor commitment to the project participation in the meetings and field works was not so much caused by the respondents' awareness of roles and responsibilities. This is because more than 58% of the respondents said that they well understood their roles to the project; 28% were not aware and about 12% were aware at a moderate level. In addition, 84% were able to mention their two basic roles while 52% were able to mention their three basic roles. Therefore, the majority of the respondents had problems neither with awareness nor with understanding their roles.

4.1.5 Community involvement in different levels of the project implementation.

In general, the results showed that most (score 2.52 out of 5.00) of the respondents were poorly involved at all the six levels of the project implementation. The majority of the respondents Mdawi Village were rated as having high level of community participation

(score 2.87). Mahoma's respondents had the lowest community participation in the study (score 2.23). At the wards level, East Old Moshi Ward had a lower score than Kimochi Ward; their mean scores were 2.28 and 2.68 respectively.

The general results showed that most (64%) of respondents admitted that there was poor involvement in project development matters which included low community participation in different stages of project development from planning, implementation of plans, decision making process within the project, control over resources, information sharing as well as monitoring and evaluation. In particular, community participation in implementation of plans was rated high (83.3%) compared to participation in all other project activities. Participation in decision-making was rated low (77.3%) for all other management activities.

Chi-Square test results showed there was statistically significant association between wards of residence and control over resources as well as monitoring and evaluation. At the village level, Chi-Square test results showed statistically significant association between village of residence and planning, control over resources, as well as monitoring and evaluation.

4.1.6 Factors associated with community involvement in different levels of project implementation

Ordinal logistic regression analysis results revealed a statistically significant association between participation in WRM and wards, years of schooling of respondents and days of receiving water. Positive coefficients 'in estimate' indicated that participation in WRM was influenced by years of schooling, household size, days of receiving water and sex of respondent. Negative coefficients of the predictor variables showed that participation in

WRM was less associated with the predictor variables (actual age, presence of tap at home, actual income and distance to the main source of water.

4.1.7 Satisfaction of community members their levels of involvement in different stages project implementation

The findings showed that 62% of the respondents were not satisfied with the level of their participation in domestic water project at the ward level in the study areas. The other satisfaction levels in descending order were: agree (30%), moderately agree (17%), disagree (13%) and strongly disagree (8%). The respondents' justifications for their lack of satisfaction were grouped into 5 main categories namely disregard of the people's opinions (27%), late delivered of information and reports (21%), poor participation in decision-making (20%), lack of transparency and accountability among project leaders (17%) and poor participation in planning (15%).

4.1.8 Women involvement

The study findings showed that there was poor women participation in project matters in general; the general score was 1.44, which means that most of the respondents admitted that there was no special consideration for vulnerable groups and women in terms of engagement in the project implementation. However, it was noticed that one of the limiting factors against women's participation was not so much about poor community awareness because; the mean score of 3.42 and revealed that community members believed in women's participation that it would make water projects successful. Data from a key informant revealed that one of the key challenges to women's participation in water projects was women involvement in farming and domestic activities, which were daily routines for most women as opposed to men.

4.1.9 Project committees in relation to community participation

The study findings showed that project committees in villages lacked ability of organizing, supervising, and managing domestic water projects. In general, committees' score was 1.75. Mdawi Village had the highest score (1.98) while Kidia Village had the lowest score (1.56) compared to other villages. At the ward level, East Old Moshi Ward a lower average score than Kimochi Ward; their average scores were 1.25 and 1.38 respectively. Chi-Square test showed statistically significant association between wards and the perception of committees to serve others. Also, at the village level, Chi-Square test showed statistically significant association between villages and projects' commitment to serve others.

Water committees were rated poor on all the aspects, except efforts of motivating others to attach value to project infrastructures where the score was 2.14. In particular, committees' responsibility to motivate others valuing project infrastructure was rated better than other aspects. The study findings showed that the project committees in villages lacked ability of organizing, supervising and managing the domestic water projects (score was 1.75). Further findings from key informants revealed that the committees lacked regular training and allowances to motivate them to perform their duties.

4.1.10 Environmental protection

Local governments in the study area have a significant contribution to protection of environment and water sources; 32% of the respondents mentioned it as one of the important actors in environmental protection processes. The other actors that were mentioned were as follows in an ascending order: educational institutions (25%), mass media (12%), private institutions (11%), public institutions (8%), cultural norms and traditions (8%) and religious institutions (5%). However, in general data showed that most

of the respondents rated the institutional contribution to environmental protection as ‘moderate’ as the general score was 2.94.

4.1.11 Existing WCMs in Moshi rural

Results revealed that on average 90 respondents (60%) used various WCMs whereas 60 respondents (40%) did not use any WCMs. For those who had adopted various water conservation measures, rainwater harvesting in the tanks was the most preferred water conservation measure (41%). Other WCMs were: reuse of wastewater (34%), use of alternative sources including brooms, towels, fabrics and other dry materials instead of water where possible (33%), performing cleanness for only full loads (32%), use of vessels to tap water when performing cleanness instead of letting water run (30%), water saving gardening (28%), installation of water-efficient devices including low flow showerheads, low flow high efficiency faucet aerators, automatic shut-off nozzles, dual flush toilet converters, soaker hoses (10%) and rainwater harvesting in wells (8%). Some of the WCMs such as rainwater harvesting in the tanks, reuse wastewater, use of alternative sources, perform cleanness for only full loads and water saving gardening differed significantly ($p \leq 0.05$) among villages. East Old Moshi Ward had higher average in application of WCMs (33%) compared to Kimochi Ward (21%).

4.1.12 Extent of adoption of WCMs in the study area

The extent of adoption was measured through different measures applied, one of which was rainwater harvesting for domestic uses. The study revealed extents of choice differed by village with lower parts of the wards having high extent of harvesting water per season. On average, the leading villages in rainwater harvesting in descending order were Kikarara (15 635 litres), Kidia (8130 litres), Mdawi (7650 litres), Mahoma (7070 litres), Lyakombila (3250 litres) and Mowo (2900 litres). Further analysis revealed that the amount of rainwater harvested differed significantly among the villages.

4.1.13 Factors affecting choice of the types of WCMs

Binary logistic regression revealed that the choice of WCMs was significantly associated with respondents' age and distance to the alternative source of water. On the age perspective, the results showed that elders were poor in choice of WCMs. On the geographical location, the differences were caused by dissimilar administrative activities, leadership skills, rules and regulations as well as water availability; hence different choices of WCMs were expected. On the distance to the alternative source of water, the results revealed that the farther the distance to the source of water was, the higher was the expected numbers of WCMs applied to save time and energy.

4.2 Conclusions and Recommendation

The study findings show that the problems of water competition in the study area are contributed by many factors which can be grouped as community members' lack of commitment to participate in water project meetings and manual works, poor leadership which causes improper oversight of project resources, and lack of transparency and accountability which causes local community members to be discouraged to participate well in the project matters. Also, lack of regular maintenance and repair of reservoirs, break pressure tanks (BPTs), pipes, and their valves especially in the upper areas causes improper water conveyance efficiency and increase water competition.

Public and private institutions have to invest more in awareness creation in order to make sure that all community members are well cooperating with respective authorities to protect water resources and environment at large. Creation of awareness will help to improve the situation since there are already strict rules but they are not obeyed by community members due to different reasons mainly because some people do not report their fellow villagers who secretly break the rules. The study also recommends effective

community participation to enable water project attain their goals to end the water problems for domestic uses.

WCMs applied in the study area depend on status of water availability of particular places and seasons. The study findings showed that the problems of water competition in the study area is contributed by many factors which can be grouped as poor WCMs applied by local communities to reduce water consumptions. It was further concluded that, local community's adoption of WCMs was generally low. Cost of some measures, little education and poor water devices used for conservation measures were some of the factors hindering applications of WCMs. Therefore, it is recommended that, in order to improve WCMs to local communities, education should be provided especially to elders and people residing in upper parts of the community.

APPENDICES

Appendix 1.1: Questionnaire for community members

Title: Assessment of Local Communities' participation on water resources management

SECTION A: Household's information. For the household's head or his/her partner

Date _____ District _____

Ward _____ Village _____

Respondent's name _____

Street _____

1. Are you a household head? (1) Yes ( ) (2) No ( )
2. If the answer above is (No), what is your relation with the head of household? _____
3. Sex (i) Male. ( ) (ii) Female. ( )
4. Age _____
5. Education Level _____
6. Marital status _____
7. Occupation _____
8. Total income per week _____
9. Sex of the household head. (i) Male. ( ) (ii) Female. ( )
10. Age of the household head. ( )
11. Education level of household head ……
12. What is your main source of income? _____
13. What is your alternative source of income? _____
14. What is the size of your household? _____
15. What is the labour power of your household? _____
16. Do you own these in your household?

a) Home tap. (1) Yes ( ) (2) No ( )

b) Electricity (1) Yes ( ) (2) No ( )

17. Who makes decision in your household for the uses or application of the following matters?

Items on which decisions are made at the household level		Husband	Wife	Both
a)	Farm activities			
b)	New farm technology			

c)	Sells of farm yields			
d)	General income			

18. Quality of your house

	Floor	Wall	Roof
House			
Toilet			
Kitchen			

SECTION B: WATER USES IN FARM AND HOUSEHOLD

What are the sources of your household water?	How many days per week you got water during dry seasons?	How many minutes to get there?	How much do you pay per month?
19. Main source	20.	21.	22.
23. Alternative source	24.	25.	26.

27. What conservation measures do you apply in the household?

Water conservation measure	Where did you learn it	Challenges you face applying the measure or cause you not to apply it.	Possible measures to solve the mentioned challenge
a)			
b)			
c)			
d)			
e)			
f)			
g)			
h)			

28. If you harvest rainwater on tanks what is its volume per single rainy season?

29. If you harvest rainwater on wells what is its volume per single rainy season? _____

SECTION C: PARTICIPATION IN WATER RESOURCES MANAGEMENT.

30. To what extent do you accept that there is true community's participation in domestic water project at this village? (Answer between 1-5; whereby 1= Very low, 5 = Very high)

a)	You are well involved in project planning	

b)	You are well involved in implementation of plans	
c)	You are well involved in decision making	
d)	You are well involved in control over resources	
e)	You are well involved about project matters/development	
f)	You are well involved in monitoring and evaluation	
g)	Women are involved in WRM matters	
h)	The project will be successful when there is full women's involvement	
i)	Are you satisfied with the way you have been involved in water project processes?	

31. Explain why, (In your last answer above).

_____

How would you like to be participated later in the project?

_____

_____

SECTION D: CHALLENGES IN PARTICIPATION IN DOMESTIC WRM.

32. Please rank your satisfaction with the way water services provided to you?

1	2	3	4	5

33. What challenges do you face in the water services supplied to your area?

_____

_____

What can be done to solve the challenges mentioned above?

_____

_____

Is there any conflict rise concerning the domestic water project in last 5 years?

1) Yes _____ 2) No _____

34. Mention the reasons for the conflict above? _____

35. How do you rate the village's water project's committee members on each of the following aspect at this area? (Rank 1-5)

a)	Possession of basic knowledge and skills on project implementation	
b)	Motivation of others for valuing of the project infrastructure	
c)	Transparency and accountability	
d)	Commitment to serve others	

36. Do you know your responsibilities in this domestic water project? 1) Yes _____ 2) No _____

37. If Yes, please mention three of them

_____

38. In the past five years, to what extent did you implemented your following responsibilities in the domestic water project? ***(Rank 1-5)***

39. Participating in the project meetings _____
40. Participating in the project manual works _____
41. What challenges do you face in implementing the above two asked responsibilities?

_____
_____

42. What can be done to solve the challenges you mentioned above?

_____
_____

SECTION E. ENVIRONMENTAL CONSERVATION

Do you know by laws protecting environment and water sources in this area? ***(Rank 1-5)***

_____

43. Please mention 3 of them.

1. _____
2)_____
3) _____

44. Do communities around water sources cooperate well with authorities to protect environment and water sources? Yes _____No_____
45. Do you receive educational/legal contribution about protection of water sources and environment in general? Yes _____No_____
46. Where do you receive educational/legal contribution about protection of water sources and environment in general?

_____

47. Where the most do you get environmental protection education/assistant (mention any institution or authority)
48. Where the most does the educational/legal contribution about protection of water sources and environment in general comes from. Rank between 1-5

a) Education institution [ ]	b) Medias [ ]
c) Religious institutions[ ]	d) Customs and tradition [ ]
e) NGOs/Private institutions[ ]	f) Local Government and By laws [ ]
g) Public institutions [ ]	h) Others…… …

Rank the villagers' commitment to the above mentioned environmental protection laws. (1-5)

49. Prohibition to perform any activities within 60 meters of water source and course reserves ___
50. To seek for permission from authorities before cutting their trees _____
51. To report where their fellow conduct an unlawful act against environment ____

52. What can be done to insist/motivate communities to implement the above mentioned laws? _____

Appendix 1.2: Key Informant Interview guide

1) What are the roles and responsibilities of your office to make sure the proper functioning of the domestic water project above?
2) How is the water project functioning in this area?
3) What challenges face the proper functioning of the water projects at this area?
4) What should be done to solve the challenges?
5) What measures your office have taken to resolve the challenges?
6) What measures have you taken to conserve environment?
7) What measures have you taken to ensure water conservation in general at this area?
8) What challenges hinder the initiatives to conserve environment?
9) What challenges hinder those initiatives to ensure water conservation in this area?
10) What should be done to solve the challenges above?
11) Is it true that women are well participated in the domestic water project at this area?
12) What challenges face women in participating effectively in domestic water project?
13) What weaknesses have you observed in the whole process of community participation in the domestic water project?
14) How would you like community members to be involved later, on the domestic water project?

THANK YOU FOR YOUR COOPERATION

Appendix 1.3: Focus group discussion guide

1) Is it true that women are well participated in the domestic water project at this area?
2) What challenges face women in participating effectively in domestic water project?
3) What weaknesses have you observed in the whole process of community participation in the domestic water project?
4) How would you like community members to be involved later, on the domestic water project?
5) Do community members satisfy with the way water services provided to them?
6) If Yes, how?
7) If No, why?
8) Why most of the people do not satisfy with the way water services provided to them
9) Are there any disputes emerged within past five years in this ward pertaining domestic water project?
10) What are the main causes of the conflict?
11) What should be done to resolve the conflict?
12) What measures should be taken to conserve environment and water sources in general at this area?
13) What challenges hinder those initiatives to conserve environment and water sources in general at this area?
14) What challenges hinder the community members to fail to participate fully in the domestic water project at this area?

THANK YOU