

**WATER RESOURCE MANAGEMENT AND WATER USE CONFLICTS IN
NGERENGERE WATER CATCHMENT, MOROGORO TANZANIA**

AMINA SAIDI MHINA

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

EXTENDED ABSTRACT

Water use conflicts are widely reported and are said to affect socio-economic development. This study examined the main types and factors of water use conflicts in the Ngerengere catchment in Morogoro Region. A cross-sectional research design was adopted and 136 respondents participated in the study. A combination of purposive and simple random sampling techniques was used to select wards and respondents. A structured questionnaire for the household survey and a checklist of questions for focus group discussions and key informants interviews were the main tools for data collection. Descriptive statistics complemented with qualitative data described the types of water use conflicts. Convention mapping was used to map the existing water resource management institutions while content analysis was used to establish the roles, functions, and relationship between these institutions. The binary logistic regression model estimated the factors associated with water use conflicts in the study area. Findings from this study shows that domestic users are the most affected group by water use conflicts particularly because conflicts between them were reported by almost upstream and downstream water users (27.2%) and domestic users and irrigators (22.8%). Education level, misallocations of water points and failure of water resource management institutions were significantly associated with water use conflicts ($P < 0.05$). The study also found that WRMIs are formal and informal in nature playing three major roles in the Ngerengere catchment area namely: water catchment management, water catchment protection and water uses planning. The study concluded that, water catchment management institutions are not adequately accountable for water service delivery in the Ngerengere catchment area thus leading to frequent water use conflicts and other challenges associated with these conflicts. Therefore, the study recommends that water catchment management institutions should be accountable for water service delivery in the Ngerengere catchment area to avoid water use conflicts and overcome factors associated with these conflicts.

The study recommended further that the Local Government Authority (LGA) particularly water resource management institutions should ensure good management and availability of enough water sources for easy accessibility.

Key words: Ngerengere catchment area, Water use conflicts, water resource management institutions

DECLARATION

I, Amina Saidi Mhina, do hereby declare to the senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

.....

Mhina, Amina Saidi

(MA. Project Management and Evaluation)

.....

Date

The above declaration is confirmed:

.....

Dr. Goodluck Dastan Massawe

(Supervisor)

.....

Date

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system, or transmitted in any form or by any means without prior permission of the author or Sokoine University of Agriculture in the behalf.

ACKNOWLEDGEMENTS

The preparation and accomplishment of this dissertation would not have been possible without the assistance of many people and institutions. For those reasons, in the first place, I would like to thank the Almighty God for his inspiration upon me. Otherwise, this work would not have been accomplished.

A lot of thanks are extended to my supervisor, Dr Goodluck Dastan Massawe from the Department of Policy, Planning and Management, College of Social Sciences and Humanities at Sokoine University of Agriculture for his enduring efforts, guidance, encouragement, constructive criticisms and ideas, which were extended early from the proposal development, data collection, data entry, analysis and report writing. His support made this thesis work possible. Further, my appreciations go to all academic members of staff and colleagues of the Department of Policy, Planning and Management and the College of Social Sciences and Humanities for their support.

I would also like to extend my sincere thanks to Wami/Ruvu Basin Office, Morogoro Urban Water Supply and Sanitation Authority (MORUWASA), Water Users Associations (Mvomero and Morogoro Municipal Councils), LGA's, Community Water Supplier Organization (COWSO) leaders and elders, persons and volunteers for their assistance during data collection process as they played a big role in mobilizing the respondents to take part for focus group discussions, key informant interviews and household surveys. My great thanks also go to all water management institutions staffs who were interviewed for their commitment to providing me with the needed information.

Many thanks also to Professor Peter Gillah, Professor Kim Kayunze, Dr Msinde, Dr Ringo and my classmates: Daniel Joseph, Gasper Ringo, Erick Makanda, Nandrie Janet Joseph and Ainess Ngole. I would like to thank my fellow student at SUA Mr Johnson Gudaga for their useful advice during the study period. I also thank leaders from Mlali, Mindu, Kilakala, Mzinga and Bigwa wards from Mvomero and Morogoro Municipal councils who organized participants to take part in Focus Group Discussions, key informant interviews and all head of household respondents whose member spared their precious time responding to questions of this research.

Last but not least, special regards and blessings go to my beloved family members for the moral and material support they offered to me during my study period. I am deeply appreciative of the patience and understanding of my husband, Mustafa Ngonyani and our son Karim, my mother Rehema Mhina, my father Saidi Gegedellah, my sisters and brothers who always encouraged me during good and bad times of learning which in one way or another made my study successful.

Finally, it is not easy to mention all who in one way or another played a role in this study, I simply say, thank you all.

DEDICATION

This dissertation is dedicated to my beloved son Karim and my mother Rehema S. Mhina who sacrificed much for the value of my education, shaped my career with their time for moral support, love, encouragement, diligence, affection and financial support to ensure that I successfully accomplish my studies. This work is also dedicated to my husband Mustafa I. Ngonyani for his support, encouragement and tolerance. May God the Almighty give them a healthy and long life.

TABLE OF CONTENTS

EXTENDED ABSTRACT.....	ii
-------------------------------	-----------

DECLARATION.....	iv
COPYRIGHT.....	v
ACKNOWLEDGEMENTS.....	vi
DEDICATION.....	viii
TABLE OF CONTENTS.....	ix
LIST OF TABLES.....	xii
LIST OF FIGURES.....	xiii
LIST OF APPENDICES.....	xiv
LIST OF ABBREVIATIONS.....	xv
 CHAPTER ONE.....	 1
1.0 INTRODUCTION.....	1
1.1 Background of the Study.....	1
1.2 Problem Statement.....	3
1.3 Justification of the Study.....	4
1.4 Objectives.....	4
1.4.1 General objective.....	4
1.4.2 Specific objectives.....	4
1.5 Research Questions.....	5
1.6 Theoretical and Conceptual Framework.....	5
1.7 Research Methodology.....	7
1.8 Study Limitation.....	8
1.9 Organization of the Dissertation.....	8
References.....	9
 CHAPTER TWO.....	 12

2.0	TYPES AND FACTORS ASSOCIATED WITH WATER USE CONFLICTS	
	IN NGERENGERE WATER CATCHMENT, MOROGORO TANZANIA.....	12
2.1	Abstract.....	12
2.2	Introduction.....	13
2.3	Theoretical Framework.....	15
2.4	Conflict Resolution Theory.....	15
2.5	Methodology.....	17
2.5	Results and Discussion.....	21
2.5.1	Socio-Demographic Characteristics.....	21
2.5.2	Types of water use conflicts in Ngerengere catchment area.....	22
2.5.2.1	Domestic Users.....	22
2.5.2.2	Upstream and Downstream.....	23
2.5.2.3	Domestic and Irrigators.....	23
2.5.2.4	Farmers and Livestock Keepers.....	24
2.5.3	Factors Associated with Water Use Conflicts in the Ngerengere Catchment Area.....	24
2.5.3.1	Education Level.....	25
2.5.3.2	Wrong Placement of Water Points.....	25
2.5.3.3	Failure of Water Management Institutions.....	27
2.7	Conclusions and Recommendations.....	28
	References.....	28
	CHAPTER THREE.....	33

3.0	WATER RESOURCE MANAGEMENT INSTITUTIONS AND WATER USE CONFLICTS IN NGERENGERE WATER CATCHMENT, MOROGORO TANZANIA.....	33
3.1	Abstract.....	33
3.2	Introduction.....	34
3.3	Theoretical Framework.....	36
3.4	Methodology.....	37
3.4.1	Study Area.....	37
3.5	Study Design.....	38
3.6	Sampling Strategy.....	38
3.7	Data Collection and Analysis.....	38
3.8	Results and Discussion.....	39
3.8.1	Water Resources Management Institutions and their Roles.....	39
3.8.1.1	Formal Water Resource Management Institutions.....	41
3.8.1.2	Informal Water Resource Management Institution.....	45
3.8.2	Relationship between WRMIs and conflicts.....	47
3.8.3	Conclusions and Recommendations.....	50
	References.....	51
	CHAPTER FOUR.....	54
4.0	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	54
4.1	Summary.....	54
4.2	Conclusions.....	55
4.3	Recommendations.....	55
4.4	Areas for Further Research.....	56
	APPENDICES.....	57

LIST OF TABLES

Table 2.1:	Distributions of households in the study area.....	19
Table 2.2:	Variables used in the binary logistic regression model.....	20
Table 2.3:	Socio-demographic characteristics of the household head.....	21
Table 2.4:	Main types of water use conflicts.....	22
Table 2.5:	Factors associated with water use conflicts	26
Table 3.:	Role of water resource management institutions in the study area... ..	40

LIST OF FIGU

Figure 1.1: Conceptual Framework showing the relationship between the dependent and independent variables.....	7
YFigure 2.1:Location of the Ngerengere catchment showing the study wards	18
YFigure 3.1: Relationship between WRMIs and conflicts.....	49

LIST OF APPENDICES

Appendix 1: Respondents Questionnaire.....	57
--	----

Appendix 2:	Socio-Demographic Characteristics.....	57
Appendix 3:	Conflicts Questions.....	59
Appendix 4:	Socio-economic impact of the Water use conflicts.....	62
Appendix 5:	Resolution and Management questions.....	63
Appendix 6:	Checklist for Key Informant.....	64
Appendix 7:	Checklist for Focus Group Discussion.....	65
Appendix 8:	Mapping Existing water resource management institution In The Study Area.....	66
Appendix 9:	Types of Water use conflicts In the Study area.....	70
Appendix 10:	Roles of water resource management institutions on Water use conflict Management.....	71

LIST OF ABBREVIATIONS

ADB	Africa Development Bank
BWO's	Basin's Water Offices
COWSO	Community Water Users Organization
CRT	Conflict Resolution Theory
FGDs	Focus Group Discussions
FYDP	Five Years Development Plan
IWASH	Integrated water, sanitation and Hygiene
JICA	Japan International Cooperation Agency
KI	Key Informants
LGA's	Local Government Authorities
MABILU	Maji Bigwa na Lukuyu
MABIRA	Maji Bigwa Barabarani
MMC	Morogoro Municipal Council
MORUWASA	Morogoro Urban Water Supply and Sanitations Authority
NCA	Ngerengere Catchment Area
NGO	Non-Government Organisations
NAWAPO	National Water Policy
RUWASA	Rural and Urban Water Supply Agency
SAKOVICHA	Sangasanga, Konga, Vikenge and Changarawe
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
SPSS	Statistical Package for the Social Sciences
TDV	Tanzania Development Vision
UNICEF	United Nations International Children Emergency Fund
UNDP	United Nations Development Programme

URT	United Republic of Tanzania
UWAMALU	Umoja wa Watumiaji Maji Lukuyu
UWAJAKUVI	Uwajibikaji wa Jamii Kupitia Vijana
UWAWAMABI	Umoja wa Watumiaji Maji mto Bigwa
UWAMABO	Umoja wa Watumia Maji Bong'ola juu
USAID	United States Agency for International Development
WARIDI	Water Resource Integration Development Initiatives
WEO	Ward Executive Officer
WHO	World Health Organization
WRMA	Water Resources Management Act
WRMIs	Water Resources Management Institutions
WRMA	Water Resources Management Act
WUA's	Water User's Associations

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Water use conflicts, defined as conflicts between groups, countries or states over access to water resource(s) (Robins and Fergusson, (2014) are reported everywhere from the grassroots communities, sub-national to national and international levels. These conflicts occur when the demand for water resources from water catchments exceeds the supply or because of the dispute on the control over access and allocation of water.

A water catchment is an area where water is collected by the natural landscape. In a catchment, rainwater runoff eventually flows to creeks, rivers, dams, lakes, and into the ocean or a groundwater system (Schaefer and Dietrich, 2016). In this study, water catchment is defined as an area of land where all surface water from rain converges to a single point at a lower elevation, usually, the exit of the basin, where the water joins another body of water, such as a river, a lake, a reservoir, an estuary, a wetland, the sea, or ocean (Masifia and Sena, 2017). Tanzania has nine Basin Water Offices (BWOs) namely Pangani River Basin, Wami/ Ruvu River Basin, Rufiji River Basin, Ruvuma River Basin and Southern Coast, Lake Nyasa, Lake Victoria, Lake Tanganyika and the Internal Drainage Basin. These BWOs are very important for the country's socio-economic development and for regulating and planning the use of water resources, as guided by the Water Resources Management Act No. 11 of 2009 (URT, 2013).

In many African countries, conflicts over water uses are frequent in most catchment areas (Kashaigili *et al.*, 2003). There is an ongoing conflict on the use of the river Okavanga in countries such as Angola, Namibia, Botswana and Namibia and constant conflicts in Kenya and Ethiopia over the use of river Omo, which supplies water to Lake Turkana

(Ashton, 2007) .These are just a few examples of the existing conflicts over water uses in Africa.

In Tanzania, water use conflicts are on the increase with an increasing demand for water due to rapid population growth and an increase in the requirements for water caused by diversity in the people's livelihoods which tend to rely on the same water catchments. Thus, water use conflicts and associated factors are widely reported in areas surrounding water resources because these resources play important roles for both production and domestic use activities (Ncube *et al.*, 2018). Such production activities include agriculture (irrigation), fishing and industrial, which are also carried out by people of Ngerengere catchment area. The importance of water used in irrigation, fishing and industries is unquestionable, in this respect water resources need to be managed for the sustainability of water and human lives. Current literature indicates that in many regions water resources are inadequate in meeting domestic, economic development and environmental needs (Cosgrove and Louck, 2015; Loucks and Beek, 2017).

Water resources are generally considered as a community property; however, there is often a concern that water is put under other uses different from domestic and production purposes. In this regard, the government adopted water management frameworks in the basins in Tanzania. Examples include, WAMI/Ruvu basin uses the National Water Policy (NAWAPO) of 2009 framework for the management and use of water resources. NAWAPO 2009 is a comprehensive framework for management sustainability of water resources in Tanzania, focusing on water resources management, rural water supply and urban water supply and sewerage.

1.2 Problem Statement

The importance of good water resource management in improving social, economic and ecosystem development is well known. However, until recently, there has been very little published literature on water resource management and water use conflicts in Morogoro. The study by Mahoo *et al.* (2015) found that an integrated participatory approach helped considerably in setting up and maintaining the monitoring network. Other studies conducted currently in Morogoro focused on the drivers of conflicts between farmers and pastoralists (Mwasha, 2016; Falanta and Bengesi, 2018).

Although there have been significant advances in forming different institutions responsible for water resource management in Tanzania, their impacts on effective management of water use conflict have not yet been documented in a consolidated manner. For example, the establishment of Basin Water Offices (BWOs), which are responsible for regulating and planning the use of water resources is based on the Water Resources Management Act No. 11 of 2009. However, effective management of water resources use has not been without challenges, and these include lack of materials, human resource (experts) and limited financial resources. As a result water use conflicts have still been frequent (Falanta and Bengesi, 2018), making it difficult to know what has been achieved, what are the key roles of institutions responsible for water catchment area management. These observations therefore motivated the current study whose aim is assessing the contribution of institutions responsible for water resources management on managing water use conflicts. The study mapped the water resource management institutions and examined the types and causes of water use conflicts in the study area.

1.3 Justification of the Study

Water is fundamental to life and plays a central role in the social and economic development of Tanzania. Thus, the results from this study would inform policymakers and leaders of the Wami/Ruvu Basin, water user associations. Community water users organization and other water management authorities' community groups on how effectively they can manage water use conflicts.

At the national level, this study aligns with the first goal of Tanzania Development Vision 2025, which emphasizes on high-quality livelihood (URT, 2000) and the second Five Years Development Plan (FYDP II) - 2016/2017-2021, which aims at enhancing access to clean and safe water (URT, 2016). Globally, this study aligns with the sixth global Sustainable Development Goal (SDG) which calls for clean water and sanitation for all people.

1.4 Objectives

1.4.1 General objective

The overall objective of this study is to assess the contribution of water resource management institutions to water use conflict management in Morogoro.

1.4.2 Specific objectives

This study is organized under the following specific objectives;

- i. To map the existing water resources management institutions in the study area
- ii. To identify the main types and causes of water use conflicts in the study area.
- iii. To determine the role of the existing water resources management institutions on water use conflict management.

1.5 Research Questions

- i.** What are the existing water resources management institutions in the study area?
- ii.** What are the types and causes of water use conflicts in the study area?
- iii.** How do the water resources management institutions contribute to managing water use conflict?

1.6 Theoretical and Conceptual Framework

Water is a natural resource whose use involves different actors particularly agency (service provider), principal (services user) and institutions (governing structures). It is therefore important to understand how the scarcity of the resource leads to conflict among actors, the existing relationship between agency and principal, and the contribution of institutions on water use conflict management.

This study is built on the combination of three theories namely Conflicts Resolution Theory (CRT) by Akhbari (2012), Agency Theory by Mitnick (2015) and the principle of Good Governance Theory. According to CRT water resources are managed by different actors such as farmers, industries, institutions and domestic users (Tir, J. and Stinnett, 2012). The Agency theory on the other hand, and which was developed by Jensen and William in 1976 has been fruitfully applied in examining the nature of the relationship in a firm that exists between the principal and the agent (Mkalagale, 2013). According to Mkalagale (2013), the key argument of this theory is that the agent's preferences or goals may at times differ from those of the principal; thus, the agent has an incentive to deviate from the principal's interests. For the case of this study, it means that water suppliers are likely to serve their interest rather than the interest of water users, something which creates misunderstanding between the two. The theory is relevant in this study as it discusses the problems that surface in the water catchment management due to the

separation of water suppliers or owners, managers (institutions) from water users and emphasizes on finding a solution to this problem. According to Panda and Leepsa (2017), the weakness of the Agency theory's is its lack of interest in the principals (water users), who might deceive, shirk and exploit the agents (water suppliers). In the same line, Mkalagale (2013) observed that the agent is more informed on what is going on in the company than does the principal.

The principles of Good Governance were used to support the function of the Agency Theory. Thus, the principles of good governance have been used to show the relationship between water management institutions themselves and the manner in which they can involve and cooperate with other institutions such as laws and informal institutions in solving water use conflicts in the Ngerengere catchment area. Generally, principles of Good governance in this study was used to understand the types and roles of WRMIs in managing water use conflicts in the Ngerengere catchment area. The continuation and persistence of water use conflicts are influenced by the failure of water resources management institutions, policies, rules and regulations in resolving water use conflicts as presented in Figure 1.1.

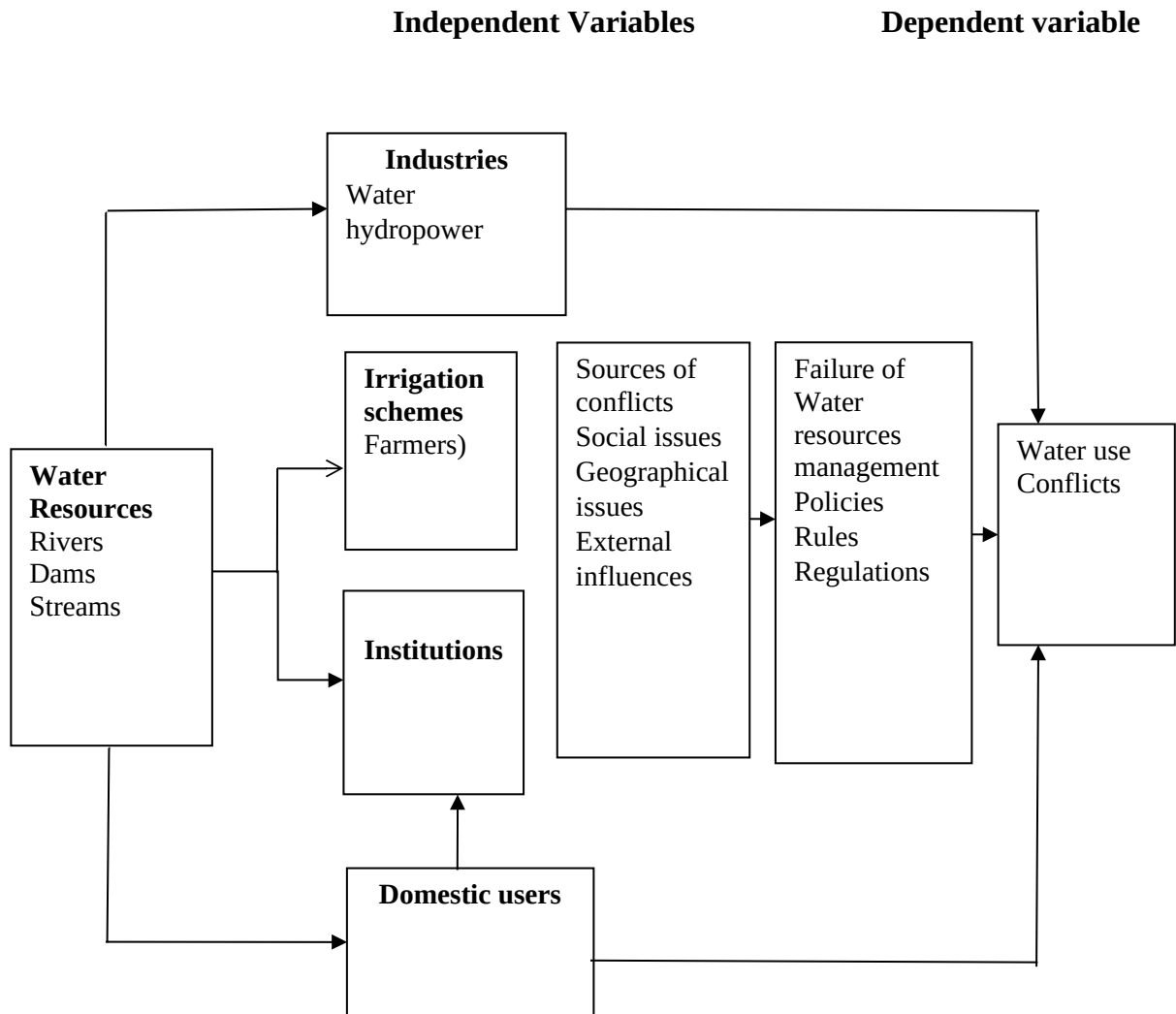


Figure 1.1: Conceptual Framework showing the relationship between the dependent and independent variables

1.7 Research Methodology

The study was conducted in the Ngerengere catchment area, which is located in the middle of the Wami/Ruvu Sub-basin. Ngerengere River originates from the Uluguru Mountains and covers a large part of Morogoro Region. Both primary and secondary data were collected. The research used both qualitative and quantitative data which were collected through a household survey, focus group discussion, key informant interview and observation. The FGDs and KIIs generated information on the types and roles of water resource management institutions in managing water use conflicts. While data from households' survey generated and summarized information on the types of water use

conflicts, the binary logistic model determined the factors associated with water use conflicts. Detailed descriptions of the methodology part employed in this study have been discussed in subsequent chapters.

1.8 Study Limitation

It was difficult to access the important information from some of the water management institutions in Morogoro Municipal since information provided had some conditions attached on how it should be used. The institutions were more concerned with protecting their reputations and thus provided information on positive aspects only about their institutions. In overcoming this limitation, the researcher searched for information from social media and held consultations with local authorities including ward and Mtaa/Village Executive Officers. The majority of water users especially at Mzingu, Mlali and Mindu wards were not available as mostly were involved in farming or fishing activities during the survey.

1.9 Organization of the Dissertation

This dissertation adopts the publishable manuscript format. Therefore, it is organized into four chapters. Chapter one covers the introduction which includes background information, statement of the problem, justification, objectives and research questions, theoretical and conceptual framework, research methodology and study limitations. Chapter two presents the first manuscript on the types and factors associated with water use conflicts in Ngerengere catchment while chapter three presents water resource management institutions and water use conflicts in Ngerengere catchment area in Morogoro, Tanzania. Lastly, the overall conclusions and recommendations are presented in chapter four.

References

- Akhbari, M. (2012). Models for management of water conflicts: A case study of the San-Joaquin Watershed, California. A dissertation submitted for the Degree of Doctor of Philosophy Colorado State University, United States of America. 89pp.
- Ashton, P. (2007). Water and Conflict. Natural Resources and Conflict in Africa: *The Tragedy of Endowment* 207pp.
- Cosgrove, W. J. and Loucks, D. P. (2015). Water management: Current and future challenges and research directions. *Water Resources Research* 51(6), 4823-4839.
- Falanta, E. M. and Bengesi, K. M. (2018). Drivers and consequences of recurrent conflicts between farmers and pastoralists in Kilosa and Mvomero districts. *Tanzania. Journal of Sustainable Development* 4:1-14.
- Kashaigili, J. J., Kadigi, R. M., Sokile, C. S. and Mahoo, H. F. (2003). Constraints and potential for efficient inter-sectoral water allocations in Tanzania. *Physics and Chemistry of the Earth* 839-851pp.
- Loucks, D. P. and Van Beek, E. (2017). Water resource systems planning and management: An introduction to methods, models, and applications. 624pp.
- Mahoo H., Simukanga L. and Kashaga, R. A. L. (2015). Water resources management in Tanzania: Identifying research gaps and needs and recommendations for a research agenda. *Tanzania Journal of Agricultural Sciences* 14 (1):57-77.
- Masifia, Y.Y. and Sena, S. O. (2017). Factors influencing water resource governance among pastoral community at Mkondoa sub catchment, Morogoro region. Tanzania. *International Journal of Scientific & Technology Research* 6(06): 1-25.
- Mitnick, B. M. (2015). Agency theory. *Wiley encyclopaedia of management* 1-6pp.

- Mkalagale, V. (2013). The Poor Performance of Student in Community Secondary Schools in Tanzania: A case of Temeke District. A Dissertation Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Public Administration (MPA) of Mzumbe University. 110pp.
- Mwasha D.I. (2016), Farmer-Pastoralist Conflict in Kilosa District, Tanzania: A Climate Change Orientation. A Dissertation Submitted in A Partial Fulfilment of the Requirements for The Degree of Master of Arts in Rural Development of Sokoine University of Agriculture. Morogoro, Tanzania. 72pp.
- Ncube, E., Gumata, N. and Ndou, M. (2018). Global economic uncertainties and exchange rate shocks: Transmission channels to the South African economy. 34pp.
- Panda, B. and Leepsa, N.M. (2017). Agency theory: Review of theory and evidence on problems and perspectives. *Indian Journal of Corporate Governance* 10(1): 74–95.
- Robins, N. S. and Fergusson, J. (2014). Groundwater scarcity and conflict–managing hotspots. *Earth perspectives* 1(1), 1-9.
- Schäfer, M. P., Dietrich, O. and Mbilinyi, B. (2016). Stream flow and lake water level changes level changes and their attributed causes in Eastern and Southern Africa: state of the art review art review. *International Journal of Water Resources Development* 32(6): 853-880.
- Tir, J. and Stinnett, D. M. (2012). Weathering climate change: Can institutions mitigate international water conflict?. *Journal of Peace Research* 49(1), 211-225.
- URT, United Republic of Tanzania (2013). National strategy for reduced emissions from deforestation and forest degradation (REDD+). *Main Report*. Government printer, Dar es salaam, Tanzania, 54pp.
- URT, United Republic of Tanzania (2000). *Poverty Reduction Strategy Paper (PRSP)*. Dar es Salaam: Vice-President's Office.

[<https://www.imf.org/external/pubs/ft/scr/2008/cr0822.pdf>] site visited on 13th August 2021.

URT. United Republic of Tanzania (2016). Tanzania in Figures, National Bureau of Statistics, Dar es Salaam, Tanzania". [<http://www.nbs.go.tz/pdf>] site visited on 20th July 2021.

CHAPTER TWO

2.0 TYPES AND FACTORS ASSOCIATED WITH WATER USE CONFLICTS IN NGERENGERE WATER CATCHMENT, MOROGORO TANZANIA

¹Amina Saidi Mhina and ²Goodluck Dastan Massawe

¹MA. Project Management and Evaluation Student, College of Social Sciences and
Humanities, Department of Policy, Planning and Management
P. O. Box 3035, Morogoro, Tanzania.

²Lecturer, College of Social Sciences and Humanities, Department of Policy,
Planning and Management
P. O. Box 3035, Morogoro, Tanzania.

2.1 Abstract

Water use conflicts are widely reported and are said to affect social and economic development. This study examined the main types and factors of water use conflicts in the Ngerengere catchment in Morogoro Region of Tanzania. A cross-sectional research design was adopted involving 136 study respondents. A combination of simple random and purposive sampling techniques was used to select wards and respondents respectively. A structured questionnaire for a household survey, a checklist of questions for Focus Group Discussion (FGD) and Key Informants interviews were the main tools for data collection. Descriptive statistics complemented with qualitative data were used to describe the types of water use conflicts, and binary logistic regression model estimated the factors

¹ Corresponding email: aminasmhina@gmail.com

associated with water use conflicts in the study area. The study findings revealed that domestic users are more affected by water use conflicts as the conflict between them was cited by 45.6 percent of the respondents as the major type followed by upstream and downstream (27.2%) and domestic users and irrigators (22.8%). Education level, misallocation of water points and failure of water resource management institution were statistically and significantly associated ($P < 0.05$) with water use conflicts. The study concludes that water catchment management institutions are not accountable for water service delivery in the Ngerengere catchment; hence persistence and escalation of water use conflicts. The study therefore recommends that water catchment management institutions should be accountable for water service delivery in the Ngerengere catchment area to avoid water use conflicts and overcome factors associated with these conflicts the study recommends further that the government particularly water use management institutions should ensure good management and availability of enough water sources for easy accessibility.

Key words: Water catchment, Water use conflicts, Water management institutions, and Water users.

2.2 Introduction

Many African countries including Tanzania experience conflicts over water uses in most catchment areas (Kashaigili *et al.*, 2003). The water conflicts occurred at two levels: first, at water users level, and secondly, at the institutional level (Gudaga *et al.*, 2018). In Tanzania, water use conflicts are on the increase with an increase in the demands for water resulting from rapid population growth and requirements of meeting diverse ways of livelihoods, which rely heavily on the same water catchment. This trend has therefore made water use conflicts and associated factors become a frequent phenomenon in the areas surrounding the water catchments.

This is especially because these catchments play an important role in both production activities and domestic use (Ncube *et al.*, 2018). Current literature indicates that, in many regions, water resources are too inadequate to meet domestic, economic development and environmental needs (Loucks and Beek, 2017).

Furthermore, there is evidence that the available water catchment areas are facing enormous threats from human activities are likely to lead to reduced quality of life over the coming decades (Oremo *et al.*, 2019). It is from these grounds that Tanzania established Basin Water Boards in nine main catchment areas namely Rufiji, Wami/Ruvu; Pangani, the internal drainage, Lake Victoria, Lake Tanganyika, Ruvuma, Lake Nyasa and Lake Rukwa Basin for water resources management (Roberts, 2014).

According to the UNICEF and WHO (2019) report, about 2.2 billion people around the world do not have safely managed drinking water services and have poor access to water, sanitation and hygiene. This scenario is not unique in Sub-Saharan Africa including Tanzania. For instance, a study by Ntilicha *et al.* (2012) and another by Said *et al.* (2019) in the Pangani Basin show that water use conflicts in Tanzania are increasing as a result of population increase, water scarcity, inadequate participation of the local community in the management of water resources, and irregularity in scheduling water for irrigation. In this regard, water catchment management authorities are likely to exacerbate water use conflicts due to irregularities of water distribution among the beneficiaries. Mdee (2017) attributes irregularities in water use management to lack of institutional capacity and co-ordination mechanism amongst water basin authorities which have remained weak and unable to achieve the required performance and sustainability in catchment conservation. In this case, water use conflicts are widely reported in such domains as irrigation schemes, farming, hydropower, and domestic uses (Falanta and Bengesi, 2018; Fundi and Kinemo,

2018; Mwasha, 2016). However, studies regarding the types of water use conflicts and factors associated with conflicts in the Ngerengere water catchment management area are scarce in Tanzania. Therefore, this study was conducted to address this knowledge gap by assessing the types of water use conflicts and determining the factors associated with these conflicts using the Ngerengere water catchment area as a case study. The results from this study would inform policymakers, community groups and water users' associations on how to develop a proper solution for water use conflicts in Tanzania and elsewhere in the world.

2.3 Theoretical Framework

Conflicts over water resources are increasing domestically and internationally and are more rapid in developing world. Despite these challenges, there is little evidence indicating what the relevant authorities are doing to reverse the trend. According to Ravnborg *et al.* (2012), over the past decade, policy debates have increasingly associated water scarcity at the national or local level as the conflict over access to and use of water between different users and sectors. Since water is a natural resource whose use involves different actors particularly agency (service provider), principal (services user) and institutions as governing structures, then it is imperative to understand the manner in which scarcity of the resource leads to conflict among actors, the existing relationship between agency and principal, and the contribution of institutions on water use conflict management. It is this background that motivated the current study; in this endeavour therefore the study applied Conflict Resolution Theory (CRT) by Akhbari (2012).

2.4 Conflict Resolution Theory

According to CRT an increase of water use conflict is the result of high competition for water use, which is influenced by various interests with complex goals in water management systems (see Akhbari, 2012). Therefore, Akhbari (*ibid*) in this theory argues

that, to address such a challenge a variety of reforms are required and inevitable in the management policies. Further according to Ndelwa (2014), conflict resolution is a process of constructing or strengthening psychological and structural bridges, and this requires tapping into the emotions that develop a sense of hope, trust, empathy, cooperation, inclusiveness and non-violence. The question is to what extent do water catchment management institutions contribute to the management of water use conflicts by developing a sense of hope, trust, empathy, cooperation and inclusiveness among water users and other water stakeholders. The key argument of CRT is that, a successful management scheme should take into account the interests of all stakeholders in all domains such as irrigation, industries, domestic use and wildlife. In this study, if the interests of all water users, institutions, the types of conflicts and their causes are taken into account then water use conflicts expected to be minimized if not eliminated altogether. This theory is relevant in the current study as it is currently used by different scholars studying water use conflicts and it offers a simple solution which relates to considering the interests of all stakeholders. Therefore, the current study adopted CRT to explain the manner in which different variables such as water resources, the types of water use conflicts, factors associated with water use conflicts and water catchment management institutions can be understood in developing solutions to water use conflicts in Ngerengere catchment area.

Application of CRT in this study will help to understand why it is important for water catchment management scheme to take into account the interests of all stakeholders to develop a sense of hope, trust, empathy, cooperation and inclusiveness among water users and other water use stakeholders (Ndelwa, 2014). This is because an increase of water use conflicts is a result of high competition for water resources, which is influenced by lack of institutional capacity and coordination mechanisms among water catchment institutions.

The key argument of CRT, and which is advocated in this study is that if all interests of water users, institutions, types of conflicts and their causes are taken into account then water resource conflicts will be a history.

2.5 Methodology

This study was conducted in the Ngerengere catchment which is a sub-basin of the Wami-Ruvu River Basin in Tanzania with approximately 2 780 km² large (Schaefer and Dietrich, 2016). The catchment covers 154 km along Ngerengere River from its source in the Uluguru Mountains in the west to its junction with Ruvu River near Mafisi Village to the East (JICA, 2013). From an elevation of up to 2 260 miles in the Uluguru Mountains, the topography of the catchment varies considerably towards the plains at around 300 miles in the East. The largest town in the catchment, Morogoro, is the centre of intense agricultural and industrial growth; the region is exemplary for environmental changes induced by these developments. The study area covered five (5) wards namely Mindu, Bigwa Kilakala, Mzinga and Mlali. From each ward, three streets/villages were randomly selected for the study. The selected streets include Nughutu, Bong'ola and Bigwa Kisiwani in Kilakala Ward; Mikoroshini, Mgaza and Kasanga in Mindu Ward; Lukuyu, Mgolole and Bigwa Barabarani in Bigwa Ward and Mlali, Kipera and Kinyenze in Mlali Ward. Figure 1.1 presents the map of Ngerengere catchment area showing the study wards.

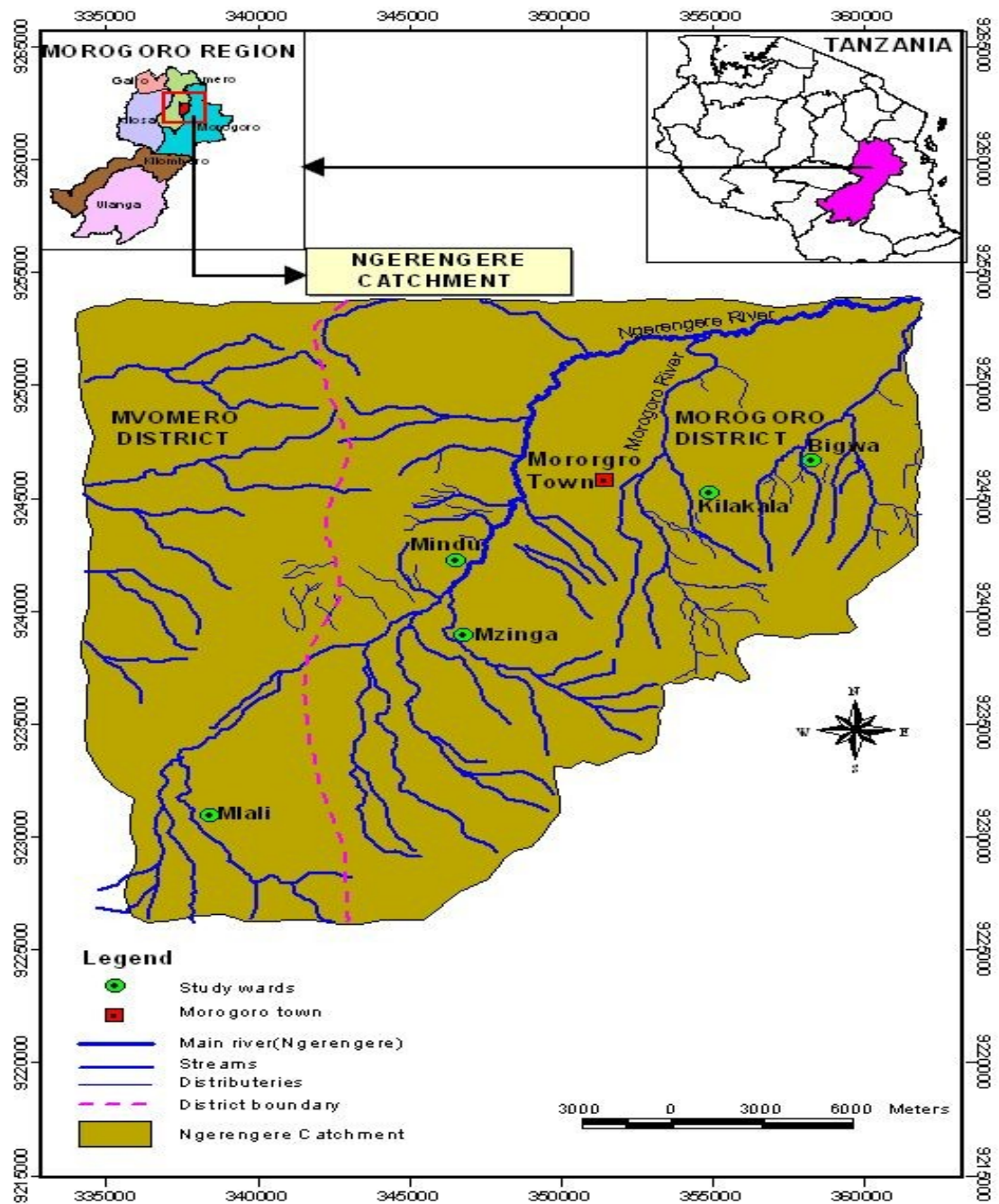


Figure 2.1: Location of the Ngerengere catchment showing the study wards

The study adopted a cross-sectional research design, whereby data were collected at a single point in time from the selected sample of respondents (see Corbin and Strauss, 2014). This approach was relatively cheap, quick and effective since it utilizes limited resources in terms of time, funds, labour and transport. Fieldwork was carried out from December 2019 to March 2020.

Questionnaires and checklists were pre-tested before using for data collection. Questionnaires and checklist questions were translated into Kiswahili language for ease of comprehension by the respondents. This aimed at ensuring data validity and reliability; the pre-test results were incorporated in the final version. Some changes were made to the questionnaires in accordance to the observation during pre-testing in the study area.

Three villages from Mlali Ward in Mvomero District and three streets from each ward in Morogoro Municipality (i.e. Kilakala, Mindu, Mzinga and Bigwa) were purposefully selected and thereafter a sample of 136 respondent households was proportionately and randomly selected from the village/ street registers. The total population of the selected wards was 60 041 with 13 216 households. The participants' distribution is detailed in Table 2.1

Table 2.1: Distributions of households in the study area

Ward	Total population	Total households	Total villages/ streets	Villages /streets selected	Sampled Households
Kilakala	19 420	4 308	15	3	40
Bigwa	14 260	3 272	15	3	30
Mindu	13 106	2 851	8	3	27
Mlali	11 550	2 303	8	3	23
Mzinga	1 705	485	5	3	16
TOTAL	60 041	13 219	51	15	136

Structured questionnaires were used to collect data from 136 randomly selected households. The heterogeneous purposive sample of key informants and a homogeneous purposive sample of FGD participants were expected to provide qualitative information on the types and factors associated with water use conflicts in catchment areas. A total of 38 Key Informants were interviewed including the Community Owned Water Supply Organization (COWSO) leaders, Water users' organization leaders, Government leaders, long-time residents/elders, ward leaders and community influential leaders.

Moreover, the study conducted 5 Focus Group Discussions (FGDs) involving 6 to 12 persons from the water users group.

Quantitative data from the household survey were analysed using the Statistical Package of Social Sciences (SPSS) software. In this case, descriptive statistics mainly percentages and totals were computed to summarise information on the types of water use conflicts; and a binary logistic regression model was used to determine the factors associated with water use conflicts in the study area. In this study, seven predictor variables as indicated in Table 2.1 were fitted in the binary regression model. The model specification is as follows:

$$Y = \ln[P_i / (1 - P_i)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} \quad \dots\dots\dots(1)$$

where: the subscript i denotes the i^{th} observation in the sample, P is the probability of the outcome, β_0 is the intercept term and $\beta_1, \beta_2, \dots, \beta_k$ are the coefficients associated with each predictor variable

Table 2.2: Variables used in the binary logistic regression model

Variable	Definition
Response variable	
Experience water use conflict	1=Experienced, 0=Not experienced
Predictor variable	
Sex of the household head	1=Male, 0=Female
Age of the household head	Age in years
Education level of the household head	Number of years spent in school
Occupation of the household head	1=if employed by formal sector, 0 otherwise
Wrong placement of water points	1=Yes, 0=No
Lack of community involvement in water use plans	1=Yes, 0=No
Failure of water management institutions	1=Yes, 0=No

Thematic analysis was used to analyse qualitative data whereby information generated from the respondents was summarized thematically to complement information generated through quantitative analysis.

2.5 Results and Discussion

2.5.1 Socio-Demographic Characteristics

The finding in Table 2.3 indicates that the majority (75%) of the heads of the households were married. Also, 22.1 percent of the respondents are educated with salaried employment followed by farming/ livestock keeping as a secondary occupation. This implies the availability of personal income is likely to reduce some conflicts because people can afford to get basic needs including payments of water bill. Furthermore, high level of education is likely to reduce conflicts. The findings in Table 2.3 also indicate that 52.9 percent of the respondents were males and 47.1 percent were females, this shows how females have been actively engaged in different activities, implying that women can also manage their life socially and economically as is the case with men.

Table 2.3: Socio-demographic characteristics of the household head

Variables	Category	Frequency	Percent
Sex of the House hold Head	Male	72	52.9
	Female	64	47.1
Marital Status	Single	22	16.2
	Married	102	75
	Divorced/Separated	5	3.7
	Widow/Widower	7	5.1
Relationship with the household head	Head of Households	77	56.5
	Spouse	42	30.9
	Son/Daughter	11	8.1
	Others	6	4.4
Occupation of the Household Head	Salaried employment	30	22.1
	Crop production	60	44.1
	Livestock keeping	10	7.4
	Trade/ Business	30	22.1
	Others	6	4.4
Total		136	100

2.5.2 Types of water use conflicts in Ngerengere catchment area

The study sought to understand the main types of water use conflicts in the study area. The findings in Table 2.4 indicate that domestic and irrigator users, upstream and downstream

users, domestic and domestic users, farmers and livestock keepers were the four major types of water use conflicts cited by the respondents. Each of the four major types of water use conflicts is discussed in the subsequent sections.

Table 2.4: Main types of water use conflicts

Type of conflicts	Frequency	Percent
Domestic and Irrigator	31	31
Upstream and Downstream	37	37
Domestic Users	62	62
Famers and Livestock keepers	6	6
Total	136	100

2.5.2.1 Domestic Users

The findings in Table 2.4 reveal that in the Ngerengere catchment area there is intra-sectorial competition among domestic users; and this was reported by 45.6 percent of the respondents, followed by Upstream and Downstream users. However, experience from the literature shows that while the requirement of water for domestic use is a priority, a large amount of water is used in the irrigation system (Masifia and Sena, 2017). This result implies that there is still a shortage of water for domestic use regardless of having the institutions responsible for water supply and water catchment management. According to Le Meur *et al.* (2006), where there are water use conflicts, national decision-makers and international development agencies should formulate policies and prioritizing their action for improved sustainable use of water resources, while resolving conflicts among the different users. For this study, it means water use conflicts have continued to exist in the study area due to the absence of sustainable water infrastructures and lack of community awareness on water catchment management plans.

The study conducted by Massawe *et al.* (2019) found sufficient water for irrigation and domestic use, however the spatial distribution of water suggests that, in many cases, it is not available as a result, majority are living under water stress.

2.5.2.2 Upstream and Downstream

The study findings revealed that conflict between upstream and downstream water users is another type of water use conflict in the study area as reported by 27.2 percent of the respondents (see Table 2.4). This type of conflict is common among irrigators in the upstream and hydropower in the downstream whose cause was cited as lack of good water infrastructure. a respondent from key informant interview with representative from Wami/Ruvu said,

“...Morogoro has no major problem of water scarcity, but it is clear that lack of water infrastructures is the key problem here. And to end this problem, in the long run, there must be integrated water use planning involving all stakeholders involved in water use...” (Wami / Ruvu Basin officer key informant interview organized on 4th February 2020).

This finding is in contrast with the finding reported in a study by Kabogo *et al.* (2017) conducted in Tanzania which revealed that, conflict between upstream and downstream water users was caused by water shortage, especially during the dry period. Failure of leaders to bring together water users for common agreement on water use during the dry period was cited as a cause of this type of conflict.

2.5.2.3 Domestic and Irrigators

Generally, it is also obvious that domestic water users and irrigators have different requirements for water. Table 2.4 shows the findings on conflicts between domestic and irrigators over water use from the Ngerengere water catchment area.

According to Komakech *et al.* (2012), conflict between domestic users and irrigators is intensified by the urbanities in Tanzania who take advantage of the Water Act which gives

priority to domestic water users to claim the right to water which was formally used for irrigation by small scale farmers in rural areas. This type of conflict occurred because the community and Water Users Association (WUA) are minimally involved in water use plans. similar findings are reported in a study by Ambonisye (2019) whereby a low level of community involvement in water use plans led to water use conflict in Gairo District.

2.5.2.4 Farmers and Livestock Keepers

Findings in Table 2.4 show further that farmers and livestock keepers was another type of water use conflict in the study area. However, this was the least prominent type of conflict in the Ngerengere catchment area, reported by only 4.4 percent of the respondents. This may be because the majority of the households who participated in this study are living in the municipal area where livestock keepers are mostly engaging in zero-grazing. These findings are consistent with the findings from other studies conducted in Kilosa where the two groups have, for a long time, been in deadly clashes, most of which resulted in the loss of lives and destruction of properties (Mwasha, 2016; Falanta and Bengesi, 2018).

2.5.3 Factors Associated with Water Use Conflicts in the Ngerengere Catchment Area

Table 2.5 presents the results from the binary logistic regression model on the factors associated with water use conflicts. The results indicate that education level, misplacement of water points in the community and failure of water use management institutions were statistically and significantly associated with water use conflicts in the study area.

2.5.3.1 Education Level

The study results reveal that the education level of the respondents had a negative and significant ($P < 0.05$) relationship with water use conflicts, implying that as the education level of the respondent decreases by one unit then the likelihood of such an individual to engage in water use conflicts increases (Table 2.5). This means if majority of the community members in the study area have the opportunity of increasing their education level, then they will be able to access proper education on water catchment and equitable water use in their communities hence reduce water use conflicts. similar findings are reported a study by Falanta and Bengesi (2018) who revealed that the higher the level of education, the higher the ability of addressing issues confronting water users. There is a consensus that the education level of an individual is an important tool of facilitating proper use of resources available in their environment (Mwasha, 2016). It is also argued that where there is a problem of water accessibility, the education of an individual becomes a tool of enabling them adopt the coping strategy to solve water challenges. In this case, it was expected that people with good education could be resourceful in solving water use conflicts.

2. 5.3.2 Wrong Placement of Water Points

Unequal distribution of water points was one of the stimulating factors for water use conflicts. According to Seluhinga (2013), geographical location and climate of a place and ecological integrity of the resource base play an important role in analysing access to water for different uses. Based on this argument, it is clear that water use conflicts in an area where water points are misplaced in the community. Table 2.5 shows that wrong placements of water points ($\beta = +1.96$) and failure of water management institutions ($\beta = +2.498$) had positive effects on water use conflicts. Results from focus group

discussion show that people experienced water use conflicts in their area because water points are wrongly placed in areas, which are inaccessible by most people. One FGD participant said,

“... Our Ward (Mindu) has eight streets and is located closer to the Mindu Dam that provides water to the whole Morogoro Region. However, only a few streets have full access to water from water points established by MORUWASA due to poor infrastructure and the displacement of water points. . .” (Focus Group Discussion organized on, 3rd February 2020).

This abstract implies that poor infrastructure and water points' allocation are the challenge revealed in this study. In other words, different institutions are responsible for water supply based on the nature of the water catchment present in each area. The study findings revealed that MORUWASA was the major institution responsible for supplying or allocating water points in different wards involved in this study. On the other hand, other stakeholders such as Wami Ruvu Basin, Street committee, Community elders, environmental committee, and water users associations were minimally involved, implying that when decisions are made to one entity majority are left out thus exacerbating conflicts in the community. According to Masifia and Sena (2017), this situation put other stakeholders under difficult conditions and hence failing to participate in implementing various national policies and acts especially related to water resource management and environmental conservation.

Table 2.5: Factors associated with water use conflicts

Variables	B	S.E.	Wald	Sig.	Exp(B)
Age of Household Heads	0.019	0.035	0.304	0.582	1.019
Sex of Household Heads	0.796	0.717	1.234	0.267	2.216
Number of years spent in school	-0.943	0.48	3.849	.050*	0.39
Occupation of the Household Head	-0.122	0.238	0.26	0.61	0.885
Wrong placement of water points	1.965	0.687	8.173	.004*	7.137
Lack of community involvement in water use	-1.919	1.435	1.79	0.181	0.147

plans					
				.047*	
Failure of water management institutions	2.498	1.256	3.954	*	12.162
Constant	0.761	3.177	0.057	0.811	2.14

Note: *, and **are significance level at 1% and 5%, respectively

2. 5.3.3 Failure of Water Management Institutions

The findings reveal that the failure of water management institutions was positively and statistically ($P < 0.01$) associated with water use conflict (Table 2.5). This result implies that an increase in the failure of water management institutions to deliver efficient services is likely to lead to water use conflict since people do not get enough water for their daily use, thus exacerbating water use competition and conflicts. As reported by Mehta (2007), the shortage of water is an indication of water management institutional failure. Shagama, (2019) also notes, limited access to quality water service is a result of institutional failure. This builds a strong base for this study to comment that water catchment institutions need to play their roles in managing water for better community access and hence avoid water use conflicts. Proper management of water catchment will reduce illegal connections and water shortage, which lead to misunderstanding between water user groups.

Similarly, this study was conducted to find out responsible institutions for resolving water use conflicts in the study area and found that only MORUWASA was more responsible in solving water use conflicts. This means that not involving other responsible institutions such as community elders, Wami Ruvu Basin, street committee, and other stakeholders is an institutional failure. Conflicts are likely to continue as communities are minimally involved in managing water use conflicts in the catchment. Poor community participation in the water catchment management was also confirmed during focus group discussion when one participant said,

“... We have received various water projects from donors, but in the end, we

don't benefit. For example, The World Bank supported us to drill a deep well, but MORUWASA did not involve the targeted communities and they used very substandard pipes as results we don't get sufficient water here. . ." (Kasanga ward Focus Group Discussion organized on 3rd February 2020).

In this study, demographic factors such as age, sex, and occupation of the head of the household as well as lack of community involvement in water use plans were not statistically significant at 5 and 1 percent respectively. However, during FGD it was reported that water resource management institutions have failed to involve the targeted community in water use plans thus resulting in conflicts among water users. In this regard, there is a need of conducting more research to find out the relationship between these factors and water use conflicts in the study area.

2.7 Conclusions and Recommendations

Based on the study findings, it can be concluded that domestic users a domestic users' conflicts were the results of the shortage of water for domestic use. The study concludes that water catchment management institutions are not accountable for water service delivery in the Ngerengere catchment area thus water use conflicts and other factors associated with these conflicts are still on the increase. Hence, it is recommended that the Government particularly water use management institutions should ensure good management and availability of enough sources of water for ease accessibility.

References

Akhbari, M. (2012). Models for Management of Water Conflicts: A Case Study of the San-Joaquin Watershed, California. A dissertation submitted for the Degree of Doctor of Philosophy Colorado State University, United States of America. 150pp.

- Ambonisye, H. (2019). Gender mainstreaming in water resource management. 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. 86pp.
- Corbin, J. and Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications. 436pp.
- Falanta, E. M. and Bengesi, K. M. (2018). Drivers and consequences of recurrent conflicts between farmers and pastoralists in Kilosa and Mvomero Districts, Tanzania. *Journal of Sustainable Development* 11 (4):1-14.
- Fundi S.S. and Kinemo, S.M. (2018) Water user's conflicts in irrigation schemes in Tanzania, Mzumbe University, Tanzania school of public administration and management. *Journal of Public Administration and Governance* 8(4):1-15.
- Gudaga, J. L., Kabote, S. J., Tarimo, A. K. P. R., Mosha, D. B. and Kashaigili, J. J. (2018). Effectiveness of groundwater governance structures and institutions in Tanzania. *Applied water science* 8(2): 1-14.
- JICA (2013). The Study on Water Resources Management and Development in Wami/Ruvu Basin.
[https://www.jica.go.jp/tanzania/english/activities/water_05.html.] site visited on 18th May, 2020.
- Kaboko, J.E., Anderson, E.P., Hyera, P. and Kajanja, G. (2017). Facilitating public participation in water resources management. *Reflections from Tanzania. Ecology and Society* 22(4):1-9.
- Klare. M.T. (2002). *Resource Wars: The New Landscape of Global Conflict*. Henry Holt and Company. New York.172pp.

- Kashaigili, J. J., Kadigi, R. M., Sokile, C. S. and Mahoo, H. F. (2003). Constraints and potential for efficient inter-sectoral water allocations in Tanzania. *Physics and Chemistry of the Earth* 28(20-27): 839-851.
- Komakech, H. C., Van der Zaag, P. and Van Koppen, B. (2012). The last will be first: Water transfers from agriculture to cities in the Pangani River Basin, Tanzania. 720pp.
- Le Meur, P., Hochet, P., Shem, M. and Touré, O. (2006). Conflict over Access to Land & Water Resources within Sub-Saharan Dry Lands. Underlying factors, conflict dynamics and settlement processes. *GRET-FAO LEAD Final Report*. 108pp.
- Loucks, D. P. and Van Beek, E. (2017). *Water resource systems planning and management: An introduction to methods, models, and applications*. Springer. 624pp.
- Masifia, Y. and Sena, S. (2017). Factors influencing water resource governance among pastoral community at Mkondoa Sub-Catchment, Morogoro Region, Tanzania. *International Journal of Scientific & Technology Research* 6(6), 148-172.
- Massawe, P.I., Mvena, A., Nyoki, D. and Chambile, E.L. (2019). Effects of Anthropogenic Activities on Availability of Clean and Safe Water: A Case of Uluguru Forest Catchment Areas Morogoro, Tanzania. *South Asian Journal of Development Research* 1(2): 114-123.
- Mdee, A. (2017). Disaggregating orders of water scarcity-the politics of nexus in the Wami-Ruvu River Basin, Tanzania. *Water Alternatives*. 10(1), 100.
- Mehta, L. (2007). Whose scarcity? Whose property? The case of water in western India. *Land use policy*. 24(4): 654-663.
- Mwasha, D.I. (2016), Farmer-pastoralist conflict in Kilosa District, Tanzania: A climate change orientation. A Dissertation Submitted in a Partial fulfilment of the

requirements for the degree of Master of Arts in Rural Development of Sokoine University of Agriculture. Morogoro, Tanzania. 72pp.

Ncube, E., Gumata, N. and Ndou, M. (2018). Global economic uncertainties and exchange rate shocks: Transmission channels to the South African economy. 60pp.

Ndelwa, L.L. (2014). Role of water user associations in the management of water use conflicts: A case of Ilonga Sub-catchment in Wami-Ruvu Basin, Tanzania. A Dissertation Submitted in Partial Fulfillment of the requirements for the Degree of Master of Arts in Rural Development of Sokoine University of Agriculture. Morogoro, Tanzania. 93pp.

Ntilicha, M., Kilungu, H. and Munishi, P.K.T. (2012). Water use conflicts in northern Tanzania. A case study of Rundugai river catchment, Pangani Basin Hざai District. *Tanzania Journal of Forestry and Nature Conservation* 81(2): 1-17.

Oremo, F., Mulwa, R. and Oguge, N. (2019). Knowledge, attitude and practice in water resources management among smallholder irrigators in the Tsavo Sub-Catchment, Kenya. *Resources*. 8(3), 130.

Ravnborg, H. M., Bustamante, R., Cissé, A., Cold-Ravnkilde, S. M., Cossio, V., Djiré, M., Funder, M., Gómez, L.I., Le, P., Mweemba, C., Nyambe, I., Paz, T., Pham, H., Rivas, R., Skielboe, T. and Yen, N. T. (2012). Challenges of local water governance: the extent, nature and intensity of local water-related conflict and cooperation. *Water Policy* 14(2), 336-357.

Roberts, S. M. (2014). Development capital: USAID and the rise of development contractors. *Annals of the Association of American Geographers* 104(5), 1030-1051.

Said, M., Komakech, H.C. and Munishi, L.K. (2019). Evidence of climate change impacts on water, food and energy resources around Kilimanjaro, Tanzania. *Reg Environ Change*. 1 (19): 2521–2534.

Seluhinga, H.P. (2013). Local institutions and water resources management in urban areas of Tanzania: The case of Mazimbu Ward in Morogoro Municipality. A dissertation submitted in partial fulfilment of the requirements for award of degree of Master of Science in Development policy (MSc. DP) of Mzumbe University. 95pp.

Shagama, B. (2019). Governance and the quality of water services delivery in Iramba and Singida Rural Districts, Tanzania. A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy of the Sokoine University of Agriculture. Morogoro, Tanzania. 181pp.

CHAPTER THREE

3.0 WATER RESOURCE MANAGEMENT INSTITUTIONS AND WATER USE CONFLICTS IN NGERENGERE WATER CATCHMENT, MOROGORO TANZANIA

¹Amina Saidi Mhina and ²Goodluck Dastan Massawe

¹MA. Project Management and Evaluation Student, College of Social Sciences and
Humanities, Department of Policy, Planning and Management
P.O. Box 3035, Morogoro, Tanzania.
Corresponding email: aminasmhina@gmail.com

²Lecturer, College of Social Sciences and Humanities, Department of Policy,
Planning and Management
P.O. Box 3035, Morogoro, Tanzania.

3.1 Abstract

Water resource management activities are characterized by a lack of integrated institutional coordination. Despite good institutions responsible for water catchment management, the performance of the water sector delivery system has remained very poor. The study used a descriptive cross-sectional research design to map the existing water

resource management institutions (WRMIs) and to determine the role of the existing water use management institutions on water use conflicts in the Ngerengere catchment area. Observation, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) were the major tools used to collect data. Conventional mapping was used to map the existing WRMIs. Content analysis was used to analyse qualitative data obtained through FGDs and KIIs. The study found that WRMIs are formal (Wami/Ruvu Basin Office, MORUWASA, Local Government Authority, Community Owner Water Supply Organizations (COWSO), Water Users Associations, Non-Government Organization, Civil Society) and informal (beliefs, norms and customs, bylaws) in nature. The WRMIs have three major roles including water catchment management; water catchment protection; and water uses planning. The study concludes that, although the water management institutions are present, some of the institutions were less effective in performing their roles related to water resource management, protection and planning. The study recommends that there is a need for all stakeholders including the Ministry of Water to establish a strong negotiation platform between the water resource management institution and water users (community). An integrated water resource management plan is very important for sustainable water resources.

Keywords: Water use conflicts, Water catchment, Water resource management institutions

3.2 Introduction

Water resources management may be referred to as institutionalized activities of water resources development, utilization, allocation, conservation and control (Africa Development Bank, 2002). Tanzania has a National Water Policy (NAWAPO), which was established in 1991 and revised in 2002 to accommodate global development changes. NAWAPO aimed at having a comprehensive framework for sustainable development,

utilization and management of water resources (URT, 2009), which can be achieved through community involvement, transparency, effective institutions and legal framework. The policy has a clear definition of the commitment of and relationship between all stakeholders in water resource management including formal and informal institutions, communities, the private sector, non-governmental organizations (NGOs) and civil societies. The Ministry of water through the Water Resource Management Act No 11 of 2009 and NAWAPO have a role of managing water resources and of enabling the country to have equitable use and sustainable management of water resources for economic development and environmental conservation (Haule, 2019).

According to Cosgrove and Louck (2015), good water resource management is very important for increasing food production and protecting the ecosystem. However, there is evidence that the existing water catchment areas are facing enormous threats from human activities leading to reduced quality of lives in the coming decades (Oremo *et al.*, 2019). To address this problem Tanzania established nine water basins to manage water resources. The basin includes Rufiji which is the largest covering 177 420 km², followed by Wami/Ruvu, Pangani and Ruvuma on the southern coast, all of which drain their waters into the Indian Ocean. Other basins include Lake Nyasa, Lake Rukwa, Lake Tanganyika and Lake Victoria (Shagega *et al.*, 2018). The informal water resource management institutions dominate at the grassroots level while the formal institutions dominate at the basin level (Sokile *et al.*, 2004).

Tanzania like other Sub Sahara African countries has made efforts of ensuring equitable distribution of water among users. For instance, the Tanzania Water Management Act No 11 of 2009 has three important frameworks to implement, which include the provision

concerning water management, use, and protection of water resources. The act sets out fundamental principles of water use and conservation.

Water resource management activities in Tanzania are characterized by an institutional gap (Sokile *et al.*, 2000), in that the existing institutions have poor or lack basic and integrated coordination. For stance, water supply is under urban water authorities, irrigation is under the Ministry of Agriculture and Food Security and hydropower is under the Ministry of Energy (Ndelwa, 2014). Likewise, while one of the key determinants of the quality of water service delivery is the institutions responsible for water catchment management (Alexander *et al.*, 2015; Spaling *et al.*, 2014), the performance of the water sector delivery system has also been inadequate resulting in conflicts among water user (UNDP and UNICEF, 2015).

The main objective of this study was therefore to map the existing water resources management institutions and examine their contributions in managing water use conflicts in the study area. This study is important since it highlights the different aspects of water resources management and responsibilities of the water resource management institutions (Davis, 2007). The study findings will also help policymakers to understand the importance of WRMIs and their responsibilities in controlling water use conflicts in the study area.

3.3 Theoretical Framework

This study applied a combination of Agency theory and the principle of good governance. The Agency theory was developed by Jensen and William in 1976 and has been successfully applied in examining the nature of the relationship between the principal and the agent (Mkalagale, 2013). According to Mkalagale (2013), the key argument of this

theory is that the agent's preferences or goals may at times vary from that of the principal; thus, the agent has an incentive of deviating from the principal's interests. This implies that water suppliers are likely to serve their interest rather than the interest of water users something which creates misunderstanding between the two. This theory is relevant in the current study as it discusses the problems existing in the water catchment management due to the separation of water suppliers or owners, managers (institutions) and water users, and emphasizes on finding a solution to this problem.

According to Panda and Leepsa (2017), the Agency theory's weakness is its lack of concern about the principals (water users), who might deceive, shirk and exploit the agents (water suppliers). In this regard as Mkalagale (2013) observes, the agent is more informed on what is going on in the company than does the principal.

The principles of Good Governance were used to support the use of Agency Theory. In this study the theory has been used to show the relationship between water resource management institutions themselves and the manner in which they cooperate with other institutions such as laws and informal institutions in finding solutions to water use conflicts. There are seven principles of good governance including accountability, responsiveness, equity and inclusiveness, participation, rule of law, effectiveness, efficiency, consciousness oriented and transparency. Governments must exercise these principles to realize sustainable water resource management. This can be done through planning in terms of policy, legal and political will. When the government fails to fulfil good governance principles, stakeholders talk of poor governance (Mahoo *et al.*, 2015). Seven principles set of governance and related performance outcomes provide a platform for the assessment of governance quality for an individual global protected area, a network of several protected areas, or a national protected area system (Michael, 2009).

3.4 Methodology

3.4.1 Study Area

The study was conducted in the Ngerengere catchment area (NCA), which is located in the middle of the Wami-Ruvu basin, covering an area of approximately 2 780 kms. Ngerengere River originates from the Uluguru Mountains and covers a huge part of Morogoro Region. The catchment area consists of sub-catchments including Mindu Dam, which was built in the late 1980s for industrial and domestic purposes. In addition, catchment area covers 154 km along Ngerengere River from its source in the Uluguru Mountains in the west to its junction with Ruvu River near Mafisi Village to the East (JICA, 2013).

3.5 Study Design

The study adopted a cross-sectional research design to map the existing water resource management institutions and their roles on water use conflicts in the Ngerengere catchment area. With cross sectional research design, data were collected at a single point in time from a selected sample of respondents (Corbin and Strauss, 2007). This design was relatively cheap, quick and effective since it utilizes limited resources in terms of time, funds, labour, transport and time.

3.6 Sampling Strategy

Three villages from Mlali Ward and a total of twelve streets (3 from each ward) from Kilakala, Mindu, Mzinga, and Bigwa wards were purposively selected to be involved in the study based on the fact that the area is endowed with water catchments and reported to have experienced water use conflicts. The selected streets and villages include Mikoroshini, Mgaza and Kasanga for Mindu Ward; Bong'ola, Nughutu and Bigwa Kisiwani for Kilakala Ward; Konga A, Konga B and Kidangawa for Mzinga Ward; Bigwa

barabarani, Lukuyu and Mgolole streets for Bigwa Ward and Mlali, Kipera and Kinyenze villages for Mlali Ward. The total population of the study area was 60 041 with 13 216 households.

3.7 Data Collection and Analysis

Both primary and secondary data were collected. The FGDs and KIIs generated information on the types and roles of water resource management institutions and associated roles in water use conflict management. Related documents including National Water Policy of 2002, National Water Management Act of 2009, National Water Management Act of 2016, National Water Strategic Plan Number 11 of 2009 Mvomero District Investment Profile of 2017 and Morogoro Municipal Council profile of 2019, were reviewed to get information on water resource management institutions and associated roles in water use conflict management. Qualitative data obtained from FGDs and KIIs were summarized and analysed thematically to map the existing water resources management institutions and their roles in managing water use conflicts in the study area.

3.8 Results and Discussion

3.8.1 Water Resources Management Institutions and their Roles

The structure of water governance was determined through FGDs and KIIs. The study findings show that water resource management institutions in the study area are of two categories formal and informal. Table 3.1 summarizes all institutions (formal and informal) and their roles. These are in turn discussed in Sections 3.8.1.1 and 3.8.1.2.

Table 3.1: Role of water resource management institutions in the study area

Formal Institutions	
Institutions	Roles
1) Wami/Ruvu Basin Office	Managing water for economic development, and maintenance of the environment.
2) Morogoro Urban Water and Sanitation Authority (MORUWASA)	- Managing, distributing and conserving water from their sources jointly by the members of association - Acquire and operate any water permit. - Resolve conflicts between water users related to water sources - Present special interest and values arising from water used for public purposes including an environmental and conservation area. - Monitoring water availability, operating and maintaining a water service or structure and managing water distribution system and setting tariffs and collection of water fees.
3) Local Government Authority	- Resolve water conflicts - Ensuring fair distribution of water among the community members
4) Community Owner Water Supply Organizations (COWSO)	- Ensuring fair distribution of water among the community members - Resolving water conflicts, accountability in the water resource management - Having a proper relationship with other government structures,
5) Water Users Associations	- Owing, managing, protecting water resource - Controlling, operating and maintaining water supply services
6) Non-Government Organization	- Facilitates water plans, infrastructures and utilization of water resource - Contribute money for pump/tanks, water pipes maintenance
7) Civil Society	- Facilitates water plans, infrastructures and utilization of water resource - Contribute money for pump/tanks, water pipes maintenance

Informal Institutions	
1) Community Elders	• Supervision and management of water resources • Proper managed and maintenance and works in collaboration with Wami/Ruvu Basin office
2) Belief of the presence of dangerous wild animals	• Strong influence in protecting and proper utilization of water source • Act as a guiding tool and power of the community elders in protecting and preserving water sources using their norms.
3) Norms and customs,	• Overseeing the implementation of water use norms by laws and values • Raise and improve the community awareness on water conservation, law enforcement and community involvement in water resource management.

3.8.1.1 Formal Water Resource Management Institutions

1) Morogoro Urban Water Supply and Sanitation Authority (MORUWASA)

Tanzania Water Management Act No.11 of 2009, has paved the way to the establishment of MORUWASA, which has the role of managing, distributing, and conserving water. The Act aims at resolving conflicts between water users and present special interest and values arising from water use. Other functions include monitoring water availability, operating and maintaining water services or structures, managing the water distribution system, and setting tariffs and collecting water fees.

Despite the good intentions of the government in establishing the institutions such as MORUWASA in every city, municipality and urban areas, this study has identified challenges facing MORUWASA and other government authorities, and these include insufficient budget for establishing and maintaining water development projects and a shortage of human resource. These challenges led to the failure of completing various plans or not completing them in time.

The FGDs with water users in Morogoro Municipality revealed that most people connected to MORUWASA network still use water, which is under the supervision of the COWSO; thus, MORUWASA has not fully implemented its intended objectives to the

people of Morogoro. This has been observed in Kilakala, Bigwa, Mzinga and Mindu wards where many people use water connected through the efforts of COWSO under the supervision of Water User Associations (WUAs), which are under the umbrella of the Wami/Ruvu Basin office. One of the key informants in Kilakala had this to say,

“... Most of us have been connected to the MORUWASA network but we don't have any water, that's why many people prefer to be connected to COWSO though it's more expensive than MORUWASA services” (Kilakala Ward officer key informant interview organized on 6th February 2020).

MORUWASA is facing several challenges in Morogoro, which include lack of resources especially experts and funds for water projects, lack of community awareness and poor participation in water project planning and their implementations. In the study area, people were not aware of MORUWASA's duties and responsibilities.

“... In this area, MORUWASA has installed pipes that are too small to handle the high pressure of water flowing to the community, as a result, most of the pipes get damaged and eventually, water does not reach the people as it gets lost in the way. If the Government knows MORUWASA as the institution responsible for water supply, why don't they support the institution to perform its functions easier?” (Mindu Ward Focus Group Discussion organized in 20th February 2020).

2) Wami / Ruvu of Tanzania Basin Office Wami/Ruvu Basin Office

The Government of Tanzania through its National Water Policy (NAWAPO) of 2002 has established nine hydrological zones or River Basins including Wami/Ruvu to enhance effective water resource management. Water Basins are part of the management continuum starting with the upstream freshwater sources in the watershed, moving down into the freshwater-seawater interface in the deltas and estuaries.

The study revealed that Wami/Ruvu Basin is an institution that has been the main organ for water users and the government. Similarly, the community believes that this institution has the responsibility of managing, preserving, protecting and distributing water resources. This means that Wami/Ruvu works closely with the community.

One of the responsibilities of this institution is to issue water permits to the group of water users in areas where MORUWASA is not ready to offer service. Through this responsibility, research results sometimes cause conflicts especially when MORUWASA is ready to supply water services in the areas where community had already been granted water permits. Through cooperating with the village/street communities, different plans and strategies have been established to manage the water resources and this has brought them closer to the community in water resource management.

Despite the existence of this institution, the study results show that the majority of the community trusts MORUWASA. However, there are circumstances that prevent it from performing properly. One of them is the interdependence of the sectorial responsibilities in the respective sectors including Agriculture and irrigation, Electricity and hydropower, Energy and mining, industrial which limit each other's functions due to interconnectedness of the sectors with the Ministry of water.

“.....the integrated plan of water resources management and its uses are supposed to start from the low to the national level to stimulate good results in water resource management. I know this plan will be productive because five out of eight basins have already submitted their plans to the Ministry of Water. We will submit our plan soon after all the plans have been reviewed. I hope we will be able to get one good plan for implementation.” (Wami/ Ruvu Basin Officer key informant interview organized in 12th February 2020).

3) Community Owned Water Supply Organizations (COWSO)

The functions of COWSO are to ensure a fair distribution of water among the community members, resolve water conflicts, maintain proper relationships with other government structures, ensure accountability in the water resource management, oversee the implementation of water use by laws and facilitate water users to contribute money for pump/tanks and water pipes maintenance (URT, 2002). This study noted that, COWSO is actively involved in two wards except for Mindu, Kilakala and Bigwa. There is COWSO known as SAKOVICHA which stands for Sangasanga, Konga, Vikenge and Changarawe. This Organization used to unite water users through principles of proper water uses and protection of the water sources. At Kilakala, there is one organization with four groups of water suppliers under the union of (*Umoja wa Watumia Maji Bong'ola*) and at Mindu, the water users community is known as UWAJAKUVI, which stands for (*Uwajibikaji wa Jamii Kupitia Vijana*). The organizations are not active at Kilakala, Bigwa and Mindu due to the presence of MORUWASA services. Generally, legally COWSO is not allowed to operate in urban areas where UWA is available especially in the Morogoro Municipality:

“After realizing that the water volume in the river was decreasing and the community could not afford water pipes, we established a union known as UWAWAMABI which stands for (Umoja wa Watumiaji wa Mto Bigwa) which, currently has 9 groups, we then asked for support from the Tanzania Integrated Water, Sanitation and Hygiene (IWASH) project which constructed a water network by constructing a water tank to store water. The infrastructure had been helping us for many years until MORUWASA came and instead of assisting us in maintaining the storage facility; they took it away and put it

under their control” (Bigwa Ward Focus Group Discussion organized in 18th January 18, 2020).

4) Water Users Associations and Village Committees

This study revealed that Water Users Associations and Village Committees worked together on water resource management issues. They are fully responsible and trusted by the community. The study found these institutions more active at Bigwa, Mlali and Kilakala wards. For stance, FGDs from Mlali Ward reported that within the ward there are committees under the supervision of Water Users Associations (WUAs) responsible for the formulation and implementation of by-laws to govern water resources.

“We have by-laws implemented by the village government that govern the use of water. WUAs with the village committees set by-laws that whoever goes against them is punished by paying fines. Among by-laws implemented by the village government include restricting washing clothes around the tap water surrounding area, cutting trees, grazing animal and farming activities within 60 meters from the water sources” (Mlali Ward Focus Group Discussion organized on 1st March, 2020).

3. 8.1.2 Informal Water Resource Management Institution

Informal water resource management institutions are socially shared rules usually unwritten aimed at protecting water resources. The study shows that NCA has institutions such as norms, customs, traditions, cultural beliefs, values and others, which are under the control of the community elders. The findings from KIIs and FGDs revealed that informal institutions have a great role in water conflict management. Community elders as a part of the community have the responsibility of supervising and preventing the destruction of water sources through establishing or formulating plans, principles and regulations that

will be followed by the people in a particular community. Among these principles is ensuring participation of Women in water use, management and decision making, ensuring sanitation of water points, mutual respect among water users at water points and maintaining equal access to water resources (Gudaga *et al.*, 2018). This is because the main function of informal institution is to protect water sources from all traditional activities that can cause destruction. The main informal institutions responsible for water use management in the study area are discussed in the subsequent sections.

1) Community Leaders

According to the study results, there has been proper supervision and management of water resources in the study area where this institution operates. One of the most successful areas for the institution is Bigwa Ward whereby through community elders in collaboration with Wami/Ruvu Basin officers, the Uluguru Mountains and Bigwa River is properly managed and maintained. The findings revealed further that, community elders have a huge contribution to water resources management since they are the ones closest to water users than is the case with other institutions.

“.....In the past, our ancestors took very good care of these mountains which explain the history of water flowing from the mountains. However, in recent years, the water sources on the mountains have been badly destroyed by human activities to the extent that the mountains look deserted. At the beginning of the year 2000s, we solely agreed as elders of the area to cooperate in ensuring the revival of the natural vegetation in the area to its original condition by establishing ethics and restrictions on the people from entering the mountains where our water source is. Currently, little force is used in preventing human activities around the water sources because the people now understand the importance of protecting the water resource” (Bigwa Ward Officer key informant Interview organized in 12th January, 2020).

A study by Ambonisye (2019) conducted in Gairo found that informal institutions are strong and powerful in managing water resources since they are led by community elders with more indigenous knowledge thus contributing to effective conservation of water resources using norms and taboos. a similar observation was made by Kabote and John (2017) who found that water governance including groundwater is largely dominated by informal institutions including norms at a local level. In this case, it is possible to reduce water use conflicts in the community.

2) Presence of Dangerous Wild Animals

The study found that traditions have a strong influence and are properly utilized in protecting and managing water sources. In all the study wards, only one (Bigwa) has been observed to exercise the power of the community elders in protecting and preserving water sources using their norms, which prohibit anyone from entering the forest without following the regulations.

“... Whoever goes on the top of the mountains without following regulations can face dangerous and huge snakes, hyenas and lions which could harm them and this is due to good water source management that has supported the presence of several wild animals occasionally in the area” (Bigwa Ward Officer key informant Interview organized in 12th January, 2020).

3) Norms

The study found that norms are used to raise and improve the community awareness on water conservation, law enforcement and community involvement in water resource management.

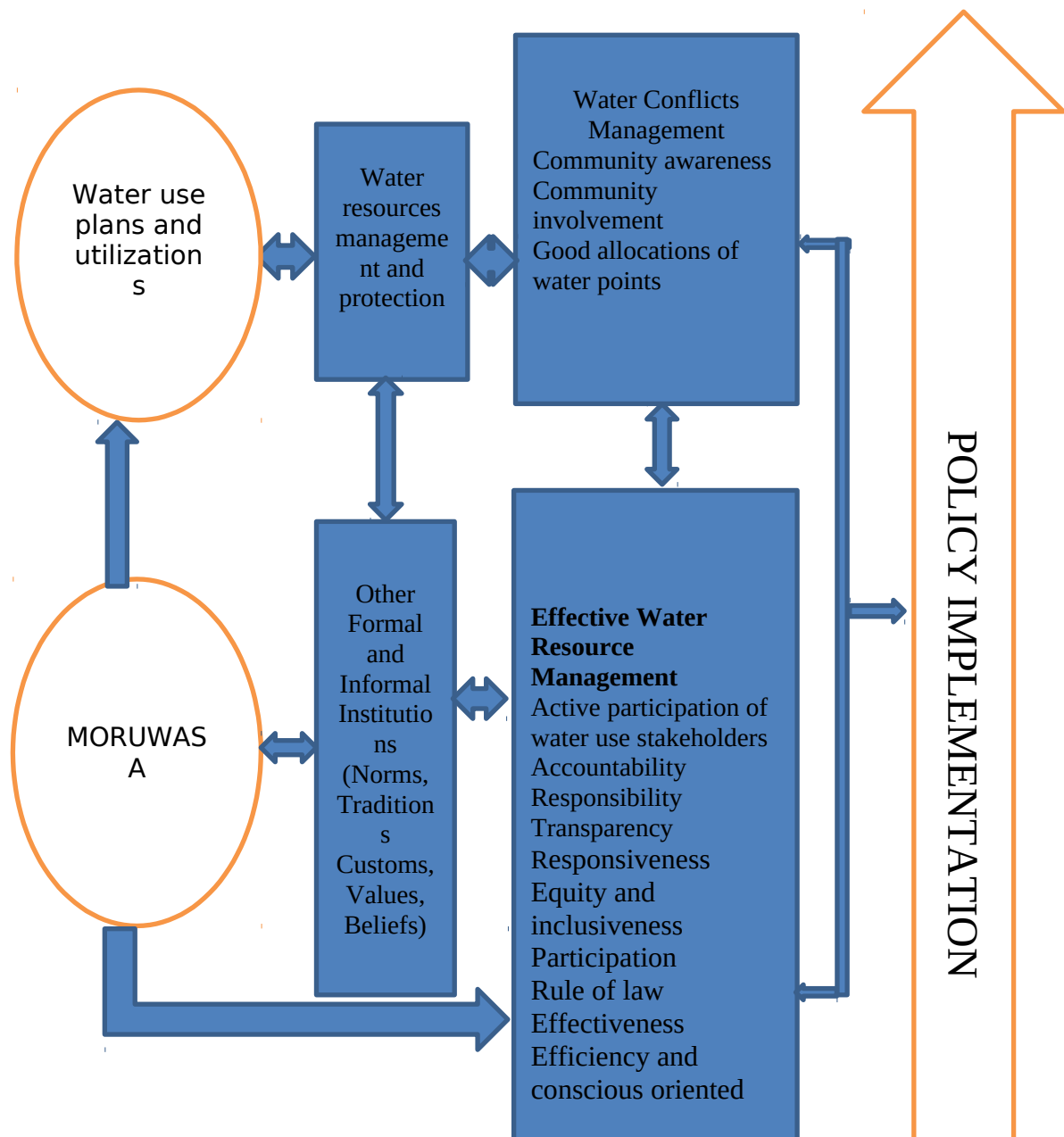
“... In our village, we have norms that restrict us to behave different. We are strictly not allowed to cut trees, the establishment of fire nearby water sources,

grazing animals and farming activities within 60 meters from water sources”

(Mlali Ward Focus Group Discussion organized on 1st March, 2020).

3.8.2 Relationship between WRMIs and conflicts

According to the study results, there is a good relationship between water resource management institutions though some institutions fail to fulfil their goals/roles due to different circumstances such as materials, funds and human resource. In addition, informal institutions have some influence, but are not properly implemented in protecting, preserving and managing water sources in the study area. According to NAWAPO (2002), MORUWASA was supposed to have a strong influence and direct link between itself and other water users, but the opposite seems to be the case, whereby Wami/Ruvu Basin office and the water users associations have stronger influence on water users that is the case with MORUWASA on water users. Also Figure 3.1 shows that, the local government has played its role in bridging the gap between water users and the formal/informal sectors. Figure 3.1 shows further that all institutions are interdependent in water resource and conflict management. This is to say, if every institution plays its part, then water resource management will become stronger and therefore reducing the conflicts among water users.



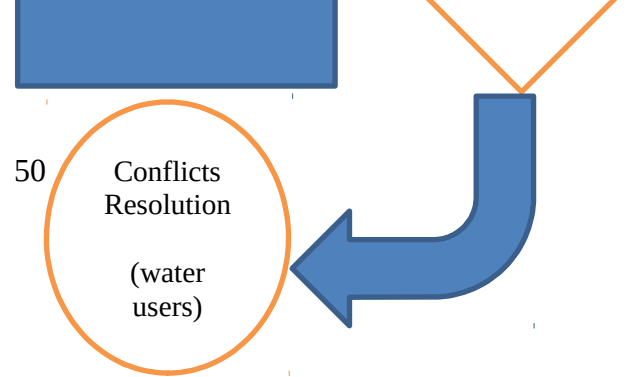


Figure 3.1: Relationship between WRMIs and conflicts

3.8.3 Conclusions and Recommendations

The main objective of this chapter was to map water management institutions, determine the roles of these institutions and their contribution to reducing water use conflicts in the Ngerengere catchment area. The study revealed poor collaboration among water resource management institutions in enhancing water management in the study area. The study revealed further that, resources such as financial, material and experts for water resource management were among the constraints facing WRMI. These constraints were therefore associated with underperformance of WRMIs in the study area. The study concludes that, despite the availability of water management institutions, many of these institutions were ineffective in performing their roles related to water resource management.

The study recommends that, there is a need for all stakeholders including the Ministry of Water to establish a strong negotiation platform between the water resource management institutions and water users (community). An integrated water resource management plan is very important for sustainable water resources management. This will reduce water use conflicts resulting from unsustainable utilization of water resources in the study area. Proper cooperation among water resource management institutions will also enhance the water resource management plan. Finally, there is a need for the government authority to

strengthen financial conditions of their institutions and deploy enough experts to enable them to perform their duties more effectively.

References

- Alexander, K. T., Tesfaye, Y., Dreibelbis, R., Abaire, B. and Freeman, M. C. (2015). Governance and functionality of community water schemes in rural Ethiopia. *International Journal of Public Health* 60(8): 977–986.
- Ambonisye, H. (2019). Gender Mainstreaming in Water Resource Management. 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. 86pp.
- Corbin, J. and Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications. 436pp.
- Cosgrove, W. J. and Loucks, D. P. (2015). Water management: Current and future challenges and research directions. *Water Resources Research* 51(6): 4823-4839.
- Davis, M. D. (2007). Integrated water resource management and water sharing. *Journal of water resources planning and management* 133(5): 427-445.
- Gudaga, J. L., Kabote, S. J., Tarimo, A. K. P. R., Mosha, D. B. and Kashaigili, J. J. (2018). Effectiveness of groundwater governance structures and institutions in Tanzania. *Applied Water Science* 8(2): 1-14.

- Haule, A. (2019). Gender mainstreaming in water resource management: A case of water resources integration development initiatives (waridi) project in Gairo District, Tanzania (Doctoral dissertation, Sokoine University of Agriculture). 65pp.
- JICA (2013). The Study on Water Resources Management and Development in Wami/Ruvu Basin.
- Kabote, S. J. and John, P. (2018). Water Governance in Tanzania: Performance of governance structures and institutions. *World Journal of Social Sciences and Humanities* 3(1): 15 – 25.
- Loucks, D. P. and Van Beek, E. (2017). *Water resource systems planning and management*. An introduction to methods, models, and applications. 624pp.
- Mahoo, H., Simukanga, L. and Kashaga, R. A. L. (2015). Water resources management in Tanzania: Identifying research gaps and needs and recommendations for a research agenda. *Tanzania Journal of Agricultural Sciences* 14(1):45-60.
- Michael, A. M. (2009). *Irrigation Theory and Practice: Theory and Practice*. Vikas publishing house. 755pp.
- Mkalagale, V. (2013). The poor performance of student in community secondary schools in Tanzania: A case of Temeke district. Unpublished Masters Dissertation from Mzumbe University. 60pp.
- Ndelwa, L. L. (2014). Role of water user associations in the management of water use conflicts: A case of Ilonga sub-catchment in wami-ruvu basin, Tanzania. Doctoral dissertation, Sokoine University of Agriculture. 98pp
- Oremo, F., Mulwa, R. and Oguge, N. (2019). Knowledge, attitude and practice in water resources management among smallholder irrigators in the Tsavo Sub-Catchment, Kenya. *Resources* 8(3), 130.

- Panda, B. and Leepsa, N. M. (2017). Agency theory: Review of theory and evidence on problems and perspectives. *Indian Journal of Corporate Governance* 10(1): 74-95.
- Shagega, F. P. (2018). Assessment of estimated potential impacts of climate change on the hydrology Ngerengere river catchment, Tanzania. Doctoral dissertation, University of Dar es Salaam. 99pp.
- Sokile, C. S. and Van Koppen, B. (2004). Local water rights and local water user entities: the unsung heroines of water resource management in Tanzania. *Physics and Chemistry of the Earth* 29(15-18): 1349-1356.
- Spaling, H., Brouwer, G. and Njoka, J. (2014). Factors affecting the sustainability of a community water supply project in Kenya. *Development Practice* 24(7): 797 – 811.
- URT, United Republic of Tanzania (2002). Tanzania Public Service Act of 2002. President's Office, Public Service Management. Government printer, Dar es Salaam. 45pp.
- URT, United Republic of Tanzania (2009). Water Supply and Sanitation Act.

CHAPTER FOUR

4.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

The main objectives of this study were to map the existing water resources management institutions in the Ngerengere catchment area examine the main types and causes of water use conflicts in the study area and determine the role of the existing water resources management institutions on water use conflict management.

The study revealed that there are formal and informal institutions that deal with water resources management but collaborated poorly with other stakeholders in enhancing water resource management in the study area. The study revealed further that, conflicts between domestic users themselves are the major problem caused by unsustainable use of water, which does not meet the requirements for domestic use. Education level, misallocation of water points and failure of Water Resource Management Institution were statistically and significantly associated ($P < 0.05$) with water use conflicts.

In addition, the study found that water resource management institutions in the Ngerengere catchment area have three major roles namely, water resource management,

water resources protection and water use planning. Institutions use different mechanisms to implement National water policy including raising community awareness on water conservation and law enforcement.

4.2 Conclusions

Generally, based on the study's findings it can be concluded that water catchment management institutions are not accountable for water service delivery in the Ngerengere catchment area thus leading to water use conflicts and other factors associated with these conflicts.

Furthermore, poor collaboration between water resources management institutions and other stakeholders in enhancing water resource management is among the challenge holding these institutions back from fulfilling their duties. Moreover, limited resources such as financial, material and human resource for water management has been compromising for the efforts of water resource management institutions resulted in rendering services to the people.

4.3 Recommendations

In respect of the cited challenges and other related issues, the study recommends the following:

- i. Water resource management institutions should ensure good management and availability of enough sources of water for ease of access to water resources.

- ii. Water Resources Management Institutions should be accountable for water service delivery in the Ngerengere catchment area to avoid water use conflicts and overcome factors associated with these conflicts.
- iii. All stakeholders including the Ministry of Water should establish a strong negotiation platform between Water Resource Management Institutions and water users.
- iv. Integrated water resources management plan should be adopted as it is a very important aspect for sustainable water resources management and water distribution. This will reduce conflicts resulting in unsustainable utilization of water resources in the study area. Proper cooperation among water resource management institutions will improve the water resource management plan and its utilization to the community.
- v. The Government should strengthen water resources management institutions by providing financial support and enough experts to help them perform their duties more effectively.

4.4 Areas for Further Research

The current study was limited to water use management and water use conflicts in Ngerengere catchment in Morogoro Region only despite the fact that there are other areas that experience water use conflicts in Tanzania. A more inclusive study covering water use management and water use conflicts is advised in future to ensure there are sustainable ways in reducing water use conflicts. This study was also limited at assessing types and factors associated with water use conflicts and in assessing water resource management institutions and water use conflicts in Ngerengere water catchment. A more

comprehensive study is recommended to find out on community capacity to solve water use conflicts, the solutions to water use conflicts and the proper utilization of water infrastructures in Tanzania.

APPENDICES

Appendix 1: Respondents Questionnaire

TITTLE: Water resources management and water use conflicts

Appendix 4.1.1: Questionnaire for Households Survey

Socio Economic Characteristics of Household Head General Information

Questionnaire number.....

Date of interview.....

Name of interviewer.....

Name of interviewee.....

1.Household head's name:

2. Ward:.....

3.Date of interview:

Appendix 2: Socio-Demographic Characteristics

4.Sex

1.Male 2.Female.....

5.Age (yrs).....

6. Relationship with the Household Head

i. Head of household

ii. Spouse

- iii. Son/Daughter
- iv. Others (Specify)

7. Marital status

- (i) Single
- (ii) Married
- (iii) Divorced/ Separated
- iv) Widow

8. Education level

- i. No formal education
- ii. Primary education
- iii. Secondary education
- iv. Post- secondary education

9. Number of years spent at school or college?.....

10. Occupations

- i. Salaried employment
- ii. Crop production
- iii. Livestock keeping
- iv. Trade/ Business
- v. Others (Specify)

11. How long have you been staying in this Ward/ hamlet (Mtaa)?

(Specify).....

12. Where do you get water

- i. From the Ponds
- ii. Direct from River
- iii. Spring
- iv. Rain water

- v. Stream
 - vi. From MORUWASA Network
 - vii. Water Vendors Supply
13. Distance from your home to water service
- i. Within your home area
 - ii. Within 400 meters from your home
 - iii. More than 400 meter from your home

Appendix 2: Conflicts Questions

1. What do you understand about water use conflict?

- i. Drought
- ii. Shortage of water
- iii. No water infrastructures

2. Do you experience water use conflicts in your area?

1. Yes 2. No

3. What are the common type and characteristics of water use conflicts in your area?

- i. Livestock keepers and Irrigators
- ii. Domestic water users and irrigators
- iii. Upstream and downstream water users
- iv. Irrigators and Irrigators
- v. Domestic users and Livestock keepers
- vi. Domestic users and domestic users

If others (Specify).....

4. What are the types and major causes of water use conflicts in your area?

- i. Excessive use of water
- ii. Big number of livestock keepers and farmers
- iii. Shortage of water
- iv. Illegal connections

5. What are your water sources for domestic use in your area?

- i. Rain harvesting
- ii. Springs
- iii. Rivers
- iv. Ground water
- v. Wells/Boreholes

vi. Mindu Dam

6.If more than one source is used which one do you use most?

i. Rain harvesting

ii. Rivers

iii. Ground water

iv. Springs

v. Wells/Boreholes

7.If the source(s) you mentioned above is multiuse, what are the key uses in terms of Importance (rank)?

i. Domestic

ii. Irrigation

iii. Livestock watering

iv. Others (Specify)

8. Is the source of water you identified above, enough for your daily requirement?

1. Yes 2. No

If No, what are the other alternatives for getting water for your daily requirement?

8. In case there is water shortage, are you ready to use water less than your need so as to provide for other water users

1. Yes 2.No

If no give reason (s) why

10. If yes how much you ready to reduce?

1. Quarter 2.One third 3.Half 4.Three quarters

11. Are there institutions which are responsible for water resources management in your area?

1. Yes 2. No

If yes, how many are they?.....

12. Is there fair / equal distribution of water among the users?

1. Yes 2. No

If No, what causes the unfair distribution of water among the water users?

- i. Shortage of water
- ii. No water connections
- iii. Population increase

13. Which group frequently instigates the conflicts than the other?

- i. Domestic users
- ii. Farmers
- iii. Industries
- iv. Others (Specify)

Appendix 3: Socio-economic impact of the Water use conflicts

1. What are socio-economic impacts of water use conflicts?

- i. Building House
- ii. Own Commercial Transport
- iii. Other income generating activities
- iv. Changing life style

2. Which group is mostly affected by water use conflicts?

- i. Women
- ii. Youth
- iii. Men

3. What is the main economic activity in your area?

- i. Irrigation
- ii. Fishing
- iii. Livestock keeping
- iv. Stone breaking
- v. Blocks maker

Appendix 4: Resolution and Management questions

1. What are solutions to the conflicts at grassroots level?

- i. Community involvement in water use plans
- ii. Provide awareness to the community in water resource management
- iii. Law enforcement
- iv. Others (Specify).....

2. What measures to be considered in solving the conflicts at higher (district, regional, national) levels?

- i. Community involvement in water use plans
- ii. Provide awareness to the community in water resource management
- iii. Law enforcement
- iv. Amend policies according to challenges
- v. Others (Specify).....

3. Which measures are experienced to be effective?

- i. Community awareness in water resource conservation
- ii. Law enforcement
- iii. Use Community elders on catchment management

4. Are the solutions/measures in favor of any user group?

1. Yes 2.No

If Yes. How do you manage to maintain peace?.....

5. In what ways do you think different water user groups in a given mtaa/locality can both use water peacefully?

1. Yes 2.No

How.....

Appendix 5: Checklist for Key Informant

1. Personal details

(a) Name of the Institutions.....

(b) Name of interviewing Officer.....

(c) Designation.....

(d) Date..... & Mobile number.....

2. Is your institutions responsible for water resource management?

If Yes, How?.....

If No, Why?.....

3. How do your offices manage water use conflicts in your area?

4. How does your office cooperate with other Institutions in managing water use conflicts?

Appendix 6: Checklist for Focus Group Discussion

1. What do you understand about Water resource management institution?
2. Do you have Water Resources Management Institutions in your area?
3. Mention water management institution in this area?
4. Do you experience water use conflicts in your area?
5. What are measures taken by WRMI's to prevent water use conflicts in your area?
6. How community being participated on water resources management in this area?
7. Is there Tradition leader in this area?
8. How does Traditions leader involve in water resources management in this area?

Appendix 7: Mapping Existing Water Resource Management Institution In The Study Area

1. What institutions are involved in planning the use of water resources in your area?

- i. Wami Ruvu
- ii. MORUWASA
- iii. RUWASA
- iv. Mtaa/ Village committee
- v. Environmental committee

2. What institutions involved in protection of water catchment management?

- i. Wami Ruvu basin
- ii. Mtaa/Village committee
- iii. Community elders
- iv. Environmental committee

3. What mechanism are used by different institutions to implement water policy?

- i. Provide awareness to community
- ii. Water policy enforcement
- iii. Community involvement

4. Is there any Linkages between Land use and Water use

1. Yes 2.No

5. If Yes or No above, How?.....

- i. Irrigation agriculture
- ii. Fishing
- iii. Livestock keeping
- iv. Stone breaking
- v. Timber harvesting

6. Which institution is responsible for water catchment management in your area?

- i. MORUWASA
- ii. Wami Ruvu Water Basin office
- iii. Village / Mtaa committee
- iv. Community elders
- v. RUWASA.

7. Which Institutions are responsible for water supply in your area?

- i. MORUWASA
- ii. Wami Ruvu Water Basin office
- iii. Village / Mtaa committee
- iv. Community elders
- v. Environmental committee
- vi. Water uses association

8. Which institutions are responsible for resolving water use conflict in your area?

- i. MORUWASA
- ii. Wami Ruvu Water Basin office
- iii. Village / Mtaa committee
- iv. Community elders
- v. Environmental committee
- vi. Water uses association

Appendix 8: Factors associated with Water use conflict in your Area

1. Are social issues among the factors causing water catchment and water use conflict area?

1. Yes 2.No

If Yes, How

2. What are an Environmental issues factors causing water catchment and water use conflicts in your area?.....

How those factor cause conflicts?.....

3. Political issues are among the factors causing water catchment and water use conflicts in your area?

1. Yes 2.No

If Yes, how.....

4. Population increase are among factors causing water use conflicts in your area?

1. Yes 2.No

If Yes, How?.....

5. Is the miss allocation of water service points causing water use conflicts?

1. Yes 2. No

(a) If Yes,

How?.....

(b) If No

How?.....

6. Traditional, norms and values that govern water catchment areas are the source of water use conflict in your area?

1. Yes 2.No

If Yes or No, How

7. Lack of community involvement in water catchments management is the source of water use conflict in your area?

1.Yes 2.No

If Yes, how?.....

8. Failure of institutions to manage water Catchment is the source of water use conflict in your area?

1. Yes 2.No

If Yes, How?.....

THANK YOU FOR YOUR COOPERATION

Appendix 9: Types of Water use conflicts In the Study area

1. What are the main types of water use conflicts in your area?

- i. Domestic and domestic water use
- ii. Irrigators and irrigators
- iii. Upstream water use and downstream water use
- iv. Farmers and domestic water use

2. Why these conflicts are outstanding in this area?

- i. No community awareness on water catchment management
- ii. Water shortage
- iii. Population increase
- iv. Irresponsibility of Water Resource Management Institution

3. What internal and external catalysts to the conflicts?

- i. Wami Ruvu basin
- ii. MORUWASA
- iii. Political leaders/ political issues

THANK YOU FOR YOUR COOPERATION

Appendix 10: Roles of Water resource Management institutions on Water use

conflict Management

1. What are the major roles of the following institutions on water use conflicts management in your area? (Multiple responses possible)

(a) Policy makers

i. Produce water policies

ii. Collect data and information on water catchments and water use conflicts

iv. Amend policies according to challenges

iv. Provide policy awareness to the community

v. Enforcement of the law other (specify).....

(a) Community elders and customs

i. Local-level management of allocated water resources

ii. Conservation and protection of water sources and catchment areas

v. Observe traditions and customs for water sources sustainability. Other (Specify)

.....

© Rules and Regulations

i. Ensure equitable and fair distribution of water among users

ii. Maintain peace and harmony among water users.

iii. Law enforcement

(d) Village leaders/ Mitaa committees

i. Mediation of disputes among users and between groups

ii. Participation in the preparation of water utilization plans

vi. Conservation and protection of water sources and catchment areas

iv. Enforcement of the rules and regulations

v. Build trust between stakeholders and partners

(e) Industries

- i. Participation in the formulation of water utilization plans
- ii. Pay water bills
- iii. Abide to the rules and regulations from water authorities
- iv. To protect water sources and infrastructures. Other (Specify).....

(f).MORUWASA

- i. Mediation of disputes among users and between groups
- ii. Administer and collect the water use fees
- iii. Issuing of new water connections to customers
- iv. Ensure regular water supply maintenances
- v. To ensure efficient and effective water use and ensuring return flows
- vi. Enforcement of the law
- vii. To protect water sources and infrastructures

(g) Wami Ruvu Basin Office

- i. Mediation of disputes among users and between groups
- ii. Conservation and protection of water sources and catchment areas
- iii. Monitor the available water resources in the basin
- iv. Regulation of existing and issuing of new water right permits for water abstractions
- v. Administer and collect the water abstraction fees
- vi. Enforcement of the law
 - i. Build trust between stakeholders and partners
- viii. To protect water sources and infrastructures

(h)Domestic Users

- i. Mediation of disputes among users
- ii. Participation in the preparation of water utilization plans
- iii. Abide to the water use permits and regulations. Other (Specify).....

(i)Irrigation Schemes

- i. Mediation of disputes among users
 - ii. Participation in the preparation of water utilization plans
 - iii. Abide to the water use permits and regulations
 - iv. Formulate by-laws for efficient and effective distribution of water among members.
- Other (specify).....

THANK YOU FOR YOUR COOPERATION