

**ROLE OF WATER USER ASSOCIATIONS IN THE MANAGEMENT OF
WATER USE CONFLICTS: A CASE OF ILONGA SUB-CATCHMENT
IN WAMI-RUVU BASIN, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
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ABSTRACT

A study was conducted to assess the role of Water User Associations in the management of water use conflicts in Kilosa District, using a case of Ilonga River Sub-catchment. The specific objectives of the study were to characterize water resources and water users in the study area, to determine the level of conflicts among water users before and after the formulation of water user associations and to identify and assess the challenges and opportunities facing water user associations in water resource and water use conflicts management. The study used descriptive research design supplemented by the cross-sectional research design to achieve its objectives. Household survey through questionnaires and focus group discussions were used to collect data from three villages which were selected from the sub-catchment in such a way that the first village represented upstream users, and second village represented the midstream and the third village represented downstream users. The sample size was 120 representing 40 respondents from each village. A Statistical Package for Social Sciences software was used to analyze quantitative data while, inferential statistical analysis (t-test) was used to compare the level of conflicts before and after the formation of WUAs at Ilonga Sub-catchment. The results reveal that river water is the main source of water for agricultural production. The percentage of conflicts before the formation of WUA was found to be 22% but this fell to 4% after the formation of WUAs. This difference was found to be statistically significant ($t=3.391$, $p=0.015$). In order to reduce water use conflicts in the sub-catchment, solutions to conflicts among the farmers were identified. Among these is to ensure equitable water distribution among water users as it is considered to be the most effective solution in resolving water use conflicts in sub-catchment. The challenges facing water user associations include, climate change, water shortage, limited resources, and low community participation. Hence water management education is needed in order to design strategies towards sustainable water use and conflict management in the area.

DECLARATION

I, Lonze Lusani Ndelwa, 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

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Date

The above declaration is confirmed:

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LIST OF ABBREVIATIONS AND SYMBOLS

ADB	African Development Bank
ANOVA	Analysis of Variance
AWEC	Annual Water Experts Conference
DANIDA	Danish International Development Agency
DED	District Executive Director
DM	Decision Maker
FGD	Focus Group Discussion
GWP	Global Water Partnership
Ha	Hectare
IKS	Indigenous Knowledge System
IUCN	International Union for Conservation of Nature
IWASH	Integrated Water, Sanitation and Hygiene
IWRM	Integrated Water Resources Management
NAWAPO	National Water Policy
NBI	Nile Basin Initiative
NGO	Non-Governmental Organization
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
TANESCO	Tanzania Electric Supply Company Limited
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organization
URT	United Republic of Tanzania
USAID	United States Agency for International Development
WRM	Water Resources Management
WUAs	Water User Associations

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Water is a finite vulnerable resource and which is under pressure; and when it is available in adequate quantities and in good quality it becomes a primary input for a whole array of productive activities (URT, 2002). Water is a public good of a very high value for all competing uses; and thus it requires careful conservation and sustainable utilisation. According to Ashton (2000), water is a common good because it flows naturally from one place to another which makes it difficult to establish “ownership”. Over two billion people in 40 countries live in river basins which are under water stress (World Bank, 2005). Deliberate efforts are therefore needed to protect and sustain the resource and ensure that it is used efficiently and effectively for the benefit of present and future generations (Howard, 2002; URT, 2002).

Water catchment areas sustain life on this planet by providing food and water for our communities, contribute substantially to our economy and provide the foundation for our rich and diverse natural environment. Evidence shows that our catchment systems face enormous and ongoing threats from human activities and thus reducing the quality of our life over the coming decades (Mbuya, 2004). Having limited supply of water makes water users compete to meet their basic needs (Nsolomo, 2000).

In addition, fragmented planning and management, lack of or inadequate integrated approaches and conflicting sectoral policies have accelerated the conflicts over water use (URT, 1995) and climatic conditions such as global warming have worsen the situation even further. In many areas, the demand for water has been increasing due to rapid

population growth, economic development and climatic change. Water scarcity exacerbates social conflicts between various users: Individual communities, Industries, livestock, wildlife, and agriculture (Hinrichsen *et al.*, 1998). Water scarcity is also considered to be an important environmental constraint on development and food production. Since the 1960's, significant progress has been made to redress the situation but there are still some big challenges (World Bank, 1992). Sound management of water resources and access to water services are regarded as key components of sustainable development. Conflicts over water resources vary from one area to another as the resource is unevenly distributed, and because distribution and use of the resource is uneven water use based conflicts at local, regional and even international levels have been a frequent phenomenon (Gleick *et al.*, 2005). These conflicts have many negative impacts as valuable resources are diverted to conflict management at the expense of the provision of basic needs (Omasa, 2005). It is commonly assumed, and rightly so, that conflict would intensify if not addressed appropriately and timely.

However, not all conflicts can be easily resolved, hence most authors referred to conflict management rather than resolution (Yasmi *et al.*, 2006). The dominant water use conflicts over river basin resource allocation are to do with water quantity and water quality in space and time. Uses might be classified as either consumptive or non consumptive (Ngereza, 2005). Sustainable management of water catchment is one of the options that need to be considered to ensure that all development activities have a desirable impact on both water yield and water quality.

During the past two decades, most sub - Saharan, countries embarked on comprehensive reforms towards Integrated Water Resources Management (IWRM). Tanzania recently engaged in a far-reaching formal institutional reform towards Integrated Water Resources

Management (James, 2009). However, Tanzania lacks resources to harness water and overcome the extreme temporal and spatial variability in rainfall and surface flow.

According to Sokile (2005), Tanzania faces a number of conflicts which emerge in sub-catchments. For example, there were conflicts in the Wami Ruvu Basin over pollution by untreated water from the effluent of Mtibwa factory (IUCN, 2010) and other conflicts were noted in Mkoji sub-catchment within the Rufiji Basin. These provided indication of social value associated with the existing water management practices whereby many severe conflicts have been recorded so far, such practices is an indication of social instability. Similarly, conflicts in the Mkoji sub-catchment are a common phenomenon during dry season and at the onset of wet season (Hermans, 2006).

According to Ntilicha (2009), water use conflicts are exacerbated by rapid population growth, lack of awareness, inadequate political will, and low economic incentives. The priorities of water use must base on participatory mechanisms that enable conservation and equitable access to water resources. Rundungai river catchment in Hai district is an example of place where water use conflicts from the above factors are frequent. In trying to minimize the conflicts, many countries have made efforts to formulate, empower, and transfer water use permits, formally water rights and water management imperatives to Water User Associations (WUAs). The basic assumption has been that WUAs involvement is the end result of participation in water resource management (GWP, 2000).

1.2 Problem Statement

Tanzania faces water resource conflicts in some parts of the country as the demand for water exceeds the available water resources. The National Water Policy (NAWAPO) of 2002 and the Water Resources Management Act No. 11 of 2009 have given a mandate to

Basin Water Boards to promote water user associations as a mechanism of enhancing sub-catchments for introducing community participation in the management of sub-catchments and promote the conservation of water quality (Sokile *et al.*, 2003).

The policy has a broader mandate of overseeing water basins making the management of water resources on this scale a difficult task. The WUAs comprises of irrigators, water consumers, cooperative societies, NGOs, companies and any other bodies or organizations established under any written law (URT, 2009). Despite all the efforts made by water boards of forming Water user associations in Tanzania, little is known about the role of WUAs water resources management. Furthermore, the extent to which the formation of WUAs has reduced water use conflicts or improved water resources management is also not known. Despite the efforts of engaging communities in resource management, persistent conflicts among users and resource deterioration are still reported (see for example, a study by Ntilicha, 2009). Therefore, this study assessed the role of WUAs in management of water use conflicts, using a case study of Ilonga Sub-catchment.

1.3 Justification for the Study

According to (URT, 2009), Water Users Associations are formed to conserve water from a source and which is used jointly by the members of the water users association, resolve conflicts related to the joint use of water resource among members of the association and collect water use fees on behalf of the Basin Water Board. These functions cannot be realized unless researches are done to determine efficiency of WUAs in managing water use conflict and catchment management. Most of the WUAs have just been established within this decade and have not yet been assessed. As a result, there is no enough evidence/information to guide future expansion of WUAs; and further it is not yet known as to whether or not such WUAs are worthwhile. Thus, this study provides

useful information to both policy makers and water resource managers at both local and national levels and elsewhere, which could be used in developing interventions and strategies required to address conflicts over water use.

1.4 Study Objectives

1.4.1 General objective

The general objective of the study was to assess the role of Water Users Associations in management of water resources and water use conflicts.

1.4.2 Specific objectives

The specific objectives of the study were to:-

- (i) Characterize different water resources and water users in the study area.
- (ii) Determine the level of conflicts among water users before and after the formulation of Water User Associations.
- (iii) Identify and assess the challenges and opportunities facing water user association in water resource and water use conflicts management, in the study area.

1.5 Research Questions

- (i) What are the available water resources and the different types of water users in Ilonga sub-catchments?
- (ii) What are the types and the causes of water use conflicts; and to what extent has WUAs formation reduced water use conflicts among water users in the area?
- (iii) What are the challenges and opportunities facing WUAs in the management of water use conflict?

1.6 Conceptual Framework

A conceptual framework is a couple of facts linked together and that assist in providing guidance towards realistic collection of information (Mbwambo, 2000). The conceptual framework underlying this study is based on the role of WUAs in the management of water use conflicts. Water resource management is a process of becoming aware of the actual or potential conflicts, diagnosing their nature and scope and analyzing the appropriate methodology to diffuse the emotional energy involved and to enable disputing parties to understand and resolve their differences. Furthermore, conflict management includes prevention strategies and policies aiming at avoiding the growth of conflict while maintaining control (NBI, 2006). Conflict over water use has to do with a number of factors including natural and human activities such as socio-economic forces; and on the other hand, the enacted laws like Water Resources Management Act No. 11 of 2009. This study considers water user associations, and water users' management of water use conflicts as important institutions for improving the socio-economic development of the sub-catchment community members. Thus, there is a mutual relationship among water users, management of water use conflicts, and water users association for sustainable supply of quantitative and qualitative water.

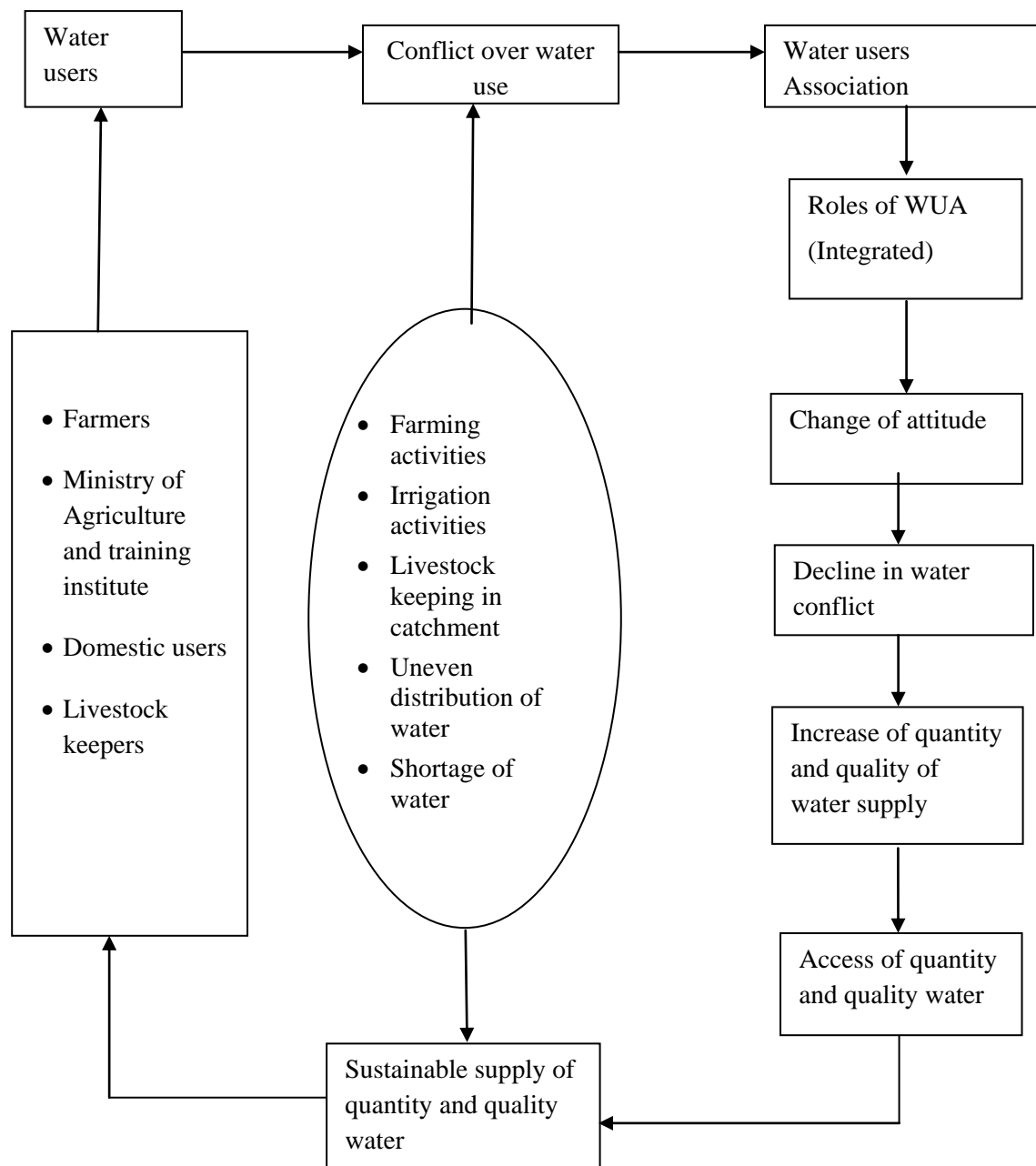


Figure 1: Conceptual framework

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definitions of Basic Concepts

2.1.1 Water Users Associations

Water Users Associations (WUA) are voluntary, non-governmental, non profitable entity established and managed by a group of farmers located along one or several water source canals. Water users include farmers, peasants and other owners who pull together their financial, material and technical resources to improve the productivity of irrigated farming through equitable distribution of water and efficient use of irrigation and drainage systems (USAID, 1992).

2.1.2 Water use Conflict

Water use conflict is a term used to describe a conflict between countries, states, groups, individuals over access to water resources Beddow (2010). The United Nations recognizes that water disputes result from opposing interests of water users, public or private. According to Lewis (1996); and Blomely (2003) there are conflicts between the resource poor households, national, and international interests on biodiversity. With respect to natural resource use, there are several interrelated drivers of conflicts, namely, population growth, economic activities, legal provision, shift in the value system, changes in government policy, and poverty.

2.1.3 Water use

Water use means the amount of water used for a given task or for the production of a given quantity of some product or crop. The term "water footprint" is often used to refer to the amount of water used by an individual, community, business, or nation

(Chenoweth, 2008). The geographical location of an area is also reported to be a contributing factor in water use conflicts in some places in the world (UN, 1999). For example, nearly 47% of land area of the world, excluding Antarctica fall within the international water basins shared by two or more countries. There are 44 countries with at least 80% of their total areas within the international basins.

The number of rivers and lake basins shared by two or more countries is currently over 300. In Africa alone, there are 54 drainage basins covering approximately 50% of the total land area of the continent, including water resources.

2.2 The Potential Causes of Water use Conflicts

According to Grossman (2004), there are many speculations over what cause conflicts over water. The conflicts arise because those with power wish to control water and therefore control the economy and population. By breaking it down into categories, one can begin to understand the causes. Conflicts can be caused by water use which includes military, industrial, agricultural, domestic and political uses. Conflicts can further be a result of pollution affecting the quality of the water supply. This lack of water quality can cause conflict resulting from water distribution. Uneven distribution of water among people and countries creates an imbalance among those who share the supplies; particularly in developing countries; an increase in urbanization has also increased the demand for water. However, the supply cannot take care of the demand. With the problem of uneven distribution of water, future conflicts can occur. As societies become more developed, they tend to use more resources such as water (Klare, 2004).

Population pressure has also many influences on water resources use conflict (Dislodges and Gauthier, 1996). This can arise as a result of increased demand and competition for

definitive resources through population increase. On the same aspect, Peter (2002) reports that the high rates of population growth accompanied by an increase in the demand for water has made several countries pass the point where scarcity of water supplies is effectively limiting further development in Africa, Tanzania included. As Kilahama (2003) reports, population of a country has raised from less than 10 million in 1961 to over 33.5 million in 2002. This portrays an increase of about 23.5 million people in about a number of years or an average of 587 00 people per year. This poses a challenge for the availability of social services and other resources in meeting the basic human needs. Borrini and Feyerabend (1997) reveal further that an increase in population which is associated with an increase in the household size may mean more people more resources for example in upper catchments of the Ruaha River catchment in Usangu plains, irrigated area increased from about 100ha in 1930 to about 4000 ha in 1999.

2.3 Water Resources Management

According to ADB (2002), water resources management refers to institutionalized activities of water resources development, utilization, allocation, conservation and control. Water resources in Tanzania are managed by the Ministry of Water. The Water Resource Management Act No. 11 of 2009. As part of its sector reforms, the Ministry of Water launched a NAWAPO in 2002, whose vision is to have a country which has equitable use and sustainable management of water resources for economic development, and for maintenance of the environment.

The policy recommends that water is managed at the basin level, in a participatory and equitable way which emphasizes sustainability and conservation of the resource. Water to meet basic human needs is the highest priority for water allocation, followed by water for the maintenance of ecosystems (PBWO/IUCN, 2007).

According to Sokile *et al.* (2002), water management initiatives in Tanzania are characterized by an institutional gap. The institutions that are involved in water management are loosely connected and lack basic coordination and are often at the periphery of the water management agenda divorced from water management programs. There are several institutions that are involved in water management in one way or another. Water supply is under the regional water engineers, irrigation is under the Ministry of Agriculture and Food Security and cooperatives, and hydropower is under TANESCO in the Ministry of Energy and Minerals, with almost zero coordination between them (DANIDA/World Bank, 1995), the Ministry of Natural Resources and Tourism is responsible for conservation of biodiversity in water bodies while Planning Authority oversees construction of resort facilities and hotels along the shorelines of lakes, rivers, islands and oceans. The Ministry of Industry and Commerce is responsible for industrial discharge to water. The present institutional framework ignores informal institutions, especially the traditional by-laws, norms and restrictions. According to Kaize- Boshe *et al.* (1994), such predominance of isolated institutions, locked up in narrowly defined activities with no interactive learning is likely to continue to hamper national aspirations to manage water.

2.3.1 Water user Association and their role in resolving water use conflicts

WUAs are the lowest level of management within the Tanzanian water management structure. WUAs aim at assisting the basin water office in managing water sources in the basin. Sub-catchment WUAs as legal entities, established by the users of water resources within a specified area with the aim of managing the allocation of water resources and resolve conflicts amongst water users within that area (URT, 2006). Sub-catchment WUAs are specifically formed for the purpose of owning, managing, protecting water resources, and controlling, operating and maintaining water supply services (URT, 2002).

Water management paradigm shifted to the realization that water user associations (WUAs) and other user entities have the potential of implementing sound water resource strategies. Efforts were made in many countries to formulate, empower and transfer water rights and water management imperatives to WUA. As Sharma and Minhas (2005) observed, besides technological advancement, people's participation and favourable water use and allocation policies need to be put in place for sustainable use of water. Cooperation of beneficiaries as associations of individual water users might improve water allocation activities such as control on a river or providing water for emerging farmers or WUAs could be a multi – sectoral entities dealing with a variety of water use within its area of operation.

There is paucity of literature on operation mechanisms, success or failure of WUA in Tanzania. Experience from elsewhere showed, however that WUA performance have been successful. According to Waster *et al.* (2003) in a study of water user management in Mexico for example, the government transferred the government-managed irrigation to WUAs and consequently reduced the government's expenditure on irrigation. Mexican water laws also recognized the informal WUA. Despite the trust on WUAs, Sokile (2005) cautions that these associations may be dominated by village level elites who cannot read and write and even express themselves and who might made their way to the committees thus are dragging other water users.

2.3.2 Empirical literature review

Sub-catchment WUAs are not a new thing in Tanzania (AWEC, 2007). Water resources management Act No 11 of 2009 and Water Utilization (Control and Regulation) recognized such institutions (URT, 2009). The Water Works Ordinance as amended by act No.8 of 1997 also recognizes sub-catchment WUAs that are entirely for domestic uses. NAWAPO (2002) made provisions for the establishment of such institutions to cater

for WRM in the Basins. The institutions could be either sub-catchment; WUAs at the lowest level or sub-catchment committees at the higher level. Sub-catchment WUAs might register themselves under several legal frameworks (AWEC, 2007). Based on Tanzania's decentralization policy, in which the mandate for management responsibilities is devolved to lower levels of governance, the water policies and legislation recommend that at the basin level sub-catchment WUAs are established (IUCN, 2009). Thus, this was an important process of empowering communities and local governments to manage conflicts over water resources allocation between upstream and downstream users, and between different users such as farmers and pastoralists. The WUAs proved to be quite useful WRM institutions.

The findings of a study conducted in Wami Basin by (IUCN, 2010) indicate that sub-catchment WUAs are the lowest level of management within Tanzania water management structure. WUAs were aimed at assisting the Basin Water Office in the managing of water sources in the Basin. Such associations were responsible for local-level management of allocated water resources, mediation of disputes among users and between groups within their areas of jurisdiction, collection of data and information, participation in the preparation of water utilization plans, conservation and protection of water sources and catchment areas, efficient and effective water use and ensuring return flows, enforcement of the law and implementation of conditions of water rights, and control of pollution. The findings reveal further in the future, WUAs would form sub-catchment committees and provide representatives on Basin Boards and Catchment Committees.

Another study conducted by Dungumaro and Nalahwa (2002) reveal further that the Pangani Falls Development Project made efforts to reconcile the differences and reduce the conflicts between stakeholders by involving local communities to ensure success.

By so doing, the needs, interests and demands of the local communities were considered and given priority in the negotiations and consensus building between water users. It is emphasized that full community involvement and participation at all levels of the project planning and implementation are not negotiable (Bell, 2001). This was even more serious when a new investment affected the welfare of the local communities. The involvement of the local communities and the utilization of local knowledge in project design and implementation could assist in resolving the anticipated conflicts. Such a situation could build trust between stakeholders and partners, and develop a sense of ownership and responsibility among local communities. There are several ways of getting the public involved in the WRM. These include, public hearings, notices procedures for making comments, and the use of advisory committees. However, when assigning different tasks to the local communities it is important to take into account their ability in terms of education, awareness, and economic status.

Therefore, such involvement could minimize water use conflicts. Although water scarcity is commonly mentioned in relation to water conflicts, it is not solely the quantitative issue that would trigger conflict. Contamination of the resource that negatively affected its qualitative natural regeneration so that the resource could no longer be used for life-sustaining purposes is also a catalyst of conflicts. This is particularly a notorious problem between upstream and downstream riparian villagers (Boge, 2003). The matter of contaminating water could cause conflict between pastoralists and domestic users. It is important to stress that conflict is not inherently negative. Changes often lead to conflict and inversely conflicts bring changes. When a conflict is resolved or managed, it often creates a new situation, which is likely to lessen the incompatibilities and grievances of the parties in a conflict (Thomasson, 2004). Conflicts are thus crucial not only for social changes but also for the continuous creation of society by itself. As such, conflicts are

neither positive nor negative, but they can be used constructively or destructively (Mwakaje and Sokoni, 2005). The way that conflicts evolve, depend greatly on the availability of institutions or mechanisms that are acceptable by the parties and that can address the conflict (Thomasson, 2004).

According to URT (2010), water use conflicts are a common feature in WRM in Tanzania and affect the effective management and sharing of water among the users themselves. This sometimes leads to violent actions between the concerned parties. Through awareness-raising activities, the engagement of stakeholders and the use of dialogue by Basin Water Offices, the type, nature, the number and extent of these conflicts have been reduced significantly across the country.

The study by Nkonya (2008) reveals that, conflicts over resources occur when scarcity of resources causes competition and disagreement. Conflicts can occur at the micro-micro level or macro-macro level. Micro-micro conflicts are those conflicts that occur among individuals or groups within a community. Micro-macro conflicts are those conflicts that occur between individuals or groups on one hand, and government, private companies, or civil society. Conflicts are often viewed as negative because they cause tension, wasteful competition, uncertainty, and violence. However, as said earlier conflicts are not always negative; in fact, conflicts can be beneficial if managed effectively. Conflicts can have an important role in informing society that there are problems that need to be resolved. Conflicts cause the society to think of new ideas and alternatives to solving problems. Well managed conflicts strengthened relationships, bring new ways of thinking, and lead to a consensus that better meet the needs of individuals and society in general.

An adapted empirical strategy is needed to study water governance and conflict management institutions that are shaped through users' practices. Most processes that are made by institutions are empirically substantiated through ex-post observation of institutions; consequently conclusions are made about processes at work based on reconstructions or interpretations by stakeholders (Cleaver, 2000; Cleaver and Toner, 2009; Sehring, 2009 and Nuijten and Lorenzo, 2009). These processes however can be deconstructed by uncovering the consecutive actions that follow resource conflicts, defined here as competing claims and disputes over access to or management of water and land. Therefore, we considered water resource conflicts as the unit of analysis and investigated the way they were settled in order to disentangle various actor-driven processes of making and remaking institutions. Examples of partly case-based analysis of such processes include Ribot (2009) on legitimizing practices, Galvan (2007) on syncretism and Juma and Maganga (2005) on 'bureaucratically' settled cases, (Lecoutere, 2010).

The management of conflicts in an integrated WRM is increasingly receiving attention the world over (Boge, 2003). Where resources are in short supply, as is the case with water in the Southern Africa region, more competition for resources require careful planning and an efficient allocation mechanism to ensure equitable access. These conflicts might be internal or between two or more countries. On the other side, water is discharged back into water bodies after use, thus impairing downstream usage and causing conflicts (Matsumoto, 2008). Countries in Eastern Africa and the Southern Africa Development Community are fast moving into catchment-based management of water resources which take into account stakeholder concerns, the environment, and other vulnerable groups (Mwakilila, 2005).

A study by Mtalo (2005) shows further that different people have different goals and interests while using the same resource. When people in the course of using water resource reach a point of incompatibility or non-reconciliation, the situation is described as a dispute or conflict. The existence of competition or a change in the use of the resource provides a spark that triggers a conflict. Situations which trigger conflicts over water resource include: competition for the resource when there is a scarcity, differences, an organizational status and influence, unmet expectations, unmet interests or needs, unequal power or authority, jurisdictional ambiguities, incompatible objectives or methods, communication breakdown, interdependence of people, and tasks.

The NAWAPO (2002) identifies a number of challenges in the management and development of water resources. Among the challenges are the growing scarcity of water resources, competition and conflicts among users, pollution, underestimation of the involvement of various stakeholders, especially communities, and the inadequacy of the legal and institutional framework (Sosovele and Boesen *et al.*, 2005). The main objective of the 2002 national water policy is to develop a comprehensive framework for the sustainable development and the management of the nation's water resources, for which an effective legal and institutional framework for implementation would be put in place. In order to address the widespread conflicts and inefficiencies that characterize the sector, attention has been directed to the Integrated WRM paradigm (Sosovele and Boesen *et al.*, 2005). Thus, this approach calls for community participation WRM and conflict resolution management, involving various users, planners, politicians and policy makers at all levels. Diverse customary laws are often more important than statutory laws and frequently relied upon in resolving natural resources conflicts (Mtovela, 2008).

Water is often managed at the basin level and where most of the conflicts over water use are resolved. According to Makawia (2002), a basin can be regarded as a natural hydrological unit, which contains the water system within its borders and has different users that are all dependants on the same water resources. UNESCO (2006), water management must base on a holistic concept of integrating the watershed territory, with compatible use and sustainability of the resource. The priorities of water uses must base on participatory mechanisms that enable water conservation and equitable access

A study by Facius (2008) conducted an analysis of relationship between institutions and local water conflict and cooperation documented such conflicts, in particular conflicts among small-holder irrigators.” Scarcity of water and conflicts about water are reported to be mainly connected with irrigation. The most serious of such conflicts are those between formal water rights and irrigators using water according to the indigenous system, especially between the two different small-holder irrigators. The intensive water use in connection with the improved small-holder irrigation schemes to make them economically sustainable (the heavy investments) leads to a situation where many traditional irrigators in the study area face water scarcity –and in some cases are not able any more to get sufficient water to fields which were previously used for rice cultivation” (URT, 1995).

Conflicts occur within three user groups: irrigation farmers, pastoralists, and domestic users. For the irrigation farmers, the conflicts mainly occur between upstream and downstream farmers when the upstream farmers are (perceived as) using too much water. The pastoralists are in conflict with one another when a pastoralist takes his cattle to the well of another pastoralist without permission. The domestic users experience disputes when a woman fails to wait for her turn when getting water from the wells, the river bed

or the taps. As for conflicts between the user groups, the empirical studies did not reveal any water conflicts between irrigation farmers and pastoralist as they had different sources of water. On the other hand, conflicts between pastoralists and domestic users were observed. The domestic users relied on self-dug 'wells' for water supply, but occasionally a pastoralist could take his cattle to such a well, which often ruin the well and made the water dirty. Consequently, the domestic users would complain about this violation. Conflict among groups from other villages seemed to be largely non-existent. The conflicts between the irrigation farmers occur strictly in the wet season (November-May), whereas the conflicts between the pastoralists and the domestic users only occur in the dry season (June-November). The rest of the year the pastoralists have no difficulty in finding water. As for domestic users the conflicts mainly take place during the dry season, but in relation to water supply from the taps. The fights tend to erupt whenever there is water in the taps, although this happens for only a few times per month. Majority of the conflicts are solved the actors themselves. If deem necessary, the offender would pay a fine to the victim or reconstruct the well; in cases where a well is damaged. The next step is to involve some authority such as a secretary from an irrigation group or pastoralist group, or a village government representative. The third step is to have the matter discussed at the village council, which according to the respondents is seldom needed. A fourth option is to address the water problem to the office, as one of its duties is to solve conflicts. However, in the two case villages this option is generally not used because they always manage to solve conflicts in the villages.

2.3.3 Theories of managing water use conflicts

Theories on managing water resource conflicts vary according to their choice and application to a particular locality (Joseph, 2008). The needs-based, power-based and rights-based are the dominant approaches of managing water resource conflicts, both

international and local ones. The power-based approach entails the exercise of power over a weak party in which power is defined as the ability to provide rewards to another party in an attempt to coerce it to do something it would not do. This approach diverts from power based approach, which is dominated and still dominates political science and international relations, and which arise from psychology that are interested in group dynamics, motivation and relationships between institutional structures. The needs-based water approach in resolving resources conflicts is a cooperative one, focusing on fundamental human needs, to encourage win-win solutions. It is a non-violent approach, based on the principle of the essential goodness of humanity in the management of water resource conflicts (NBI, 2006).

According to this approach conflicts are perceived as a way of achieving some kind of unity, and as a struggle over claims to scarce status, power and resources, in which the aims of the opponents are to neutralize or eliminate their rivals (Joseph, 2008). In managing water resources conflicts, the theory operates on the premises that a pre-condition for the resolution of a conflict is that fundamental human needs must be met. On the other hand, a conflict can have a positive side, in that it builds relationships, create coalitions, fosters communication, strengthens institutions, and create new ideas, rules, and laws. These are the functions of conflict. Our understanding of how conflict can benefit us is an important part of the foundation of constructive conflict management (NBI, 2006).

Conflict resolution or management is therefore a process of constructing or strengthening psychology and structural bridges, and this requires tapping into the emotions that develop a sense of hope, trust, empathy, cooperation, inclusiveness and non-violence. These are basic foundations that are a prerequisite for peace and friendship between former enemies (Mills, 2006 quoted in Joseph, 2008). The power-based or force-based or

coercive based approach to conflict resolution is what is called realism and is the dominant or normative theory of international relations and security studies. A power-based water resource conflict takes both violent and non-violent forms. Normally the approach results in a win-lose scenario. Negotiators advance their own positions and the process is decided by the most powerful party. As noted by NBI (2006), the power-based approach to conflict resolution ends with a coercive settlement and not a resolution.

On the other hand, the rights based approach to managing water resource conflicts based on the use of an organization or society's laws, norms, and values to determine who is right. The legitimacy of parties' claims is decided through the application of an independent set of criteria, for measuring formal or informal justice and fairness. This approach often involves using the judicial system to resolve or regulate water use conflicts (NBI, 2006). Thus, the methods of rights-based conflicts resolution include both formal (adjudication in courts) and informal law (arbitration or alternative conflict resolution measures (Mills, 2006 quoted in Joseph, 2008)).

The interest based approach to conflict resolution seeks to reconcile the interests and needs of the parties. In this approach, parties work together in an effort to negotiate their differences and agree on an outcome that meets their respective interests and needs. Such negotiations are less focus on the positions taken by the parties, which are what they say, they want as the outcome, but rather on the underlying concerns that motivates parties to adopt their positions (NBI, 2006). Thus, this approach focuses on both the interests and needs of the parties. Other theories as defined by different scholars are the organism's survival and wellbeing theory, esteem recognition theory, and societal capital theory.

This is supported by Nkonya (2008), who develops some theories on WRM. The first theory is moral theory that focuses on moral codes, traditions, and values systems that are

crucial for the management of water resources. This theory includes: the moral economy and the evil market ones. The second set is built on rational choice theories. Rational choice theories view individuals as rational decision makers who calculate the relative costs and benefits of alternative actions, and make choices that would maximize their ability. Examples of these approaches include: the tragedy of the commons, political economy, and the “community- yoke” theories. Therefore, different conflict resolution scholars, despite their preference for the needs-based or cooperative approach, tied to the social capital approach managing to water resources conflicts, still acknowledge the place held by the power-based and rights-based approach to resolving water resources conflicts (NBI, 2006). To date the emphasis is moving from power-dominated distress to the needs-dominated effective dispute resolution system.

2.3.5 Game theory applications in water resources management

These models can also be classified according to the number of actions that each decision makers can take and the kinds of structures of preference adopted by the model (transitive cardinals, related transitive, also called ordinals or even related non-transitive) Game theory applications in conflict analysis for environmental and water resources planning are very common. Abraham (2008) Game theory is very useful in solving conflicts between upstream user and downstream users in the study area, game theory can be used as a negotiation instrument in group decision support system, comparing the performance and information exchange truthfulness of groups under these different experimental conditions. According to Cesar Vieira *et al.* (2006) in a study of game theory analyzes how cooperation among irrigators affects global agricultural production. To accomplish it, they consider the cooperation relying on the redefinition of water quota established by the water manager, analyzing the importance of the water management institutional system in the solution of a conflict over the use. This theory is useful to this study because it put the researcher in a position to know the extent to which Von Neumann (1928) arguments are applicable to this research.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

3.1.1 Location

The study was carried out in Ilonga Catchment of Ruvu-Wami Basin in Kilosa District, Morogoro Region (Fig. 2). The District was chosen due to the following reasons: it is one of the districts with a lot of rivers, WUAs was introduced in the district in 2009 earlier than was the case with other catchments in the Wami sub-basin also experiences in different water management challenges. The district has a total area of 14 245 km². The district is one of 7 districts of Morogoro Region. Kilosa District is located 100 km North West of Morogoro Region. It is located at about latitudes 06°49'48" South and longitudes 36°59'15" East. The district shares borders with Tanga and Arusha Regions border on the North, Morogoro on the Eastern side, Kilombero District and Iringa Region on the Southwest, and Dodoma Region on the West (URT, 2002).

About 51% of the respondents were located in the upstream of the sub-catchment, while 49% were located downstream the sub-catchment. The people in the upstream were reported to be benefiting more from the water resources than the downstream users who face water scarcity during dry season. This is also supported by a study by ICUN (2009) which reveals that users located in the upstream areas are more favoured in water abstraction than downstream users and this leads to upstream and downstream water use conflicts.

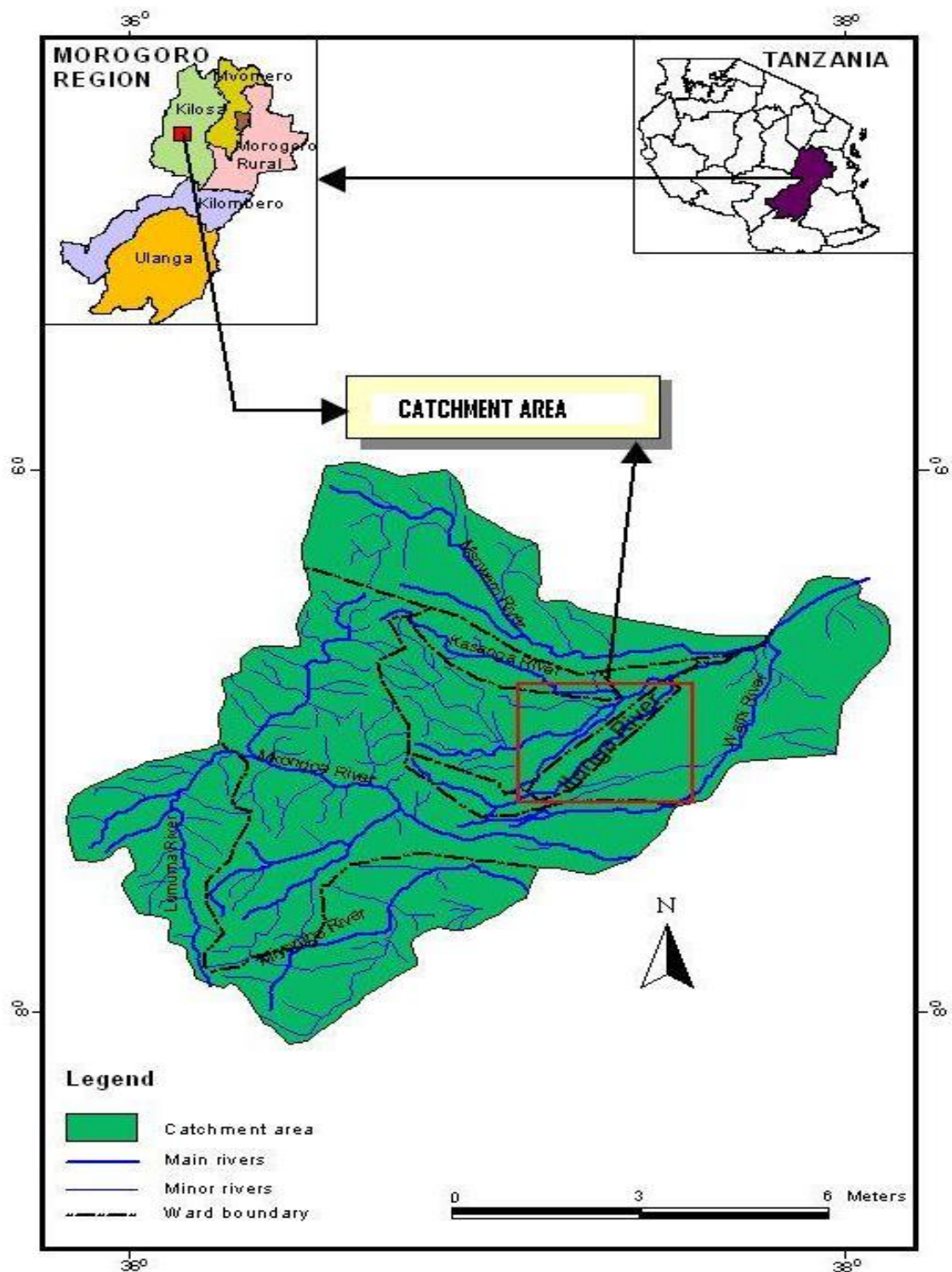


Figure 2: Location of Ilonga catchment area

3.1.2 Climate

The climate of Kilosa District is characterized by a dry tropical climate of semi arid type (Claude and Mwamfupe, 2003). The mean annual temperature is 25°C. The annual rainfall ranges from 800mm to 1300mm in low and high altitude areas.

3.1.3 Topography and soils

The vegetation is dominated by miombo woodland in the highland areas and grassland in the low land areas. The district is divided into three physic-geographic units, which also constitute different agro-ecological zones; high altitude zone (up to 2200 m above the sea level) and plateau zone, which is characterized by plains and dissected hills with moderately fertile and well-drained soils suitable for agriculture. The third zone is flood plains which comprise both flat and undulating plains extending to the foot of the hills in the west. The plains are subjected to seasonal flooding. Soil types in the district range from dark-red- brown sandy loam in most parts to sand clay in the valleys (NBS, 2002). Different soil types support different land covers and uses.

3.1.4 Population

According to the 2012 Tanzania National Census, the population of Kilosa District is 438 175 (URT, 2012) with an annual growth rate of 2.4%. Kilosa District is occupied by different tribes namely Wakaguru, Wasagara, and Wavidunda.

3.1.5 Land use and socio-economic activities

Agriculture is the main economic activity, Production of food and cash crop accounts for more than 90% of Gross Domestic Product , and over 95% of population is employed in this sector (URT, 2004). Major food crops grown in this zone include: maize, paddy, sorghum, beans, rice, cassava, fruits and vegetables. Cash crops are cotton,

sisal and oil seeds. Livestock raised include cattle, sheep and goats in the areas with no tsetse fly problem. Roads and transport communication infrastructure in this area is problematic due to frequent flooding during the rainy season

3.1.6 Social services

The district has a number of social services. Education institutions include: primary schools, secondary schools, teachers training college and vocation training. There is health services, district hospitals, one health centre and dispensaries though they are not enough compared to the population size which is found in the District. Although such facilities are found in the District, there is a very big number of illiterate people where only 2% have completed secondary education, 40% have completed primary education, 55% have informal education and 1% had adult education (URT, 2004).

3.2 Data collection

3.2.1 Research design

In this study a cross-sectional research design was used. This approach enabled a researcher to collect data at one point in time (Bernard, 1994; Babbie, 1990). It can be used in descriptive study for the determination of relationships of variables Barley, (1998). This design was used because of the limited time in the process of data collection

3.2.2 Data

Both primary and secondary information was collected. The qualitative data were through interviews using questionnaires. FGD guide was administered to FGD participants comprising people other than those participating in questionnaire interview. Secondary data were gathered through personal communication with District Water Engineer, and Wami Ruvu Basin officers and water stakeholders.

3.3 Sampling Procedures

Sampling techniques used were simple random and purposive sampling. Purposive sampling was used to select the study area, and simple random sampling was used to select the respondents from among the community members. The sample size for questionnaire survey was 120 water users 40 water users from each village. According to Bailey (1994), a sample or sub-sample of 30 respondents is bare minimum for the studies in which statistical data analysis is to be done regardless of the population size. Ten (10) Participants for Focus Group Discussion and 10 key informants were selected from 3 sample villages, making a total of 140 respondents. Key informant interviews were conducted using a prepared checklist. The identified key informants included the Sub-catchments WUA leaders, Wami-Ruvu Basin Water Officer, IWASH officers, District Facilitation Teams and District Water.

Table 1: Distribution of all respondents in the study area

Types of respondent	Male	Female	Total
Community member respondents	60	60	120
Key informants	5	5	10
FGD	5	5	10
Total	70	70	140

3.3.1 Data collection procedures

Field work took place in October 2012 to June 2013. Questionnaires and checklists for collecting data were pre-tested before the collection of data so as to ensure their validity and reliability, and then incorporated pre-test results in the final version. Slight changes were made to the questionnaires, the researcher and two research assistants collected primary data from household heads by using household heads questionnaire. The information from key informants was collected by using a checklist. Kiswahili

language was used to collect data from both household head respondents and key informants. Each interview schedule lasted for 20 to 30 minutes.

3.3.2 Questionnaire administration

Three villages (Ilonga, Chanzuru and Idete) in the study site were randomly selected based on accessibility and proximity to Ilonga sub-catchment and thereafter a sample of households was randomly selected from village registers, which were considered to be the sampling population. The total number of households in the selected villages was randomly picked for the interview. Ilonga, Chanzuru, and Idete villages had a total of 3519 households out of which 40 households were sampled from each village. This was a reasonable sample size according to Bailey (1994) and Mbeyale (2007).

3.3.3 Focus group discussions

In focus group discussion, government officers and long time residents were involved. The government officers included Ward Executive officer and Village Executive officer. Also the discussion involved old people with long time knowledge about villages under study. Checklist of questions or issues of interest were used to guide the discussion. Focus group discussion availed information that could not be picked by using structured questionnaire. Such information included probing questions to capture the historical trends over time with regards to water use conflicts before and after the formulation of water user association.

3.4 Data Processing and Analysis

The primary data which were collected from household respondents using questionnaires were verified, compiled, coded, reorganised and summarised for computer analysis. Data which were collected from other sources using researcher's diary and checklists were processed manually. The primary data were processed from household's respondents and analysed using Statistical Package for Social Sciences software.

3.5 Descriptive Analysis

Descriptive analysis involved percentages, means, charts bar graphs and distribution tables, standard deviation, and ANOVA, to compare the differences on the numbers of conflicts before and after formation of WUAs at Ilonga Catchment area.

3.6 Inferential Analysis

Inferential analysis was used in objective three whereby t-test was used to compare the level of conflicts before the formation of WUAs and after formation of WUAs at Ilonga Catchment area.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Respondents

4.1.1 Sex of the respondents

The water resources management conflicts affect both men and women in the community. Among the respondents involved in the study, 48.3% were males and 51.7% were females. It can be argued that in water resources management, males play a great role in the control, allocation, resolving conflicts, and distributing the water. On the other hand, females are responsible for domestic water use as shown in Plate 1. Men and women often have different priorities and responsibilities. Therefore, sex of the respondents plays a big role in recognizing the roles of both males and females in water resources management (Ademun, 2009). Domestic water supply was seen to have implications on women welfare in rural households in Amuria and Rakai Districts of Uganda (Ademun, 2009). This study, like most others dealing with women, showed that gender equality in water service provision aiming at improving access to water, can only be possible if women are empowered in decision making process. This is particularly so in aspects like household water supply, provision, use, technology, construction, problems solving, management and maintenance (Mwakila, 2008). Special emphasis should be put upon active involvement of both men and women by giving priority to their needs and ideas in planning, implementation and management of the water projects in these communities.



Plate 1: Ground water well (Other source of water apart from the river source used for domestic uses)

4.1.2 Age of respondents

Results revealed that most of the households (51.7%) were headed by people aged between 31 and 50 and relatively few (2.5%) households were headed by the people aged 70 years and above (Table2). In many cases, the 31-50 years age group constituted the productive group of a population and were usually the ones involved in the exploitation of water resources in the study area. It is therefore, the age group which has the greatest influence on water use conflicts.

Table 2: Age of respondents

Age of respondents	Percentage of respondents (n=120)
19-30	20.0
31-50	51.7
51-70	25.8
71-90	2.5
Total	100

4.1.3 Education level of respondents

Majority of respondents (56.7%) have primary education and few (2%) have secondary education. (Table 3) The result shows that respondents have varying levels of education across villages. This variation might be due to the distance from the households to schools as it was observed that the enrolled students who were far from school had irregular attendance. According to Mwansasu (2001), education level is a factor that may either facilitate or hinder access to information.

Table 3: Education level of respondents

Education Level	Percentage of respondents (n=120)
No formal Education	18.3
Adult Education	23.3
Primary Education	56.7
Secondary Education	1.7
Total	100

Kajembe and Luoga (1996) argued that education tends to create awareness, positive attitudes, social values, and motivation which stimulate self reliance. This implies that education level has a crucial impact on community in managing water use conflict, thus, reducing stress on these resources.

4.1.4 Ethnicity and migration

Being born in the sub-catchments or migrating to the sub-catchments had an impact in the water resources management and water use conflicts. The findings showed that majority (75 %) of the respondents were born in the village, while only (25%) of the respondents were not born in the village. The management of water resources and water use conflicts depend on which type of people live around sub-catchments or villages surrounding the water resources. It can be argued that people who were born and lived permanently in the sub-catchments, understood well the history of sub-catchment and water use conflicts resolutions. Studies IUCN (2010) revealed that few (25%) of the respondents was not born and have not lived permanently in the sub-catchments and the studied villages. People migrated to these villages for various reasons, such as conducting agricultural activities, livestock keeping, looking for fertile land and water for their livestock. Employment opportunities were another reason. For instance people who were employed by the government such as teachers and nurses migrated to the area.

Furthermore, focus group discussion revealed that many of the immigrants are engaged in agricultural activities. These immigrants were reported to invite other fellows who were looking for suitable land for agricultural activities. As one member was quoted saying,

“I came to Kilosa District in 1998 after having been informed by my friend who discovered that the area was suitable for crop production as there is plenty of water” (Focus group discussion in Chanzuru village).

4.1.5 Economic activities

The study revealed the kinds of economic activities carried out in the sub-catchment. Ninety one percent (91.7%) of the respondents were reported to engage in agriculture. About 7.5% of the respondents are engaged in pastoralism, while 8% are engaged in both agriculture and pastoralism (Table 4).

Table 4: Economic activities of respondents

Economic activities	Percentage of respondents (n=120)
Agriculture	91.7
Pastoralism	7.5
Agriculture and Pastoralism	0.8
Total	100

The results implied that crop production and livestock keeping are the main economic activities in the sub-catchments. This could be possibly because of the presence of fertile land and water resources, particularly river water.

Also irrigation schemes, labour, and markets boost the growth of these economic activities. Since irrigation is commonly practised in the area, more initiatives for creating awareness about proper water resources use are needed. However, irrigation expansion in these sub-catchments is likely to create shortages downstream. As Sokile (2005) noted, irrigation for example, draws a considerable amount of water of up to an estimated total of 12.4 million cubic meters in the dry season in the upper zone of Rufiji basin leaving the downstream people with very little water for both domestic and irrigation uses. Therefore, agriculture and pastoralism demand the use of water in the area and sometimes a lot of water and hence may cause water use conflicts.

4.2 Source of Water and Water Use

The findings revealed that river water is the main source of water for agricultural production, as was revealed by 51.7% of the respondents. This was followed by boreholes, 20% of the respondents and then groundwater (10.8%). Other sources of water for agricultural production included spring water (9.2%) and lastly rain water harvesting which was reported by 8.3% of the respondents. These results are illustrated in Table 5 and Plate 2 below, showing irrigated land in Ilonga sub-catchment.

Table 5: Sources of water for irrigation

Sources	Percentage of respondents (n=120)
Rivers	51.7
Boreholes	20.0
Ground water	10.8
Springs	9.2
Rain water harvesting	8.3
Total	100

Results revealed that more water is used to irrigate vegetables and in many cases this period coincides with an increased occurrence of water use conflicts. Currently in Tanzania, almost all river basins have been reported to experience water use conflicts (Makawia, 2002). Thus, deliberate efforts are needed towards protection and sustaining water resources in the area.

4.2.1 Water users in study area

Ilonga catchment has three villages namely Ilonga, Idete and Chanzuru with different types of water users who depend on Ilonga River for use. The results from FGD discussion and key informants showed that water users included Irrigators

(Traditional Irrigation Project), and Institutions (Roman Catholic Church, Ilonga Teachers College, and Minister of Research Institute). Agriculture as the main economic activity has an impact on the water resource management and water use conflicts. Therefore, the respondents were asked to identify different types of agriculture practised in these sub-catchments. This was an important question in determining the type of agricultural activities carried out in the study area and which depend on irrigation or rain-fed agriculture. The findings showed that (37.5%) of the respondents said that irrigation agriculture is practised in the area. About 31.7% of the respondents reported that agriculture depends on rainwater, while 30.8% of the respondents reported to be depending on both irrigation and rain-fed agriculture. Plate 2 below shows irrigated land in Ilonga Catchment.



Plate 2: Irrigated paddy field in Ilonga river catchment

Table 6: Type of agriculture practices

Type of Agriculture	Percentage of respondents (n=120)
Irrigated Agriculture	37.5
Rain-fed Agriculture	31.7
Irrigated agriculture and rain-fed agriculture	30.8
Total	100

These results imply that both irrigation and rain-fed agriculture are practised in the area. Majority of the respondents depend mostly on irrigated agriculture. This could be attributed to the presence of water resources especially river.

Similar findings are reported in a study by PBWO/IUCN (2007) which reveals that most rural households rely primarily on farming. Small-scale farmers grow main staple food such as maize, and a variety of other crops that varied from place to place across the basin. Coffee, bananas and rice are important crops in the highland areas and most fields are irrigated through traditional systems. Therefore, there is an increasing competition for water resources in this area. It is also argued that improving irrigation efficiency and equal distribution should be given first priority in the study area.

4.2.2 Reasons for the establishment of water users association

Table 7 shows that 37.5% of the respondents cited conflict resolutions among water users as one of the reasons for the establishment of sub-catchment WUAs, 32.5% cited equitable distribution of water among water users, and 28.3% of the respondents cited proper management of sub-catchment water resources as among the reasons. Only 1.7% of the respondents cited unity among the water users as a reason for the establishment of sub-catchment WUAs. In view of the reasons given and their percentages, the results

implied that the establishment for WUAs were well understood. Most of the respondents were found to understand the viability and characteristics of the sub-catchment WUAs as an important tool for conflict resolution.

Table 7: Reasons for the establishment of WUAs

Reason for establishment of water user associations	Percentage of respondents (n=120)
Water use management	29.3
Conflict resolutions among users	37.5
Equal distribution of water users	1.7
Unit among the water users	32.5
Total	100

Thus, the establishment of sub-catchment WUAs was aimed at enabling the community participate in water resources management and water resource conflicts resolution in their respective areas. As pointed out in URT (2010), the objective of facilitating the establishment of Water Users Association was to ensure that water resources are managed primarily by the users themselves within their areas of jurisdiction.

4.3 Water Use Conflicts among the Mid Stream Users

The findings (Table 8) showed that 43.3% of the respondents cited misunderstandings among water users as a source of water use conflicts in the areas while 25 the respondents cited misunderstanding, and disputes among users as sources of water use conflicts. About 13.3% of the respondents perceived water use conflicts as disputes over water use by the users, and only 10% of the respondents attributed these conflicts to lack of suitable environment; about 8.3% of the respondents attributed water use conflicts to violation of prevailing laws and regulations on water use.

Table 8: Source of water use conflicts

Conflicts source	Percentage of Respondents (n=120)
Misunderstanding among water users	43.3
Disputes over water use by the users	13.3
Lack of suitable environment	10.0
Violation of prevailing laws and regulation	8.3
Misunderstanding and disputes among users	25.0
Total	100

From Table 8, it can be said that the issue of water use conflicts is perceived differently by respondents. Water use conflicts affected people differently according to the demand and use of the water. Similar findings are supported in a study by IUCN (2009) which reveals that conflicts over resources are just one manifestation of the very high levels of competition that exist for the Basins' resources. However, through information given by respondents, it can be concluded that the area experiences high competition for resources especially water resources.

4.3.1 Types of water use conflicts

All respondents admitted of there being water use conflicts in the study area varied from one area to another. Conflicts among irrigators themselves were the most common (46 %), followed by conflicts between farmers and pastoralists (33%) and finally conflicts between farmers and domestic water users (10%) (Fig. 3). The predominance of conflicts among irrigators seemed to be attributed to an increase in the number of farmers (91.7%) especially those who practise irrigated agriculture, making water one of the highly contested resources among users. The occurrence of conflicts between farmers and pastoralists in the area (indicated by 33% of the respondents) is attributed to

migration from one to other areas such as Gairo Kimamba to Ilonga sub-catchment especially during dry season in search of water for livestock and pasture. This leads to increased pressure among resource users. Plate 3 below shows livestock keeping inside Ilonga sub –catchment area.



Plate 3: Livestock keeping inside Ilonga sub-catchment area

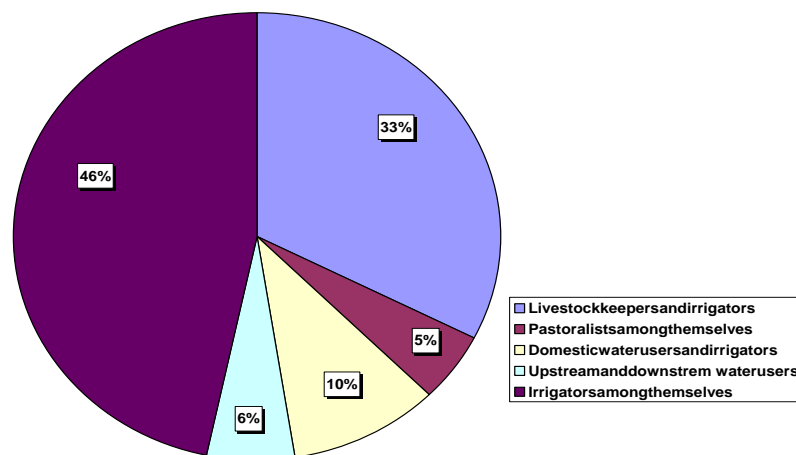


Figure 3: Types of water use conflicts

4.3.2 Common causes of water conflicts among downstream users

Conflicts over water use are a common phenomenon among downstream users. The findings (Table 9) showed that 46.7% of the respondents cited shortage of water by the upstream users as a common source of water use conflict in their area; while 25.0% of the respondents cited excessive use of water by upstream users as a common source of water use conflict. Other respondents (15 %) cited illegal connections as a common source of conflicts, and only 10% cited keeping of large numbers of livestock as a common source of water conflict. About 3.3% of the respondents cited position of the farm as a common source of water use conflict in the area. It was reported that water use conflicts among the downstream users might be the same as upstream users.

Table 9: Source of water use conflicts among downstream users

Source of conflict	Percentages of respondents (n=120)
Shortage of water	46.7
Excessive use of water by upstream user	25.0
Illegal connections	15.0
Big number of Livestock	10.0
Position of the farm	3.3
Total	100

4.3.3 Causes of water use conflicts among upstream users

Water users in the upstream faced different water use problems. About 48.3% of the respondents cited scarcity of water as a common cause of water use conflicts, while 27.5% of the respondents cited poor infrastructures as a common cause of water use conflicts. Others, 12.5% cited excessive use of water (water theft) as a common source of water use conflict; and only 10% of the respondents cited water use permits as a common

type of water use conflict; and about 1.7 % cited position of the farm as a common cause of water use conflict in the area as shown in Table 10.

Table 10: Causes of water use conflict among upstream users

Causes of water use conflict	Percentage of respondents (n=120)
Excessive use of water (water theft)	12.5
Scarcity of water	48.3
Water use permits	10.0
Poor infrastructure	27.5
Position of the farm	1.7
Total	100

The findings revealed that water use conflicts happen among the farmers who are in the same irrigation scheme or canals. Others causes include were water scarcity caused by prolonged drought, deforestation, and poor farming. Apart from that water flows needed to support downstream. Upstream traditional furrow irrigation was concentrated used by upstream user may not be available in the appropriate volumes or timing for providing in the highlands, but as migration increased this system spread to the lowlands; the increase in demand for irrigation caused the traditional system of rationing water to collapse. Small farmers in the lowlands reported that their share of the water was not adequate because upstream users were too selfish to share water with people in the downstream (IUCN, 2010). Downstream communities in the basin are often affected by upstream pollution. Downstream Impacts include sedimentation from erosion as a result of deforestation and agricultural practices and contaminated water. This reduces access to safe drinking water and water for livestock and agriculture, and investment must be made in other water resources such as ground water.

4.4 Level of Conflicts among Water Users before and After the Formation of Water User Associations

4.4.1 Farmer's involvement in water use conflicts for the past five to ten years

One of the easiest ways to assess the level of conflicts before and after the formation of WUAs was to ask the farmers whether or not they had been involved in any water conflict in the past five years (a period when WUAs were formed). The findings showed that the respondents in this sub-catchment had in one way or another been involved in water use conflicts. About 78.3% of the respondents had been involved in water conflicts several times, while 21.7% had never been involved in water use conflicts. The results showed that majority of the respondents had been involved in water use conflicts. This result implies that however useful WUA is, it has not been able to eradicate all water use conflicts.

4.4.2 Comparison of water use conflicts before and after formation of WUAs

Figure 4 shows the number of conflicts from 2005 to 2012. The findings indicated that the number of conflicts was increasing up to year 2008 (before WUAs formation) but declined thereafter following WUA formation. Looking at this trend, we can rightly conclude that WUAs had remedy to the situation. But as a matter of fact, an increase in the number of conflicts had also to do with an increase in irrigation activities due to an increase in the number of farmers participating in irrigation activities. The number of farmers in the catchment area increased from 159 in 2005 to 2500 in 2012 (Kandenguka, 2012).

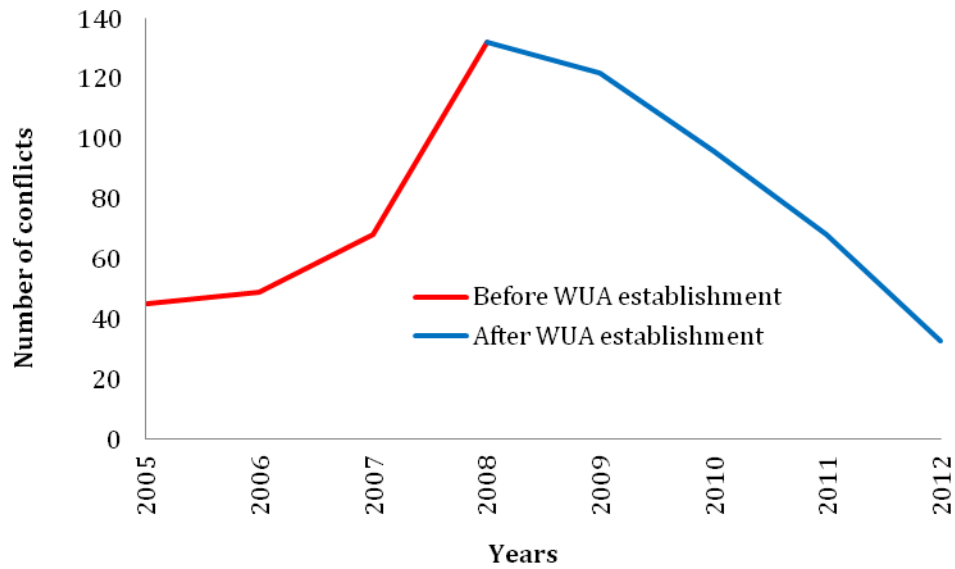


Figure 4: Conflicts situation before and after the formulation water user associations

Therefore, in order to objectively assess the role of WUAs in reducing water use conflicts, one had to consider the percentage of conflicts per a farmer so as to get rid of the variation in the number of farmers from year to year. When this was considered, the percentage of conflicts per a farmer had greatly been reduced in the subsequent years after the formation of WUAs. The difference in mean percentage of conflicts before the formation of WUAs and after the formation of WUAs was found to be statistically significant ($t=3.391$, $p=0.015$). Therefore the study revealed that WUAs in the sub-catchments have a big impact on water resources management and resolution of water use conflicts.

4.4.3 Frequency of water use conflicts

Table 11 presents results on water use conflicts. Some (12.5%) of respondents reported that water use conflicts occurred two--four quarterly. About 29.2% of the respondents said that water use conflicts occurred quarterly in their area, 55% respondents reported that water use conflicts happened frequently and 3.3% of the respondents said that water use conflicts never happened in the area (Table 11).

Table 11: Occurrence Water use conflicts

Occurrence of water use conflict	Percentage of respondents (n=120)
One every quarterly	29.2
Two-four quarterly	12.5
Several time	55.0
Never happens	3.0
Total	100

Table 11 shows of water use conflicts in the area are frequent. This is attributed to multiple uses that are put for water in things like irrigation agriculture, domestic use, and livestock watering.

4.4.4 Period of the year in which water use conflicts mostly occur

The majority (91.7) of the respondents indicated dry season as the main period for occurrence of water use conflicts; while 8.3% of the respondents indicated the rainy season.(Table 12) This shows that there are variations in terms of periods of the year when water use problems become serious depending on the category of water use; for instance, the way domestic users experience water problem differed from the way a farmer experiences shortage of water.

Table 12: Period of the year in which water use conflicts mostly occur

Period	Percentage of respondent (n=120)
During rainy season	8.3
During dry season	91.7
Total	100

It was revealed further that certain times of the year water use conflicts are acute. The respondents cited dry season as the time when water use conflicts normally occur. There are several reasons for this; during this time water is highly needed for both agriculture and domestic use, while shortage of water in the river is usually high. Thus, there is a competition in the water use and a lot of unauthorized abstractions of water occur during this time. A study conducted by Joseph (2008) revealed that unauthorized use of water, especially for brick making, and unreliability of water during dry season are the two biggest water problems for domestic users. The difficult moment to them starts in July through April. In July through December, people face serious water problems for irrigation. For domestic water users, the critical period is from June through December. This is the dry season when rivers in this sub-catchment are usually short of water leading to few abstractions of water at the domestic user's main off-take. As far as rice cultivators, the critical period is from April through November. In this period, rice cultivators need enough water for seedlings, transplanting and the general growth of rice until harvesting Time. During the interview, one respondent said:

“During rice planting, is the highest point for many water use conflicts to occur among farmers. In this period, fighting occur several times. Sometimes, men never sleep at home for a week”.

4.4.5 Times spent by sub-catchment WUAs in resolving water use conflicts

Sub-catchment WUAs are involved in resolving water use conflicts in their respective areas. Majority (34.2%) of the respondents said that sub-catchment WUAs were used frequently in resolving water use conflicts, while 10 % of the respondents said that sub-catchment WUAs were used most of frequently in resolving water use conflicts. This is illustrated in the Table 13.

Table 13: Time used by Sub-catchment WUAs in solving water use conflicts

Times used by WUAs	Percentage of respondents (n=120)
Frequently	34.3
Most frequently	10.0
Very rarely	46.7
Total	100

4.4.6 Responsibilities for the management of water resources

In the process of water resource management, there are some institutions which are responsible for managing allocation, distribution and management of water use conflicts. Majority (70%) of the respondents reported that sub-catchment WUAs were responsible for water allocation, distribution, and management, while 22% of the respondents said that village leaders were responsible, while few respondents (7.5%) said that community members were responsible. The results show that majority of the respondents used sub-catchments WUAs in water resources management, allocation and distribution. This was attributed to the reason that sub-catchments WUAs operated at the lower level which ultimately encouraged community participation on issues related to water use.

Table 14: Institutions responsible for allocation distribution and storage of water

Institutions responsible for allocation	Percentage of respondents (n=120)
Sub-Catchment WUAs	70.0
Village Leaders	22.5
Community Members	7.5
Total	100

Table 14 shows that different institutions are responsible for the allocation, distribution and management of water resources. Majority (95%) of the respondents cited sub-catchment WUAs as responsible for the allocation and distribution of water among the users. This means that sub-catchment WUAs play a great role in the process of water resources management. Proper allocation is also important in ensuring equitable use of the resource. IUCN (2010) observes, WUAs has been strengthened and empowered to participate in water resources management through enhanced dialogue, collaboration and consensus, and raise awareness on climate change and the environmental, economic and social implications for water flow and allocation. Therefore, WUAs incorporate users of different levels, organizations, groups, companies, and individuals in the management process, allocation, and storage of water to ensure sustainable water resource use in the catchments and to resolve water use conflicts. Similar observations are made by Mbwilo (2002) in a study on Usangu plains in Mbarali District which shows that the use of local institutions in regulating water and conflict management has proven to be effective because such institutions base on the values, knowledge and practices of local communities.

4.5 The Challenges facing Water User Associations

Despite the WUAs' support to members in the study area, members were found to encounter different challenges that probably limited their chances to success. Table 14 summarizes the major challenges encountered by WUAs in the study areas. The results in the table show that more than 34.2% of the members complain about lack of skilled personnel at the catchment level in mobilizing the community to participate in the development activities especially management of water resource in the study area. Moreover, other problems revealed are lack of fund (reported by 18.3%), climate change

(16.7%), water shortage (13.3%), limited resources (15.8%), and low participation of community members (reported by 1.7% of the respondents).

A study conducted by Ibrahim *et al.*, 2003). On problems facing Pangani Basin Water Office cited shortage of personnel, lack of environmental engineers and inadequate number of community development officers as among the problems.

Table 15: The challenges facing water user associations

Challenges	Percentage of respondents (n=120)
Lack of skilled personnel	34.2
Lack of fund	18.3
Climate change	16.7
Water shortage	13.3
Limited resources	15.8
Low participation of community members	1.7
Total	100

4.6 Opportunities for Water User Association

Table15 shows opportunities available for Water User Association in water resources and water use conflict management in various parts of Tanzania. The success and accessibility and sustainability of WUAs enable the communities to have a common platform for different users to come together and discuss their own problems. This study revealed that 84.2% of the respondents used the local community platform to express their water problems and 15.8% were enabled to participate in the conservation of water sources.

As Laurent (2010) observes, in order to improve water quality measures should be taken against those violating the guidelines and by-laws. If awareness is raised the number of cases about community members violating water use by-laws would decline substantially. Conflicts between various users over access and use of water would also decline. Formulation of water user associations (WUAs) is also considered as a better tool that should be set as an organ for settling disputes and also as a negotiation platform for resolving conflicts whenever they occur.

Table 16: Opportunities for water user association

Opportunities	Percentage of respondents (n=120)
The local community had get a platform to express their water Problems	84.2 15.8
Conservation of water sources	
Total	100

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study investigated the role of Water Users Associations in management of water resources and water use conflicts in and around Ilonga Sub-Catchment. The findings have revealed that the formation of water user associations has reduced water use conflicts for the period 2005/2008-2009/2012.

From water users' perceptions, it was observed that water shortage creates a great bottleneck in crop production due to a number of reasons. Many farmers pointed out that the major reasons for shortage of water are the large number of water users, drought and destruction of water sources which all together lead to water use conflict among irrigators. Ilonga sub catchment is among the catchments with a high potential for irrigation agriculture and the government should invest in the area to improve the existing irrigation scheme and possibly build new ones. Extraction of water by this scheme needs to be carefully monitored as there may be significant impact on water flows especially during the dry season. If managed in terms of its use and distribution, water can be applied to the cultivated land in the right time and right amount. The management of this kind would lead to the improved crop yield and reduced water use conflicts.

Ilonga sub catchment has different types of water users including irrigators and traditional irrigation project organization who depend on Ilonga River for use. Agriculture as the main economic activity has an impact on water resources management and water use conflicts.

Results show that before the formation of WUAs there were water use conflicts which varied from one village to another. Consequently, conflicts among Irrigators seemed to be attributed to an increase in number of farmers. Moreover conflicts over water use were found to be a common phenomenon among downstream users but declined after WUAs formation which had remedied the situation. In view of this, it is concluded that WUAs in the sub-catchments has great impact on water resources management and resolution of water use conflicts.

The findings also show that WUAs encounter different challenges such as: lack of skilled personnel at the catchment level, lack of fund and climate change. Apart from a number of challenges WUAs give opportunities for water user association to express their water problems.

5.2 Recommendations

In the view of the major findings of the study and the above conclusion, the following are recommended:

- i. Comprehensive consultations with local users of the resource have to be done frequently in the area. IWRM planning is essential at all levels from the basin to sub-catchment to streams. There is a need to understand how multiple users will access, use and manage the resource. This means designing structures for different users such as livestock keepers and farmers, promoting conservation farming and exchanging information on how to resolve conflicts.
- ii. Increasing competition for water resources in the study area with limited number of water sources is a major limiting factor for water quality that leads to water use conflict. It is strongly suggested that emphasis should be put on search for new

sources of water (e.g. construction of water dams/adopting appropriate rain water harvesting techniques and the exploitation of the ground water resources) to reduce stress and conflicts among different water users. Dip tanks should be constructed at ward level or village level whenever possible so as to give opportunity for the livestock to get the service. This however requires an establishment of an effective institutional framework to oversee the infrastructure construction. Thus, facilitation of the establishment of WUAs is a key step and an entry point towards resolving water and land related conflicts.

- iii. Water user associations should create negotiation platform involving all the three villages in the study area to design strategies towards sustainable water use and conflict management in the area. Through negotiation platform on the management of water resources, decisions on peaceful stay and sustainable resource utilization will be reached in the area.
- iv This study is not an end by itself despite usefulness and relevance of the findings. This study calls for further studies in different areas concerning the operations of WUAs in the sub-catchment in the management of water resources conflicts. The areas for further research that emanate from this study include: sub-catchment WUAs and water use permits, sub-catchment WUAs and environmental conservation and participation of communities in sub-catchment WUAs. Furthermore, there is a need for further study in gender issues in sub-catchment WUAs, sub-catchment WUAs poverty reduction and the role of Indigenous Knowledge Systems (IKS) in Sub-catchments WUAs operation.

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APPENDICES

Appendix 1: Questionnaire for Households Survey

Socio economic characteristics of the sub-catchments water user associations

Questionnaire number

Date of interview

Name of interviewer

Name of interviewee.....

A. Characterize different water resources and water users in the study area.

1. Location.

a) District name

b) Sub-catchment/Catchment name

c) Water user position

1) Upstream ()

2) Downstream ()

d) Village name.....

2. Personal description

a) Sex

b)

1) Female ()

2) Male ()

3. Were you born in this village?

a) Yes ()

b) No ()

4. What are the main reasons for moving to this village?

- a) Looking for fertile land to cultivate ()
- b) Searching water for my cattle ()
- c) Looking for settlement ()
- d) Others ()

If other reasons, specify please

5. Do you know the meaning of water users or farmers organization?

- a) Yes ()
- b) No ()

6. Do you have registered sub-catchment Water User Associations (WUAs)?

- a) Yes ()
- b) No ()

If yes, what were the reasons for its establishment and when was it formed

.....

If yes how many villages are involved explain.....

7. Are you a member of sub-catchment WUAs?

- a) Yes ()
- b) No ()

8. Are women involved in sub-catchment WUAs formation?

- a) Yes ()
- b) No ()

If yes, what are their positions and their number in the associations?

Positions.....

9. Do you have any socio economic activities in your sub-catchment water user associations?

a) Yes ()

b) No ()

If yes, mention some of them you know.....

10. Where you get information concerning the Role of WUAs in conflict management

a) NGO's ()

b) Trainings ()

c) Meetings ()

d) Leaders ()

11. What is the main economic activity in this area?

a) Agriculture ()

b) Pastoralist ()

c) Other activities ()

If others, mention some of them.....

12. If the main activity is agriculture, please, indicate the location of your farms in the following category

a) Far away from the water catchments (>1km) ()

b) Near the water catchments (60m to 1km) ()

c) Closely/around to the water catchments (<60) ()

13. What type of agriculture are you practicing?

a) Irrigative agriculture ()

b) Rain agriculture ()

c) Others ()

If others, please specify.....

14. If it is irrigative agriculture, what kind of method do you use?

- a) Small holder/bucket irrigation ()
- b) Large scale method ()
- c) All of the above ()
- d) Other methods ()

15. Where do you get water for irrigation?

- a) Traditional Wells ()
- b) River ()
- c) Rains ()
- d) Others, please specify ()

If other sources specify.....

16. Where are you in the catchments?

- a) Downstream ()
- b) Upstream ()
- c) Other places ()

17. What type of pastoralist do you practice?

- a) Nomadic ()
- b) Resident (offsite) ()
- c) Zero grazing ()

18. Where do you graze your livestock?

- a) Far from the catchment(s) ()
- b) Nearby the catchment(s) ()
- c) Within the catchments ()

19. Where do you water your livestock?

- a) To the water sources ()
- b) To river flows near us ()

c) To identified places for watering ()

d) Others ()

If others explain:-

20. Where is the watering point in the sub-catchment?

a) Upstream ()

b) Downstream ()

Rank According of Importance

Types of uses	Most important	Moderate	Least
i) Crop production			
ii) Domestic uses			
iii) Both crop and livestock production.			
iv) Fisheries			
v) Hydropower			
vi)Specify others			
iv) All of the above			

2.0 Causes of water use conflicts

2.1 What are your water sources for domestic use in your area?

a) Rain harvesting ()

b) Rivers ()

c) Ground water ()

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

a) Rain harvesting ()

b) Rivers ()

c) Ground water ()

d) Springs ()

e) Wells/Boreholes ()

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

- a) Domestic ()
- b) Irrigation ()
- c) Livestock watering ()
- d) Environment ()
- e) Others ()

If others specify.....

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

- a) Yes ()
- b) No ()

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

.....

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

- a) Yes ()
- b) No ()

If no give reason (s) why

If yes how much you ready to reduce?

- a) Quarter () b) one third () c) half () d) three quarters () e) one quarter ()

2.5 Are there institutions which are responsible for water resources management in this area?

- a) Yes ()
- b) No ()

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

2.6 Is there fair distribution of water among the users?

a) Yes ()

b) No ()

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

.....

2.7 In your life experience what do you understand about water use conflicts?

.....

2.8 Do you experience water use conflicts in your area?

a) Yes ()

b) No ()

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

a) Livestock keepers and Irrigators ()

b) Pastoralists among themselves ()

c) Domestic water users and irrigators ()

d) Upstream and downstream water users ()

e) Irrigators and Irrigators ()

If others specify.....

2.10 What are the types and major causes of water use conflicts among the upper users?

a) Excessive use of water ()

b) Scarcity of water ()

c) Use without water right ()

d) Poor infrastructure ()

e) Position of the farm ()

2.11 What are the types and major causes of water use conflicts among the downstream users?

a) Excessive use of water ()

- b) Big number of livestock ()
- c) Shortage of water ()
- d) Illegal connections ()
- e) Position of the farm

**B) *Level of conflicts among water users before and after the formation of
Water user Associations***

2.12 At what period in the year do most water use conflicts happen?

- a) During rainy season ()
- b) During dry season ()
- c) No conflicts ()

2.11 What are the common sources of conflicts?

2.12 For the past five to ten years, have ever been involved in water resources conflicts in
this Catchment?

- a) Yes ()
- b) No ()

If yes, can you show frequencies it has occurred per quarterly?

- a) One every quarterly ()
- b) two- four ()
- c) Several times ()
- d) Never

2.13 Compared to previous years (do the water use conflicts)

- 1) Increasing
- 2) Decreasing
- 3) Remained Constant
- 4) No conflicts

2.14 Do you think those conflicts have negative results on the water resources use in your area?

a) Yes ()

b) No ()

If yes, what are they?

2.15 Do you have any defined by laws for water management at river scales?

a) Yes ()

b) No ()

2.16 By laws are being implemented

a) Strongly agree ()

b) Undecided ()

c) Disagree ()

3.1 What are the responsible institutions for managing water resources in your area?

a) WUAs ()

b) iWASH ()

c) Tradition institutions and methods ()

d) Basin Water Office ()

e) RBWO staff ()

f) Others ()

If others explain.....

3.2 What are the institutions responsible for managing water resources conflicts in your area?

a) WUAs ()

b) IWASH ()

c) Tradition institutions and methods ()

d) Basin Water Office ()

e) RBWO staff ()

f) Others-please explain ()

3.3 Does sub-catchment WUAs assist in reducing water use conflicts?

a) Agree ()

b) Disagree ()

c) Undecided ()

d) Others ()

If others specify.....

3.4 What methods do Sub-catchment WUAs use in solving water use conflicts in this area?

a) Meetings ()

b) Using the existing by- laws ()

c) Dialogue ()

3.5 Do you have other ways you use in solving water use conflicts in your place?

a) Yes ()

b) No ()

If yes, please explain at least four ways.....

3.6 For how many times have you used Sub-catchment WUAs in solving water use conflicts in your area?

a) Many times ()

b) Very rarely ()

c) Most of time ()

d) Never did it ()

3.7 What are measures taken by Sub-catchment WUAs to prevent future water use conflicts in this area?.....

3.8 What methods do Sub-catchment WUAs use in punishing the wrong doers in water use in your area?

- a) Warning ()
- b) Penalties ()
- c) Others ()

3.9 Who is responsible for allocation, distribution, storage and management of water use in your place?

- a) WUAs ()
- b) Village leaders ()
- c) Others ()

If others please mention.....

3.10 Mention the most important approaches that you think have had positive influence to water User conflict management in Ilonga Sub-catchment.....

3.11 Major recommendation to improve water use conflict in Ilonga sub-catchment

.....

c) Challenges and opportunities facing water user association in water resources and water use conflict management

4.1 What constraints/challenges do water user face in Ilonga sub-catchment?

.....

4.2 What are the opportunities.....

4.3 What do you recommend?

4.4 Mention socio-economic factors that facilitate/constrain efforts towards sound management of water in the study area?.....

4.5 Is there any Act which entities facilitate the formation and strengthening of water user Associations?.....

THANK YOU VERY MUCH FOR YOUR COOPERATION

Appendix 2: Checklist for Key Informants

1. (a) Name of office.....
- (b) Name of interviewed officer.....
- (c) Designation
2. Is your office responsible for managing sub-catchment water resources?
 - a) Yes ()
 - b) No ()

If yes, please give explanation on the roles played by your office in management of the existing sub-catchment water resources?

If No, how are the water resources managed in your area?
3. Do you have sub-catchment water user associations (WUAs) in your area?
 - a) Yes ()
 - b) No ()

If yes, how many of them?.....
4. What were the reasons for establishing them?.....
5. What are the functions of WUAs in managing water resources in your place?
.....
6. What are the difficulties encountered in managing sub-catchment water user associations?.....
7. What were the conflicts occurred in the sub-catchments areas.....
- If yes, how many are they quarterly ?
8. How were these conflicts solved?
9. How does your office support WUAs in their daily obligations?
10. What are the roles played by your office in assisting WUAs in the process of managing water use conflicts in this place?

11. What strategies do your office has in solving water conflicts in your places?

.....

12. What is the coordination between WUAs and your Office in water resources
Management and water use conflicts resolution?

THANK YOU VERY MUCH FOR YOUR COOPERATION

Appendix 3: Focus Group Discussions-Interview Guide

1. Do you have Sub-catchment WUAs in your area?

a) Yes ()

b) No ()

2. What are their functions and roles in managing water resources?

.....

3. Why are Sub-catchment WUAs introduced in your area?

.....

4..Do you have experienced water use conflicts in your area?

a) Yes ()

b) No ()

5. What type of water use conflicts do you experiences in your area?

6. What are the roles of Sub-catchment WUAs in managing water resources conflicts?

.....

7. How many number of conflicts do you have in this area/catchment that occur quarterly?.....

8 What are the challenges of Sub-catchment WUAs in managing water use conflicts in your area?.....

9 Are there other institutions than WUAs responsible for managing water resources in your area?

a) Yes ()