FARMER'S KNOWLEDGE, ATTITUDE, AND PRACTICE ON WATER STEWARDSHIP AS A WATER MANAGEMENT TOOL: A CASE STUDY OF KAPORO SMALLHOLDER FARMERS ASSOCIATION IN KARONGA, MALAWI

MSc (WATER RESOURCES MANAGEMENT AND DEVELOPMENT) THESIS

ALICE NGULUBE

MZUZU UNIVERSITY, MALAWI

OCTOBER, 2022

FARMERS' KNOWLEDGE, ATTITUDE, AND PRACTICE ON WATER STEWARDSHIP AS A WATER MANAGEMENT TOOL: A CASE STUDY OF KAPORO SMALLHOLDER FARMERS ASSOCIATION IN KARONGA, MALAWI

ALICE NGULUBE

A THESIS SUBMITTED TO THE FACULTY OF ENVIRONMENTAL SCIENCES, DEPARTMENT OF WATER AND SANITATION IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE DEGREE IN WATER RESOURCES MANAGEMENT AND DEVELOPMENT

MZUZU UNIVERSITY

OCTOBER 2022

DECLARATION

I hereby declare that this thesis titled "*Farmers' knowledge, attitude and practice on water stewardship as a water management tool: A Case study of Kaporo Smallholder Farmers Association in Karonga, Malawi"* has been written by me and presents a record of my research work. All citations, references, and borrowed ideas have been duly acknowledged. It is being submitted in fulfilment of the requirements for the award of the Master of Science Degree (MSc) in Water Resources Management and Development of the Mzuzu University. None of the present work has been submitted previously for any degree or examination in any other university.

Parts of the materials presented in this thesis have been submitted for publication.

_____ _____

ALICE NGULUBE **Date**

CERTIFICATE OF APPROVAL

The undersigned certify that this thesis is a result of the author's own work and that to the best of our knowledge, it has not been submitted for any other academic qualification within the Mzuzu University or elsewhere. The thesis is acceptable in form and content, and that satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held on: **26th August, 2022**

Associate Professor Dr Rochelle Holm (Ph.D.)	**Date**
(Supervisor)	
Mr Mphatso Malota	**Date**
(Co-supervisor)	
Post graduate Coordinator: Dr Russel Chidya (Ph.D.)	**Date**
Head of Department: Dr Brighton Chunga (Ph.D.)	**Date**

ACKNOWLEDGEMENTS

I would like to acknowledge the support of my supervisors Associate Professor Rochelle Holm (Ph.D.) and Mr. Mphatso Malota for their guidance and support. I also wish to thanks all lecturers and the entire members and staff of the Department of Water and Sanitation.

This work was supported as part of the Climate Justice Water Futures Program funded by the Scottish Government through a grant facilitated by Balmore Trust. The funding source had no role in study design, data collection, analysis, interpretation of data, in the writing of the report, nor in the decision to submit this thesis.

Many thanks to my Husband Stater Magombo, who boosted my molaro and gave me strength throughout my academic journey.

Lastly but not least, to my Father and Mother whose love, care and desire was to see me educated.

ABSTRACT

The limitation in application of water stewardship as a water management tool by farmers under Kaporo Smallholder Farmers Association (KASFA) in Karonga district, Northern Malawi was mainly due to knowledge gaps, attitudes, and practices of farmers. As such the study of farmers' knowledge, attitude, and practice on water stewardship as a water management tool was conducted to assess farmers' knowledge, attitude, and practices on water stewardship as a water management tool for farmers under KASFA. Data was collected from farmers under the Kaporo Smallholder Farmers Association (KASFA). The study used qualitative and quantitative data from 302 KASFA farmers on which 60 farmers who were the only irrigation farmers within KASFA were purposively selected and surveyed on irrigation issues and 242 farmers were randomly sampled and surveyed on water stewardship. Collected data were analyzed using IBM SPSS (Version 20). The results indicated farmers' knowledge and the variables of water stewardship such as training attendance and water quality were highly associated with a significance of $p < 0.05$. Contrary, no significant association was found between knowledge and other variables such as gender, marital status, irrigation practice and land size ($p > 0.05$). The results on farmers' practice showed that most farmers have no water right as the association has no water abstraction license. This was mostly due to farmers' limited knowledge and unawareness of water use statutory requirements which contributed to the poor application of water stewardship as a water management tool. These results can enhance the application of water stewardship as a water management tool by irrigation farmers. The study recommends the use of multidisciplinary approach in farmer's water stewardship sensitizations. Farmers should form or join water management groups through a ripple effect approach, sustainable water management and water resource use awareness.

ACRONYMS AND ABREVIATIONS

AWS	Alliance for Water Stewardship
CBM	Community Based Management
CSR	Corporate Social Responsibility
CWP	Community Water Partnerships
DC	District Commissioner
DWDO	District Water Development Officer
FAO	Food and Agriculture Organization
FAL	Farmers' Adult Literacy
FGD	Focus Group Discussion
GoM	Government of Malawi
GVH	Group Village Head
GWPSA	Global Water Partnership Southern Africa
IBM	International Business Machines
INWaSP	International Water Stewardship Programme
IWRM	Integrated Water Resources Management
JTS	Just Trading Scotland
KAP	Knowledge Attitude and Practices
KASFA	Kaporo Smallholder Farmers Association
MAC	Malawi Association of Counselling

MDGs	Millennium Development Goals
MSc	Masters of Science
NASFAM	National Smallholder Farmers Association
NCST	National Commission for Science and Technology
NGO	Non-Governmental Organization
NARBO	Network of Asian River Basin Organization
NWP	National Water Policy
SGDs	Sustainable Development Goals
SPSS	Statistical Package for Social Science
UNICEF	United Nations Children's Fund
VDC	Village Development Committee
WARFSA	Water Research Fund for Southern Africa
WHO	World Health Organization
WUA	Water Users Association
WWF	World Wildlife Fund
WWI	Water Witness International

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Background

Water stewardship is a fundamental water resource management tool with the primary object of enhancing socially equitable use and managing water resources sustainably by various stakeholders. The tool is recognized and recommended by international cooperation. In 2014, Alliance for Water Stewardship (AWS), an international cooperation established global standards compliant with best practices for standards set by the International Social and Environmental Recognition and Alliance. AWS is devoted to supporting accountable use of freshwater by all users through a system that drives, recognizes and rewards an enhanced water management outcome (Hepworth & Orr 2013).

The standard comprises four themes which are good water governance; sustainable water balance; good water quality status; and healthy status of important related areas (Newborne & Dalton 2016). The standards ensure water is used sustainably while addressing water challenges and shared water issues in the watershed, and also ensure the accountable water stewardship activities are in place to minimize negative effects and exploit positive impact for users based on the report of AWS (2014) and users require certification. The water stewardship certification programs normally focus on water utilities and businesses in order to empower stakeholders to minimize water footprints (Richter & Nature Conservancy 2008). Through a business case centered on sustainability performance, risk management and productivity, and implementation of a strategic framework based on a water mass balance at the enterprise level, industry can take actions that support restoration of a sustainable water balance at the community and watershed levels while also generating business value for that particular enterprise.

Within the business framework, the volume of consumptive water use can be used to establish the target water volume that an enterprise would balance through the implementation of community water partnerships (CWP) that provide water access and sanitation, watershed restoration and protection, and water for productive use benefits achieved through either metering or acceptable standard methods and broadly described as corporate water stewardship (Joe *et al.,* 2013). The corporate water stewardship commitment is interpreted and moved by business imperatives with a goal of a sustainable environment or a genuine desire to maintain the viability and integrity of natural ecosystems (Jones *et al.,* 2015).

In Malawi, water stewardship is explicitly illustrated in the National Water Policy of 2005, and the guiding principles of Integrated Water Resource Management (IWRM) and Community Based Management (CBM) which provide guidance on sustainable water resources management in addressing key challenges affecting water resources in the country. Water Stewardship is described by Newborne & Dalton (2016) as a driving tool for IWRM, integral in the development of policies and financial projections by governments and promotes best practices in the management of water resources. As a tool in managing water resources, it is required to be applied by all stakeholders at the catchment level.

In contrast, there is mismanagement of water resources as evidenced by the occurrence of shared water related risk (Hepworth and Orr, 2013). The water-related risks include floods, erosion, cyclone, salinity, droughts, pollution, groundwater depletion, and tsunamis and the management of these risks is through prioritizing the preparation of national climate change adaptation plans with an IWRM approach and concern for food security (Global Water Partnership, 2015).

The country of Malawi is vulnerable to a number of hydro-meteorological and other hazards including floods, droughts, hailstorms, strong winds and earthquakes reported in the Malawi 2019 Floods Post Disaster Needs Assessment (Government of Malawi, 2019). It further reported that in 2015, the country was affected by the worst floods experienced in 50 years (Government of Malawi, 2019). These impacts are due to adverse effects of climate change resulting from anthropogenic activities (Cosgrove & Loucks, 2015).

Climate change related events have affected irrigated agriculture and caused food insecurity and malnutrition in several parts of the world (WHO, 2018). Climate change has resulted in the frequent occurrence of floods and droughts, reduction of water resources, rising sea levels, changes in ecosystems, reduced food production levels, the prevalence of water borne illnesses and increase in disability rate, and decline of economic development and productivity (Bill *et al.*, 2015). These climate change related events are mainly caused by the combustion of fossil fuel, cement production, deforestation, and agriculture activities such as the use of nitrogen based fertilizers and land use changes and affect the strength and frequency of floods, droughts, hurricanes and tornadoes by increasing evaporation of land (Royal Society & Natural Academy of Sciences, 2020). The climate of the earth is also caused by warming effects such as the output of energy from the sun and concentration of greenhouse gases in the atmosphere, and cooling effects such as volcanic eruptions and aerosols (Bill *et al.*, 2015).

The WWF (2020) identifies six solutions for climate change; breaking the link between energy services and primary energy production, stopping forest loss, concurrent growth of low-emissions technology, developing flexible fuels, energy storage, displacing high-carbon coal with low-carbon gas, and carbon capture and storage.

The aforementioned solutions are in tandem with the mitigation and adaptation measures expressed by Bill *et al.,* (2015) where they propose (i) adoption of low-energy or zero carbon producing energy sources; (ii) sustainable agriculture practices (crop land management; (iii) grazing land management; (iv) restoration of organic soils; (v) reduction in the amount of animal agriculture; (vi) disaster risk management; (vii) ecosystem management (maintaining wetlands, afforestation, watershed and reservoir management, and community based natural resource management); (viii) environmental protection; and (ix) water management.

1.2 Problem Statement

Limitation in the application of water stewardship as a water management tool by farmers under Kaporo Smallholder Farmers Association (KASFA) in Karonga district was primarily attributed to costs, capacity, monitoring, and certification (WWI, 2017). The limitation may also be due to lack of knowledge by some water users in water resources management (Rolston, 2017). Oremo *et al.,* (2019) observed that the knowledge, attitude and practice of smallholder farmers on water resource management are culture-dependent being impacted by local networks, access to extension, attendance to farmers' education meetings, level of income, access to credit, land tenure and proximity to stream or natural spring. Additionally, water stewardship is a function of geographical experiences, farm characteristics, social experiences, residency status and psychological factors (Dean *et al.,* 2016; Rolston *et al.,* 2017). Although some literature has provided insights on the knowledge, attitude and practices of smallholders on water resource management, it was not explicit on the water resource management tool used in addition to being site specific. It also focuses less on agriculture even though the sector is responsible for 70% of the worlds' freshwater withdraws and up to 90% in some developingcountries (Easton, 2015).

In Malawi, studies of farmers' knowledge, attitude, and practice on water stewardship have not been done evidenced by the unavailability of data, and the introduction of a water stewardship initiative for African Water Users in Malawi as a knowledge and practice hub to stimulate action (WWI, 2017). However, in other countries, the studies have been conducted only that the results of such studies of farmers' knowledge, attitude and practice on water stewardship are site specific (Easton, 2015). Therefore, the study was conducted to assess farmers' knowledge, attitude, and practice on water stewardship as a water management tool for farmers under Kaporo Smallholder Farmers Association (KASFA) in Karonga district, Northern Malawi.

1.3 Study Objectives

1.3.1 Main Objective

To assess farmer's knowledge, attitude and practice on water stewardship as a water management tool.

1.3.2 Specific Objectives

The study specifically addressed the following objectives:

a) To examine the farmer's knowledge on water stewardship as a water management tool.
b) To determine the farmer's attitude towards water stewardship as water management tool.
c) To establish the farmer's practice on water stewardship as a water management tool.
d) To compare and contrast Alliance for Water Stewardship and Integrated Water Resources Management

1.4 Research Questions

a) Do KASFA farmers have adequate knowledge of water stewardship as a water management tool?
b) What are the KASFA farmer's attitudes towards water stewardship?
c) What are the KASFA farmer's current practices towards water stewardship as a water management tool?
d) What are the similarities and differences between AWS and IWRM?

1.5 Justification of the study

Programming

The study will help to improve on minimizing shared water challenges. It will also help the key players in the water sector such as NASFAM, KASFA, district assembly, and Non-Governmental Organization to see whether Karonga is improving in governing water resources.

Economically

A holistic approach will be employed by KASFA in its business operations to increase economic gains through a robust adaptive basin management command. Henceforth, sustainable utilization and management of water resources as stipulated in the Malawi National Water Policy (GoM 2005). The study will also equip smallholder farmers with knowledge on how business engagement and stewardship contribute to public policy goals, compliance and regulatory implementation.

Academically

The findings will inform potential areas for further research which are not only limited to Malawi. Uptake of results from the study will facilitate proper designs of global water management in knowledge, attitude and practice and strategies which suit the local context. Furthermore, a publication on management and operation of irrigation water management structures at scheme level: knowledge gaps, attitudes, practices and farmer experiences were generated to inform the global community.

Social and Cultural

The study will deepen the farmer's knowledge on the interaction between water stewardship and other water management approaches, mainly IWRM. It will also necessitate the development of contextual water management interventions. This will help to minimize the risk of shared water challenges for KASFA farmers and the entire catchment area community.

1.6 Ethical Consideration

The researcher was granted consent from the authorities including National Commission for Science and Technology (NCST) (Protocol Number P.12/18/341), the Board members for KASFA, The District Commissioner (DC), and District Water Development Officer (DWDO) in Karonga District before the study was conducted. Traditional leaders were also consulted. Written informed consent was obtained from all study participants.

1.7 Conceptual framework

The conceptual framework for farmers' knowledge, attitudes and practices on water stewardship suggested by this report is grouped into 3 categories as shown in figure 1;

- Knowledge; understanding the knowledge of farmers on water governance, water quality, and water balance to critically examine farmer's knowledge on water stewardship, analyze involvement and provide information on water stewardship.
- Attitudes; determining the attitudes of farmers towards water stewardship to instill positive attitudes on water stewardship as a water resource management tool.
- Practice; establishing farmers' practices on water stewardship in order to promote good practices on water resource management

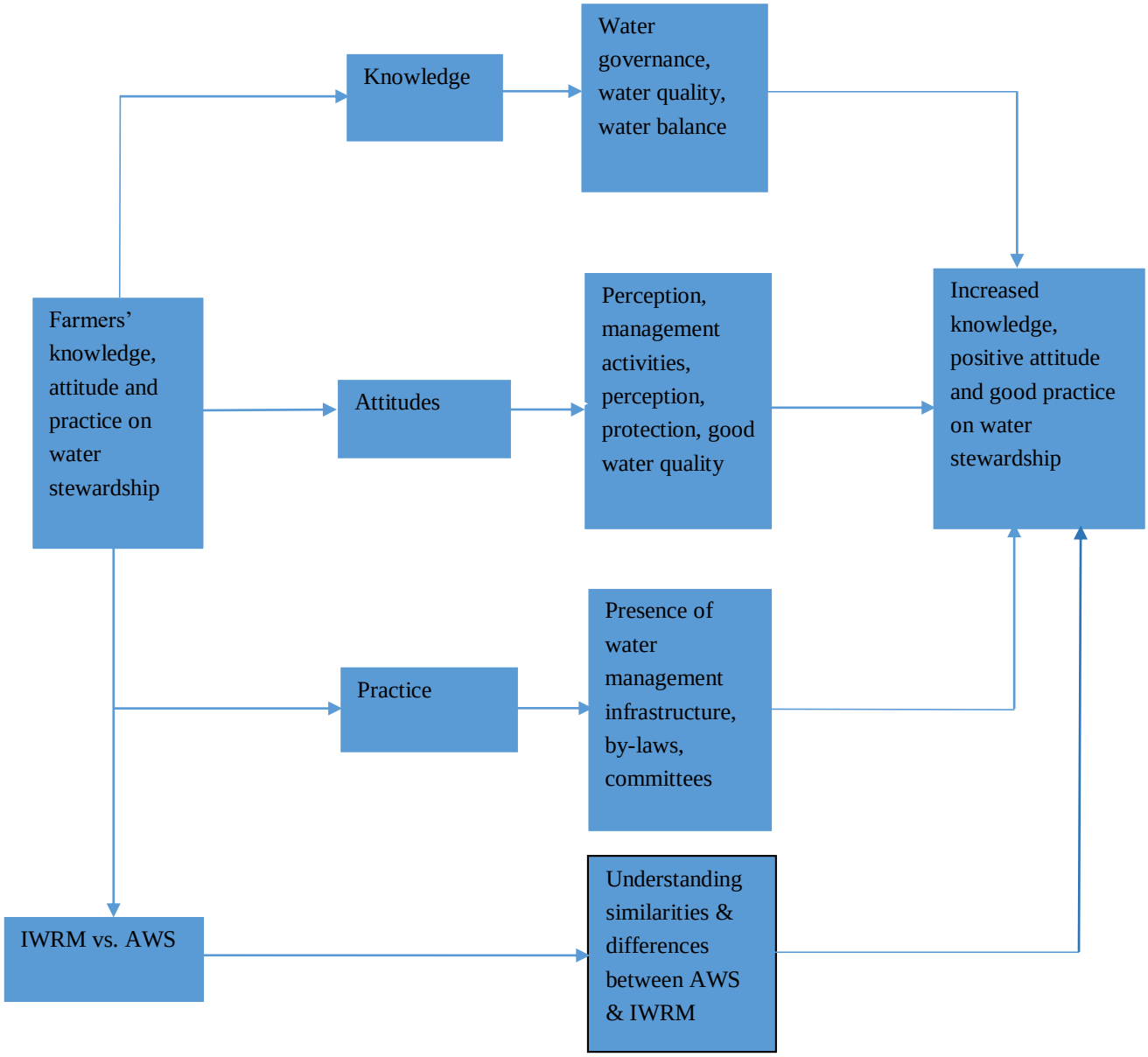

Figure 1: Conceptual framework of the study

The above conceptual framework was supported by conducting a research study in 2019 in order to collect qualitative and quantitative data on farmers' knowledge, attitudes, and practices on water stewardship as a water resource management tool in the Kaporo Smallholder Farmers Association in Karonga district of Malawi. Although the research provides significant information on the

farmers' knowledge. Attitudes, and practice, it is limited in reflecting the knowledge, attitude and practice of farmers on water stewardship in other catchment areas outside Karonga district.

CHAPTER 2:LITERATURE REVIEW

2.1 The increasing demand for water

Increasing water demand is the main threat to human health, ecosystem and environmental integrity (Boisson & Tignino, 2011). The water demand for household, urban, and agricultural usage is directly proportional to global population thus the increase in population corresponds to an increase in water demand (McDonald *et al.*, 2014). The increased water demand has resulted into several water challenges. These water challenges are expected to continue to increase due to high population growth, and high demand for water in different sectors (Namala *et al.*, 2010). Wada *et al.,* (2011) found that clean water stress is more adverse and common in relatively high-density population regions such as India, the United States, Spain and China.

It is projected that approximately 100 million urbanites will be affected due to the expected population growth of 1 billion, and the impacts of global climate change (McDonald *et al.*, 2011). Further, Laisi (2009) observed that there is also high water demand in the rural areas, especially for domestic and agriculture use evidenced by a rapid increase in the drilling of boreholes, and rehabilitation of old earth dams and construction of new ones which may result in over-abstraction of groundwater resources. This signifies that water is highly demanded by both urban and rural populations. And out of all sectors, agriculture demands 70-90% of the worlds' freshwater (Easton, 2015).

The water challenges influenced by climate change, and population growth affect most agriculture sector as it demands high percentage of water resources. The effect causes agricultural land to decline especially irrigation land due to increased competition over freshwater (Hussein, 2007).

This is contrary to the Government of Malawi's National Irrigation Policy (2016) whose objective is to increase land under irrigation farming. For this reason, there is a need to develop sustainable policies for managing water resources. These policies would also govern water projects to maximize people's desired benefits. For instance, irrigation farming projects subject to the availability of water resource as described by Hussain & Hanjra (2004) allows the cultivation of crops throughout the year which leads to food self-sufficiency for vulnerable smallholder farmers. The development of sustainable water management policies can potentially minimize the water challenges.

In the United States of America and other countries reusing both potable and non-potable water due to water stress as a sustainable water management technique is becoming common (Moe & Rheingans, 2006). The technology is feasible for high income and developed countries and the water stress challenge is minimized. This is not the case with middle income and developing countries where the resources are insufficient and hence notable for maintaining the water management infrastructures (Moe & Rheingans, 2006). The provision of water rights for water users is also a widely known strategy for effective water management. The strategy is receiving increased attention in South Africa and some countries in southern Africa including Malawi from stakeholders and scholars (Speelman *et al.,* 2010). It generally provides an opportunity for other water users to access and utilize the available water resource for domestic, irrigation farming, and other agricultural activities (National Water Policy, 2005).

Water availability in most countries has been affected by climate change and variability leading to low agricultural production and productivity (Aliche, 2008). The effect of limited water availability is even more pronounced on drought intolerant crops.

The limitation especially on freshwater for irrigated agriculture has been a foremost challenge and farmers are forced to use low quality water (Choudhary *et al.*, 2011). It has a consequential effect on the livelihoods of most people in Sub-Saharan Africa. For instance, a study by Nkegbe (2018) revealed that high levels of poverty in Ghana are partly due to inadequate water availability for crop, and livestock production.

Sustainable water resources management is the only approach to addressing the challenge of the inadequacy of water resources. The approach became visible and publicly acknowledged in the Millennium Development Goals (MDGs) (Government of Malawi, 2015). Through this, a number of concepts have been developed addressing water challenges including Integrated Water Resource Management (IWRM) (Malawi National Water Policy, 2005). The actualization of such concepts is a joined effort with the main players being Government, Non-Governmental Organizations (NGOs) and donor communities.

One such global organization is the Alliance for Water Stewardship (AWS), whose goal is to uphold conscientious use of freshwater enough for everyone, having financial benefits and with sustainable value (Waters, 2018). The AWS has been advocating for water stewardship which aims at promoting best practices in Integrated Water Resource Management (Newton & Dalton, 2016). The IWRM is basically aimed at achieving sustainable and integrated water resources management and development that make water readily available and equitably accessible to be used by all people in pursuit of their human development, and enhancement of the country's natural ecosystems as contained in Malawi National Water Policy, (2005) and addresses problems of excess precipitation and inadequate rainfall which lead to floods and droughts.

2.2 The adoption of water stewardship concept as a water management tool

Mathevetetal. (2018) defined stewardship as a collaborative form of joint preparation and accountable administration of setting by using long lasting environmental management activities which value environmental functions. Global governance rationale for water stewardship include: (a) the earth has a single hydrological system; (b) climate change and loss of varieties of plants and animal species within regions and their fundamental causes are worldwide; (c) local problems can cumulatively lead to global challenges, and (d) both the seen and unforeseen direct and indirect impacts of water use may lead to global impacts (Valk and Keenan, 2011). The challenges rising from global water governance can be countered by arranging global water sciences thus the introduction and adoption of water stewardship.

A study by Waters (2018) revealed that there is slow adoption of water stewardship as a water management tool, particularly in developing countries. This was a direct outcome of failure to value the need for commitment, understanding and planning in the adoption process by the water users and stewards. Further, the stewards fail to collect necessary data on water use and processes at its site and in the catchment area. He concluded that this trend makes the water stewardship adoption process slow, making most of the users to be at the receiving end without being directly involved in the adoption process itself.

Kaufmann *et al.,* (2006) presuppose that a stewardship scheme requires public dialogue, rule of law, proves and stabilities. Administration and governance are significant; hence one needs to take a study for the other. Newborne & Dalton (2016) agree that mostly this practice is fixed and needs to happen in a gradual process by learning from doing. Toonen *et al.,* (2006) look at the effectiveness of water stewardship adoption as affected by policy makers.

Water management includes accomplishing objectives and performance management, not only mutual decision-making but also building agreement and ruling disagreements, and concerning outside lawful, which entails accountability. The problems which arise at grass root level among the water stewards are paramount to the achievement and success of many water stewardship projects include lack of conflict resolution, lack of accountability as well as failure to build consensus can bring negligence to the water users in the adoption process hence (Toonen *et al.,* 2006). Kay *et al.,* (2012) found that, regardless of the significant gaps, agriculture stewardship can help control water pollution on farms effectively.

Giordano and Shah (2014) argue the process of adopting the stewardship projects sometimes cannot work if donors fail to properly plan, for instance not involving the locals which leads them not to meet their immediate needs. For instance, in Tanzania, water development and supply were recognized as an input national policy goal in their 1991 water policy though its budget was highly dependent on donor basis and implemented what donors would bear (Shah & van Koppen, 2006).

Adoption of stewardship activities can sometimes fail to be implemented due to residents' beliefs towards responsibility for the stewardship. Moskell & Allred (2013) study results on tree planting stewardship in New York City reveals that the majority of residents had a belief that stewardship responsibility belonged to the government only a few believed that the responsibility needed to be shared. In the same development, the Ethiopian government considered the implementation of IWRM as a pillar of their government by establishing river basin councils (Federal Democratic Republic of Ethiopia, 2007). Although IWRM aims at incorporating across sectors it is still driven by professionals of water, hence, the tangible accomplishment frequently neglects the incorporation of land with water abstraction rights (Oorthuizen, 2003).

2.3 Shared water risks and water management opportunities

According to a report by WWF (2012), the issue of risk should not be considered only as perceived as a commercial subject matter. The reaction of company's risks has negative effects on savings and productivity through employment and levels of income which leads to negative effects on the local economy.

Knowledge of these risks is important because it helps alert all concerned stakeholders for constructive engagement in improving the management of the stewardship of water resources and thus minimize the challenge to all groups, including the users. Morton *et al.,* (2015) noted that the water risks in the Upper Mid-West, United States, are associated with persistent rainfall, runoff and sediments in cultivated ecosystems were due to climate change as well as human action. Foster (2017) identifies regulatory risks as those associated with governance at a local scale of stewardship projects. While concurring with Foster (2017), Mandate (2016) observes that the results of the risks are due to varying, unproductive, poorly implemented and incompatible policies of water. He adds that unproductive policies can result in poor business settings due to lack of policy designs which form non-attractive and unsteady environment or ruined watersheds conditions because of illogical policy design and applications that are not in agreements and enforcements. Another risk he notes is related to the water resources and the ecosystem, which he views as a physical risk of having for instance inadequate or too much water, all can have negative impacts to use. However, Pegram *et al.,* (2009) added that inadequate, too much or polluted water, all can lead to high costs in labor, capital, logistics and marketing.

The IWRM approach focuses on four key terms. Firstly, it looks at freshwater as a limited and susceptible supply, necessary to maintain life, progress and the setting. Secondly, it underpins water development must involve users, planners and policy makers at all levels.

Thirdly, it focuses on women as major players in the supplying, administering and conservation of water. Lastly, it looks at water as having a financial value in all its competing users (Stucki *et al*., 2012). Biswas *et al.*, (2010) observe in India that one advantage of an IWRM approach is water related decisions made by involving all stakeholders at all levels leads to positive results of broader national objectives.

Another approach used in the management of water resources is Community Based Water Management. This approach does not involve all the stakeholders in decision making (Faruqui *et al.,* 2001). Comparatively, the Community Based Water Management falls behind the IWRM approach in the sense that it lacks full participation, transparency, solidarity and empowerment.

2.4 Water Stewardship vs. IWRM

2.4.1 IWRM

The IWRM is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (Global Water Partnership 2000). Implementation of IWRM requires water governance that is coordinated across levels and promotes and facilitates consensus building. In the Tanzania National Water Policy, the issue of integrated management is focused on addressing participatory, multi-sectorial, multidisciplinary river basin management in order to address the issue of managing water as a scarce resource (Lein and Tagseth, 2009). The IWRM focuses on the implementation of the four Dublin Principles although Principle no. 3 which states that women play a central part in the provision, management and safeguarding of water was reported to be neglected (Derman & Prabhakaran, 2017) by failure to reflect the role of women in development and management of

water resources programs. The International Conference on Water and the Environment held in Dublin 1992, set out the following four guiding principles associated with water use;

Dublin Principle No. 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.

Dublin Principle No. 2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

Dublin Principle No. 3: Women play a central part in the provision, management and safeguarding of water. This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programs, including decision-making and implementation, in ways defined by them.

Dublin Principle No. 4: Water has an economic value in all its competing uses and should be recognized as an economic good. Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price.

Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.The IWRM is to be viewed as a process with the goal of maximizing social and economic welfare without damaging life essential ecosystems and utilizing resources under fair conditions. In this context, ecological goals are to be linked to social goals. In order to accomplish this in regards to the proper handling of water, active participation and cooperation of the different social and private actors are necessary for the planning and decision-making processes.

There are several key elements of an integrated water resources management program. It includes; firstly, the relevant planning and management units are the watersheds. These can be watersheds of rivers, seas, groundwater and coastal zones. This approach requires institutional integration and coordination because the watersheds normally extend across administrative and country borders.

Secondly, complex interactions occur between the surface and subterranean strata of bodies of water, as well as between water and land resources. All strata should be regarded in an integrative manner and managed with an eco-systematic approach. Furthermore, so-called “green water” (water in the ground and plants that evaporates into the atmosphere) and “blue water” (water in water ecosystems) are to be considered in any examination of sustainable and efficient water resource management. Blue water is what is usually controlled for use, for example, for drinking water extraction, irrigation and industrial purposes. However, the management of “green water” (rain and ground water management) has significant potential for increased water efficiency. The third key element is that the effects of human activities lead to the need for recognition of the linkages between upstream and downstream users of water.

Upstream users must recognize the legitimate demands of downstream users to share the available water resources and sustain usability. Excessive consumption or pollution of water by upstream users may deprive the downstream users of their legitimate use of the shared resource.

The fourth element requires that sector comprehensive overall plan is to follow the IWRM concept, which considers the qualitative and quantitative aspects in equal measure and is ultimately in line with the protection and sustainable use of water resources. To achieve this, the perceptions of various disciplines (economics, ecology, sociology, hydrology, engineering, etc.) are to be incorporated into the preparation of management alternatives.

Another important element of IWRM is also the participation of stakeholders in the decision-making process. Stakeholders in this context include suppliers of drinking and household water, energy producers, and waste management providers, shipping interests, agriculture and forest industries and the tourism industry, all of which are potential competitors for the earth's scarce water resources. For this purpose, the corresponding participation structures for enhancing the integration and equalization of different demands are to be developed within the scope of holistic management of water resources. Political, institutional and economic reforms are essential for integrated handling of water resources in order to coordinate water resource policy with economic policy and other political sectors

There are further 25 elements that are widely accepted to be important in introducing IWRM in river basins. Incorporating these elements into institutional reforms, development strategies, and investment projects is known to make a significant difference for IWRM in the Network of Asian River Basin Organization (NARBO). Some of the elements are detailed in Table below.

Table 1: Key IWRM elements of river basin

No.	Element	Description
1	River Basin organization	Build capacity in new or existing RBO, focusing on the four dimensions of performance (stakeholders, internal business processes, learning and growth, and finance) under the Network of Asian River Basin Organization's (NARBO) benchmarking service
2	Stakeholder participation	Institutionalize stakeholder participation in the river basin planning and management process including active participation of local governments, civil society organizations (academe, NGOs, parliamentarians, media), and the private sector, and an enabling framework for meaningful stakeholder participation in project specific planning decisions
3	River basin planning	Prepare or update a comprehensive river basin plan or strategy, with participation and ownership of basin stakeholders, and application of IWRM principles in land use planning processes
4	Public awareness	Introduce or expand public awareness programs for IWRM in collaboration with civil society organizations and the media
5	Water allocation	Reduce water allocation conflicts among users and geographical areas in the basin with participatory and negotiated approaches, incorporating indigenous knowledge and practices
6	Water rights	Introduce effective water rights or entitlements administration that respects traditional or customary water use rights of local communities and farmers and farmer organizations
7	Wastewater permits	Introduce or improve wastewater discharge permits and effluent charges to implement the polluter pays principle
8	IWRM financing	Institutionalize models whereby all levels of government contribute budget to IWRM in the basin
9	Economic instruments	Introduce raw water pricing and/or other economic instruments to share in IWRM costs, stimulate water demand management and conservation, protect the environment and pay for environmental services
10	Regulations:	Support the development and implementation of a legal and regulatory framework to implement the principles of IWRM and it's financing in the basin, including tariffs, charges, quality standards and delivery mechanisms for water services
11	Infrastructure for multiple benefits	Develop and/or manage water resources infrastructure to provide multiple benefits (such as hydropower, water supply, irrigation, flood management, salinity intrusion, and ecosystems maintenance)
12	Private sector contribution	Introduce or increase private sector participation in IWRM through corporate social responsibility (CSR)-type contributions

13	Water education	Introduce IWRM into school programs to increase water knowledge and develop leadership among the youth, including responsibility for water monitoring in local water bodies
14	Watershed management	Invest to protect and rehabilitate upper watersheds in collaboration with local communities and civil society organizations
15	Environmental flows	Introduce a policy and implementation framework for introducing environmental flows and demonstrate its application
16	Disaster management	Investments in combined structural and non-structural interventions to reduce vulnerability against floods, droughts, chemical spills and other disasters in the basin.
17	Flood forecasting	Introduce or strengthen effective flood forecasting and warning systems
18	Flood damage rehabilitation	Investments in the rehabilitation of infrastructure after floods.
19	Water quality monitoring	Initiate or strengthen basin-wide water quality monitoring and application of standards.
20	Water quality improvement	Invest in structural and non-structural interventions that reduce point and non-point water pollution
21	Wetland conservation	Invest to conserve and improve wetlands as integral part of the river basin ecosystems
22	Fisheries	Introduce measures to protect and improve fisheries in the river
23	Groundwater management	Institutionalize and strengthen sustainable groundwater management as part of IWRM
24	Water conservation	Institutionalize a policy and implementation framework to promote efficiency of water use, conservation, and recycling
25	Decision support information	Improve on-line publicly available river basin information systems to support IWRM policy, planning, and decision-making, including dissemination of "tool boxes" and good practices

2.4.2 Water Stewardship

Stewardship is the willingness to be accountable to a larger group that is operating in service and working to achieve a fundamental change (Shepheard & Norer 2013). Stewardship is a form of collaborative planning, responsible management of the environment through sustainable natural resources management with respect to the ecosystem function (Mathevet *et al.,* 2018). Stewardship is about taking care of something that we do not own. Stewardship approaches focus on the management of common pool resources like forests, fisheries or in our case, freshwater. Water stewardship is based on the principle of there being a collective need for sustainable water resources and a collective need for effective responses to address shared water-related challenges. Water stewardship is viewed as a comprehensive concept that includes the evaluation of the sustainability of water use across the entire value chain (Hoekstra, 2017).

Water stewardship for business was defined by WWF (2013) as improved water use and reduced water-related impacts from internal value chain operation while committing to the sustainable management of the shared water resources in the public interest through collective actions with other stakeholders. Stewardship can be in form of reformist, adaptive, sustainable, and transformative (Mathevet *et al.,* 2018). Public engagement is the critical element of stewardship formally and informally (Miller *et al.,* 2015). Stewardship evaluation at a catchment level showed that stewardship, in form of restoration, is influenced by the population density, political and program boundary, financial and technical resources, collaboration, and communication (Sheppard *et al.,* 2017). Trust among different stakeholders is the key to the success of a stewardship program by focusing on a single problem at a time (Carrie *et al.,* 2016).

A water stewardship partnership program was launched in Lake Naivasha Basin to improve water availability for domestic and business use within the basin and to improve water quality by implementing soil and water conservation activities (INWaSP, 2011). There are also international cooperation mainly focuses on water stewardship. The Alliance for Water Stewardship is one of the well-known cooperation's.

AWS is a global membership collaboration comprising businesses, NGOs and the public sector. Members of AWS contribute to the sustainability of local water-resources through their adoption and promotion of a universal framework for the sustainable use of water – the international water stewardship standard or AWS standard that drives, recognizes and rewards good water stewardship performance. Implementers follow steps and guidance in the AWS standard (Commit, gather & process, plan, implement, evaluate, and communicate & disclosure) to achieve good water stewardship practices that improve site water performance and contribute to wider sustainability goals (Sustainable Development Goals).

CHAPTER 3:MATERIALS AND METHODS

3.1 Study area

The study was conducted in Karonga district, Northern Malawi. Specifically, it involved farmers under the Kaporo Smallholder Farmers Association (KASFA). It is the same community or area where Alliance for Water Stewardship standard was testing its AWS global certification in the district. The study area is located at a latitude of 9.7000'S and longitude of 33.8833'E and 10.7500'S and 34.1000'E for Lufilya and Wovwe Irrigation Scheme respectively in Karonga district which is bordered by Tanzania in the north (Karonga District Council, 2020). Its headquarter is found about 50km south of the Tanzania border, 226km north of Mzuzu city and 585km north of Lilongwe, the capital city of Malawi (Karonga District Council, 2013). The district has an approximate area of 3,355 km, with an estimated population of 365,028, (Malawi Government, 2018). The district is divided into 6 Traditional Authorities (TAs) and additionally subdivided into 39 Group Village Heads (GVH) with 50 Village Development Committees (VDC) and 336 Villages (Karonga District Council 2013). The dominant tribe is Ngonde.

Karonga has sub-tropical weather with two diverse seasons; rainy season from November to May and dry season from June to October. The district has a mean temperature of 24 degrees Celsius. Karonga experiences the hottest temperatures in October and November and is cooler in June and July. According to the Karonga District Council, 2020 data, the district experiences north-easterly winds in October and November while south-easterly from April to September. The Town and Country Planning Act (CAP 23:01) define Karonga district as a municipality with clear developmental plans and all land use zones are documented in Urban Structure Plan document. This in reference to Karonga Urban Structure Plan, 2012 ensures that any development in the district is cross-examined and permitted if in compliance with the developmental plans of the area.

Karonga rural area has four main water sources which are; boreholes, domestic water taps, public water taps, and protected dug wells. The town centre and other peri-urban areas within the district are supplied by the Northern Region Water Board which is mandated to supply water to urban and peri-urban areas as mandated by the Waterworks Act of 1995. As stated in the report of Welfare Monitoring Survey, 2011 the water supply to people in urban areas is covered by 43.9% of domestic water taps, 44.3% of public taps, and 7.9% of boreholes and protected dug wells whereas in rural areas domestic water taps and public taps cover 14.3% and 63.0% for boreholes. The district exploits both surface and groundwater for irrigation farming mostly dominated by smallholder farmers and irrigation groups seldom practice water stewardship.

KASFA was the only group of smallholder farmers implementing AWS standard in Malawi supported by the Scottish Government. The farmers in KASFA practice irrigation farming in Wovwe and Lufilya irrigation schemes in the district of Karonga. The Wovwe Irrigation Scheme was developed in the year 1974. The main type of crop grown at Wovwe is rice. The scheme has a main distribution system of 3.7 km lined canal which diverts water from Wovwe River. The river also supplies water to Wovwe mini hydroelectric power plant and two other rice schemes, Fulirwa and Mphinga rice schemes. Gondwe and Mayo (2018) reported that Water Users Association was given a water right 14 years ago authorizing it to abstract approximately 3,944.6 m^3 per day for irrigation purposes at an annual rental of 41,025 Malawi Kwacha (US$ 295). The members of the association are allocated a share of water fees according to the size of land they are irrigating in the scheme. The water right application for Wovwe was facilitated by the government with partnership with Concern Universal. As for Lufilya irrigation scheme, it was developed in the early 1970s and is also under rice cultivation. Lufilya scheme abstracts water from Lufilya River which also supplies water to communal water supply system. Lufilya was granted a water right in 2001.

Wovwe and Lufilya schemes have a total of 417 ha and 400 ha respectively. All land within the schemes is under public land, thus it belongs to the government. This land is sub-leased to farmers at a price of Mk7, 000 per plot per season. Each farmer is allocated an average land size of 0.78 hectares, with 77% of the respondents cultivate within 0.4 ha and 0.8 ha. The figure. 2 shows the study area and location of Wovwe and lufilya Irrigation Schemes;

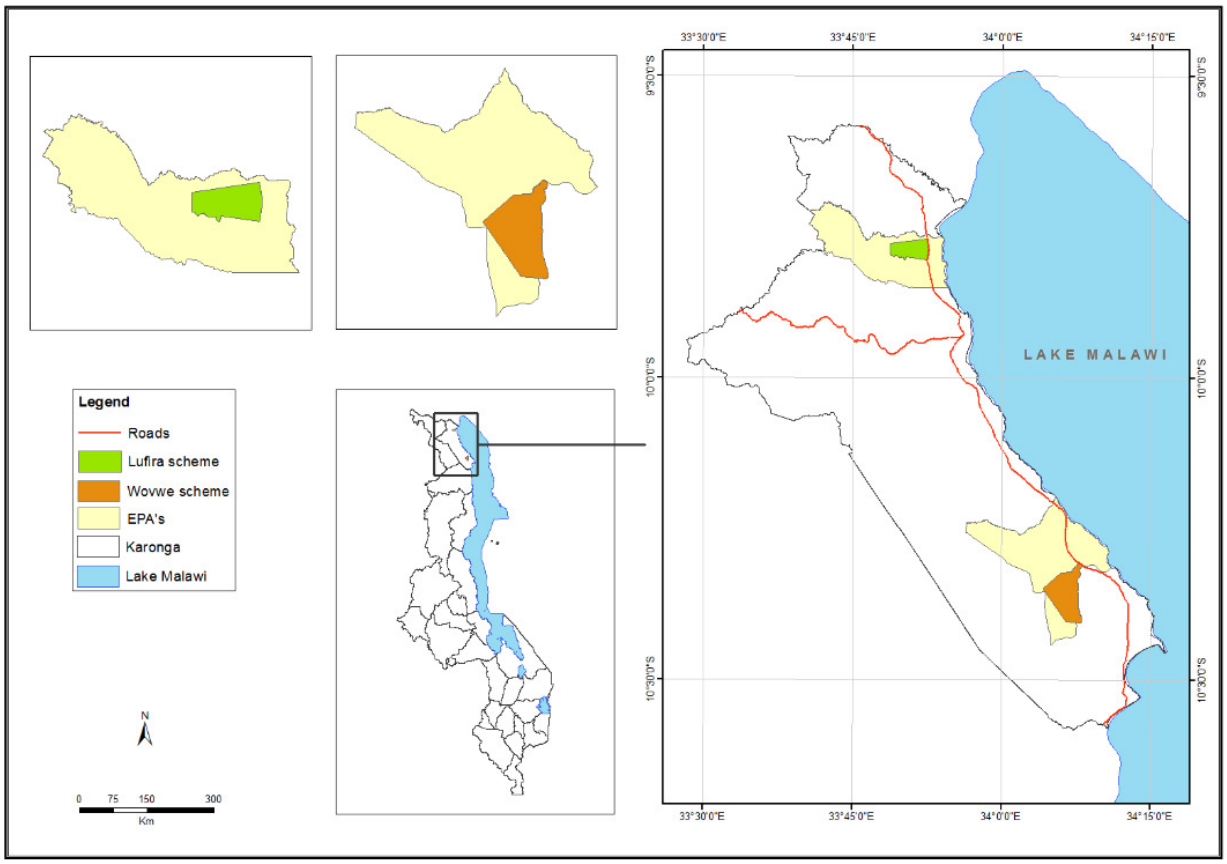

Figure 2 : Study District and location of Wovwe and Lufilya irrigation schemes, Karonga

3.2 Study design

The study used a mixed methods design utilizing both qualitative and quantitative methods. The general methodological approach for the study was grounded in knowledge, attitudes and practice survey (KAP). This was chosen since the study sought to understand famers' knowledge, attitude

and practice towards water stewardship as a water management tool. The study gathered and analyzed quantitative and qualitative data to answer the research questions as per recommendation of Creswell *et al.* (2003). It targeted farmers in KASFA who practice irrigation farming in Wovwe and Lufilya irrigation schemes which turned to be specific study sites. Table 2 provide summarized information of the two study sites;

Table 2: Description of study irrigation sites

	Site	
Site description	Wovwe	Lufilya
Year of development	1974	1970
Area (hectares)	417	400
Year of water right authorization	2006	2001
Main crop	Rice	Rice
Functionality	Fully operational	Partly operational
Road and market accessibility	Good	Good
Current scheme status	Very good	poor

Source: Karonga district irrigation office

3.3 Study participants

The study population comprised of 302 KASFA farmers. Among the 302, 60 were the only farmers practicing irrigation farming from the two large irrigation schemes within the KASFA catchment (Wovwe and Lufilya) and they were surveyed on irrigation as one of the requirements for AWS certification. While the 242 farmers were trained and surveyed on AWS.

3.4 Sampling and sample size

A sample of 242 farmers out of 5,819 farmers in the four KASFA associations was selected using systematic random sampling using Microsoft Excel Random Function proportionately to the size

of the KASFA population. (Formula 1) for the study. The study was conducted one year after farmers were trained on water stewardship training. A total of 60 other irrigation farmers were purposively selected.

Sample size calculation;

$$n=N/1+N^{(\mathfrak{e})2y}$$

The sampling formula is denoted as follows

N= population of KASFA farmers (5820)

ɛ= Marginal Error (0.05)

n= sample size (302 KASFA farmers)

Table 3: Population of KASFA farmers and study sample size

ASSOCIATION	POPULATION	SAMPLE
Mpata	1687	71
Ntchowo	1541	62
Kaporo South	1392	58
Kaporo North	1200	51
TOTAL	5820	242

3.5 Data collection

Qualitative and quantitative data were collected from February 2019 to August 2019. Data were collected on knowledge, attitude and practice attributes of water stewardship as a water management tool. The survey was conducted through face to face interviews of irrigation farmers using semi-structured questionnaires to collect primary data on knowledge gaps, beliefs and practices of irrigation farmers in reference to water resource management significant in the

development of solutions to water resource management challenges. The interviews were also for documentation, establishing baseline indicators and sharing of information for planning purposes. The data was also collected through Focus Group Discussions (FGD) using the same semi-structured questionnaires for comparative analysis of the data collected from individual farmers.

Table 4: Project Objectives and Methodology Matrix

Specific Objectives	Data Collection Methods	Data collected	Data Analysis
a) To assess the farmers' knowledge on water stewardship as water management tool	Questionnaires, observational checklists, FGD	Farmers knowledge on water stewardship in areas: • water governance • water quality • Sustainable water balance • Meaning of AWS	• Descriptive statistics • Frequencies • Cross tabulation • Fishers test • Qualitative data was coded by themes that emerged
b) To examine farmers attitude on water stewardship as a water management tool	Questionnaires	• Farmers perception on water governance issues • Farmers willingness to attend water management activities • Farmers perception on protection of catchment areas • Farmers perceptions on good water quality	- Descriptive statistics - Frequencies - Cross tabulation - Chi-square - Qualitative data was coded by themes that emerged
c) To establish the farmers practice on water stewardship as a water management tool	Questionnaires, observational checklists Literature review	• Presence of water management infrastructures • Existence of water management bylaws • Presence of water management committees	• Descriptive statistics • Frequencies • Cross tabulation • Chi-square • Qualitative data was coded by themes which emerged
d) To compare and contrast Alliance for Water Stewardship and Integrated Water Resources Management		• Similarities between AWS and IWRM • Differences between AWS and IWRM	• Content analysis of themes (principles of AWS & IWRM) • - Meta analysis of published articles on AWS and IWRM

3.6 Data analysis

Descriptive statistics and frequencies were used to analyse quantitative data in Statistical Package for Social Sciences (SPSS) (IBM® SPSS ® Statistics version 20). Cross tabulation and chi-square test were used to determine the association between categorical variables and this was compared at alpha level of 0.05. Qualitative data was analysed using content analysis. This involved transcribing audio recordings and reading through the transcripts to identify common issues. These were later grouped into narratives and quotes that have been used to explain some quantitative data in this report.

3.7 Research Dissemination strategy

The study report was submitted to the Faculty of Environmental Sciences in fulfilment of MSc Degree in Water Resources Management and Development. An article titled "Management of irrigation water structures at scheme level: Knowledge, Attitude, Practice and Farmer experiences" was accepted for oral presentation in the 20th Water Net/WARFSA/GWPSA Symposium held in Johannesburg, South Africa and presented on 30th October 2019. An article "Between Water Stewardship and independent global water certification: learning from smallholder rice farmers, Karonga, Malawi was published in the Waterlines, 2021.

CHAPTER 4:RESULTS

The activities planned and implemented by KASFA farmers during the training of water stewardship, a water resource management tool were summarised in the Table 5. Some of these activities were sponsored while others were being implemented with farmers' initiatives.

Table 5: Activities committed by farmers in action plans

Area	**Planned Activities and practices**	**Actual activities and practices implemented**	**Sponsor**	**Remarks**
Water governance	Processing a water permit and election of AWS committee, training fellow farmers, strengthening water by-laws	3032 KASFA farmers were trained in AWS by fellow farmers	JTS	No water permit was processed by farmers and no AWS committee was formed
Water Quality	Construction of permanent latrines, No river bank cultivation, Stop defecating and urinating in the field and surrounding bushes,	Pit latrines constructed on farm at Kaporo North (3) and Ntchowo (4), and households in all associations	Self-initiative	
Sustainable water balance	Digging shallow wells, planting trees and vetiver and making contour band in the farms	Irrigation shallow wells by individual farmers were dug at Kaporo North (4), Kaporo South (1) and at Mpata and Ntchowo (5)	NASFAM, JTS	Temporary contour bands were made in almost all plots. NASFAM sponsored tree planting activities and JTS sponsored 16 shallow wells

4.1 Socio and Demographic information

Table 6 presents a summary of demographic and socio-economic information including gender, age, marital status, education level, the main source of income, nature of landholding and irrigation.

Table 6: Socio-economic and demographic characteristics of interviewed farmers

Characteristic	Description	Percentage (%) (n=302)
Gender of respondent	Male	40
	Female	60
Age	18-35 years	32
	36-60 years	60
	>60 years	8
Marital status	Divorced	6
	Married	59
	Single	5
	Widowed	10
Level of education	Polygamous	19
	Primary	84
	Secondary	14
	Tertiary	3
Main source of income	Farming only	59
	Farming and casual labor	15
	Farming, casual labor and petty trading	39
	Farming and petty trading	14
Nature of landholding	Owned	62
	Renting	58
	Rain-fed	80
	Irrigation	20

4.2 Major crops and frequency of crop cultivation for irrigation farmers

Results showed that all the 60 individual plots of Wovwe and Lufilya schemes were under rice cultivation, as a staple food and income for most farmers in the area. Karonga district is well known for the high valued and most demanded rice brand called *Kilombero* in the local language. It was observed that 63%, 23%, and 13% of the respondents (n = 60) cultivate crops through irrigation twice, three times, and once per year respectively. The above information was further supported by study participants.

*"Farmers who cultivate three times a year have increased income levels than those who cultivate once or twice year and I am one of them" (*KASFA lead farmer, Wovwe*).*

*"We are unable to harvest more than once because of water shortages during summer and also nonfunctional structures in our scheme but we have an interest to cultivate up to three times a year with irrigation farming" (*male Respondent from Lufilya irrigation scheme*).*

4.3 Farmers knowledge towards water stewardship

4.3.1 Farmer's knowledge on Alliance for Water Stewardship

Farmers' knowledge of the meaning of AWS was generally low. The majority of the respondents (84%, n = 242) reported not knowing the meaning of AWS. Only a few reported knowing what AWS means, with many citing that "*it is all about management of water at catchment level by multiple users*". There was no significant association (p = 0.060) between knowledge of AWS meaning and the gender of the farmer. Of the 147 interviewed female farmers, very few (13% n = 147) reported knowing AWS. Similarly, few (22%, n = 95) male farmers reported knowing what AWS meant.

Table 7: Knowledge of AWS Meaning vs. Gender

Do you know what water stewardship is?	Gender		Total
	Female	Male	
No	128	74	202
Yes	19	21	40
Total	147	95	242
Significance (*P*)	0.060		

As for the knowledge of AWS meaning with respect to marital status, there was a significant association ($p = 0.004$) between knowledge of AWS meaning and marital status of a farmer. More (64%, n = 242) married farmers had knowledge AWS compared to unmarried, widowed and divorced respondents (Table 7).

Table 8: Knowledge of AWS Meaning vs. Marital Status

Do you know what water stewardship is?	**Marital Status**					**Total**
	Divorced	**Married**	**Polygamous family**	**Single**	**Widowed**	
No	12	132	34	0	24	202
Yes	2	24	11	2	1	40
Total	14	156	45	2	25	242
Significance (*P*)	0.004					

Regarding the themes and benefits of AWS, the majority of farmers (93%, n = 242) reported not knowing the themes of AWS. Out of the 39 farmers who reported knowing what 'alliance for water stewardship' means, many (68%) reported not knowing the four themes and benefits of water stewardship. There was no significant association ($p = 0.974$) between knowledge of AWS themes and the gender of respondents. Very few female farmers (7%, n = 147) and male farmers (7%, n = 95) reported knowing the themes of AWS.

Table 9: Knowledge of AWS themes vs. Gender

Do you know the four themes of Alliance for Water Stewardship?	Gender		Total
	Female	Male	
No	137	88	225
Yes	10	7	17
Total	147	95	242
Significance (*P*)		0.974	

Similarly, there was no significant association (p = 0.086) between knowledge of AWS themes and the marital status of farmers (Table 10).

Table 10: Knowledge of AWS themes vs. marital status

Do you know the four themes of Alliance for Water Stewardship?	**Marital Status**					Total
	Divorced	**Married**	**Polygamous family**	**Single**	**Widowed**	
No	12	147	40	1	24	224
Yes	2	9	5	1	1	18
Total	14	156	45	2	25	242
Significance (*P)*			0.086			

Regarding AWS training, the majority of farmers (91%, n = 242) reported that they have not attended AWS training and therefore have not been able to implement any activities following the AWS training. A few (9%, n = 242) who reported to have attended AWS training also reported having implemented some AWS activities following the training. The implemented activities included: planting trees, starting irrigation farming, training other farmers on AWS, good water management practices (contour bands), and digging shallow wells. Fisher's test results showed a

non-random significant association (p = 0.000) between knowledge of AWS and attendance of training on AWS by farmers. Farmers who did not know the AWS and the four themes of AWS did not attend training of AWS. There was no random significant association (p = 0,868) between gender of farmers and implementation of activities after AWS training. More than half (59% n = 242) of the farmers who implemented some activities after the AWS training were female farmers. There was no non-random significant association (p = 0.08) between marital status and implementation of activities after the AWS training (Table 11).

Table 11: Implementation of activities after AWS training vs. marital status

Have you done some activities after the AWS training?	**Marital Status**					**Total**
	Divorced	**Married**	**Polygamous family**	**Single**	**Widowed**	
No	12	145	38	1	24	220
Yes	2	11	7	1	1	22
Total	14	156	45	2	25	242
Significance (*P)*	0.08					

Table 12: Irrigation practice and land size

Do You Practice Irrigation?	**Land Size**			**Total**
	<1 Hectare	**1 - 2 Hectares**	**> 2 Hectares**	
No	41	150	19	210
Yes	5	24	3	32
Total	46	174	22	242
Significance (*P)*	0.872			

A majority of the interviewed farmers (87%, n = 242) reported not practicing irrigation. There was no significant association (p = 0.872) between land size and irrigation practice. Of the 32

farmers who reported practicing irrigation, the majority (75%, n = 32) owned 1-2 hectares of land.

4.3.2 Gender and irrigation practice

The role of women in providing, managing and safeguarding water as illustrated in the Dublin principle No.3 is likely to influence their knowledge in water stewardship hence inclusion of gender in the study.

The results showed that there was no statistically significant association between gender and irrigation practice ($p = 0.650$). Few farmers (14%, n = 242) practiced irrigation while the rest (86%, n = 242) did not practice irrigation. Overall, females (13%, n = 148) practiced irrigation while (87%, n = 148) did not practice irrigation. While males (15%, n = 94) practiced irrigation while (85%, n = 94) did not practice irrigation.

4.3.3 Farmer's knowledge on water quality

Overall knowledge on the importance of water quality in irrigation was poor with a few farmers (19%, n = 242) reporting to know the importance of good water quality in irrigation. There was a significant association ($p = 0.000$) between practicing irrigation and having knowledge of water quality in irrigation. A majority of the farmers (81%, n = 242) who were practicing irrigation had knowledge on the importance of water quality in irrigation. The most cited importance of water quality in irrigation by farmers was that "good water quality leads to health crops leading to good production". One of the farmers has the following to say with regards to water quality: *"I don't practice irrigation but I think good water quality which is free from salts can lead to high crop yields"* (male respondent from Jenala MAC*).*

4.3.4 Farmer's knowledge on sanitation

Descriptive statistics (proportion and frequency) showed that all the farmers had knowledge on sanitation (100%, n = 242), a significant component which influence water quality especially when sanitation standards have been compromised. Overall, farmers had good awareness of different sanitation facilities, their importance and the effects of poor sanitation. When further asked to mention some of the facilities that show that there is sanitation on a particular site, the commonly mentioned facilities included pit latrines, dish racks, bathroom, kitchen, and rubbish pit. These were found in homes and not on their farms as observed by the researcher. Farmers mostly said that the importance of good sanitation was the prevention of disease spread leading to good health. Further, farmers stated poor sanitation leads to outbreaks of waterborne diseases.

4.3.5 Farmer's knowledge on Climate change

A majority of the farmers (96%, n = 242) reported knowing something about the meaning of climate change while few farmers did not have knowledge on climate change. Most of the farmers observe changes in rainfall pattern, floods, strong winds, earthquakes, disease outbreaks, water shortages, dry spells, and high temperatures. The most commonly cited effects of climate change by farmers in the study area included; low crop yield and loss of property and life. Deforestation was the principal cause of climate change as reported by farmers in the study. This was evidenced by the below quotations from respondents;

"*We are highly affected by the effects of climate change in our area more especially earthquakes and floods and we are suspecting that some of these challenges could be because of Kayerekera Coal mine"* (Respondent from Kaporo North*).*

*"In the past, we were able to cultivate even without fertilizer but now we cannot even try to plant our crops without fertilizer, we are thinking that this could be really an evidence of climate change" (*male respondent from Mwangosi MAC).

*"Most of the tree species in our surroundings are gone we are suspecting it is due to climate change" (*female respondent from Kaporo north).

4.3.6 Knowledge on water governance

The overall farmers' knowledge of the National Water Policy of 2005 was low (6%, n = 242) were able to state the meaning of the National Water Policy. Those who had knowledge on the meaning of water policy cited commonly "*National rules of regulating water", "the rules and regulations that oversee good water management", and "management of water facilities"*. Only one farmer accented to possessing a permit while the rest of the farmers did not possess permits. Few (44%, n = 242) had knowledge on water management by-laws while the rest did not have knowledge on water management by-laws. The majority of the farmers (70%, n = 242) paid water fees while the rest were not paying fees for water consumption. Most of those who said they do not have water permits or do not pay fees, stated a number of reasons as indicated in the direct quotes from respondents below: *"A water permit is not necessary for me because I do not practice irrigation" (*115 n = 242 Respondents from all associations)

*"We don't' pay water fees for domestic because we don't access water from the taps rather we use water from the boreholes and shallow wells. (*198, n = 242 respondents from all associations*)*

*"I don't use more water at my house, so I think there is no need for me to have a water permit" (*37, n = 242 respondent from all associations*) "We don't have money for water permit processing" (6*9, n = 242 respondents from all associations)

4.3.7 Farmer's knowledge on conflict management

The majority of farmers (67%, n = 242) did not experience water related conflicts while the rest of the farmers acknowledged experiencing water related conflicts. With regard to conflicts, farmers reported facing water related conflicts on their farms in terms of distribution of household drinking water points. The respondent from Lusako MAC confirmed the occurrence of conflicts *"Water conflicts here usually arise due to water shortages in dry season more especially in communal water points"*. Water scarcity was cited to be the common cause of such conflicts and farmers showed awareness of some conflict resolution strategies which have been used before and others that can be employed if a conflict arises. Where by-laws are available, they are used in conflict resolution by the committees. Other farmers reported that local leaders are involved in resolving water related conflicts.

4.3.8 Farmer's knowledge on availability and use of water management structures

The majority of the irrigation farmers (82%, n = 60) reported to have good knowledge and use of water management structures available in their schemes. A few farmers (18%, n = 60) reported to have no knowledge and use of the water management structures available in their schemes. Those who reported to have knowledge on irrigation water management structures singled out canals, gate valves, contour bands, block structures, distribution boxes, drainage structures, water storage tank, inlet and outlet structures and dams as the prominent water structures. During a transect walk by the researcher within the two schemes to see the available water management structures a number of observations were made. All necessary water management structures were found at Wovwe scheme while some were missing at Lufilya (Table 13). On operation of the structures *"Men are usually the ones who are assigned to operate the structures in the scheme" (*female Respondent from Wovwe irrigation scheme*).*

Table 13: Characterization of water management structures at Wovwe and Lufilya schemes

Water Management Structure	Description	Wovwe	Lufilya	Remarks
Water intake to field	withdraws water from an irrigation source	Yes	Yes	Not in good condition at Lufilya
Flow measurement Structures (Weir Flumes, Spillway, Hydrant chamber)	Measure the amount of water going to the irrigable area.	Yes	No	Available and functional at Wovwe and not available at Lufilya
Gate valves	control the flow of water during irrigation	Yes	Yes	Non-functional at Lufilya
Energy dissipaters	dissipate the power of water (pressure regulation)	Yes	No	Available and functional at Wove and not available at Lufilya
Distribution boxes	distribute water in the canals	Yes	Yes	Nonfunctional at Lufilya
Tail end structures	carry irrigation waste water back to the source	Yes	No	
Block structures	regulate the flow of water and deliver the correct amount of water to different water branches or networks to the irrigated area	Yes	Yes	Non-functional at Lufilya
Check structures	used to temporarily block the flow of water in order	Yes	Yes	Available at both sites but

Water Management Structure	Description	Wovwe	Lufilya	Remarks
	to raise the upstream water level			functional only at Wove
Drop structures	control the energy and velocity of the water as it passes over in the canals	Yes	Yes	Available and functional at Wove and not available at Lufilya

Current status of irrigation water source for Lufilya and Wovwe

Many farmers (63%, n = 30) from Wovwe scheme reported the reliability of the water source to support irrigated crop production for the whole irrigation season was good (a high water level). This could explain why more farmers at Wovwe were able to irrigate two or three times for some farmers a year. From Lufilya irrigation scheme, a large proportion of farmers (70%, n = 30) claimed their irrigation water source was poor (extremely low). The farmers who described their source to be extremely low attributed it to sediments at the intake; old structures in the scheme; poor rainfall; climate change; environmental degradation; and problems at the head works.

This is what a respondent from Lufilya scheme said *"We are really facing serious challenges starting from the intake up to the scheme tail-end, this is affecting us to cultivate more than once a year in the scheme, only a very few who are close to the water source are able to harvest twice a year" (FDG with Lufilya irrigation scheme farmers).* In contrast, a respondent from Wovwe scheme said on a different Focus Group Discussion *"Our scheme is now in good state and almost every member is able to cultivate twice or three times a year" (respondent from Wovwe scheme)*.

(A) **(B)**

Figure 3: Wovwe scheme intake Structure (A), Lufilya scheme intake full of sediments (B)

Responding on how they have been affected, a considerable proportion of farmers (43%, n = 30) reported that low water levels at the intake impacted them to cultivate twice per irrigation period as they were used to before. Some farmers (57%, n = 30) reported conflicts arise due to limited access to irrigation water source. On remedies carried out, a considerable number of farmers (70%, n = 30) reported that nothing has been done. A moderate farmer (30%, n = 30) reported in common that they have excavated their own shallow wells, purchased pumps, planted trees, reported the issue to the scheme management committee and to the district irrigation office and tried to de-silt the sediments at the intake. However, these remedies have not yielded permanent results. Farmers had the following to say with regards to waterworks at the scheme *"As you have seen our spillway, it is no longer raising the water level to divert water to the irrigable area" (FDG with Lufilya irrigation farmers)*

"We don't have enough money to recover our scheme to the normal state as it was before" (Lufilya scheme chairman).

4.4 Farmer's attitude towards water stewardship

4.4.1 Perception on major benefits of irrigation farming in the schemes

The figure below shows major benefits of irrigation farming derived from crop production in Wovwe and Lufilya irrigation schemes.

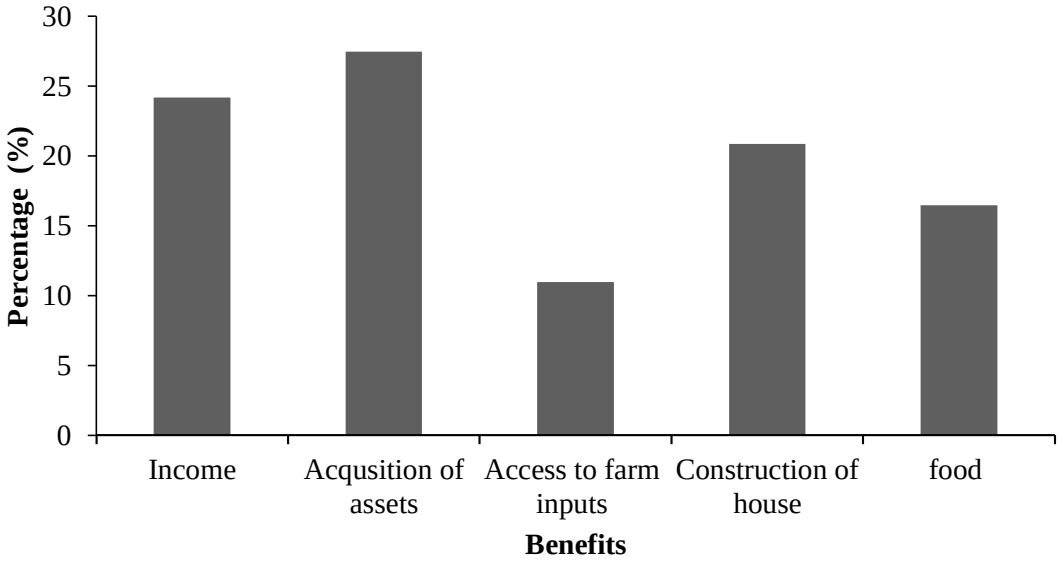

Figure 4: Major benefits of irrigation farming in the schemes

The majority of the KASFA farmer respondents (82%, n = 60) indicated they benefit from the development of Wovwe and Lufilya schemes. A considerable proportion of farmers (38%, n = 60) reported availability of the two schemes had increased their household income which enabled them to pay school fees for their children. Other farmers (27% n = 60) reported to have bought household assets such as oxcart, livestock, sofa sets, beds and bicycles as a result of their participation in the irrigation schemes. The rest (35%, n = 60) reported they were able to purchase farm inputs and equipment, constructed houses and improve the household nutritional statuses. The majority of respondents who did not benefit from the scheme were first entrants in the scheme. The few respondents (18%, n = 49) who reported not benefiting from irrigation schemes were from

polygamous families and they indicated they do not benefit with these schemes since they do not manage to get farm incentives.

The respondent said this *"Most of us do benefit in the scheme at least for food but those who do not benefit, most of them are the ones who are managing big families (polygamous families) which is a common tradition in our area" (respondent from Mayibiyibi)*. Another respondent said *"I have benefited a lot being part of an irrigation farmer from Wovwe scheme as well as KASFA member, because I am able to pay school fees for my children and one of them has been enrolled at Karonga Teachers Training College" (KASFA lead farmer, Tilora MAC)*. During a combined FGD with farmers from Lufilya and Wovwe irrigation scheme, a respondent remarked *"We can benefit more if we can be provided with fertilizer and farm equipment loans and recover after our harvests just as we do with rice seed recoveries"*. On meeting conditions to obtain loans, the respondent further said*"Some of us are permanent employees in scheme as guards, plant/machine operators, and scheme performance supervisors" (FGD, Wovwe irrigation scheme).*

4.4.2 Farmers' response on major causes of conflicts in schemes

A majority of the respondents (80%, n = 60) reported to have downstream or upstream users in the scheme. Chi-square results show that there was a significant association between having downstream or upstream users and reports of experiencing water conflicts in a scheme. Most farmers (86%, n = 44) reported experiencing conflicts with downstream users. Almost half of the respondents (47%, n = 38) who reported having conflicts with downstream users noted that water distribution and rotation in the farm fields were the major cause of conflicts in the schemes. Less than half of farmers (29%, n = 38) reported *'pressure over irrigation water during dry season'* as a major cause of conflict. Very few farmers (24%, n = 38) pointed out the unwillingness of other farmers to pay water fees in the scheme as a major cause of conflict.

Additional information from focus group discussions with farmers revealed other issues which lead to conflicts in their schemes. Illegal blocking of water to enter into other individual farm fields and some farmer's secretly opening water from their fellow farmers through the bands. On the accessibility of irrigation water, farmers from Wovwe reported facing no problem and added that irrigation water rotation and scheduling was well managed in their blocks by the block chairs. Farmers who are found to miss their schedule on their allocated irrigation period were not allowed to irrigate until the next rotation. While farmers from Lufilya complained of facing serious challenges of accessing irrigation water, only a few (30%, n = 30) who were close to the source were able to harvest twice a year and this led them to high poverty levels in the area surrounding the scheme. MAC chairman of Mwangosi complained *"We are really facing serious challenges in managing water starting from the intake to wastewater disposal area which makes it difficult for water to flow into the individual plots easily".*

They reported to have tried to work on their own in some areas but the challenge seemed larger and required government and the donors to assist in restructuring the whole scheme because the remaining works required a lot of money.

"We are not facing challenges concerning water in our scheme the only challenge we are facing currently is loans of fertilizer and farm equipment which can enable us to extend our farm lands to big hectares" (MAC chairman, Tilora MAC).

4.5 Farmer's practice towards water stewardship

4.5.1 Fees for water abstraction

Results showed a majority of respondent farmers in groups (88%, n = 60) reported contributing towards payment of water abstraction fees which ranged from MK5000 to MK7000 per plot per

season for irrigation. A range of MK100 to MK500 per month was paid by each KASFA farmer for water domestic use. The water prices which the individual farmers paid varied with the plots which the individual farmers were cultivating. In regards to qualitative findings on farmer's involvement in water governance issues, farmers from Wovwe reported they have stable water committees in the scheme ranging from the main WUA committee to block committees. Committees were reported to oversee good water management and sanitation in the scheme. Farmers from Lufilya complained that the water governance issues in the scheme were not followed properly. Everyone focused on their individual plots. To support the above information, the lead farmer from Mwangosi MAC added that; *"The water committees are available, but not serious ones because of the water challenges we are currently facing".*

4.5.2 Farmers practice on drinking irrigation water

The results on the farmers practice on drinking irrigation water showed that the majority (90%, n = 60) did not drink irrigation water. The farmers who reported not to drink irrigation water commented that they carry drinking water from their home when going to the field while those who reported drinking irrigation water added they do so because it is very clear water and none of their family members got affected by irrigation water.

4.5.3 Farmers participation in other water management and sanitation groups

The results on the farmers' participation in other water management and sanitation groups or associations showed that the majority (95%, n = 242) did not belong to any water management and sanitation groups or association. Those who reported to belong to other water management groups mentioned in common, water supply, hand washing with soap and tree planting projects.

4.6 AWS vs. IWRM

4.6.1 Comparison between Alliance for Water Stewardship and Integrated Water Resources Management

The table below summarizes the comparisons between AWS and IWRM.

Table 14: Comparison between AWS and IWRM

Comparison areas	**Alliance for Water Stewardship**	**IWRM**
What it is	- Global membership collaboration to contribute to the sustainability of local water-resources	- Is a process which promotes the coordinated development and management of water, land and related resources
Purpose	- Sustainable use of water	- Maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems
Forms/types	- Reformist - Adaptive - Sustainability - Transformative	- Prescriptive - Discursive - Practical
Principles/focus	- Sustainable water balance - Good water quality - Healthy water related areas - Improved water governance	- Social equity - Participatory water development and management - Economic efficiency
Success factors	- Trust among stakeholders - Public engagement - Population density - Political and program boundary	- River basin organization, Stakeholder participation, River Basin planning, Public awareness, Water allocation, Water rights, Wastewater permits, IWRM financing,

Comparison areas	Alliance for Water Stewardship	IWRM
	- Financial and technical resources - Collaboration - Communication	Economic instruments, Regulations, Infrastructure for multiple benefits, Private sector contribution, Water education, Watershed management, Environmental flows, Disaster management, Flood forecasting, Flood damage rehabilitation, Water quality monitoring, Water quality improvement, Wetland conservation, Fisheries, Groundwater management, Water conservation, Decision support information
Implementation (steps followed)	- Site owners commit to water stewardship - Gather and understand water related data - Create water stewardship plan - Implement plans - Evaluate performance - Communicate progress	- Acquire enabling environment (government legislation, policies, and rules) - Institutional roles (policies and programs of organizations) - Management instruments (direct action)
Who is involved?	- Businesses facing risks related to operations, Supply chains, Local stakeholders, End of line consumers,	- Local water users - Government agencies - Industry - Basin authorities

Comparison areas	Alliance for Water Stewardship	IWRM
	Public sector organizations working in water-relevant policy, Investors and financial service providers, Development agencies, NGOs with water related programs, Sustainability service providers	- NGOs

CHAPTER 5:DISCUSSION

5.1 Farmers Knowledge towards water stewardship

From the results presented in Chapter 4, there is an indication of low knowledge among the farmers regarding water stewardship. Oremo *et.al.*, (2019), found water resources management challenges normally arise due to lack of knowledge and information on water issues.

5.1.1 Farmer's knowledge of Conflict Management

Most of the farmers had some knowledge of occurrences of conflicts mainly due to the scarcity of water. The conflicts arose among the farmers themselves and others with downstream and upstream users. According to the results, the commonly cited reasons for the conflicts were illegal blocking of water to enter into other individual farms fields, farmers' secretly opening water from their fellow farmers through bands, improper water distribution to the individual farms and water rotation to the farming fields. All these were reported to commonly arise during dry season when water was scarce. Bijani & Hayati (2015) found out that the conflicts at Doroodzan dam irrigation in Fars province, Iran, which also concerned water scarcity, were commonly between government and farmers. Farmers downstream were not satisfied with how water was managed upstream. This shows that water scarcity is the main challenge that led to disputes and disagreements among water users.

5.1.2 Availability of water management structures and water governance

Most farmers expressed knowledge of the availability of water management structures in their schemes though the majority had no knowledge of the use and operation of the available water management structures. However, they showed a lack of knowledge towards water governance which are supposed to be factors influencing each other positively.

Regarding the National Water Policy, farmers further expressed low knowledge and many even claimed that they have never held about it. Having little or no knowledge about policy and governance is a risk towards the scheme because the users will not appreciate their responsibilities of taking care of the structures within the schemes. These results show that there is still a need for farmer's awareness campaigns and training on water governance and on the management, and operation & maintenance of water structures. It was observed there were only few farmers (mostly men) who were trained on the management, and operation & management of the structures and were able to respond to the questions properly.

These farmers had more benefits in the scheme. Similar research conducted in rural Canada, discovered the importance of farmer's knowledge on governance because it can help them to identify common beliefs and risks within the scheme which they can share responsibility and they can help to educate new members of the scheme on policy matters (Loe *et al.,* 2015). During training for KASFA farmers, matters concerning policy need to be emphasized because the success or failure of stewardship depends on the farmer's understanding of the policy and their willingness to apply it towards the management of the structures for long term sustainability. There is widespread awareness that property rights act as a leading role in reinforcing how people manage natural resources (Meinzen and Pradhan 2011). The results in the study showed that the farmer's knowledge of water rights was low and the majority of farmers had no ideas on water rights.

5.1.3 Farmers knowledge on Climate change

Climate change is among the most known challenges globally (Foguesatto *et al.,* 2018). In this study, findings indicated farmers had limited knowledge about climate change. It is also necessary that the farmers be aware that with climate change, there are new challenges and risks.

In Zimbabwe, the farmers saw the need to prepare themselves against such new risks such as pests and diseases that come with the changing environment (Chapoto *et. al.,* 2017). While reinforcing the need to prepare the farmers for the risks, underpins that such understanding of climate risk is important because it is a prerequisite for adaptation strategies to reduce vulnerability to climate change (Sarr *et al.*, 2015). KASFA farmers reported that climate change led to water stresses in their areas restricting them to produce enough rice in their fields. This is in line with Bouman & Tuong (200) who indicated that the production of irrigated rice decreased rapidly when there was scarcity of water.

5.1.4 Farmers knowledge on Sanitation on site

According to the results, all the respondents reported to be knowledgeable in sanitation issues. However, it was observed the majority had no sanitation facilities both at household and at their farms. The farms and the home gardens which they used to cultivate food for sale as well as for consumption is where they were also defecating and urinating. Some farmers disclosed openly to the researcher that when nature calls while working in the farms they dug holes and help themselves in the fields. When further asked about their knowledge of the associated risks, they had their own defensive mechanisms that 'they are used' and 'nobody reported ill or dead' because of their ongoing practice. This shows that the farmer's level of practice on sanitation issues was low despite them ably citing the meaning and available sanitation facilities at home. Keraita *et al.,* (2008) found out that when farmers sense that the practice they are doing is socially unacceptable they tend to underestimate the risks when interviewed. A similar case was noted during this study.

5.1.5 Perceived benefits in irrigation

The findings from this study are in agreement with findings by Khalkheili & Zamani (2009) who found family size as one of the obstacles that affect farmer's attitudes in irrigation farming participation and benefits. The benefits from irrigation schemes are also affected by the availability of a water user association and good markets for the produce realised from the schemes (Gondwe & Mayo, 2018). Integration of various water management approaches is reported to contribute to even higher benefits for farmers in irrigation systems as they lead to increased production and ensure the sustainability of resources (Fraiture *et al.*, 2014).

Oremo *et al.*, (2019), reported land tenure and level of income were among the factors influencing the attitude and practices of irrigation farmers in Kenya. Further, lack of access to enough land, capital and farm inputs including fertilizer affect the production and benefits realized by smallholder rice farmers in Kano State, Nigeria (Sani *et al.*, 2010). Similarly, to what KASFA farmers wished on loans and incentives from the project, the Bwana Visege smallholder rice farmers in Tanzania also showed desire to be enabled with access to tractors on loan from the Kisarawe District council in Tanzania and settle the loans after harvesting and marketing of their produce (Rugumamu, 2014).

5.1.6 Perception on causes of conflicts in irrigation schemes

The findings from the study reveal a pattern that has been observed in other studies. Results showed illegal blocking of water to enter into other individual farm fields and some farmers' secretly opening water from their fellow farmers through the bands was perceived as a cause of conflict in schemes. This is in line with water conflicts on the Manjirenji-Mkwasine irrigation water supply canal in Masvingo province, Zimbabwe where illegal water diversion by other users also dominated as the main issue of their conflicts (Svumbe *et al.*, 2010).

They further noted, "stakeholder participation, institutional support, treatment of water as an economic good and as a natural God-given resource have potential to minimize tension and conflicts among stakeholders in shared resources such as irrigation water" (Svumbe *et al.,* 2010). In a similar study, Levy & Sidel (2011) found insufficient access to freshwater results in conflicts between countries and groups of people in the countries. This relates to this study where some farmers indicated insufficient irrigation water during dry season which also was a major cause of conflict. Good water distribution is crucial in irrigation schemes and is one of the most common issues observed in this study. The inequitable distribution of water was an issue that added fuel to the political tensions between Israel and Arab nations, especially between Israel on the history study of the Jordan River basin (Kasymov, 2011). The participation of farmers in irrigation schemes is reported to be affected if the distribution of the water is not equitable (Chandran & Chackacherry, 2004). A similar study in Tanzania, however, shows different outcomes. In that study, the factors that influenced conflicts in the scheme were intensified mostly by the absence of effective water conveyance infrastructures. This study recommended strengthening the infrastructures for conveying water from sources to the farms (Fundi, 2018).

Water scarcity and conflicts findings are in line with findings by Oremo *et al.,* (2019) in Tsavo sub-catchment, Kenya where they found conflict cases reported high during water stress seasons when the stream flows were low. Poor water governance was projected to be the leading cause of conflicts due to water scarcity relating to allocation and management than physical scarcity in China (Khan *et al.,* 2009). However there is no connection with low cases of conflict amongst irrigation farmers having appropriate schedules for water distribution (Satyal *et al*., 2006). The study findings herein have revealed much of the conflict occurs during the summer season when water levels are generally low in the water sources.

5.2 Farmers Practices towards water stewardship

5.2.1 Abstraction fees

Results from this study indicated that the abstraction fees were relatively low, making it affordable to farmers across the board. This is in line with Finney (2013) who confirms in his study that abstraction fees must be low. Finney (2013) further discloses that abstraction fees are not meant to be too high and meant to recover costs of water resource management. Results from Speelman *et al.,* (2010) show that farmers are willing to pay even higher prices as long as they are connected to good water systems. Chandrasekaran *et al.,* (2009) found out that farmers were more willing to pay for irrigation water than what is drawn from good systems like tanks. They recommended that water user associations need to be strengthened through empowerment for them to manage the irrigation systems thereby ensuring that farmers will continue to pay fees for water abstraction. Although the abstraction fees were affordable for all farmers across the board, farmers were still reluctant to pay at a required time and in full amount. This shows that even if the fees can be raised for the scheme infrastructure maintenances, the majority of farmers cannot manage and that means it cannot be possible.

5.2.2 Perception on drinking irrigation water

The majority of farmers were not drinking their irrigation water. This is in line with earlier findings that farmers are knowledgeable about sanitation and hygiene. Still, drinking irrigation water did happen in some cases of this study. In Punjab, safe use of canal water was shown to be possible if users can pump the seepage water into a reservoir in their homes and have continuous supply for sanitation and hygiene uses (Hoek *et al.,* 2001).

According to the researcher's observation, the majority had shallow wells as the main water source, although many were using them as a surplus during water stresses. Similarly, to the study by Holm *et al.,* (2016) where the majority of participants in their study area had shallow wells as the main overall water source for other domestic purposes mainly during water scarcity seasons. Irrigation structures normally experience the growth of cyanobacteria, algae and aquatic plants in which some may be poisonous to crops and human health (Tads' & Danka, 2017). Hence some farmers in the study reported to have drinking irrigation water without treating and defending themselves that none of them got affected because of irrigation water since they started farming. According to the results, among the farmers who reported that they do drink irrigation water, none seem to have knowledge of the side effects of drinking irrigation water without treating it. This is similar to the study by Kreutzwiser *et al.,* (2011) in Southern Ontario, Canada, where farmers refused to get their water tested by claiming that they feel they have good water and it was not necessary to test it. However, the study by Michetti *et al.,* (2019) on interpreting farmer's perceptions of risks and benefits on wastewater reuse for irrigation in Italy shows that the farmer's perception and knowledge on water quality in irrigation was good.

5.2.3 Failure of AWS training

Ultimately, the KASFA farmers have not yet achieved AWS certification, 18 months after the training by the research. Water stewardship certification with KASFA could have been possible because the farmers failed to achieve all the AWS activities which were planned in the action plans.

During the AWS training conducted at KASFA, the majority of farmers showed interest towards AWS and assured to commit themselves to be accredited with AWS Certification.

This is in line with the study by Isundwa & Mourad (2019) where stakeholders surrounding River Nzoia Basin showed interest and promised to engage themselves in stewardship partnership. In this study, KASFA farmers were able to respond to some questions concerning good water quality and good water governance. This means that they had already some ideas on the need to manage water and eradicating communal water risks. The challenge was raised when it came time to train their fellow farmers. The farmers to be trained and the lead farmers to train their fellow farmers both had a lot of expectations that the project or KASFA will provide them with training materials and refreshments. This made the attendance to be poor. Hence other individual farmers committed themselves and started practicing individually in their households and field.

The training of AWS did not require trainer of trainer basis rather all farmers to be trained by the main facilitator. The farmers had negative attitudes to be trained by their fellow farmers, creating impressions that their fellow farmers benefited for money, direct knowledge and refreshments from the main facilitator than them. Another reason was due to some other grudges they already had in the villages so some members failed to attend the training. Other farmers disclosed openly to the main facilitator that they did not want their fellow farmers to train them.

Karonga district is highly prone to natural disasters, farmers are also very used to hand-outs and other incentives from NGOs and the Malawi Government. KASFA farmers were expecting a lot from the project. This also affected farmer's participation in the training.

Since AWS is new, the training needed more time for theory as well as practical orientation and to include some site visits for farmers to appreciate and learn from what others are doing on AWS. This could help them to make some demonstrations for other farmers to learn through hands-on. Hands-on could have made it easier for farmers to easily achieve the four outcomes of AWS.

When introduced to water governance issues, farmers had in mind that the increased proceeds will enter their pockets for long time. This was noted the time they were given a chance for questions during the water governance lesson, although the main facilitator tried to explain to them how it goes. Another reason could be the fact that most KASFA farmers do not practice irrigation only those who are surrounded by irrigation schemes. In this case, they also had a mind that water permit is just necessary for only irrigation farmers and not for shallow wells or drilled boreholes.

Farmers who were able to practice some of the AWS activities seem to already have determination of hardworking spirit. During some of the researcher's site visits, some farmers showed interest after watching their friends benefiting from the shallow wells constructed with their own efforts while they were waiting for the project to provide them with materials. However, Namara *et al.*, (2007) suggested that provision of subsidies, targeted training opportunities, fostering of private participation in the supply chain of inputs, focusing on short payback period technologies and fortifying of public research on the systems as the remedy to catch the farmer's interest for them to realise the potential benefits of the innovations.

Ntchowo and Mpata Association did better in training their fellow farmers than Kaporo South and Kaporo North. The reason could be because the MACs for Ntchowo and Mpata are close to each other and lead farmers were able to walk and train their fellow farmers. Whereas, Kaporo South and North MACs are far from each other. Ntchowo, Kaporo South and North individual farmers did better in maintaining sustainable water balance through shallow well excavations. But because there were no exchange visits, farmers could not have a chance to learn from each other in achieving all the activities.

A similar case happened in South Africa where Fanadzo & Ncube (2018) found out failure of small-scale irrigation schemes was due to lack of capacity building. Capacity building was lacking in the smallholder irrigation schemes for both farmers and field staff in areas of irrigation water management which resulted in more water challenges in the schemes.

5.3 Comparison between Alliance for Water Stewardship and Integrated Water Resources Management

Results have shown that AWS and IWRM have more similarities than differences. These two approaches are all concerned with the sustainable management of water resources. Therefore, results have shown similarities of these two approaches with regard to factors which affect the success of these two approaches, and stakeholders who are involved in these two approaches However, a few differences exist in terms of their definitions, scope, and steps followed in implementing activities. In terms of meaning, results have shown that though AWS and IWRM have a similar goal of ensuring sustainability of water resources, AWS is more of a global membership while IWRM is more of a process. Results show that AWS is a cooperation focuses mainly on management of water resource using water stewardship tool only while IWRM focuses on management of water resource in an integrated approach for socio-economic development.

AWS and IWRM have similar factors which affect the success including collaboration of stakeholders, financial and technical resources and communication. This means that with poor stakeholder interaction, poor financial and technical expertise, and poor communication, both AWS and IWRM would be a failure. Further, results reveal that IWRM has more factors that could affect its success than AWS. This could be due to the differences in scope of these two approaches as AWS is more focused on the management of the resources while IWRM is covering more areas including human dimension and women participation as highlighted in the four Dublin Principles.

AWS and IWRM differ in the approach of implementation as AWS focuses on members who are in the alliance, who first have to commit to water stewardship as the first step. On the other hand, IWRM being a process which can be adopted by governments starts with the step of acquiring an enabling environment that includes government legislation, policies and rules. This means that it is possible for countries to have IWRM covered in national water policies and AWS not covered because AWS is based more on membership. For example, the Malawi National Water Policy covers areas of IWRM but issues of AWS are not covered in the policy (GoM, 2005).

In terms of who participates in AWS and IWRM, results have shown that these two approaches have similar stakeholders. This could be attributed to the fact that all these two approaches are concerned with the sustainable management of water resource.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The study focused on farmers' knowledge, attitude, and practices on water stewardship as a water management tool to help minimize water challenges and inform key players in the water sector in development of plans and policies for the district of Karonga. On the assessment of farmers' knowledge on water stewardship, the study analyzed data using descriptive statistics, frequencies, cross tabulation, and Fisher's test. The data on examining farmer's attitude, and on establishment of farmers practice on water stewardship were both analyzed using chi-square, descriptive statistics, frequencies, and cross tabulation. It also analyzed similarities and differences of water stewardship and IWRM as water resource management tools using content and Meta-analysis.

The results show that farmers' knowledge on water stewardship was low relative to farmers towards water stewardship concept. The high perception of farmers was evidenced by the practices and benefits gained by the farmers. The results further showed that farmers attitude towards water stewardship primarily on payment of abstraction fees was affordable even though most of the farmers perceive inappropriate.

The farmers also perceive irrigation water as not meant for drinking. On comparison of water stewardship and IWRM, the results showed that the two tools have more similarities than differences and only differ on definitions, scope and steps followed in implementing activities. The water stewardship is more focused on the management of water resource while IWRM is more integrative in nature and involves a wider scope including social, economic, and environmental aspects.

6.2 Recommendations

Due to the low knowledge among the farmers, other user groups like the youth and children should be included in the water stewardship programs for enhanced sustainability. The introduction of Farmers' Adult Literacy programs (FAL) would help in benefiting the farmers. These plans should incorporate and involve a multidisciplinary approach for effective outputs.

Water stewardship though with a high perception needs to be visible through the ripple effect to other areas. This could be done through exchange programs and increased training to neighboring area. Studies on the same should be done in other parts of Malawi to determine the effectiveness of the water stewardship management tool.

Farmers should be encouraged to form and join water management groups. Through groups, it is easier to access services than individual or at household level. Water sources for irrigation must be protected from consumption by the farmers as this will reduce disease incidences.

Based on findings and conclusions from objective #3, the following recommendations have been drawn: Since IWRM has a wider scope, the study recommends that this approach is more suited to management of complex water systems than AWS which could be more effective to management of small units.

REFERENCES

Alliance for Water Stewardship (2011). *Exploring the Value of Water Stewardship Standards in Africa: Kenya Case Study Summary Report.*

Alliance for Water Stewardship (2014). *The AWS International Water Stewardship Standard*, Version 1.0. North Berwick, Scotland.

Aliche, E.B, Oortwijn, M, Theeuwen, T.P, Bachem, C.W, Visser, R.G. & van der Linden,C.G (2018). *Drought response in field grown potatoes and the interactions between canopy growth and yield*. *Agriculture water management*, 206, pp.20-30, doi.org/10.1016/j.agwat.2018.04.013

Bhattarai, M., Barker, R., & Narayanamoorthy, A. (2007). Who benefits from irrigation development in India? Implication of irrigation multipliers for irrigation financing. *Irrigation and Drainage*, 56(2-3), pp. 207-225.

Bijani, M. & Hayati, D 2015, *Farmers' Perceptions toward Agricultural Water Conflict: The Case of Doroodzan Dam Irrigation Network, Iran*. Journal of Agriculture Science and Technology, 17(3), pp. 561-575.

Bill, B., Friesen, T., Gue'rard, Y., Brissette, C., Lindman, C., Lockridge, K., Mulgund, S., & Walke, B. (2015). Climate Change and Resource Sustainability: Canadian Institute of Actuaries: Research Paper.

Biswas, A.K., Varis, O. & Kajander, T (2010). Integrated Water Resources Management in South and Southeast Asia. New Delhi. Oxford University Press.

Boisson de Chazournes, L, Leb, C. &Tignino, M (2011). "Environmental Protection and Access to water: The Challenges Ahead". *The right to water and water rights in a Changing World*, pp.9-24

Bouman, B.M. & Tuong, T.P 2000, Field water management to save water and increase its productivity in irrigated lowland rice. *Agricultural Water Management*, 49(1):11 - 30

Chandran, M.K., & Chackacherry, G. (2004). Factors influencing farmer participation in irrigation management. *Journal of Tropical Agriculture,* 42(1-2). Pp,77-79.

Chandrasekaran, B., Hornickel, J., Skoe, E, Nicol, T., & Kraus, N. (2009). Context dependent encoding in the human auditory brainstem relates to hearing speech in noise: Implications for developmental dyslexia. *Neuron*, 64(3):311-319.

Chapoto, K., R.D, Mafongoya, P.L., & Gubba, A, (2017). Farmer Knowledge of Climate Change Impacts and Adaptation Strategies in Management of Vegetables Insect Pests in Zimbabwe. Journal of Agriculture Science, 9 (12), pp.194-204

Choudhary, O.P, Grattan, S.R. &Minhas, P.S (2011). Sustainable Crop Production using Saline and Sodic Irrigation Waters. In Alternative Farming Systems, Biotechnology, Drought Stress and Ecological Fertilizations. *Sustainable Agricultural Reviews*, 6, pp. 293–318.

Creswell, J.W, Clark, V.P & Garrett, A.L (2003). Advanced mixed methods research. Handbook of mixed methods in social and behavior research. Thousand Oaks, CA: Sage,

Cosgrove, J.C. &Loucks, D.P (2015). Water management: Current and future challenges and research directions. Water Resources Research, 51(6), pp.4823-4839.,

Dean A, Fielding K, Newton F. Community knowledge about water. Who has better knowledge and is this associated with water-related behaviours and support for water related policies? PLoS ONE 2016, 11 e0159063

Easton, P. (2015), Water Stewardship in Sustainable Agriculture, Farm and Catchment Level Assessments, 2015

Fanadzo, M. & Ncube, B. (2018). Challenges and Opportunities for revitalizing smallholder irrigation schemes in South Africa. *Water South Africa*, 44 (3), pp. 436-447.

Faruqui, I.N., Biswas, K.A. &Bino, J.(2001). Water Management in Islam. UNU Press, IDRC/01-01. ISBN: 0889369240

Federal Democratic Republic of Ethiopia. (2007). River Basin Councils and Authorities Proclamation (No. 534/2007), Addis Ababa.

Finney, C (2013), Water Abstraction Charges as a Water Management Tool in Irrigation and Drainage. *Irrigation and Drainage*, 62(4), pp. 477-487.

Foguesatto, C.R, Artuzo, F.D, Talamini, E. & Machado, J.A.D. (2008). Understanding the divergences between farmer's perception and meteorological records regarding climate change. *Environmental, Development and Sustainability*, 1-16: doi.org/10.1007/s10668-018-0193-0.

Foster, H. (2017). Water Risks and Management. A Different Perspective. Newman. USA

Fundi, S., & Kinemo, M. (2018). Water User's Conflicts in Irrigation Schemes in Tanzania. *Journal of Public Administration and Governance*, 8(4), pp. 2161-7104.

Giordano, M. & Shah, T (2014), From IWRM back to integrated water resources management. International. *Journal of Water Resources Development*, 30(3), pp. 364-376.

Gondwe, D.J., & Mayo, A.W. (2018). Prospects and challenges of management of smallholder's Wovwe Rice Irrigation Scheme in Malawi through participatory approach. *Journal of Agricultural Extension and Rural Development*, 10(7), pp.121-133.

Government of Malawi .(2015). Karonga District Council Disaster Assessment Report, Lilongwe, Malawi.

Government of Malawi (2005). National Water Policy. Ministry of Irrigation and Water Development. Lilongwe.

Government of Malawi (2019). Malawi 2019 Floods Post Disaster Needs Endline Assessment (PDNA)

Government of Malawi (2015). Malawi 2015 Floods Post Disaster Needs Assessment Report

Government of Malawi, Malawi .illennium Development Goals Endline Report, 2015

Global Water Partnership (2015). National Stakeholder Consultations on water: Supporting the Post-2015 development agenda, 2015

Global Water Partnership (2000). Integrated Water Resources Management. Global Water Partnership (GWP) Technical Advisory Committee, Background Paper No.4.

Government of Malawi (2016). National Irrigation Policy. Ministry of Agriculture, Irrigation and Water Development, Lilongwe.

Government of Malawi. (2018). Malawi Population and Housing Census Report. National Statistical Office, Zomba.

Hepworth, N. & Orr, S., (2013). Corporate Water Stewardship: New paradigms in private sector water engagement. Water security: principles, perspectives and practices. London: *Earth scan Publications.*

Hoek, W.V, Konradsen, F, Ensink, J. H, & Mudasser, M (2001). Irrigation water as a source of drinking water: is safe use possible? *Tropical Medicine and International Health*, 6(1), pp.46-54.

Holm, R, Kunkel, G. &Nyirenda, L. (2018). A thought leadership piece: Where are the Rural Groundwater Quality Data for the Assessment of Health Risks in Northern Malawi? *Groundwater for Sustainable Development*, 7, pp. 157-163.

Holm, R, Wandschneider, P, Felsot, A, & Msilimba, G. (2016). Achieving the sustainable development goals: a case study of the complexity of water quality health risks in Malawi. Journal of Health Population and Nutrition, 35(1), pp.20

Hussain, I. (2017). Direct and indirect benefits and potential dis-benefits of irrigation: evidence and lessons. *Irrigation and Drainage*, 56(2-3), pp. 179-194.

Hussain, I. & Hanjra, M.A. (2004). Irrigation and poverty alleviation: review of the empirical evidence. *Irrigation and Drainage*, 53(1), pp. 1-15.

Isundwa, F.K., &Mourand, A.K (2018). The potential for water stewardship partnership in Kenya. *Arabian journal on geosciences*, 12(12), pp. 389.

Jones, P. Hillier, D, and Comfort, D (2015). Water stewardship and Corporate Sustainability. A Case study of reputation management in the food and drinks industry. Journal of public affairs, 15 (1), pp. 116-126

Joe P., Brian, R., Richter, D., Larson, W., Redder, T., Vigerstol, K., & Bowen, P. (2013). Corporate water stewardship: Achieving a sustainable balance

Karonga District Council (2013). Social Economic Profile (SEP) 2013-2018, Karonga, Malawi.

Kasymov, S 2011, Water resource disputes; conflicts and cooperation in drainage basins. *International Journal on world peace*, 28(3), pp. 81-110

Kaufmann, F., Majone, G. &Ostrom, V (2006). Guidance, Control, and Evaluation in the Public Sector – The Bielefeld Interdisciplinary Project; Walter de Gruyter, Berlin/New York.

Kay, P., Grayson, R., Phillips, M, Stanly, K., Dodworth, A, Harrison, A, Walker, A, Foulger, M., McDonnel, I. & Taylor, S (2012). Effectiveness of Agriculture Stewardship for improving water quality at the catchment scale, *Hydrology*, 422-423, pp.10-16. Doi.org/10.1016/j.jhydrol.2011.12.005

Keraita, B., Jimenez, B &Drechsel, P (2008). Extent and implications of agricultural reuse of untreated, partly treated and diluted wastewater in developing countries. *CAB reviews: Perspectives in agriculture, veterinary science, nutrition and natural resources*, 3(58), pp. 1-5.

Khalkheili, T.A., &Zamani, G.H (2009), Farmers participation in Irrigation management: the case of Doroodzan Dam Irrigation Network, Iran. *Agricultural Water management*, 96(5), pp. 859-865.

Khan, S., Hanjra., M.A., & Mu., J. (2009), Water management and crop production for food security in China: A review. *Agricutural Water Management,* 96 (3), pp.349-360.

Kreutzwiser, R, der Loe, R, Imgrund, K, Conboy, M.J, Simpson, H. & Plummer, R (2011), Understanding Stewardship behavior: factors facilitating and constraining private water well stewardship. *Journal on environmental management*, 92(4), pp. 1104-1114.

Levy, B.S &Sidel, V.W (2011), Water rights and water fights: preventing and resolving conflicts before they boil over. *American Journal of public health*, 101(5), pp. 778-780.

Loe, R., Murray, D. & Simpson, H. (2015), Farmer perspective on Collaborative Approaches to Governance for Water. *Journal of Rural Studies*, 42: 191-205.doi.org/10.1016/j.jrurstud.2015.10.005.

Laisi, E. (2009). IWRM Survey and Status Report: Malawi, Centre for Development Research and Information in Southern Africa (CEDRISA), Lilongwe.

Manda, M., & Wanda, E. (2017). Understanding the nature and scale of risks in Karonga, Malawi. *Environment and Urbanization*, 29 (1), pp. 15-32.

Mathevet, R, Francois, B & Raymond, C.M (2018), The Concept of Stewardship in sustainability science and conservation biology. *Biological conservation* 217, pp. 363-370.

Meinzen-Dick, R. S. & Pradhan, R. (2001). Implications of Legal Pluralism for Natural Resource Management. *IDS Bulletin*, 32, 10–17.

McDonald, R.I, Weber, K, Padowski, J, Florke, M, Schneider, C, Green. P.A, Gleeson, T, Eckman, s, Lehner, B, Balk, D & Boucher, T (2014), Water on an urban planet: Urbanization and the reach of urban water infrastructure. Global Environmental Change, 27, pp. 96-105

McDonald, R.I, Green ,P, Balk, D, Fekete, B.M, Revenga, C, Todd, M & Montgomery, M (2011). Urban growth climate change and freshwater availability. Proceedings of the National Academy of Sciences, 108(15), pp.6312-6317

Michetti, M, Raggi, M, Guerra, E, & Viaggi, D (2019). Interpreting Farmers' Perceptions of Risks and Benefits Concerning Wastewater Reuse for Irrigation: A Case Study in Emilia-Romagna, Italy. *Water*, 11(180), pp. 1-20.

Moe, C.L., & Rheingans, R. D. (2006). Global challenges in Water Sanitation and Health. *Journal of Water and Health* 4(s1), pp. 41-57

Morgan, A.J. (2017). Water risk in agricultural supply chains: How well are sustainability standards covering water stewardship-A Progress Report, WWF Germany, Berlin.

Moskell, C., & Allred, B. (2013). Residents beliefs about responsibility for the stewardship of park trees and street trees in New york city. *Landscape and urban planning* 120, pp. 85-95.

Morton, W.L., Hobbs, J., Arbuckle, G., & Loy, A. (2015). Upper Midwest climate variations: Farmer responses to excess water risks. *Journal of environmental quality*, 44(3), pp.810-822

Namara, E, Hanjra, M.A, Castillo, G.E, Ravnborg, H.M, Smith, L, Van koppen , B (2010). Agriculture Water Management and poverty linkages. *Agriculture Water Management* 97(4), pp. 520-527.

Namara, R.E, Hussain, I., Bossio, D&Verma, S (2007). Innovative land and water management approaches in Asia: Productivity impacts, adoption prospects and poverty outreach. *Irrigation and Drainage*, 56(2-3), pp. 335-348.

Newborne, P, & Dalton, J (2016). Water Management and Stewardship: Taking stock of corporate water behavior. Gland, Switzerland: IUCN and London, UK.

Nkegbe, P.K (2018). Soil and Water conservation practices and smallholder farmer multi activity technical efficiency in Northern Ghana. *Ghana Journal of Development Studies* 15(1), pp. 55-91.

Oorthuizen, J. (2003). Water, works and wages: The everyday politics of irrigation management reform in the Philippines. https//: books. Google/books.

Oremo, F, Mulwa, R, &Oguge, N (2019). Knowledge, Attitude and Practice in Water Resources Management among Smallholder Irrigators in the Tsavo Sub-Catchment, Kenya. *Resources*, 8(3): 130.doi.org/10.3390/resources8030130

Orr, S. & Cartwright, (2010). Water scarcity risks: Experience of the private sector, In Re-thinking Water and Food Security 181(189), pp.181-189.

Oremo, F., Mulwa, R., & Oguge, N., (2019). Knowledge, attitude and practice in water resources management among smallholder irrigators in Tsavo Sub-catchment, Kenya

Pegram, G.C, Orr, S. & Williams, C.E (2009). Investigating Shared Risk in Water: Corporate Engagement with the Public Policy Process. WWF-UK

Qadir, M, Wichelns, S.D, Rashid-Sally, L., McCornick, P.G, Drechsel, P, Bahri, A &Minhas, P.S (2010). The challenges of wastewater irrigation in developing countries. *Agriculture Water Management* 97(4), pp. 561–568.

Rolston A, Jennings E, & Linnane S; Water matters: An assessment of opinion on water management and community engagement in the Republic of Ireland and the United Kingdom. PLoS ONE 2017, 12, e0174959

Royal Society and Natural Academy of Sciences (2020), Climate change evidence and causes; update

Rugumamu, C.P (2014), empowering smallholder rice farmers in Tanzania to increase productivity for promoting food security in Eastern and Southern Africa. *Agriculture and food security* 3(1), pp.7

Richter, B, and Nature Conservancy, (2008). Water Stewardship Certification: Promoting Social Responsibility and Environmental Sustainability. Journal- American Water Works Association, 100(12), pp.28-34

Royal Society and National Academy of Sciences, (2020). Climate Change evidence and causes; update, 2020

Sani, A, Yakubu, A.A, & Bello, H.M (2010). Resource-Use Efficiency in Rice Production Under Small Scale Irrigation in Bunkure Local Government Area of Kano Estate. *Nigerian Journal of Basic and Applied Science*, 18(2), pp.292-296.

Sarr, B., Atta. S., & Ly, M. (2015). Adapting to Climate Variability and Change in Smallholder Farming Communities: A Case Study from Burkina Faso, Chad, and Niger. *Journal of Agricultural Extension and Rural Development* 7(1), pp. 16-27.

Satyal, G.S., Kumar, K., and Kandpal, K.D. (2006). Traditional practices of water scheduling in farmer-managed irrigation systems in central Himalaya, India. *Outlook on Agriculture* 35(4), pp. 273-280.

Shah, T. & Van Koppen, B (2006). Is India ripe for integrated water resources management? Fitting water policy to national development context. *Economic and Political Weekly*, 41:3413–3421.

Shepheard, M., & Norer, R. (2013). Increasing Water Stewardship Responsibility: Water Protection Obligations and the Watershed Management Policy Affecting Farmers in Lucerne, Switzerland.

Speelman, S, Farolfi., S., Frija, A, D'haese, M. &D'haese, L (2010). The impacts of the water rights system on smallholder irrigators willingness to pay for water in Limpopo province, South Africa. *Environment* 15(4), pp. 465-483. https://doi.org/10.1016/j.agsy.2008.03.006

Stucki, V, Wegerich, K, Rahaman, M.M. & Olli Varis, eds (2012). Introduction: Water and security in Central Asia-Solving a Rubik's cube. *International journal of Water Resources Development*, 28(3), pp. 395-397.

Svumbe, O, Soropa, G., Mandirega, S, Rusere, F, Ndeketeya, A, & Moyo, D (2010) Water conflicts on the Manjirenji-Mkwasine irrigation water supply canal, Masvingo province, Zimbabwe. *Journal of Agricultural Extension and Rural Development*,2(10), pp.219-227.

Toonen T.A, Dijkstra, G.S, & Van der Meer, F (2006). Modernization and Reform of Dutch Water Boards: Resilience or Change? *Journal of Institutional Economics*, 2(2), pp. 181-201.

Van Koppen, B. (2007) Dispossession at the interface of community-based water law and permit systems. 612, pp.2016-40580.

Water Mandate (2016). Guide to Responsible Business Engagement with Water Policy, SDC. Switzerland.

Waters, N. (2018). What is the Alliance for Water Stewardship (AWS)? https://www.nestle-waters.com/ accessed August 12, 2018

Wellman, K. & Spiller, M (2012). Urban infrastructure. Finance and management, Jon Wiley and Sons

World Health Organization. (2018). The state of food security and nutrition in the world 2018: building climate resilience for food security and nutrition. Food & Agriculture Org.

World Wildlife Fund (WWF). (2012). A report on Shared Risk and Opportunity in Water Resources. Seeking a Sustainable Futurefor Lake Naivasha.

WWF International. (2020). Climate Solutions; WWF's Vision for 2050

Water Witness International. (2019). Malawi Water Stewardship Master class, Event summary and evaluation report.

Wada, Y., Beek, L., Viviroli, D., & Hans, H. (2011). Global monthly water stress: II. Water demand and severity of water.

APPENDICES

Appendix A: Research Ethics and Regulatory Approval by NCST

NATIONAL COMMISSION FOR SCIENCE & TECHNOLOGY
Lingadzi House
Robert Mugabe Crescent
P/Bag B303
City Centre
Lilongwe

Tel: +265 1 771 550
+265 1 774 189
+265 1 774 869
Fax: +265 1772 431
Email:directorgeneral@ncst.mw
Website:http://www.ncst.mw

NATIONAL COMMITTEE ON RESEARCH IN THE SOCIAL SCIENCES AND HUMANITIES

Ref No: NCST/RTT/2/6 **23rd January 2019**

Ms Alice Ngulube,

P.O. Box 7,

Mchinji.

Email: alicengulube@yahoo.com

Dear Ms Ngulube,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL NO. P.12/18/341: EFFECTIVENESS OF ALLIANCE FOR WATER STEWARDSHIP STANDARD AS A WATER MANAGEMENT TOOL, KAPORO SMALLHOLDER FARMERS ASSOCIATION, KARONGA

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the National Committee on Research in the Social Sciences and Humanities (NCRSH) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee and the Commission with a final report of the study. The committee reserves the right to carry out compliance

Committee Address:
Secretariat, National Committee on Research in the Social Sciences and Humanities, National Commission for Science and Technology, Lingadzi House, City Centre, P/Bag B303, Capital City, Lilongwe3, Malawi. Telephone Nos: +265 771 550/774 869; E-mail address: ncrsh@ncst.mw

Appendix B. Water Stewardship KASFA Farmers Questionnaire

Introduction

The main aim of the study was to assess the Effectiveness of Alliance for Water Stewardship Standard as a water management tool. The study will be achieved by assessing the knowledge and the practice of smallholder farmers on the adoption of Alliance for Water Stewardship concept as a water management tool and to advance and formalize KASFA's approach to water stewardship using the AWS standard, to better manage water risk and support collective action for water security.

Interviewee Location of the interview Date Serial No

A. Demographic Information

1. Name of respondent……

2. Age…….

3. Sex (1) Male (2) Female

4. Marital Status (1) Married (2) Single (3) Divorced (4) Widowed (5) Polygamous family

5. Household size…….. (Number of people)

6. Respondents level of Education (1) Primary (2) Secondary (3) Tertiary (4) None

B. Household Economic Information

1. What are your major sources of income?

(1) Farming (2) Employed (3) Casual Labor (4) Petty Trading (5) Artisan (6) Others Specify ……..

2. What is nature of your landholding (1) Owned (2) Customary (3) Leased (4) other

3. How many acres of land is allocated to farming?

4. Major crops cultivated

(1) Rice, (2) Maize (3) Cassava (4) Bananas (5) Others Specify…….

Introduction to Alliance for Water Stewardship

1. What is Alliance for Water Stewardship?
2. What are the four themes of Alliance for Water Stewardship?
3. What activities have you done after AWS trainings?

II. Water Quality

1. Do you practice Irrigation in your farms?
2. If yes, do you get idea of the quality of water you use?
3. What is the importance in water quality when used in irrigation?
4. When determining water quality does it benefit in any way?
5. Do you use chemicals in your farms?
6. If yes do you have ideas to the quality of water? And what are the ideas if yes

III. Sanitation on Site

1. What is sanitation onsite?
2. Mention some of the sanitation facilities available at your site (homes and farms)
3. Why is sanitation important on site?
4. Mention some of the effects of poor sanitation

IV. Climate Change

1. What do you understand the word Climate Change?
2. What are the indicators of Climate Change in your area?
3. Identify the main causes of climate change in your area
4. What are the effects of Climate Change?

V. Water Governance

1. Do you belong to any water user association? (1) Yes (2) No
2. Are there any by-laws put in place to regulating water use in your area (1) Yes (2) No
3. Do you pay any fee for water use? (1) Yes (2) No
4. If yes, how much…….
5. How frequently do you pay……?

6. Have you ever held about The National Water Policy? (1) Yes (2) No

7. If yes, what is Water Policy?

8. Do you have a Water permit for regal abstraction of water?

9. If not, why?

VI. Conflict Management

1. Do you experience the conflicts concerning water in your area? (1). Yes (2) No

2. If yes, what kind of conflicts do you experience…….....

3. How best can you solve water conflicts when they arise?

1) What activities have you done after the AWS training?

……
……
……

2) What are the benefits of Alliance for Water stewardship?

a) For KASFA

……
……
……

b) For your MAC

……
……
……

c) For you as individual farmer

……
……
……

3) What are challenges hindering you in achieving Alliance for Water Stewardship activities?

(a) As KASFA

……
……
……
……

(b) As MAC

……
……
……
……

(c) As an individual farmer

……
……
……
……

4) What are your suggestions for making AWS approach useful for your business/livelihood?

Appendix C: Alliance for Water Stewardship Training Checklist

TOPIC	Question1	Question 2	Question 3	Question 4	Question 5	Question 6
Introduction to Alliance for Water Stewardship	What is Alliance for Water Stewardship?	What are the four themes of Alliance for Water Stewardship?	What activities have you done after AWS trainings?	What are the challenges in achieving AWS activities in your Association, MAC or as an individual farmer		
Water Quality	Do you practice Irrigation in your farms?	If yes, do you get idea of the quality of water you use?	What is the importance in water quality when used in irrigation?	When determining water quality does it benefit in any way?	Do you use chemicals in your farms?	If yes do you have ideas to the quality of water? And what are the ideas if yes

Sanitation on Site	What is sanitation onsite?	Mention some of the sanitation facilities available at your site (homes and farms)	Why is sanitation important on site?			
Climate Change	What do you understand the word Climate Change?	What are the indicators of Climate Change	Identify the main causes of climate change in your area	What are the effects of Climate Change?		

		in your area?				
Water Governance	Do you belong to any water user association?	Are there any by-laws put in place to regulate water use in your area?	Do you pay any fee for water use?	If yes, how much do you pay for water use?	How frequently do you pay?	
Conflict Management	Do you experience the water conflicts	If yes what kind of water conflicts do you	How best can you address the water conflicts in your area?			

	in your area?	experience?				

Appendix D. Questionnaire for Irrigation Schemes

Introduction

The main aim of the study is to assess the Effectiveness of Alliance for Water Stewardship Standard as a water management tool. The study will be achieved by assessing the knowledge and the practice of smallholder farmers on the adoption of Alliance for Water Stewardship concept as a water management tool in Irrigation Schemes and to advance and formalize KASFA's approach to water stewardship using the AWS standard, to better manage water risk and support collective action for water security.

Name of Interviewee Interview Place Date of Interview Serial No

A. Demographic Information

1. Name of respondent……

2. Age…….

3. Sex (1) Male (2) Female

4. Marital Status (1) Married (2) Single (3) Divorced (4) Widowed (5) Polygamous family

5. Household size…….. (number of people)

6. Respondents level of Education (1) Primary (2) Secondary (3) Tertiary (4) None

B. Household Economic Information

1. What are your major sources of income?

(1) Farming (2) Employed (3) Casual Labor (4) Petty Trading (5) Artisan (6) Others Specify

……..

2. What is nature of your landholding (1) Owned (2) Customary (3) Leased (4) other

3. How many acres of land is allocated to farming?

4. Major crops cultivated

(1) Rice, (2) Maize (3) Cassava (4) Bananas (5) Others Specify…….

(C) Irrigation Water Management in Schemes

1. How big is this irrigation scheme in terms of hectarage?

……

2. How many beneficiaries in this irrigation scheme?

…….

3. What crops do you grow in your portion in the scheme?

……

4. What is the schemes irrigation system? (1) River diversion (2) treadle based irrigation (3) motorized pump (4) watering cane (5) residual moisture (6) Others, specify

5. Do you pay for water abstraction fees to your scheme? (1) Yes (2) No

6. How many times do you cultivate per yr in the scheme?

7. Do you benefit in the scheme? (1) Yes (2) No

8. If 'yes' what benefits have you gained in the scheme since it started?

9. What suggestion can you give what will make you benefiting much?

10. If your suggestion in Q8 can be put in place what will be your opportunities in irrigation farming?

11. If 'no' what makes you not to benefit in the scheme?

12. Are there any downstream users surrounding your scheme? (1) Yes (2) No

13. If 'yes' are there any conflicts or complaints of diverting water downstream? (1) Yes (2) No

14. What kind of conflicts?

15. Do you have water management infrastructures in the scheme? (1) Yes (2) No

16. If 'yes' mention some of the water management structures in your scheme?

Appendix E: Farmers level of Knowledge regarding the use of irrigation infrastructures Checklist

Questions
1. What is the schemes irrigation system?
2. Do you pay for water abstraction to your scheme? (1) Yes (2) No
3. How many times do you cultivate per yr in the scheme?
4. Are there any downstream users surrounding your scheme? (1) Yes (2) No
5. If 'yes' are there any conflicts or complaints of diverting water downstream? (1) Yes (2) No
6. Do you have water management infrastructures in the scheme? (1) Yes (2) No
7. If 'yes' mention some of the water management structures in your scheme?
8. If 'no' what ways do you follow in managing water in the Scheme?
9. Do you use water for irrigation for domestic purposes as well? (1) Yes (2) No
10. If yes is the water treated before consumed?
11. How can you rate the water level of your source today and before
12. If "low"- "drastically low" what do you think is the reason to this?
13. How have you been affected to this problem?
14. What remedies have you put in place to recover your source?

Appendix F: Irrigation Farmers Researcher Observation Checklist

	Question	**Remark**
1.	Are there available water management infrastructures in the scheme	
2.	Are the irrigation farmers aware and able to follow water governance issues	

3. Has the scheme have harmonised/joint water management plans	
4. Is the scheme affiliated to Water Users Associations/Groups (WUA's/ WUG's	

Appendix G: Translated KASFA Farmers Questionnaire in Chichewa

Malonje

Cholingachenicheni cha kafukufukuyutikufunatichezenanuzokhuzanandichilinganizochaumodziposamalamadzingatiimodzimwanjirayosamaliramadzi.

Kafukufukuyuakwanilitsidwapofufuzazomweinumukudziwapopankhaniyaumodziposamalamadzingatinjiraimodziyogwiritsidwantchitoposamaliramadzikomansokomansokupititsapatsogolondikukudziwitsaningatialimi a KASFA ubwinoogwiritsantchitozilinganizozaumodziposamalamadzi (AWS Standard) kutitichepesemavutookhuzanandimadzindikutetezamadzi.

Dzina la ofunsaMafunso	**Maloopangirakafukufuku**	**Tsikulopangirakafukufuku**	**Chiphaso**

A. Demographic Information

1. Dzina la oyankhamafunso……

2. dzaka…….

3. Wam'munaWamkazi (1) Wam'muna (2) Wamkazi

4. Nkhaniyabanja (1) Married (2) osakwatira (3) Divorced (4)Widowed (5) Polygamous family

5. Mulipoangatimubanjalanu?…….. (number of people)

6. Munafikapatindimaphunziroanu? (1) Primary (2) Secondary (3) Tertiary (4) None

B. Household Economic Information

1. Mumapangachanipaumoyowanuwatsikunditsikuchomwechimakupezetsanindalama?

(1) Ulimi (2) ndimagwirazolembedwa (3) Maganyu (4) malondaang'onoang'ono (5) ntchitozamanja (6) Zina , tchulani ……..

2. Maloanuamenemumalimapondiandani (1) a makolo (2) amafumu/amudzi (3) ogula (4) zina

3. Maloanundiokulabwanji?.....

4. Mumalimachainpamaloanu?

(1) Mpunga (2) Chimanga (3) Chinangwa (4) Nthochi (5) zinatchulani…….

C. Zomwealimiakudziwapopankhaniyaumodziposamalamadzi

i. Chiyambichaumodziposamalamadzi

1. Kodimukudziwakochanizaumodziposamalamadzi?

2. Tchulanimagawoanayi a zilinganizozaumodziposamaliramadzi?

3. Ndintchitozitizomwemunagwirakomutapindulakumaphunziroaumodziposamaliramaadzi?

4. Phindu la umodziposamalamadzindilotani?

a. Ku KASFA

……

……

……

b. KuMACyanu

……

……

……

c. Panokhangatimlimi

……

……

……

5.

Ndimavutoanjimukukumananawoakukulepheresanikukwanisazintchitozazilinganizozaum odziposamalamadzi?

(a) Ku KASFA

……

……

……

……

(b) Ku MAC yanu

……

……

……

……

(c) Panokhangatimlimi

……

……

……

……

1) Maganizoanundiotanikutizilinganizozaumodziposamalamadzizikhalezopindula mu busnessyanukomasopaumoyowanuwatsikunditsiku?

……

……

……

……

ii. Madziaukhondo/otetezedwa

1. Kodimumapangaulimiothilirammundamwanu? (1) Eya (2) Ayi

2. Ngati ‘eya’ mumaonaposozaukhondowamadziothililirambewuzanu?

3. Kodiubwinoowonazaukhondowamadzi mu ulimiothilirandichani?

4. Poonetsetsakutitikugwilitsantchitomadziaukhondo mu ulimiwathu, kodizilindiubwinouliwonse?

5. Kodimumagwiritsantchitomankhwalaaliwonsemmundamwanu? (1) Eya (2) Ayi

6. Ngati ‘eya” mukudziwapomgwirizanowamakhwalawondiukhondowamadzianuaulimiothilira?

iii. Ukhondowapa malo

1. Ukhondowapamalondichani?

2. Tchulanizipangizozomwemulinazommakomomwanukomansokumindayanuzosonyezaukhondopamalo?

3. Kodiubwinowaukhondopamalondiotani?

4. Nenanikuipakosowekeraukhondopamalo?

iv. Kusinthakwanyengo

1. Kodimauotikusinthakwanyengoakutanthauzachani?

2. Kodizizindikilozakusinthakwanyengo mu deralanundizotani?

3. Nenanizinthuzomwezikupangisakusinthakwanyengo mu deralanu?

4. Kodikuipakwakusinthakwanyengondikotani?

v. Ndondomekozoyang'aniramadzi (WaterGovernance)

1. Kodimuli mu gululililonseloyang'aniramadzi? (1) Eya (2) Ayi

2. Kodi mu deralanumulindimalamulookhazikika a kasamalidwekamadzi? (1) Eya (2) Ayi

3. Kodimumaperekandalamainailiyonsepogwilitsantchitomadzimuderalanu? (1) Eya (2) Ayi

4. NgatiEya, ndalamazingati?…….

5. Mumaperekakangati?……

6. Kodimunanavakozamalamulookhuzamadzi a dzikolino? (1) Eya (2) Ayi

7. Ngati 'Eya' malamulo a dzikolinookhuzamadziamatichani?

8. Koimulindichiphasochovomelezekapogwiritsantchitomadzi?

9. Ngati 'ayi' chifukwachani?

vi. Kuthesamikangano

1. Kodimumakumanandimikanganoinayokhuzamadzi mu deralanu? (1). Eya (2) ayi

2. ngati ‘eya’ ndimikanganoyanjiyokhuzamadziyomwemumakumananayo?…….....

3. ndinjirayanjiyabwinoyomwemungatsatepothesamikanganoyi?

D. Njirazinazosamaliramadzi

1. kodimuderalanumulizitukukozanjirazinazosamaliramadzizomwezinakhazikitsidwa?

(a) Yes (b) No

2. Ngati ‘eya’ tchulaninjirazinazomwezinakhazikisidwa.

……

……

3. Kodi njirazimenezimunazionakutindizofunikapaumoyowanuwatsikunditsiku? (a) Eya (b) Ayi

4. Kodinjirazimenezizikugwirabentchitokapenakutsatilidwandiinualimi? (a) Eya (b) Ayi

5. Ngatiayilongosolanizifukwa?

……

……

……

5. Maganizoanundiotanikutinjirazimenenezizizikhalazopindula mu deralanu?

Appendix G: Alliance for Water Stewardshiptraining Checklist in Chichewa

Phunziro	Funso 1	Funso 2	Funso 3	Funso 4	Funso 5	Funso 6
Chiyambi cha umodziposamalamadzi	Umodziposamalamadzizikutanthauzanji?	Magawoanayiaumodzipposamalamadzindiati?	Ndizintchitoziti zomwemwagwirakomutalandiramaphunziroaumodziposamalamadzi.	Ndimavutoanjimukukumananawo mu association yanu, mu macyanukomasopanokhangatimlimipokwanilisantchitozaumodziposamalamadzi.		
Madziabwino	Kodimumapangaulimiothiliramundakwanu?	Ngati ‘eyakodimumaonakozaukhondowamadziothilira?	Kodikufunikakwamadziaukhondomu ulimiothiliramdiotani?	Kodikuonazamadziaukjhondomu ulimiwundikwaphindu mu njirailiyonse?	Kodimumagwilitsantchitomankhwalaalionse mu ulimiwanu?	Ngatieyakodimukudziwakozamgwirizanowamankhwalawandiukhondowamadzi?
Ukhondowapamalo	Kodiukhondowamapamalondichani?	Tchulanizipangizozinazaukhondozomwezilimmakomomwanukomansokumindayanu	Ubwinowaukhondopamalondiotani?	Mavutoosowekeraukhondondiotani?		
Kusinthakwanyengo	Kodikusinthakwanyengondichanimukunv	Kodizizindikirozakusinthakwanyengondizo	Nenanizifukwazenizenizomwezikusinthisanyeng	Kuipakwakusinthakwanyengondikotani		

	esedwakwanu?	tanimuderalanu?	omuderalanu?			
Utsogoleriwamadzi	Kodimuliko muguru lililonselosamalamadzi?	Kodimulindimalamuloenalionseokhazikikaosamaliramadzi?	Kodimumalipirandalamailiyonseposamalamadzi?	Ngatieyamumalipirandramazingati ?	Mumalipirakangati?	
Kuthesamikangano	Kodimumakumanandimikanganoyokhuzamadzimuderalanu?	Ngatieyandimikanganoyanjiyomwemumakumanayo?	Mungaithesebwanjimilanduimeneyimu deralanu?			

Appendix I. Translated Questionnaire for KASFA Irrigation Schemes in Chichewa

Malonje

Cholingachenicheni cha kafukufukuyutikufunatichezenanuzokhuzanandichilinganizochaumodziposamalamadzingatiimodzimwanjirayosamaliramadzi.

Kafukufukuyuakwanilitsidwapofufuzazomweinumukudziwapopankhaniyaumodziposamalamadzingatinjiraimodziyogwiritsidwantchitoposamaliramadzikomansokomansokupititsapatsogolondikukudziwitsaningatialimi a KASFA

ubwinoogwiritsantchitozilinganizozaumodziposamalamadzi (AWS Standard) kutitichepesemavutookhuzanandimadzindikutetezamadzi.

Dzina la opangakafukufuku	Malo a zokambiranazakafukufuku	Tsiku	Chiphaso

A. Demographic Information

1. Dzina la oyankhamafunso……

2. dzaka…….

3. Gender (1) Male (2) Female

4. Nkhaniyabanja (1) Married (2) Single (3) Divorced (4)Widowed (5) Polygamous family

5. Mulipoangatimubanjalanu?…….. (number of people)

6. Munafikapatindimaphunziroanu? (1) Primary (2) Secondary (3) Tertiary (4) None

B. Household Economic Information

1. Mumapangachanipaumoyowanuwatsikunditsikuchomwechimakupezetsanindalama?

(1) Ulimi (2) ndimagwirazolembedwa (3) Maganyu (4) malondaang'onoang'ono (5) ntchitozamanja (6) Zina , tchulani ……..

1. Maloanuamenemumalimapondiandani (1) a makolo (2) amafumu/amudzi (3) ogula (4) zina

2. Maloanundiokulabwanji?.....

3. Mumalima chani pa malo anu?

(1) Mpunga (2) Chimanga (3) Chinangwa (4) Nthochi (5)

zinatchulani…….

(C) Kasamalidwekamadzi mu Ulimiothilira

1. Kodischemeyanundiyokulabwanji?

……

…

2. Mulipoanthuangati mu silkimuyanu?

…….

3. Mumalimambewuzanjipagawolanumumulimiwu?

……

4. Mumagwiritsantchitomtunduwanjiwamthilirammindamwanu?

(1)Yopatusansinje (2) treadlepump (3) motorizedpump (4) wateringcane (5)

chinyonthochammunda (6) zina, nenani?

5. Kodimumalipirandalamazogwiritsantchitomadzi? (1) Yes (2) No

6. Kodimumalimakangatimmindamwanu? (1) kamodzi (2) kawiri (3) katatu

7. Kodimumapindula mu ulimiwu? (1) eya (2) ayi

8. Ngatiayindichifukwachanichimakulepheresanikupindula mu ulimiwu?

……

…….

9. Ngatieyamwapindulamo mu njirazitichiyambireniulimiwu?

……

……

……

10. Ndimaganizoanjimungaperekekutimuzipindulamochuluka?

……

……

11. Ngatimaganizoanu mu 9 atagwiritsidwntchito, ndiumwayiwanjimungakhalenawo mu ulimiwu?

……

……

…….

12. Kodi palianthuenaomweamagwiritsantchitomadziomweinummagwiritsantchito? (1) eya (2) ayi

13. Ngatieyakodimamapezekamikanganoyokhuzakagwiritsidwentchitomadziwa? (1) Eya (2) Ayi

14. Ndimikanganoyanjiimapezekangatieya

15. Kodimulindizimangizozinazomangidwazothandizirakusamalamadzi mu sikimuyanu? (1) Eya (2)Ayi

16. Ngatieyatchulanizipangizozomangidwazosamaliramadzi mu sikimuyanu?

17. Ngatiayindinjirazitizomwemumalondolaponesesakutimadziakusamalidw mu sikimu?mongamadziothililirakomasootsaliramukathilira

18. Kodimadziamenemumagwiritsaantchitokuthiliramumamwaso? (1) Eya (2) Ayi

19. Ngatieyamumathiramankhwalamumadzimusanamwe?(1) eya (2) ayi

20. Mungayezebwanjimulingowamadzianuothilirammeneanalili kale ndipano?

1) Ambiri (2) Ambiripang'ono (3) Ochepa (4) ochepapang'ono (5) Ochepetsetsa

21. Ngatiochepessamukuganizandichifukwachani?

22. Ladzetsamavutoanjivutori?

23. Mwapanganjirazanjizobwezeresamadzianukukhalamwakale?

Appendix J: Focus GroupDiscussionQuestions

English version

1. When did your irrigation group started?

2. What are the goals for your group?

3. From the time you started your group up to now do you see any achievements for being in this group?

4. If 'Yes" what are the strengths for your achievements?

5. If "NO" what are the weaknesses hindering you to achieve your group goals?

6. What do you think are the remedies that you as a group can follow to reach your group goals?

7. Dou you have open bylaws for the group?

8. Do you have water abstraction permits for your irrigation group?

9. Do you have an active group committee?

10. How often do you meet as a group?

Chichewa Version

1. Kodigurulanu la ulimiothiliralinayambaliti?
2. Kodizolingazagurulanundizotani?
3. Kuchokapanthawiyomwemunayambagurulikufikiraleromukuonapozopindulapokhalamuguluri?
4. Ngati ‘Eya” tchulanizokulimbikitsanikupitachitsogolomuguruli?
5. Ngati “Ayi” tchulanizofookazanuzomwezimakulepheresanikupitachitsogolongatiguru
6. Mukuonakutindinjirazitizomwemungatsatekutimukwanilitsezolingazanuzaguru?
7. Kodimulindimalamulookhazikikaoyendetseraguruli?
8. Kodimulindichiphasochovomelezekandibomachokuyenerezanikugwiritsatchitomadzi mu sikimuyi?
9. Kodigulurimulindiatsogoleriokhazikika?
10. Kodimumakumanakangatingatiguru