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WATER GOVERNANCE AND SUSTAINABLE RURAL LIVELIHOODS: THE CASE OF IRRIGATION REFORM AT WOVWE, MALAWI

Jolly WASAMBO

Supervisor: Prof. Brandon Anthony (CEU, Budapest)

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No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Jolly WASAMBO

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Abstract
A case study of irrigation sector reform at Wovwe, Malawi examined the influence of irrigation reform on water governance and livelihoods of rural communities within a distance of approximately 20km along the entire Wovwe River course. Interviews, focus group discussions, questionnaire surveys, documents review, and non-participant observations were the primary techniques used in data collection. Data analysis involved both qualitative and quantitative methods employing a mixed methods approach.

Findings reveal that achievement of the stated benefits of implementing irrigation reform cannot simply be guaranteed without serious and thoughtful consideration of other key factors such as spatial and temporal variations in water availability, existence of multiple and multi-sectoral users/uses across the river basin, legal and policy frameworks, the effects of extreme weather and climate events, social structure, demographics, and the capacity of local organizations taking over the management of the schemes. While irrigation management transfer (IMT) appears to improve household income, the dominance of agriculture as the main livelihood strategy counteracts possible environmental benefits of improved household economic status. Furthermore, there is a general deficit in the performance of the reform particularly with regards to meeting some key IMT assumptions e.g. improving water delivery, ensuring environmental sustainability, reversing deterioration of infrastructure, and turning irrigation systems into financially self- sustaining entities. Key factors behind the apparent underperformance include lack of capacity of the Wovwe Water Users Association (WWUA), conflicting implementation of water rights between informal traditional irrigators and the WWUA, social mistrust, and effects of climate change.

Despite the inadequacies, the IMT still manages to meet some of its stated goals e.g. reductions in government expenditure, improved rural people's income, and bringing all land within the Wovwe Irrigation Scheme (WIS) under cultivation. However, the way government achieves expenditure reductions is counterproductive to the very sustainability of the irrigation system as it negatively affects critical irrigation services such as hydrological monitoring, planning, and technical advisory services.

For any successful IMT implementation, this thesis strongly recommends a coordinated approach in enforcing conventional and customary water rights in the same basin especially where both formal and informal irrigation are simultaneously being promoted. Such implementation should be based on a thorough assessment of the water resource which will support both IMT and informal irrigation and socio-cultural parameters; and should be preceded by the establishment of functional hydrological and environmental monitoring systems. Furthermore, governments should consider building the capacity of recipient user organizations before the schemes are transferred from the state control to user.

Keywords: water governance, water resources management, irrigation reform, irrigation management transfer, sustainable rural livelihoods, irrigation expansion, Wovwe Irrigation Scheme, Malawi

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Abbreviations

AC	Agriculture Committee
ADMARC	Agricultural Development and Marketing Corporation
AISP	Agricultural Input Subsidy Program
BOT	Board of Trustees
CMC	Credit and Marketing Committee
CPR	Common Pool Resource
DCCMS	Department of Climate Change and Meteorological Services
EC	Executive Committee
EPA	Extension Planning Area
ESCOM	Electricity Supply Corporation of Malawi
FAO	Food and Agriculture Organization of the United Nations
GA	General Assembly
GBI	Green Belt Initiative
GBP	Green Belt Program
GOM	Government of Malawi
GWP	Global Water Partnership
HHI	Herfindahl-Hirschman Index
HWC	Health and Water Committee
IFAD	International Fund for Agricultural Development
I-HHI	Inverse Herfindahl-Hirschman Index
IMC	Irrigation Management Committee
IMT	Irrigation Management Transfer
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
KRADD	Karonga Agricultural Development Division
MGDS	Malawi Growth and Development Strategy
MNVAC	Malawi National Vulnerability Assessment Committee
MYP	Malawi Young Pioneer
NGO	Non Governmental Organization
NIPDS	National Irrigation Policy and Development Strategy
NOIL	National Oil Industry Limited
O&M	Operation and Maintenance
OVOP	One Village One Product
PIM	Participatory Irrigation Management
SFPDP	Smallholder Flood Plain Development Project
SMC	Scheme Management Committee
TA	Traditional Authority
TAC	Technical Advisory Committee
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

WB	World Bank
WCED	World Commission on Environment and Development
WIS	Wovwe Irrigation Scheme
WRB	Water Resources Board
WUA	Water Users Association
WWUA	Wovwe Water Users Association

1. INTRODUCTION

1.1. Background to the study

Water occupies an essential role in both human development and sustenance of natural ecosystems and their functions. Humans need water for a myriad of uses such as food production, household purposes (e.g. drinking, cooking, and sanitation), tourism, industry, and cultural purposes. Water is also central in its functioning for biogeochemical cycles, habitat provisioning, etc. Unfortunately, however, such an essential resource is becoming increasingly scarce and severely threatened across national, regional, and even seasonal boundaries – posing severe challenges for both development and environmental sustainability (Rosegrant *et al.* 2002). This is evidenced by the dramatic intensification of the world's water usage and abuse over the past few decades, and the fierce competition for the resource resulting from the rising demand from the ever-growing human population, effects of climate change, and the search to improve human living standards, among others (Rosegrant *et al.* 2002).

An outlook into the next 50 years indicates that the rising demand from the agriculture sector will drive the continued escalation of water usage in order for the sector to meet the food needs of the growing population (Gordon *et al.* 2005). Global water demand continues to grow with the growing population forcing many people into water stress[1] conditions. For example, while the global human population grew by a factor of about 3 in the 20th century, water withdrawals rose seven-fold. Furthermore, the current proportion of the world's population living in countries with "medium to high water stress" conditions (i.e. $^1/_3$) is expected to rise to $^2/_3$ by 2025 (GWP 2000). The consequences are daunting challenges to: "secure water for people and food production"; protect essential and fragile ecosystems; deal with water variability; and ensure intersectoral collaboration (GWP 2000). Vitousek *et al.* (1997) observe that social and political influences play a significant role in inducing the challenges thereby leading to water crises which are largely believed to be crises of governance (GWP 2000). The United Nations Development Program (UNDP 2006) further

[1] "**Water scarcity** occurs when the amount of water withdrawn from lakes, rivers or groundwater is so great that water supplies are no longer adequate to satisfy all human or ecosystem requirements, resulting in increased competition between water users and other demands" (UNEP 2008). "An area is experiencing **water stress** when annual water supplies drop below 1700 m^3 per person. When annual water supplies drop below 1000 m^3 per person, the population faces water scarcity, and below 500 m^3, absolute scarcity" (UN-Water 2010).

notes that water crises seriously affect economic and social development, political stability, and ecosystems integrity.

Despite such water challenges, the world today highly depends on irrigation products. This is reflected in increased irrigation development towards the end of the 20th century (Figure 1.1). Investment in irrigation between 1960s and 1970s in developing countries resulted in a 2.2% expansion of area under irrigation bringing the total land area under irrigation to 155 million hectares (ha) in 1982 (IWMI 2007c). Within the same period of time, the global land area under irrigation reached 215 million ha from 168 million ha in 1970 (IWMI 2007c); and in 2002, the figure rose to 277 million ha (FAO 2006) representing a global increase of about 65% in just over three decades.

	Total irrigated area (thousands of hectares)			As share of arable land (percent)		
Region	1980	1990	2002	1980	1990	2002
World	*210,222*	*244,988*	*276,719*	*15.7*	*17.6*	*19.7*
Developed countries	*58,926*	*66,286*	*68,060*	*9.1*	*10.2*	*11.1*
Industrialized countries	37,355	39,935	43,669	9.9	10.5	11.9
Transition economies	21,571	26,351	24,391	7.9	9.8	10.0
Developing countries	*151,296*	*178,702*	*208,659*	*21.9*	*24.1*	*26.3*
Latin America and the Caribbean	13,811	16,794	18,622	10.8	12.5	12.6
Near East and North Africa	17,982	24,864	28,642	21.8	28.8	32.3
Sub-Saharan Africa	3,980	4,885	5,225	3.2	3.7	3.6
East & Southeast Asia	59,722	65,624	74,748	37.0	33.9	35.1
South Asia	55,798	66,529	81,408	28.6	33.9	41.7
Oceania, developing	3	6	14	0.7	1.2	2.4

Figure 1.1: Irrigated land, total and share of arable land, 1980, 1990, and 2002
Source: IWMI 2007c

This emphasizes the fact that irrigated agriculture is at the centre of achieving food security and sustainable livelihoods for the poor, especially in developing countries. It enables farmers to grow diverse types and/or varieties of crops and hence improve food production (Rosegrant *et al.* 2002) thereby inducing declines in food prices (IWMI 2007c). It is more productive than rain-fed agriculture. For example, towards the end of the 20th century, yield (ton/ha) from irrigation was 2.3 times higher than that realized from rain-fed agriculture (Garces-Restrepo *et al.* 2007). Furthermore, while the current 1260 million ha of land (80% of global land under cultivation) under rain-fed agriculture contribute 60% to the total global food supplies, only 277 million ha of irrigated land contribute the remaining 40% (Garces-Restrepo *et al.* 2007).

It is, therefore, not surprising to note that irrigated agriculture is the main user of water worldwide. In 1995, it accounted for about 80% of total water consumption, with developing countries alone responsible for about 86% (Rosegrant *et al.* 2002). Furthermore, the projected rise in global population means that food requirements will translate into even higher demands for water in order to produce enough food to meet nutritional needs. By 2025, the global population is projected to rise to "7.9 billion, more than 80 percent of whom will live in developing countries and 58 percent in rapidly growing urban areas" (Rosegrant *et al.* 2002, pp. 1-2). This will translate into 46% and 65% growth in demand for cereals for the globe and developing countries respectively between 1995 and 2025; and 56% of global demand for meat (Rosegrant *et al.* 2002). Sound management of irrigation systems is therefore crucial if the demand for products is to be met.

Unfortunately, poor management of irrigation systems results in undesirable outcomes for agricultural productivity and water resources e.g. water depletion, water quality reduction, waterlogging, salinization, and reductions in annual river discharges. Poor irrigation practices result in unwelcome outcomes for the environment (Rosegrant *et al.* 2002):

- excessive river diversions reduce flows thereby causing detrimental effects to the environment and ecosystems downstream;
- higher rates of groundwater withdrawal than water recharge rates lower water table and lead to "saltwater intrusions" (p. 2), particularly in areas along the coasts;
- excessive water withdrawals result in water quality and availability problems; and
- a combination of poor irrigation practices and inadequate drainage results in soil oversaturation and salinity.

Already about 20-30 million ha of global irrigated land are saline and 60-80 million ha are both waterlogged and saline (Rosegrant *et al.* 2002; FAO 2004). Also, some rivers which support irrigation are increasingly being depleted – threatening ecosystems and prospects for food security and successful poverty reduction (Rockström *et al.* 2007).

Furthermore, although irrigated agriculture remains the major user of water, there is growing competition for the resource from other sectors such as industry, domestic needs, etc. This attracts greater scrutiny of agricultural water consumption patterns and efficiencies by the international community making it inevitable for the agriculture sector to review its water

usage (Garces-Restrepo *et al.* 2007). For example, in the past few decades, international financial institutions tasked governments to comply with requirements of structural adjustments where governments implemented measures such as privatization and reductions in public workforce in order to reduce public spending. This affected even the agriculture sector, particularly the irrigation sub-sector as evidenced by reforms initiated across the globe in order to improve agricultural productivity and enhance the performance of the irrigation sector. The most popular form of reform to-date has been irrigation management transfer (IMT) (Garces-Restrepo *et al.* 2007). Several countries have undertaken the reform process or are in the process of reforming their irrigation sector (see 2 2 3 1 and 2 2 3 2). Malawi is one of the developing countries still in the process of reforming its irrigation sector.

1.2. Research problem and questions

The dramatic irrigation expansion in the 1960s and early 1970s preceded the realization that: the functioning of several large-scale public irrigation schemes was not impressive; there was a general neglect of drainage and maintenance; and there was need for institutional reforms in order to achieve better irrigation management and sustainability of physical irrigation structures and finances (Molle *et al.* 2008). Introduction of water fees, establishment of Water User Associations (WUAs), and partial or total transfer of irrigation management responsibilities to user associations, were the main reforms aimed at bringing financial autonomy to irrigation agencies and accountability of agencies to users (Molle *et al.* 2008).

However, in the face of growing demand and competition for water, rising realization of the importance of water for ecosystems and others uses, increasing population growth, and reliance of the rural poor on irrigation for their livelihoods; means that irrigation reforms need to have positive influence on water resources, the rural poor, government spending, and the irrigation system itself – if development is to be sustained and equitable. This dissertation attempts to understand how irrigation reforms implemented among rural poor communities in a developing country serves specific reform objectives, and contributes to the livelihoods of the rural poor, and management and governance of the environment, particularly water resources. The investigation focused on addressing the following research problem:

- *How is the recent irrigation reform in Malawi influencing water resources management and governance, and rural livelihoods in the Wovwe River catchment?*

The study adopted a case study approach where irrigation reforms and their outcomes in the entire Wovwe River catchment including the Wovwe Irrigation Scheme (WIS) were investigated. In order to address the above-mentioned research problem, the investigation uses the Franks and Cleaver (2007) Water Governance and Poverty Analytical Framework (2.5) and was guided by four key questions:

1. How has the irrigation sector in Malawi reformed?
2. Who are the current Wovwe River water stakeholders and how do they negotiate and shape their access to, and control over, water?
3. What resources for water governance do different stakeholders possess and how do possession/lack and/or use of specific resources influence livelihoods of the rural poor?
4. What are the reform outcomes for water resources, the rural poor and their livelihoods in the Wovwe catchment?

1.3. Justification

The sub-Saharan Africa region is characterised by seasonal rainfall, intermittent dry spells, recurrent drought years, and low fertile soils which are vulnerable to erosion (Falkenmark and Rockström 2004). Malawi, like most sub-Saharan African countries has an economy which is predominantly agriculture-based. Agricultural production accounts for nearly 90% of its foreign exchange; and the agriculture sector contributes about 37.6% of the country's GDP (FAO 2005). From the colonial era up to the late 1960s, the country predominantly relied on rain-fed agriculture with only limited irrigation which was characterized by stream-bank cultivation and use of seasonal floodplains (Mandala 1990). But in the late 1960s, problems of climatic variation, rapid population growth and land scarcity led the government into establishing sixteen smallholder canal irrigation schemes in order to promote rice production and form nuclei for rural development (Kishindo 1996; GOM 2000a). However, in the 1980s, the government could not sustain management and maintenance of the schemes due to financial constraints following withdrawal of donor support for running the schemes. Accelerated occurrence of extreme climatic events i.e. droughts and floods, added challenges to management and productivity of the schemes. Consequently, significant declines in production were experienced across the schemes.

This prompted the government to reform its policies and initiate a rapid phase-out of government support and consequential transfer of management of the schemes to beneficiary

farmers (GOM 2000a; 2000b; Nkhoma and Mulwafu 2004). The aim of the irrigation sector reform is two-fold: 1) to transfer the management of government-operated irrigation schemes into the hands of beneficiary farmers through the process of irrigation management transfer (IMT) (GOM 2000b); and 2) to expand irrigation farming to areas within 20km from any surface water source through promotion of informal household irrigation and the implementation of the Greenbelt Program[2] (GOM 2010).

With respect to IMT, three schemes (Kasinthula, Likangala, and Wovwe irrigation schemes) entered the transfer process in 2002 on a pilot basis. Farmers' associations called Water User Associations (WUAs) were created as recipient entities of the schemes. However there have been no studies yet to draw lessons on the performance of the reform and its contribution to rural people's livelihoods, agricultural productivity, and management and governance of both water resources and the irrigation systems. The few studies conducted in the early stages of the transfer centered on the transfer process, land use, and extension services (Chirwa 2002; McCracken 2002; Nkhoma and Mulwafu 2004; and Ferguson and Mulwafu 2005). This study is based on the realization that understanding the effect of the reforms on irrigation performance, water resources management and governance, rural livelihoods, and consequential effects on rural peoples' socio-economic status, would be vital for targeted efforts towards sustainable water resources management and poverty reduction both in Malawi and in other countries with similar economic and climatic conditions.

Furthermore, the government is promoting informal small scale irrigation at a household level to ensure food security and sustained generation of income (GOM 2000b). In some places, such as at Wovwe, informal irrigation is being promoted alongside IMT – meaning that informal irrigation is being done with the same source of water i.e. the Wovwe River. However, it is not clear what water governance arrangements are emerging between these informal irrigators and water users in Wovwe Irrigation Scheme (WIS) which is being transferred to beneficiary farmers. Furthermore, it is not clear how customary water rights held by informal irrigators and formal rights held by irrigators in transferred schemes practically work. Recognizing that the existence of multiple water users may shape the way water resources are being managed, and determine the outcomes for water resources and rural

[2] The Green Belt Program is the Malawi government program aimed at bringing land within a 20km radius from any perennial source of water under irrigation

livelihoods, this study also explores these rights issues to assist policy-makers and water professionals devise informed and effective policies and workable models for positive environmental and livelihood outcomes.

By employing a case study approach, the study utilized a mixed methods approach (a combination of qualitative and quantitative methods of data collection and analysis) where data collection methods included questionnaire surveys, non-participant observations, secondary sources, focus group discussions, and interviews – including key informant interviews. Both quantitative and qualitative data analyses were performed with results presented in forms of graphs, tables, matrices, quotations, narratives and photographs. The Franks and Cleaver (2007) Water Governance and Poverty Analytical Framework (see 2.5) helped to understand how irrigation reform influences outcomes for the environment (particularly water resources) and livelihoods of rural people, and affects different stakeholders to gain access to water.

1.4. Limitations of scope and key assumptions

The Wovwe Irrigation Scheme is one among the sixteen schemes earmarked for transfer and one of the three schemes undergoing the transfer process on a pilot basis. While conditions at Wovwe may not exactly represent those from other schemes, the Wovwe case presents a wide range of factors (see 3.2.4) which, if investigated would yield valuable information for successful implementation of the transfer process even in other schemes and places earmarked for irrigation expansion. As such, the study assumes that in this pilot phase, learning is key for successful irrigation transfer and expansion.

In order to understand the effects of the reform, ideally, data for both the pre-reform and the reform period itself are crucial for the investigation. However, official data for some of the study variables e.g. hydrological measures were not up to date. The study used official information from other government departments e.g. the Department of Climate Change and Meteorological Services (DCCMS) to establish the hydrological status in the study area. Furthermore, the study used observations of government experts working in the area and officials from Wovwe Water Users Association (WWUA) to cross-check perceptions of the local communities, farmers, and other key informants on the status of water resources. Realizing that some respondents may not accurately remember longitudinal information, the

study combined several methods of data collection and; in its data analysis, made wide-ranging comparisons of parameters between locations affected by the reform and those not affected. Several other variables such as perceptions about yield were also cross-checked by secondary data from government offices and WWUA offices.

The realignment of government ministries and departments at the start of the reform process affected the postings of members of staff, and consequently data recording, especially hydrological data. For example, the Department of Irrigation was moved from the Ministry of Agriculture to the Ministry of Irrigation and Water Development. Some staff members from the Ministry of Agriculture who were performing irrigation functions started concentrating on agriculture duties while others were posted away. This resulted in the Copy Typist being the only irrigation staff member left at the site to provide support services to new technical irrigation staff members who would later be posted to the site. However, there have been no postings of new technical irrigation members of staff up to now. Consequently, recording of hydrological data for the Wovwe River ceased (see 4.5.3 and 7.2.5). Thus, the study had to rely on several sources of information as discussed in the preceding paragraph.

Finally, field work for this study was conducted at a time when the area was heavily affected by floods which had destroyed peoples' crops in the fields, livestock, and even homes. While floods created problems with movements to interview respondents (3.4.2), some farmers may have exaggerated their agricultural productivity. To deal with this, the study cross-checked farmers' responses with secondary data from government offices i.e. the District Irrigation Office and Agricultural Extension Services Office.

1.5. Overview of the dissertation

The introductory chapter provides the focus for the research findings presented in the remainder of the dissertation. However, before presenting the results, the dissertation summarizes relevant literature in chapter 2 and describes the methodology in chapter 3. Specifically, **chapter 2** reviews literature on irrigated agriculture (including irrigation reform), water governance, water resources management, and sustainable rural livelihoods; lays down the theoretical foundations; and identifies research gaps which the study attempts to fill. The chapter describes the Water Governance and Poverty Analytical Framework (Franks and Cleaver 2007) before presenting the Malawian context. The methodology chapter

(chapter 3) presents the case study approach as a strategy used in the investigation and justifies its choice in this research. Thereafter, the chapter describes the research design, methods of data collection and analysis (both quantitative and qualitative), and ethical procedures followed.

Chapters 4 to 7 are primarily dedicated to findings of the study. The presentation of results begins with findings on irrigation reform in **chapter 4**. Here, findings focus on the context in which the reform is carried out, policy reform, and the actual reform on the ground – what has actually reformed. **Chapter 5** presents findings on processes of management and practice for water governance, water stakeholders and their attributes and characteristics, and how the reform is influencing the way specific stakeholders negotiate access to water, govern water, and devise mechanisms of water access. **Chapter 6** presents results on stakeholders' possession of water governance resources or assets and how the reform is contributing to the acquisition or loss of such resources by various stakeholders. The chapter further highlights how the possession or lack of such resources resulting from the reform is enabling on constraining specific stakeholders to access water for their livelihoods. The final results chapter **(chapter 7)** outlines outcomes of the reform to-date for the environment (mainly water resources), the government (spending), the rural poor and their livelihoods. This chapter reveals the direction of the reform and provides insights on the design and implementation of the reform.

Chapter 8 discusses the research findings in relation to issues reviewed in chapter 2, the research problem (see section 1.2), and the Water Governance and Poverty Analytical Framework. The discussion focuses on the research questions (see section 1.2) in trying to resolve the research problem. Central themes include irrigation reform (i.e. irrigation expansion and IMT), water resources management and governance, and sustainable rural livelihoods. Findings are examined to inform theory, practice, and policy on irrigation reform, water governance, and balancing concerns for water resources and rural livelihoods (water as essential for both the ecosystem and peoples' livelihoods). Finally, in **chapter 9**, the dissertation draws conclusions on the influence of irrigation reform on natural resources – on which the rural poor depend for their livelihoods, water governance, livelihoods and people's well being.

1.6. Conclusion

This chapter has essentially provided background information to the study, and introduced the problem the study is addressing. It has outlined the research questions and justified the relevance of the study. The chapter has further presented key assumptions made in the study and limitations of the study scope. Before proceeding to the literature review (chapter 2), the chapter has, finally, presented an overview of the dissertation chapters.

2. LITERATURE REVIEW

2.1. Overview

This chapter, within the context of irrigation sector reform, examines relevant literature on water resource management and governance, and rural livelihoods. Without ignoring the influence of external factors such as climate variability on rural livelihoods, the review connects previous studies to the Malawian context i.e. policy reforms and practice in areas of water, land, agriculture, poverty reduction, and local governance.

Specifically, the chapter reviews literature on agriculture (mainly irrigation agriculture), its importance to rural poor communities, and the centrality of water to peoples' irrigation-based livelihoods. The review reveals that the growing demand and competition for water by the agricultural sector and other competing uses indicate weaknesses in institutional and structural designs highlighting the governance of water as a critical issue to any sustained use of the resource for human productive purposes and maintenance of vital ecosystems. As such, water resources management becomes critical, and an analysis of literature on water resources management – particularly the concept of integrated water resource management (IWRM) and how it fits in the understanding of a wider, emerging and growing body of knowledge in water governance, reveals the significance of reliable water access in supporting livelihoods of rural communities.

The chapter further introduces the water governance and poverty analytical framework (Franks and Cleaver 2007) which guided the execution of this study. The framework, presented in section 2.5, combines concepts of governance, sustainable rural livelihoods, and social theory to aid our understanding of the influence of irrigation reform on rural livelihoods and water resources in Malawi. Thus, the review finally establishes a contextual framework through which the study was carried out by connecting it to the Malawian context i.e. political, economic, policy, social, and environmental aspects.

2.2. Irrigation agriculture

Mollinga and Bolding (2004) define irrigation as "a form of land and water management to enhance agricultural production by manipulating the availability of water in time and space for better crop growth" (p. 1). "As water is the font of life, irrigation has been the font of

civilization. It underlay the rise of the first sedentary societies organized on a large scale in Mesopotamia, Egypt, the Indus Valley and China" (Norton 2004, p. 197). Irrigation systems existed by as early as about 3500 BC in Sumerian city states; and small scale irrigated agriculture developed as early as the 7th century BC in Jericho and Çatal Hüyük (current Southern Turkey) (Norton 2004). In the 19th and 20th centuries, irrigation drove the agricultural growth in the western United States, in the deserts of Northern Mexico and Peru, Mali, Sudan, Punjab (India), China and South East Asia. Irrigation provides jobs, income, and food for the world population, and estimates show that in the next thirty years about 80% of extra food the world will need will come from irrigation (Norton 2004).

In order to ensure food security and sustain people's economic status, irrigation agriculture has become the world's largest user of freshwater i.e. accounting for about "80 percent of global and 86 percent of developing country water consumption in 1995" (Rosegrant *et al.* 2002, p.1). Such intensive water uses can, inevitably, strain water resources. The Food and Agriculture Organization of the United Nations (FAO 2000) reports that 20 of the world's countries withdrew over 40% of their renewable water resources in 1998 for agricultural purposes alone and about 23% of them were already water stressed.

The effects of high water withdrawal rates are compounded by past irrigation strategies which were premised on the assumption that water is an inexhaustible resource, and hence focused more on constructing infrastructure for water supply than on efforts to manage the water resource (Norton 2004). Such high withdrawal rates suggest that large quantities of water resources are abstracted and result in the resource overuse and misuse in some parts of the world. This is evidenced by higher rates of renewable water resources abstraction than renewable supply rates in some parts of the world (FAO 2000). The consequences are that water supply cannot be continued indefinitely; and that overuse in one area deprives other users of their access to the resource in other areas which face reductions to their agricultural productivity and hence livelihood loss (FAO 2000). Consequences of overuse of water resources are well documented e.g. the drying up of some large rivers such as the Huang He, the Colorado, and the Shebelli Rivers which now dry up before reaching the sea (FAO 2000). In Central Asia, nearly the entire flows of the Amu Darya River (which feeds the Aral Sea) and the Syr Darya River are used for cotton irrigation. In 1997, the Yellow River in China did not reach the sea for seven months (FAO 2000). Additionally, very little amounts of water

from the Nile, Indus, or Colorado Rivers reach the sea (FAO 2000; IWMI 2003). Such incidences suggest that water can no longer be considered as an inexhaustible resource, and the effect of irrigation agriculture on water resources cannot just simply be ignored.

Unfortunately, many irrigation systems which were developed on the assumption that water is an infinite resource still exist – particularly in developing countries where development of modern systems requires huge sums of money which respective countries cannot afford to provide. With demand for water from other sectors also increasing in recent years, water needs to be correctly regarded as a finite and scarce resource which needs sound management. This current realization renders past irrigation strategies as no longer viable in the present multi-user context (Norton 2004), hence the need for establishing water efficient irrigation systems (Garces-Restrepo *et al.* 2007).

2.2.1. A review of irrigation systems

Irrigation systems are distinguished on the basis of being either *modern* or *traditional (informal) schemes; full* or *supplemental systems;* and *large* or *small schemes* (Norton 2004). *Modern irrigation schemes* aim to achieve high agricultural productivity through the use of modern technology/techniques such as expensive equipment, and large quantities of pesticides and herbicides on large land areas which require large volumes of water (Cornish 1998). On the other hand, *traditional* or *informal schemes* refer to traditional practices such as recessional irrigation following the receding of flood waters (Norton 2004). Farmers engaged in traditional irrigation do not rely on technically planned and constructed irrigation infrastructures (IWMI 2007a), though, at times, informal irrigation can be enhanced by simple structures such as river intakes or small rainfall catchment structures. Traditional irrigation is still at the forefront in the production of food and enhancement of household income in most parts of the world. For example, it accounts for 72% of all irrigated rice grown in principal rice producing nations in Africa (Norton 2004). Table 2.1 summarizes the main types and features of informal irrigation systems and their objectives as practiced in Africa.

Table 2.1: Main types of informal irrigation in Africa
Source: IWMI 2007a; adapted and modified from Payen and Gillet (2007)

System	Water source	Production	Main objective
Open-space urban and peri-urban agriculture	Streams passing cities, ground water and waste water	Vegetables, paddy	Income generation
Irrigation at the border of formal irrigation schemes	Return flow, unused water, illegal connections	Cereals, vegetables	Subsistence; income generation
Groundwater use	Shallow and deeper groundwater; use often via treadle or motor pumps	Vegetables, spices	Income generation
Surface water use	Pumping from streams and rivers in rural areas	Paddy, vegetables, fruits	Income generation; subsistence
Inland valleys, floodplains	Run-off water; flood recession	Paddy, vegetables	Subsistence; income generation
Multi-purpose reservoirs	Small reservoirs with dam	Paddy, vegetables	Subsistence; income generation

Full irrigation systems are technically designed and constructed. This gives a holistic approach of managing irrigation practices. *Supplemental irrigation,* on the other hand, is used to compensate for dry spells during the rainy season, or to prolong the season of water availability for crops. Supplementary irrigation systems are most desirable during erratic or irregular rainfall as they help to avert severe crop damage (Norton 2004).

Large irrigation schemes are characterized by frequent competition for water between farmers, systems and sectors (Lankford 2003) resulting in water allocation problems (SMUWC 2000). Each user's abstractions affect others underlining the need for users to depend on one another to deal with water shortages (Lankford 2003). Integrated approach towards the use and management of water resources are, thus, vital for effective management of large irrigation systems.

Small-scale irrigation is defined as irrigation "usually on small plots, in which small farmers have the controlling influence, using a level of technology which they can operate and maintain effectively" (Smout and Shaw 1999, p. 37). It plays a critical role in the socio-economic development of many rural communities in developing countries (Elson and Shaw 1999). The main characteristic feature of small-scale irrigation systems is that they are farmer-managed i.e. farmers are involved in all decision-making regarding the scheme design e.g. scheme boundaries, canal layout, outlet and bridge positions. Although most small-scale irrigation systems serve farmers' groups, typically of 5-50 households, some serve individual

farming households (Smout and Shaw 1999). Such a characteristic makes them more convenient to rural farming households as they would engage in irrigation farming without being tied to group requirements. On the other hand, it is a potential source of conflict in water usage as each household is independent of the other in its handling of irrigation water. Small-scale irrigation systems use a range of technologies e.g. flood cropping, stream diversion (gravity supply), and lift or pump supply (Elson and Shaw 1999), and they can be effectively managed by local communities (Norton 2004).

2.2.2. Significance of irrigated agriculture

Irrigated agriculture occupies a crucial role in sustaining livelihoods and reducing poverty of rural poor communities by: stimulating the development of associated markets and support services (Lankford 2003); and providing jobs, food, and income to about 2.4 billion people worldwide (Norton 2004). Looking ahead to 2030, the share of irrigated agriculture of the total world food production will rise to 45% from the current 40% (IWMI 2007c). This will be achieved with corresponding expansion of irrigation on new land (IWMI 2007c). The implication, however, is that more marginal and fragile land will be put into irrigation use, though the IWMI (2007b) foresees that further irrigation development will largely depend on policies and plans put in place in both the agriculture sector and other sectors.

Despite the positive socio-economic role played by irrigation agriculture, not all people of the world's regions have access to affordable irrigation. Just as more than a billion of the world's people lack access to safe drinking water (Mollinga *et al.* 2007), a similar figure of the poor lack affordable irrigation (Polak *et al.* 2002). The situation is dire in Africa and Asia where hundreds of millions of poor people have limited or no access at all to reliable supplies of water for food and livelihoods, due to insufficient and erratic rainfall, lack of water infrastructure, and stiff competition for the resource (Mollinga *et al.* 2007). Although Asia is positively responding to efforts of reducing poverty through irrigation, progress in sub-Saharan Africa is still unimpressive (Hussain 2005, quoted in Mollinga *et al.* 2007). The lack of access to a reliable water source perpetuates poverty among peoples in developing countries (Merrey *et al.* 2004).

On a promising note, however, Polak *et al.* (2002) and Lipton and Litchfield (2003) argue that it is possible to transform the lives of poor people by providing them with relatively small

amounts of water for domestic and productive uses. Since livelihoods of the majority of rural people depend on agriculture, availability of, and access to, water for agricultural production and livelihoods would be vital. However, the ever growing demand for water from other sectors is forcing the irrigation sector to review its water usage polices and to adjust its water efficiencies through appropriate reforms (Garces-Restrepo *et al.* 2007).

2.2.3. Irrigation sector reform

Irrigation reform most commonly involves "… devolution of management functions from government agencies to water user groups and the institutional and financial reform of irrigation agencies" (Mollinga and Bolding 2004). While different processes of reform are being implemented worldwide, the most common and popular form of all is irrigation management transfer (IMT) (Garces-Restrepo *et al.* 2007) which is defined as

> "…the relocation of responsibility and authority for irrigation management from government agencies to non-governmental organizations, such as water users' associations" (Vermillion and Sagardoy 1999, p. 1).

Management functions and authority may be partly or wholly transferred and implementation of the transfer may be done either at the sub-system level such as distributary canal commands, or for the entire irrigation system (Vermillion and Sagardoy 1999).

The concept of IMT is closely interrelated to the concept of participatory irrigation management (PIM) which refers to "the increased involvement of water users in irrigation management, along with the government" (Garces-Restrepo *et al.* 2007, p. 4). IMT differs from PIM in that the intention of IMT is to replace the role of the government while PIM aims at strengthening the relationship between water users and government by including farmer participation within the government management. However, the two concepts overlap at "the 'comanagement' stage of IMT, where, before a final transfer takes place, the government agency and the recipient organization agree to share responsibilities" (Garces-Restrepo *et al.* 2007, p. 4). Although IMT and PIM are different terms representing different processes, their wide acceptance has seen them being used interchangeably. This study uses the term 'IMT' as it seems to be the process implemented by the Malawi government (GOM 2000b; see also 2.6.6.3).

2.2.3.1. Evolution of irrigation management transfer (IMT)

Different scholars attribute the origin of irrigation management transfer (IMT) to different time periods in different places. Mandal and Parker (1995), Bassi (2007), and Munoz *et al.* (2007) trace the IMT evolution to as far back as the late 1960s in Bangladesh and the USA. Bassi (2007) and Munoz *et al.* (2007) report that IMT surfaced in Colombia, Mali, and New Zealand in the 1970s, and the Philippines, Tunisia and Dominican Republic in the 1980s. While Bassi (2007) and Munoz *et al.* (2007) place the IMT boom in the 1990s, Garces-Restrepo *et al.* (2007) trace the evolution of IMT, as a process of irrigation sector reform, to the early 1970s. Despite these differences, the underlying issue is that IMT evolved due to poor performance of public irrigation systems despite huge investments countries made towards irrigation development in the 1950s and 1960s (Garces-Restrepo *et al.* 2007).

Garces-Restrepo *et al.* (2007) attribute the poor performance to the top-down approaches which characterized the way governments implemented development programs. The consequence was that conditions of irrigation infrastructure deteriorated. By the 1980s, governments which used to run their irrigation systems on inadequate national budgets were forced to reform their policies due to hard economic times prevailing at the time (Garces-Restrepo *et al.* 2007). Since then, the reform has taken the form of IMT with an ultimate goal of improving the performance of the irrigated agriculture sector, including agricultural productivity, and financial and physical sustainability. Specifically, initial objectives of IMT were to: "[E]liminate or reduce recurring government expenditures for operation and management of irrigation systems; establish financially self-reliant water service providers to replace the public agency in the management of systems; reverse the increasing rate of deterioration of infrastructure; provide transparency in management and accountability of the service provider to water users; and as an end-result, … to achieve improvements in the performance of the irrigated agriculture sector, including both productivity and financial and physical sustainability" (Garces-Restrepo *et al.* 2007, pp. 3-4).

The appeal for IMT is also due to the realization that governments alone cannot effectively perform its functions down to the local level; and the rising demands for public participation and accompanying responsibility for democratization (Meinzen-Dick *et al.* 2002).

2.2.3.2. Adoption of IMT

Shah *et al.* (2002) claim that the pursuit of the aforementioned objectives is based on three key assumptions:

1) government management is not ideal for achieving sustainability of irrigation systems (Shah *et al.* 2002);
2) sound irrigation management can transform irrigation schemes into financially and economically viable entities (Shah *et al.* 2002); and
3) partial or full transfer of irrigation systems to Water User Associations (WUAs) would stimulate crop diversification and significantly improve O&M of irrigation systems, water management and delivery, conflict resolution, fee collection (revenue), land productivity, and food and livelihood security (Garces-Restrepo *et al.* 2007).

However, international experiences show that implementing IMT is never successful unless certain basic preconditions are met (Vermillion and Sagardoy 1999; Shah *et al.* 2002):

- IMT should demonstrate a firm promise that it will improve and not degrade living conditions of the majority of local farmers;
- irrigation systems considered for the transfer should play a central role in farmers' livelihoods;
- the benefits of managing irrigation systems by local farmers should outweigh the costs; and
- the organizational design should have low operational costs.

Several countries including Chile, India, Kenya, Mexico, Nepal, Nigeria, Pakistan, Peru, the Philippines, and Zimbabwe have embraced IMT on assumptions that water users are more knowledgeable about local conditions and that their participation in planning and managing the schemes is vital; and that norms and conventions inherent in water users may be more effective in managing the affairs of the irrigation system than would top down approaches (Norton 2004). To the contrary, Rosegrant and Binswanger (1994) observe that the transfer has only managed to reduce financial responsibility for managing the systems on the part of governments without necessarily improving farmers' access to water. In other words, the transfer has failed to establish and give water rights to farmers, and clarify the boundaries of responsibilities between governments and WUAs. As a result, local farmers are left with no incentives for governing the usage of water. Particular considerations of various water rights,

whose establishments are facilitated by governments through a process of negotiation between different water users and water rights claimants should, thus, be deliberately pursued with a focus on strengthening 'the rights of the poor and disadvantaged groups' (Meinzen-Dick and Rosegrant 2001).

2.3. Integrated water resources management (IWRM)

Integrated water resources management (IWRM) may be understood in three different broad ways (Mitchell 1990, p.1):

1) as "the systematic consideration of the various dimensions of water: surface and groundwater, quantity and quality". In this respect, IWRM recognizes that water, as an "ecological system" is composed of different components which are interdependent. As such, management efforts focus on jointly addressing issues of water availability, quality, and waste management.

2) as implying that water, as a system, also "interacts with other systems". This viewpoint recognizes the importance of interactions between water as a system and other systems such as land; and entails that alterations in any one of the systems may have implications on others. Hence, management efforts take a broader view e.g. managing agricultural drainage, floodplains, controlling erosion, etc.

3) as managing water resources with a focus on "interrelationships between water and social and economic development". This, much broader, view is in line with sustainable development as suggested by the Brundtland Commission Report (WCED 1987). Management concerns for this approach are twofold: i.e. to establish how water can enhance or hinder opportunities for economic development; and to ensure that water resources are managed and used in a way that permits and sustains long term development.

With more than one way of understanding IWRM, the concept is being applied in different ways by different users with varying objectives for water management (Biswas 2005; Cardwell *et al.* 2006). However, this study adopts the definition by the Global Water Partnership (GWP) because it is widely being used and allows for learning. It states that IWRM is

> "...a process which promotes the co-ordinated 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." (GWP 2000, p. 22).

This definition is closely related to Mitchell's (1990) second and third ways of understanding IWRM, and portrays IWRM as a flexible goal-directed process which can be embraced by different users and advocates to achieve their specific and varied goals such as agricultural development, economic prosperity, political control, maximized ecological productivity, and even improved human welfare. As such, IWRM generally seeks to balance water needs for people's livelihoods and resource conservation needs to ensure sustainability (GWP 2003).

However, Merrey *et al.* (2004) argue that the IWRM concept is narrow and counter-productive to the poor and natural resources for two reasons. First is the alleged failure to put efforts of improving people's livelihoods at its centre, and secondly, its practical deficiency in holistically taking a 'natural resources' view rendering it incompatible with efforts for sustainable natural resources management. Accordingly, Merrey (2008) restricts the usefulness of the concept only to research and scientific understanding. On the other hand, Rahaman and Varis (2005) contend against dismissing the concept and direct critics to past positive experiences from Europe from which water professionals can draw lessons for a successful implementation of IWRM.

2.3.1. The need for good water resources management

Water is a finite and common pool resource (CPR) which exists continuously in a given basin. Such characteristics imply that it is difficult to exclude others from accessing water and that its use for one purpose or by one user affects its availability or quality for other uses or users (Gardner *et al.* 1990; Meinzen-Dick 2007). The resulting outcome is the increased competition for access to and control over the resource, often leading to water depletion, degradation, conflicts and crises (GWP 2000; 2003).

Moreover, unsystematic and uncoordinated usage combined with poverty result in unprecedented pollution and degradation. Poor people may overuse natural resources e.g. soils and forests for their livelihoods. For example, Pinstrup-Andersen and Pandya-Lorch (1995) report that since 1945, about 2 billion ha of the world's land (about 15% of vegetated soils) has been degraded. Of this, about 300 million ha are degraded to an extent that reclamation to their original state may not be practical. Asia and Africa alone account for two-thirds of the total degraded land. According to Pinstrup-Andersen and Pandya-Lorch (1995),

conversion of forested land to agricultural land is at the rate of 15 million ha per year while together, deforestation, overgrazing, and overexploitation due to fuel wood demands have, since 1945, resulted in about 70% of soil degradation worldwide.

One of the daunting water challenges the world is faced with is *securing water for domestic use and agricultural production* for its growing population (GWP 2000). Already over 1 billion people lack access to water and over 2.4 billion have no access to adequate sanitation (UNDP 2005). By the year 2025, 2-3 billion more people will require food (GWP 2000). An onward outlook into the next 50 years suggests that the world will witness a continual increase in the use of water due to increased demand from the agriculture sector to meet food requirements of growing populations (Gordon *et al.* 2005). The situation could be worse in developing countries where agricultural development is a catalyst for economic development and hunger and poverty appear to be closely linked (World Bank 2003; Rockström *et al.* 2007). For example, the sub-Saharan Africa region, which is entirely developing, faces daunting challenges. The region is characterized by seasonal rainfall, intermittent dry spells, recurrent drought years, high evaporative demand, and low soil fertility which are vulnerable to erosion (Falkenmark and Rockström 2004). Yields for food crops are low with cereal yields approximating 1 ton/ha with only 5% of agricultural land under irrigation. Furthermore, agricultural production is limited by dwindling per capita landholding and unpredictable availability of water resources as rivers supporting irrigation are increasingly being depleted, thereby limiting the potential for any irrigation expansion (Rothert 2000; Rockström *et al.* 2007).

The effect of unpredictable availability of water goes beyond the agricultural sector. It also poses a challenge to *protecting vital ecosystems* (GWP 2000). Water sustains natural ecosystems, enhances the quality of the natural environment, and supports human life (Meinzen-Dick and Rosegrant 2001). Terrestrial ecosystems enhance rainwater infiltration, groundwater recharge, and sustain the flow regimes of rivers. Both aquatic and terrestrial ecosystems provide habitats/spawning sites for wildlife (GWP 2000; MEA 2005), and timber, fuel wood, and medicinal plants which human beings utilize for economic purposes (GWP 2000). However, the existence of such vital ecosystems is continuously being threatened by water management practices which highly emphasize increasing supplies at the expense of conservation (Rothert 2000).

The need for good water resources management also stems from the fact that *precipitation*, the main source of freshwater, *varies in both time and space* due to changes in global climate (GWP 2000). Most parts of tropical and sub-tropical regions e.g. the southern Africa region, experience huge seasonal and annual rainfall variations. For example, average annual precipitation for the northern part of southern Africa ranges from 1000 to 4000 mm while the south receives between 250 and 1000 mm. This is despite the fact that on a regional basis, the region is considered water-rich with about 650 billion m^3 of annual renewable freshwater resources (Rothert 2000). Furthermore, the region's precipitation pattern varies seasonally i.e. six months (summer) wet season and a winter season of little or no rainfall at all (Rothert 2000). Also, natural meteorological changes result in droughts or floods with, for example, areas with average annual precipitation of between 400 and 600 mm experiencing drought once in every eight years (Rukuni 1995) and weather and climate-related disasters intensifying in recent decades (Vordzorgbe 2003). The challenge is how to deal with variations to ensure adequate and continued supplies without compromising the quality of the resource and that of ecosystems.

Finally, the *sectoral and fragmented approach to water resources management* is a catalyst for conflicting approaches to water management. The lack of consultation in setting sectoral policy objectives implies that interests of other stakeholders are not adequately (if at all) considered (GWP 2000). Consequently, resource use (both financial and physical) does not maximize the general welfare of human beings and water resources.

The aforementioned challenges make it hard to strike a balance between the use of water for livelihoods of the world's increasing population and the protection and conservation of water to sustain its functions and characteristics for future generations. In this context, Bucknall *et al.* (2006) observe that good water governance promises to be vital for striking the balance that ensures sustainable water resources management.

2.3.2. Governance and water

Various authors define and conceptualize governance differently (see Rhodes 2000) which may, among others, mean the state's manifestation of adaptation to its external environment; coordination of social systems (Pierre 2000); sustaining coordination and coherence among

various actors of different purposes and objectives (Rhodes 1997; Peters 2000); the way society decides to order itself (Bakker 2003); and "the exercise of political power to manage a nation's affairs" (WB 1992).

In spite of numerous meanings and conceptualizations, governance seeks to achieve effective regulation and attain accountability (Hirst 2000). In view of this, the United Nation Development Program (UNDP 2001) defines governance as

> "the exercise of economic, political and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences" (p. 12).

This definition, applied in this study: allows for a localized, context-specific conception about the way people make decisions and do things in practice (Cleaver and Franks 2005); highlights governance as process(es) of decision-making involving society at all levels; and is most relevant for use at the meso (district) and micro (local) levels of society (Franks 2004). This study was conducted at a micro level to feed national decision-making.

The rise in interest for governance is attributed to both conflict and corporation within groups of interdependent actors (Young 1994). Interdependence breeds conflict when actions of individuals to achieve their objectives result in negative outcomes on others. Conversely, interdependence yields cooperation when there are social and economic incentives to individuals for working as a group (Young 1994). High interdependence levels come along with collective-action problems which give rise to social concerns – the management of which requires an effective governance system (Young 1994). An effective governance system is characterized by the presence of social institutions (e.g. rules, codes of conduct) which are capable of making interdependent individuals work in harmony and corperation with others (Young 1994).

2.3.2.1. Water governance

As water problems are problems of governance (UNDP 2006), water governance presents a framework for dealing with decision-making and solving problems relating to water issues such as water rights, water resources management, storage, use, withdrawal, regulation, and allocation (Bucknall *et al.* 2006). Water governance is an essential process for achieving sustainable development, although, as a concept, it is still evolving. Even so, Rogers and Hall

(2003) provide a definition which is widely being used, according to which, water governance comprises

> "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (p. 7).

This definition recognises that: water governance involves multiple stakeholders; water governance process yields different outcomes; and implicitly, that outcomes of the water governance process may not be the same for different levels of society (Cleaver and Franks (2005). This underscores the importance of an effective governance system and recognition of existing relationships between various water-dependent users if sustainability of water resources and people's livelihoods are to be achieved (Elis 2001).

Rogers and Hall (2003) describe an effective water governance system as one which is open and transparent, inclusive (participatory), communicative, coherent, integrative, equitable, and ethical in its approach; and accountable, efficient, responsive, and sustainable in its performance and operation. Table 2.2 summarizes attributes of an effective water governance system.

Aware of critiques which brand the effective water governance system as a mere set of abstract terms and principles, Crook (1994) and Ikhide (1999) argue that effective water governance attributes can be achieved by employing decentralization as a strategy as it, politically, promotes greater pluralism, accountability, transparency, citizen participation and development; and administratively, reduces excessive workload on central governments to manageable levels (Crook 1994). Decision-making powers are transferred from central to local institutions, thereby enabling local authorities to decide on their own, and harnessing local knowledge, resources, and expertise in development processes (Ikhide 1999; Hussein 2004). As a consequence, services to local populations are efficiently and effectively delivered, and properly coordinated (Ribot 2002).

Table 2.2: Attributes of water governance
Source: Rogers and Hall (2003)

Principles of water governance	
Approaches	**Performance and operations**
Open and transparent • the use of language that is understood by all stakeholders • making policy decisions in a transparent manner	*Accountability* • clear roles and responsibilities among institutions • clearly defined rules and consequences for violation • clear arbitration enforcing mechanisms • accountability of decision-makers to the public
Inclusive and communicative • broad participation by all stakeholders • free flow of information among stakeholders in all directions • free expression by all	*Efficient* • ensuring environmental, political, and social efficiency • ensuring that governance systems do not impede action
Coherent and integrative • harmonization of policies • recognition and consideration of all water uses and users and their interrelationships • consideration of policy impacts on all water users and related sectors	*Responsive and sustainable* • taking decisions at the appropriate level • designing incentive-based policies • institutions should have long-term sustainability objective • policies must be demand driven, have clear objectives, consider future impacts while building on past experience
Equitable and ethical • provision of equal opportunities to people of all ages, different gender, and economic abilities to improve their livelihoods • equal penalties to offenders, and equal rewards to all	

The downside, however, is that poor or partial decentralization fails to deliver on its intended benefits i.e. efficiency, equity, service provision and development (Ribot 2002). This often happens when central offices only devolve responsibilities but not power. The consequence is that, instead of being strengthened, local structures are further weakened with excessive burden of responsibilities.

Fortunately, Principle 2 of the 1992 Dublin Water Principles[3]: "Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels" (GWP 2000, p. 14), emphasizes the importance of meaningful

[3] The Dublin Water Principles (GWP 2000, pp. 13-14):
1. "Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
3. Women play a crucial role in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognized as an economic good".

decentralization in water governance. The World Bank's (1994) argument for decentralized agriculture water is an advocacy for the transfer of responsibilities for the management of water resources and irrigation systems from governments to newly established local organizations or institutions such as water users associations (WUAs) (Norton 2004). WUAs offer numerous benefits to water users, and effective user participation improves access to information, reduces monitoring costs, establishes a sense of ownership among farmers, and increases transparency as well as accountability in decision-making (FAO 1993). However, the key factor for proper functioning of local organizations is legitimacy which can be achieved by, *inter alia,* establishing clear and proper roles for all concerned stakeholders, and motivating those involved to properly fulfill their roles (Norton 2004).

2.3.2.2. Water rights

Scholars often use the terms 'rights' and 'rules' interchangeably when referring to varied uses into which people put natural resources (Schlager and Ostrom 1992). However, rights and rules are not the same, since rights refer to "particular actions that are authorized" while rules are "prescriptions that create authorization" (Schlager and Ostrom 1992, p. 250). Rules are "generally agreed-upon and enforced prescriptions that require, forbid, or permit specific actions for more than a single individual" (Ostrom 1986 quoted in Schlager and Ostrom 1992, p.250). "A property right is the authority to undertake particular actions related to a specific domain" (Commons 1968 quoted in Schlager and Ostrom (1992, p. 250).

With regards to water resources, the most important property rights include rights of access, withdrawal, management, exclusion, and alienation (or transfer); and are grouped as either operational-level rights or collective-choice rights (Schlager and Ostrom 1992). Operational-level rights are those rights which concern exercising the authority and include access and withdrawal rights. On the other hand, collective-choice rights are rights whose holders have the authority to define the way rights should be exercised. Table 2.3 summarizes the two types of rights.

Table 2.3Common types of property rights in water resources
Source: Extracted from Schlager and Ostrom (1992) and Schlager (2005)

Type of property right	Right	Description
Operational-level	Access	• The authority to enter a physical resource e.g. water resources • Rules specify the requirements an individual or a group must satisfy for them to enter the resource
	Withdrawal	• The right to obtain appropriate water
Collective-choice	Management	• Right to regulate the use of the resource • The right to improve the resource • The right to determine mechanisms, time, and place of withdrawing the resource
	Exclusion	• Rights of determining who should access the resource and how the right may be transferred (i.e. defines qualifications individuals or groups must meet in order to access the resource
	Alienation (transfer)	• These are rights permitting rights holders to transfer part all of their rights to another holder either through sale, lease or both

The ever increasing scarcity of water is posing severe challenges for both development and environmental sustainability. This is exacerbated by increased world water usage and resulting fierce competition for the resource (Rosegrant *et al.* 2002). In the presence of multiple users of, and uses for water (Gardner *et al.* 1990; Meinzen-Dick 2007), adopting water rights system becomes crucial for ensuring that the resource is utilized equitably and sustainably. If irrigation reforms which are assumed to be a viable strategy for improving the state of the environment and people's lives are to deliver, assigning clear water rights is critical (Shah *et al.* 2002).

2.4. Livelihoods

2.4.1. Definition and concepts

The Oxford Dictionary and Thesaurus (Jewell 2002) defines livelihood as 'means of living'. Ellis (2000a) notes that this definition directs the attention on the way people attain their living rather than on the 'net results' such as income or consumption which people achieve. Nevertheless, the concept is widely used in rural development and poverty literature, sometimes vaguely and in differing ways (Ellis 2000a). Chambers and Conway (1991) have so far offered the most popular definition which most scholars e.g. Carswell (1997); Hussein

and Nelson (1998); and Scoones (1998) adopt: *"a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living"*. By adopting this definition, the study considers different characteristics of different households which enable or hinder them to acquire and utilise different assets; and engage in different activities in order to earn a living. Concepts of the definition are explained below.

'*Capabilities*' refers to the ability of individuals to realize their potential as human beings, in the sense both of being (i.e. to be adequately nourished, free of illness and so on) and doing (i.e. to exercise choices, develop skills and experience, participate socially and so on) (Sen 1993; 1997). In short, 'capabilities' means the set of alternative beings and doings that a person can achieve with his or her economic, social, and personal characteristics (Dreze and Sen 1989).

Scoones (1998) lists five categories of capital constituting *assets* which Ellis (2000a) describes as follows:

1. *Natural capital:* the natural resource base (e.g. land, water, trees) that yields products utilized by humans for their survival;
2. *Physical capital*: assets brought into existence by economic production processes, e.g. tools, machines, and land improvements like terraces or irrigation canals;
3. *Human capital*: the education level, skills, health, and the status of individuals and populations;
4. *Financial capital*: stocks of cash that can be accessed in order to purchase either production or consumption goods, and access to credit; and
5. *Social capital*: the social networks and associations in which people participate, and from which they can derive support that contributes to their livelihoods. Social capital covers personalized networks and even more formal manifestations of community organization such as co-operatives, farmers associations, village committees, etc.

Access to capital, opportunities, and services is the key element for individuals or households for their sustenance. *Access* refers to the ability to participate in, and derive benefits from social and public services such as education, health services, roads, water supplies etc (Ellis 2000a). Access may also be defined by (a) rules and social norms that determine the differential ability of people to own, control, claim, or make use of resources (Scoones 1998);

and (b) the impact of social relations e.g. gender or class, on this ability. Due to the importance of gaining access to assets and services by the rural poor, social relations, and institution, this study uses the modified Chambers and Conway's (1991) livelihood definition as presented by Ellis (2000a):

> "A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household" (p.10).

This definition introduces the concept of *'institutions'* which North (1990) define as "rules of the game in society or … the humanly devised constraints that shape human interaction". Locally, institutions determine the local rules governing access to community resources such as grazing areas and forest; customs and rules regarding access to land, land tenure and security tenure (Ellis 2000a; 2000b). It is, however, worth noting that institutions at local level may overlap, work differently or even conflict with those operating over larger territories.

2.4.2. Livelihood strategies, activities, and household income

Livelihood strategies are composed of activities that generate the means of household survival. Households adopt, or adapt to specific strategies as a result of their endowment in assets, social factors, and external trends and shocks (Ellis 2000a; 2000b). In the case of rural households, livelihood activities may be categorized as either natural resource or non-natural resource based (Table 2.4).

Table 2.4: Categories of rural livelihood activities and their corresponding example
Source: Adapted from Ellis (2000a) with modifications

Category of livelihood activities	Examples of activities
Natural resource based	• Collection or gathering (e.g. from woodlands and forests) • Food cultivation • Non-food cultivation • Livestock keeping and pastoralism • Non-farm activities (brick making, thatching, weaving, etc)
Non-natural resource based	• Rural trade (marketing of farm outputs, inputs, and consumer goods) • Rural services e.g. bicycle repair, vehicle repair etc • Rural manufacture • Remittances (urban and international) • Other transfers e.g. pensions

There are three main livelihood strategies for rural communities i.e. agricultural intensification or extensification, livelihood diversification, and migration (Scoones 1998).

Both **agricultural intensification** (intensifying resource) and **extensification** (bringing new land into use) imply continued or increasing reliance on agriculture as a strategy and natural resources e.g. land as the key asset. However, such reliance on natural resources often brings communities and institutions responsible for conservation or preservation of natural resources into conflict (Anthony 2007). This highlights the need for a coordinated approach in the use and management of natural resources between users primarily dependent on natural resources for their livelihoods and institutions charged with the responsibility of conserving natural resources. **Livelihood diversification** concerns non-farm rural employment while **migration** is about certain household members leaving their homes for labor elsewhere and sending remittances back home for the survival of the household (Ellis 2000a).

2.4.2.1. Household income

The composition and level of individual or household income at a given point in time is the most direct and measurable outcome of the livelihood process as livelihood and income are closely related (Ellis 2000a). As such, income provides a direct measure of the outcome of livelihood strategies for an individual or household. Ellis (2000a) describes three main categories of rural income i.e. farm, off-farm, and non-farm income. *Farm income* is income generated from own-account farming, whether on owner-occupied land, or on land accessed through cash or share tenancy. This includes livestock as well as crop income, and comprises both consumption-in-kind of own-farm output and the cash income obtained from output sold.

Off-farm income refers to wage or exchange labor on other farms (i.e. within agriculture). Simply put, it is income generated within agriculture or from environmental resources other than from own-account farming. It includes labor payments in kind such as the harvest share systems, other non-wage labor contracts, and income obtained from local environmental resources such as firewood, charcoal, house building materials, and wild plants – where valued and measured (Ellis 2000a). Finally, *non-farm income* refers to income from non-agricultural sources. This may include non-farm rural wage or salary employment, non-farm rural self-employment (business income), rental income obtained from leasing land or property, urban-to-rural remittances arising from within national boundaries; other urban transfers to rural households e.g. pension payments to retirees; and international remittances arising from cross-border and overseas migration (Ellis 2000a).

2.4.3. Livelihood diversity and diversification

Ellis (2000a) defines diversity and diversification as follows: diversity refers to *"the existence, at a point in time, of many different income sources"* (p. 14) while diversification refers to *"the creation of diversity as an ongoing social and economic process, reflecting factors of both pressure and opportunity that cause families to adopt increasingly intricate and diverse livelihood strategies"* (p. 14). Rural livelihood diversification is, thus, defined as *"the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living"* (p. 15). In the rural development context, both diversity and diversification imply households moving away from relying on farming as the main livelihood activity towards other non-farm activities and not just the existence of multiple income sources (Ellis 2000a; 2000b). Hence, livelihood diversification is viewed in terms of both the number of livelihood activities and the contribution of each activity to the total household income – or the reliance of the household on the particular activity (Ashley *et al.* 2003; Ellis 2001).

Livelihood diversification has varying effects to households, society, and the environment. For example, if an additional economic activity to the household offers it higher returns than the usual activities would, the household adopts it and lives quality life and/or accumulates more assets. This is referred to as **'pull'** or **positive diversification** (Ashley *et al.* 2003). Indicators of positive diversification may include buying new assets such as water pumps for irrigation, finding reliable employment, establishing small businesses like grocery shops, etc. But, if returns from new livelihood activities are lower than they were from usual activities, households tend to fight for survival by designing and adopting response or coping strategies. Ashley *et al.* (2003) refer to this as **'push'** or **negative diversification**. Households in negative diversification will, among others, sell their assets such as land and livestock to survive, and others will work in the fields of their creditors to repay the owed dues. Diversification ensures that households spread risks from adverse weather conditions to ensure food security (Reardon *et al.* 1992; Ellis 2000a; 2000b). On the other hand, diversifying livelihoods may expose households to uncertainties and shocks which could be counterproductive to the very reason for diversifying (Ellis 2000b).

From an environmental perspective, livelihood diversification is a viable policy strategy for sustainable natural resources management. Diversification into non-natural resource income

generating activities may reduce or take pressure off natural resources. For example, substitution in time spent on farming and gathering for non-farm labor, and substitutions that would occur in consumption e.g. consumption of firewood for paraffin, would be a positive step towards conservation (Ellis 2001). Furthermore, transformation from permanent or full-time to part-time nature of natural resource-based activities is a major positive implication of diversification for sustainable natural resource management. For example, part-time farming, fishing, and dependence on forests, would change the way natural resources are being managed, type of technology used, and "the relevance of community institutions that govern access to them" (Ellis 2001). However, diversification may also be a hindrance to other poor households especially when policy implementation prevents or restricts use of natural resources without considering ability of households to successfully diversify. In such cases, diversification would mean depriving other households of resources for income generation (Ellis 2001).

2.4.4. Sustainable livelihoods

"A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base" (Chambers and Conway 1991). The World Commission on Environment and Development (WCED 1987) introduced the concept of sustainable livelihoods by proposing the term "*sustainable livelihood security"*. Security was defined as *"secure ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies"* and sustainable as *"the maintenance or enhancement of resource productivity on a long-term basis"*. The Commission (WCED 1987) noted that households gain sustainable livelihood security through:

- ownership of land, livestock or trees;
- rights to grazing, fishing, hunting or gathering;
- stable employment with adequate remuneration; or
- varied repertoires of activities.

The sustainable livelihoods framework (Figure 2.1) summarizes major factors influencing livelihoods of rural people and relationships between the factors (DFID 1999). The framework highlights five key interacting elements i.e. context, resources (assets),

institutions, strategies, and outcomes. In order to understand livelihoods, the framework guides an investigation through the question:

> "Given a particular ***context*** (of policy setting, politics, history, agroecology and socio-economic conditions), what combination of ***livelihood resources*** (different types of 'capital') result in the ability to follow what ***livelihood strategies*** (agricultural intensification/extensification, livelihood diversification and migration) with what ***outcome***? ***Institutional processes*** (embedded in a matrix of formal and informal institutions and organizations) mediate the ability to carry out strategies and achieve (or not) outcomes" (Scoones 1998, p.3).

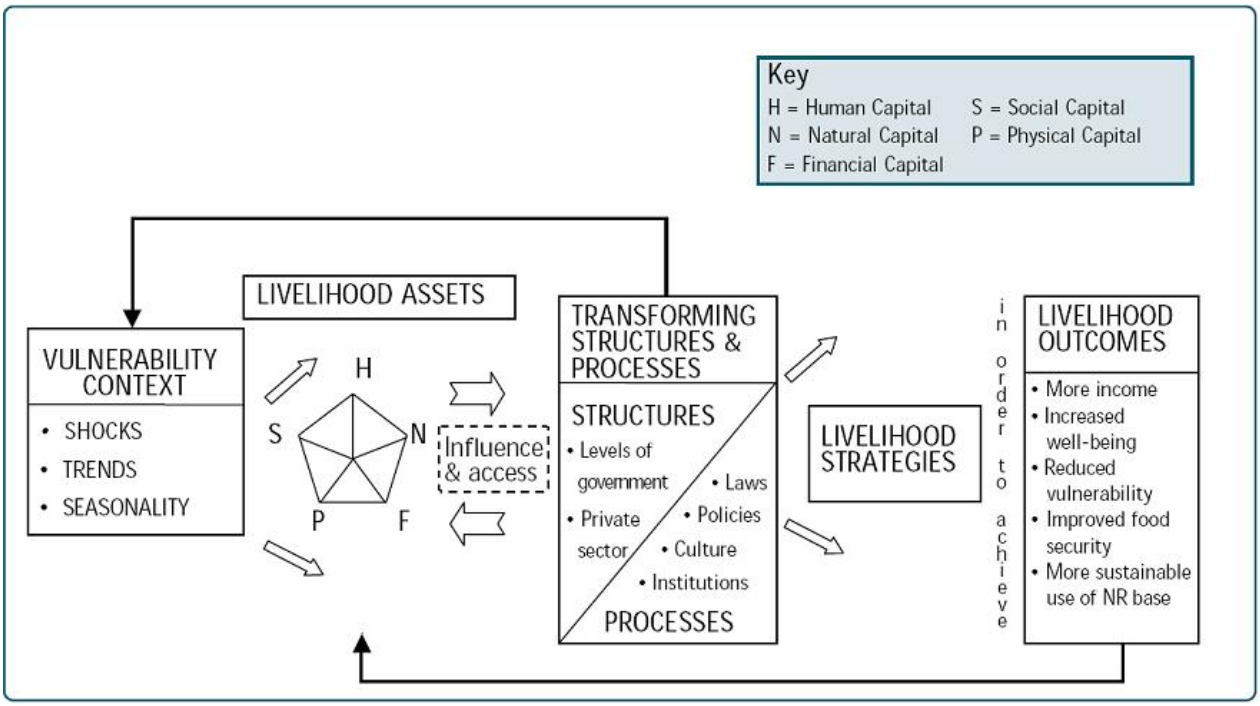

Figure 2.1: Sustainable livelihoods framework
Source: DFID 1999

2.4.5. Water, agriculture, and rural livelihoods

Communities often build their living around various livelihoods derived directly or indirectly from natural resources. Water is one such natural resource that plays crucial and multiple roles in sustaining rural people's well-beings. However, in terms of policy, tensions exist between seeking to alleviate poverty via irrigation programs and seeking to conserve or generate other values by using water elsewhere. Studies have also shown that there are often conflicts between communities which primarily depend on natural resources for the livelihoods and institutions managing the resources (Anthony 2007). Hence, sustaining water-dependent livelihoods of rural communities demands that water use between upstream and downstream users is effectively reconciled (Lankford 2003) through effective governance and

coordination. The study by Lankford (2003) in Usangu, Tanzania shows that local farmers tend to integrate across various socio-economic endeavors and that farmers' water management standards connect with wider livelihood system conditions.

Most rural livelihoods depend on agriculture either directly (growing crops and rearing livestock) or indirectly (e.g. establishing businesses dependent on agriculture for cash as capital or for raw materials). Such livelihoods appear in the course of a system at different stages. For example, in the case of irrigation agriculture, three stages of an irrigation scheme are identified which have a bearing on the progress of rural livelihoods (Lankford 2003). The first early stage when irrigation is just being established, livelihoods tend to focus more on other activities than irrigation because markets and services for irrigated crops are poorly developed and farmers are uncertain of the benefits of the irrigated agriculture. Over time, as population expands and infrastructure improves, irrigation becomes more viable. Lankford (2003) further observes that in this second stage, market developments, livelihoods, and irrigation experience progress simultaneously, generating a self-perpetuating interest in irrigation and support for that irrigation. The final stage is when irrigation has fully expanded. In this stage, other sectors, which also have growing needs for water, start experiencing water shortages (Lankford 2003). It is in this stage that livelihoods may be affected either positively or negatively by the introduction of new policies. This stage of multiple water users implies the need for constraint, water sharing, management and conflict mediation.

In the context of irrigation policy reform, this study uses the water governance and poverty analytical framework (see section 2.5) which combines concepts of sustainable rural livelihoods, governance, sustainable water resources management, and social policy to understand the extent to which the reform is influencing the governance/management of water resources and rural people's livelihoods. The water governance and poverty analytical framework also enables understanding of how upstream and downstream water demands are negotiated and met, and how conflicts are resolved (Franks and Cleaver 2007).

2.5. The water governance and poverty analytical framework

The investigation of the influence of policy reform on water resources management and sustainable rural livelihoods cuts across, and draws upon, several theories. This research utilizes Franks and Cleaver's (2007) **Water Governance and Poverty Analytical**

Framework (Figure 2.2) which draws from a wide range of theories and concepts including effective water governance (Rogers and Hall 2003), social structuration theory (Giddens 1984), new institutionalism theory (March and Olsen 1984), sustainable livelihoods (Chambers and Cornway 1992; Scoones 1998; Ellis 2000b; DFID 1999), and poverty (CPRC 2004).

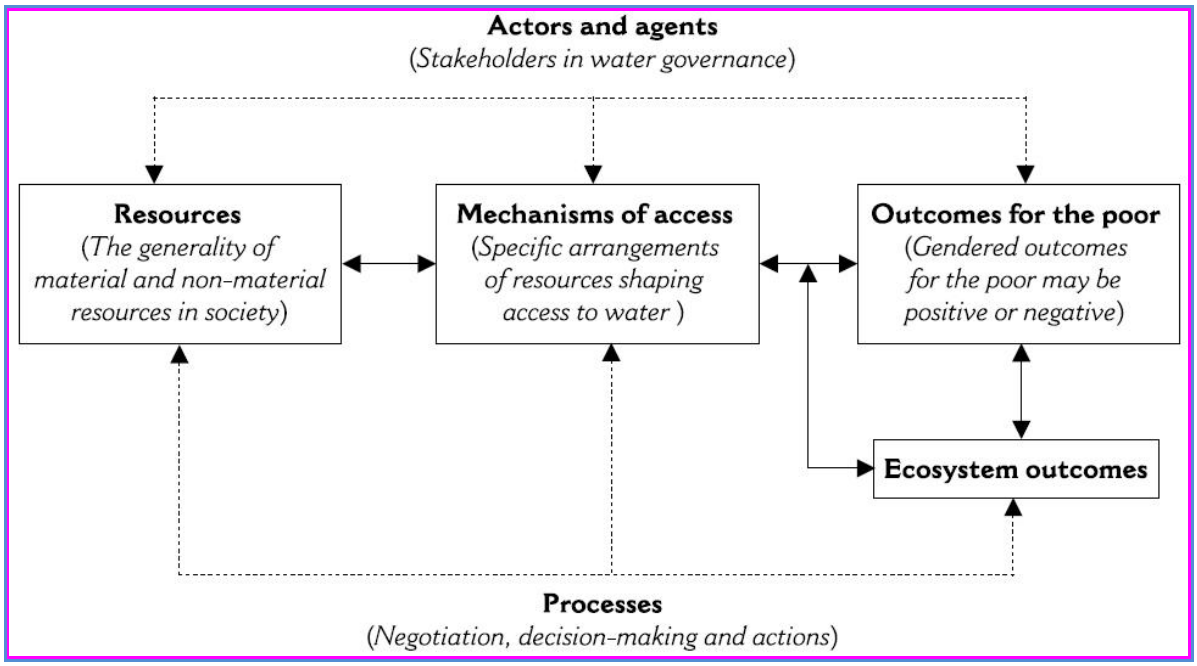

Figure 2.2: The Water Governance and Poverty Analytical Framework
Source: Franks and Cleaver (2007)

By drawing from a wide range of theories and emphasizing outcomes, the framework provides useful theoretical perspectives for understanding the influence of irrigation policy reform, including governance of irrigation water on the rural poor and ecosystems (Franks and Cleaver 2007). The framework suits the current case due to its successful use in understanding the influence of water governance on the rural poor and the environment in irrigation systems in other sub-Saharan Africa parts e.g. Kimani Catchment in the upstream of the Usangu Basin of the Great Ruaha River in Tanzania (Cleaver and Franks 2005; Franks and Cleaver 2007). Five main concepts i.e. ***resources, mechanisms, outcomes, processes,*** and ***actors/agents*** constitute the fundamental aspects of the framework.

2.5.1. Theoretical underpinnings of the framework

'Resources' is conceptualized as both "material and non-material properties of social systems from which human governance of water is constructed". It encompasses institutional resources such as rules of social life and resource allocation, social resources, resources of

rights and entitlements, financial resources, human capabilities, the natural environment and technology (Cleaver and Franks 2005; Franks and Cleaver 2007). In the sustainable livelihoods literature, resources are referred to as assets or capitals (see 2.4.1) categorized into five types i.e. natural capital (e.g. land, water, trees), financial capital (e.g. cash stock, access to credit), physical capital (e.g. tools, treadle pumps, land improvements like irrigation canals), social capital (e.g. networks, community organizations, farmers' associations, village committees or councils), and human capital which may be education, health status, etc (Scoones 1998; Ellis 2000b; DFID 1999). Individual or household possession of, or access to, resources determines the type of livelihood activities they engage in (Ellis 2000b). Hence, understanding how water resources are accessed or governed is vital for building sustainable livelihoods for the resource-dependent rural poor.

Mechanisms of water governance or mechanisms of access to water are "particular context-specific arrangements for organizing access to water … which can be negotiated and … are likely to change over time". They encompass "a variety of mediators of access ranging from formalized institutions (such as water user associations) through socially embedded norms of 'proper' use, to particular technologies (hand pumps, pipes, …)" (Franks and Cleaver 2007, p.295). In their effort to use, manage, or regulate water resources, different actors (individuals, households, groups, etc) draw upon resources in differing ways to construct arrangements for water governance. The level of access different players have to resources is defined by rules and social norms that determine the ability of people in rural areas to own, control, claim, or make use of resources (Scoones 1998); and the impact of social relations e.g. gender or class, on this ability (Ellis 2000). Understanding how different players negotiate and shape their access to water is, thus, essential for positive policy outcomes (Bruns and Meinzen-Dick 2001; Cleaver *et al.* 2005).

Impacts and ***outcomes*** of water governance mechanisms for the poor and ecosystems are shaped by processes of management and routine practice. Outcomes can be grouped into different categories:

a) basic access to water i.e. quantity available for use, quality, spatial and temporal availability, and timeliness and fairness (equity) of water delivery, etc;
b) social relations and processes i.e. whether and how the governance system yields trust, cooperation, conflicts or instances of inclusion and exclusion;

c) livelihoods i.e. the influence of water use by the poor on their ability to support their livelihoods and improve their economic status; and how the availability of water induces diversity in livelihood strategies; and
d) power and influence i.e. how the poor gain political voice and representation in structures of decision-making.

Changes in livelihood outcomes may have profound effects on the poor e.g. individual or household access to existing resources may increase, stakeholders may be enabled to access new resources which they could not access in the past, and new access mechanisms may be adopted e.g. adoption of new technologies of water access. Furthermore, outcomes for ecosystems are critical for the rural poor who rely on the ecosystem for their livelihoods. Some outcomes for water resources can include dramatic changes in river flows, levels, and volumes which stakeholders may experience immediately while others may take long to detect and have long-term effects of the poor's livelihoods. Environmental changes have profound effects on the poor and their outcomes which in turn result in changes which further affect the direction and pace of environmental change (Mehta *et al.* 2001).

Franks and Cleaver (2007) conceptualize ***processes*** as "the conscious or unconscious activities of negotiation, decision-making and action, which produce changes in the pattern or configuration of resources, mechanisms and outcomes of water governance". This implies that mechanisms of water governance are both consciously and unconsciously constructed by actors and may result in both intended and unintended outcomes. Processes of management and practice transform resources through specific water access mechanisms into water governance outcomes for the poor.

Actors or ***agents***[4] may include individuals, groups, the state, etc, who shape and are shaped by resources, mechanisms and outcomes, through a range of processes. By doing so, actors construct mechanisms of water governance and their interaction produces governance. Individualized acts and flow of action produce both intended and unintended consequences (Giddens 1984) signifying that different actors participate in water governance processes both consciously and unconsciously.

[4] The terms 'actors' and 'agents' are used interchangeably with 'actors' being commonly used in development literature and 'agents' in social theory (Franks and Cleaver 2007).

2.5.2. Interrelationships among concepts

Different stakeholders draw opon different *'resources'* in a variety of ways in order to generate arrangements suitable for organizing their water access arrangements. These arrangements, referred to here as *'mechanisms'* of water governance, are particular to different contexts and shape *'outcomes'* for both the poor and ecosystems (Cleaver and Franks 2005; Franks and Cleaver 2007). "At each interface in the framework, *actors* are recursively implicated (being shaped and shaping resources, mechanisms and outcomes). Mechanisms are fashioned from resources by actors 'managing' and 'practising' *processes* of water governance. The outcomes of such mechanisms are likewise shaped by context-specific processes of management and practice" (Franks and Cleaver 2007; p.293).

2.6. The Republic of Malawi

2.6.1. Historical brief

Malawi was established under the British rule as a British Central African Protectorate in 1891. In 1907 it changed its name to Nyasaland. In 1953 the Federation of Rhodesia and Nyasaland comprising three countries under the British rule i.e. Northern Rhodesia (now Zambia), Southern Rhodesia (now Zimbabwe), and Nyasaland (now Malawi) was created. In 1964, Nyasaland became an independent state of Malawi under the leadership of Dr. Hastings Kamuzu Banda of the Malawi Congress Party (MCP). In 1966 the country gained a republican status (NSO 2008).

Dr. Banda governed Malawi under the one-party authoritarian rule until early 1990s. He trained members of his youth paramilitary arm, the Malawi Young Pioneer (MYP), in various technical enterprises including irrigation and used them to establish his control over the country (Chirwa 2002; Ferguson and Mulwafu 2007). He placed MYP members in irrigation schemes with the apparent reason of teaching local farmers irrigation farming, while at the same time they were an eye for the Banda regime enforcing its dictatorial rule (Chirwa 2002). Some MYP members were even placed in institutions such as schools, apparently to teach Physical Education. It was not surprising for the governing party, MCP, to declare Dr. Banda its life president in 1970, and in 1971 the life president of the country. However, the country underwent political unrest and pressure mounted to have the governance system changed to multiparty democracy. In 1993 the country held a referendum and rejected the one party rule (Ferguson and Mulwafu 2007). In 1994 the first general elections were held which saw the

opposition United Democratic Front (UDF) winning the election with Dr. Bakili Muluzi as the first president in the multiparty democracy era.

2.6.2. Geography and climate

Malawi is a landlocked country with a total area of 118,483 km^2, of which 94,275km^2 (~80%) is land and 24,208 km^2 (~20%) water. The country is a sub-Saharan Africa country – part of Southern Africa (Figure 2.3), lying south of the equator between latitudes 9˚ 22" and 17˚ 03"S and between longitudes 32˚ 40" and 35˚ 55"E. It has a total length of about 900 km and a maximum width of about 250 km (FAO 2005). To the north and northeast it is bordered by the United Republic of Tanzania, to the west by the Republic of Zambia and to the southwest, south and east by the Republic of Mozambique (refer to Figure 2.4). The country's topography is divided into four major physiographic zones: 1) highlands of Mulanje, Zomba and Dedza; 2) the plateau of the central and northern regions; 3) the rift valley escarpment; and 4) the rift valley plains along the lakeshores of Lake Malawi, the Upper Shire and Lower Shire Valleys. The lowest altitude is 30 meters (the southern tip of the country where it borders Mozambique), and the highest point is Sapitwa (3,002m) at the top of Mulanje Mountain.

Figure 2.3: Location of Malawi in Africa
Source: NSO 2008

The Malawi climate is subtropical influenced by its position within the sub-continent in relation to the pressure and wind systems of the southern hemisphere and by the huge water

mass of Lake Malawi. The main features influencing the country's climate and precipitation include: the movement of the Inter-Tropical Convergence Zone (ITCZ), which is the main rain-bearing mechanism and associated belts of distribution; the Congo Air Boundary (CABS), which is a north-westerly moist air mass responsible for reliable and moderate to heavy precipitation over the country; the winter Asian monsoon, which contributes to precipitation from November to February; and the tropical cyclone and depressions from the south-west Indian Ocean entering the country through Mozambique (Chigwada 2004).

Malawi experiences two main annual seasons i.e. dry season (May to October) and wet season (November to April). From mid-November to April, it is hot and wet with almost 90% of annual rainfall occurring during this time. The wettest months are December and January. The annual rainfall ranges from 700 to 2400 mm with a mean annual rainfall of 1180 mm (FAO 2005). Rainfall distribution is mainly influenced by topography with high altitudes and mountainous areas receiving higher rainfall than low lying areas. Like rainfall distribution, temperatures are influenced by topography too. Temperatures decrease with increasing altitude with the mean maximum temperature of 28°C and minimum temperature of 10°C in plateau areas, and 32°C and 14°C respectively in the rift valley plains. Highest temperatures occur in October/November and lowest temperatures in June/July. The country's minimum and maximum temperatures vary spatially (FAO 2005).

The influence of climate change on the country is predicted to be the same as other countries within the southern Africa region. Regional temperature trends show that the region is warmer now than it was about 100 years ago (IPCC 1996). During the 20th century, average temperature rose by 0.7°C in Africa. The IPCC further predicts that the region's temperature will rise by between 0.2°C (low scenario) and 0.5°C (high scenario) per decade. A decrease in rainfall of about 5-15% during the growing season (November to May) is predicted and will bring about some water stress on countries within the region.

2.6.3. Administration

Administratively, Malawi is divided into three regions namely Northern, Central, and Southern regions each being made up of districts (Figure 2.4). The Northern Region has six districts, the Central Region comprises nine districts, and the South has thirteen districts. This

study was conducted at Wovwe in the country's northern district of Karonga in the Nkhata Bay Cassava Livelihood Zone (see 2.6.8.1).

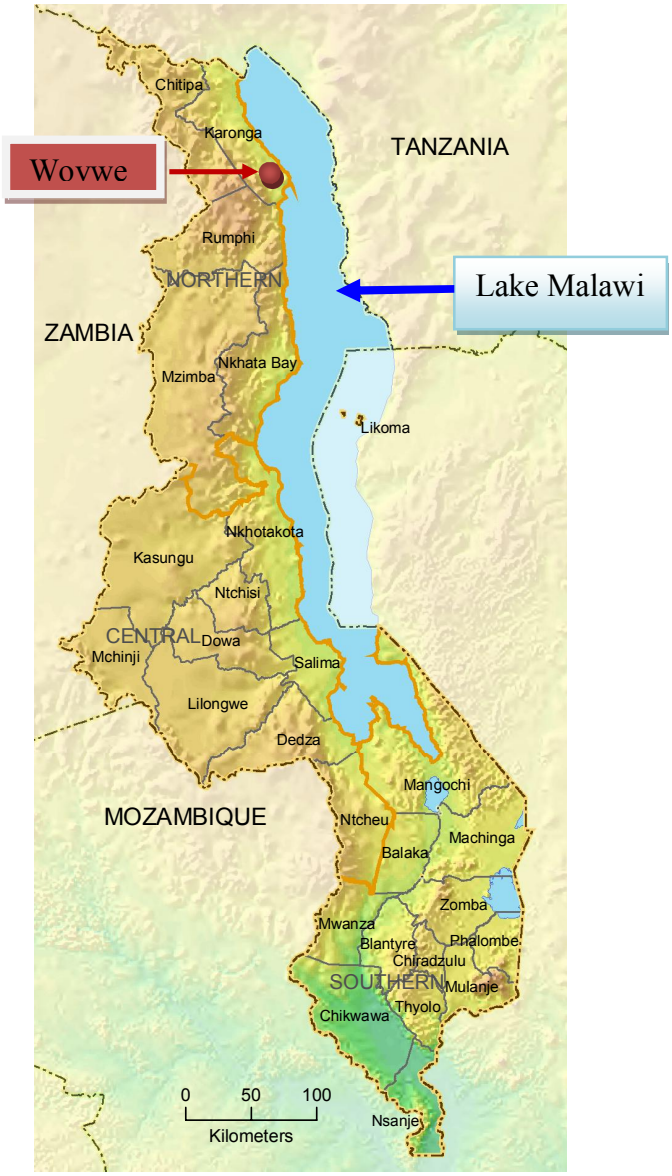

Figure 2.4: Map of Malawi showing regions and districts and its location in relation to its neighbors
Source: FEWSNET 2003

2.6.3.1. Local governance

In order to improve the local governance, the district is headed by the District Commissioner (DC) who is assisted by traditional leaders in managing the affairs of the district. The DC has overall powers over all affairs within the district including those of the WUAs. Traditional Authorities (TAs) report to the DC and oversee Village Heads through Group Village Heads (GVH) within their area of jurisdiction (GOM 2005a). Village Heads distribute land, settle disputes, and are local focal points for identifying the needy beneficiaries of any development

assistance or intervention including beneficiaries of agricultural subsidy programs and recipients of treadle pumps.

In every TA area, there is an Area Development Committee (ADC) which, among other things, sets development priorities for the area; brings together community members and resources for self-help projects; and supervises, monitors, and evaluates the implementation of projects at the TA level. The TA advices the ADC and has powers to intervene in all disputed matters between villages and local organizations in his area (GOM 2005a). On complex issues the TA refers the matter to the DC for further redress.

Traditional or local governance structures have a large influence on the governance of natural resources, including settling of related disputes, in Malawi and other African countries. Russell and Dobson's (2011) study shows that traditional chiefs in Malawi play a critical role in facilitating sustainable management of natural resources and maintenance of livelihoods of the resource-dependent households. Due to the importance of local governance structures, research by Anthony *et al.* (2010) on human-wildlife conflict in South Africa argue for the adoption of systems of good natural resources management which are developed and empowered locally and, are mutually agreed upon by relevant stakeholders.

2.6.4. Socio-economic status

Malawi has a population of about 13,066,320 persons representing an increase of 32% from the last census in 1998 with a mean annual national population growth rate of 2.8%. Intercensal growth rates have, since 1966, varied between 2.0% and 3.3% (Figure 2.5)[5]. The population density has increased from 85 to 139 persons per square kilometer over the past three decades i.e. from 1977 to 2008 (NSO 2008) making it one of the highest in sub-Saharan Africa.

[5] The drop in intercensal population growth rate to 2.0% by 1998 was due to the return of Mozambican refugees after the end of civil war in Mozambique (NSO 2008).

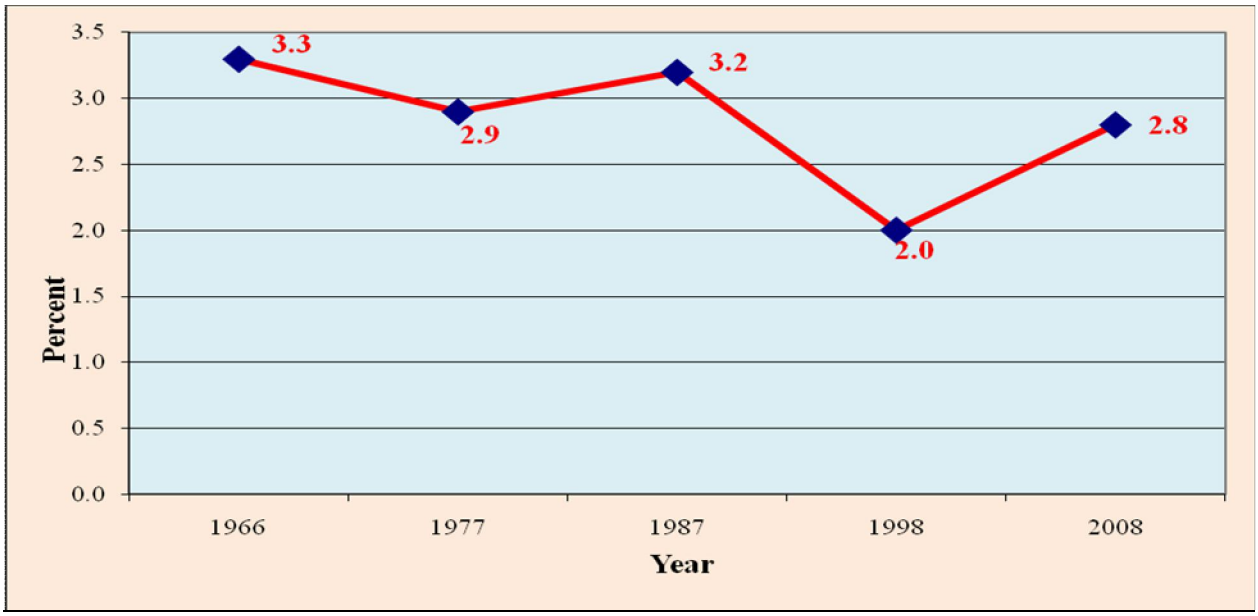

Figure 2.5: Malawi's annual intercensal population growth rates from 1966 to 2008 (%)
Data source: NSO (2008)

The 2008 population census reveals that all the three regions recorded increases in annual intercensal population growth rates and intercensal population in the decade (1998-2008). The Northern Region and Karonga district, where this study was conducted, recorded some of the highest growth rates and population increases (Table 2.5). With 89% of the country's population living in rural areas (NSO 2003) and the agriculture sector employing 90% of the country's total workforce (NSO 2000), the rapid population growth is resulting in increased pressure on land. For example, there have been significant reductions in fallow periods for restoring soil fertility in the smallholder farming systems; and rapid expansion of cultivation to marginal and less fertile areas (FAO 2005) resulting in severe deforestation, soil erosion and a general degradation of natural resources (see 2.6.5).

Table 2.5: Annual population inter-censal (1998-2008) growth rates and increases by region and for Karonga
Data source: NSO (2008).

Region/District	Intercensal annual growth rate (%)	Intercensal population increase (%)
Northern Region	3.3	38.5
Central Region	3.1	35.5
Southern Region	2.4	26.4
Karonga District	3.4	38.7
Malawi	2.8	32

In order to ease the problem of land, particularly in the southern region where land shortage is more severe than in other regions of the country, the government introduced the ***"Kudzigulira Malo Project"*** where the government acquires idle estate land and reallocates it to the landless households (GOM 2010). This scheme benefited about 1400 households in the 2008/09 financial year which starts every year on 1st July (GOM 2010).

Malawi is one of the least developed and poor countries (NEC 2002; EAD 2003) with a Human Development Index (HDI) of 0.464 in 2000 ranking it 163rd out of 174 countries (FAO 2005). The majority of the country's population (60%) live below the poverty line (<US$1 per day) and of the poor, about 89% are rural, and dependent on agriculture as their key source of income and livelihood (NSO 2003). With its narrow economic base of no significant mineral resources, high population density (NSO 2008), and its land-locked status with prohibitive costs of external trade, the country is heavily dependent on agriculture for its economic development and food security (EAD 2003). For example, in 2003 agriculture contributed 37.6% to the country's Gross Domestic Product (GDP) of US$1700 million. About 90% of export earnings come from agriculture with tobacco contributing the largest share of 60% and providing employment for 81% of the economically active population (FAO 2005). The agriculture sector employs 90% of the total workforce of the country (NSO 2000).

2.6.5. Water resources

Malawi is relatively water abundant with lakes, rivers, and aquifers being the main forms of water storage. Renewable water resources are estimated at 17.28 km^3/yr of which 16.14 km^3/yr are internally produced, about 1 km^3/yr is externally produced i.e. comes from Mozambique through the Ruo River, and 0.14 km^3/yr comes from Lake Chiuta which is shared with Mozambique. Internal groundwater resources are estimated at 1.4 km^3/yr (FAO 2005). Surface water sources constitute the main water resources which include a network of river systems and lakes i.e. Lake Malawi, Lake Chilwa, Lake Malombe, and Lake Chiuta. Surface waters constitute over 20% of the country's total area (EAD 2003). The country also has vast wetlands which, apart from lakes and rivers, also include numerous reservoirs spread across the country and marshes. The distribution of water resources varies depending on season and geography i.e. about 90% of runoff in rivers takes place between December and June (FAO 2005).

The main water uses in Malawi include those for agricultural, domestic, and industrial purposes[6] with irrigated agriculture being the main user of water (Figure 2.6). Overall, water withdrawal increased from 0.93km^3 in 1994 to 1.005km^3 in 2000 with proportions of withdrawal for domestic and industrial purposes rising from 10.1% and 3.4% in 1994 to 2000 withdrawal proportions as seen in Figure 2.6. However, the proportion of water withdrawal for agricultural purposes dropped from 86.4% in 1994 to 80.6% in 2000 (FAO 1995; 2005). This indicates that in recent years, other sectors are increasingly competing for water with the agriculture sector.

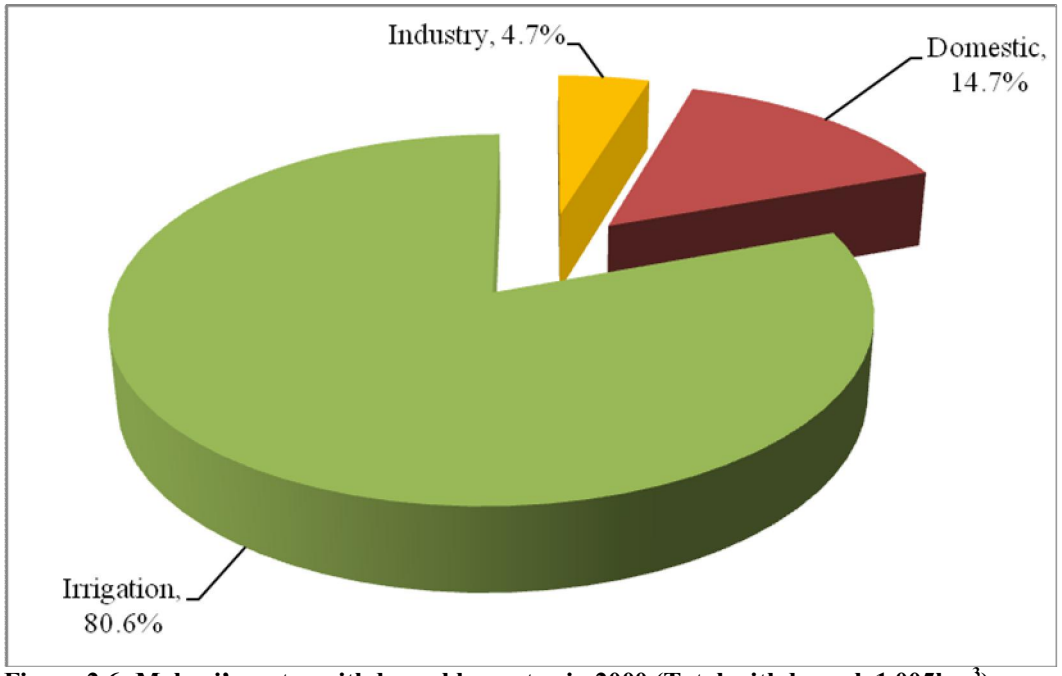

Figure 2.6: Malawi's water withdrawal by sector in 2000 (Total withdrawal, 1.005km^3)
Data source: FAO 2005

Generally, key environmental problems in order of their seriousness include soil erosion, deforestation, water resources degradation and depletion, threat to fish resources, threat to biodiversity, human habitat degradation, high population growth, air pollution, and climate change (EAD 2003). The state of water resources is characterized by declining amounts for domestic, irrigation, and industrial purposes; falling reservoir and river flow depths as a result of sedimentation; inadequate rainfall to sustain normal replenishments; reduced base flows

[6] "**Agricultural** uses of water primarily include irrigation and, to a lesser extent, livestock maintenance. **Domestic** uses include drinking water plus water withdrawn for homes, municipalities, commercial establishments, and public services (e.g. hospitals). **Industrial** uses include cooling machinery and equipment, producing energy, cleaning and washing goods produced as ingredients in manufactured items, and as a solvent" (EarthTrends 2003).

due to high siltation rates; and high pollution levels and deterioration of water quality (EAD 1998). These negatively affect both the economy and people's livelihoods. For example, 13 to 29 tonnes of soil per hectare are lost each year translating into an annual crop yield loss of between 4% and 11% (EAD 2003).

2.6.6. Agriculture

The Ministry of Agriculture and Food Security (MoAFS), emphasizes Malawi's continued dependency on agriculture for economic growth, food security, and improved livelihoods of the people (GOM 2004). It divides the country into eight agroecological zones called Agricultural Development Divisions (ADDs)[7] i.e. Blantyre, Karonga, Kasungu, Machinga, Mzuzu, Ngabu, Salima, and Shire Valley ADDs (Figure 2.7). This was done in order for the ministry to effectively implement agricultural programs in different areas. Each ADD is divided into Rural Development Projects (RDPs) which are district level establishments. RDPs are further subdivided into Extension Planning Areas (EPAs) which are area-specific. This study was done in Nyungwe EPA in Karonga RDP within Karonga ADD.

[7] Although some ADDs are named after names of districts e.g. Blantyre, Karonga, Salima, etc, each ADD is comprised of at least two districts.

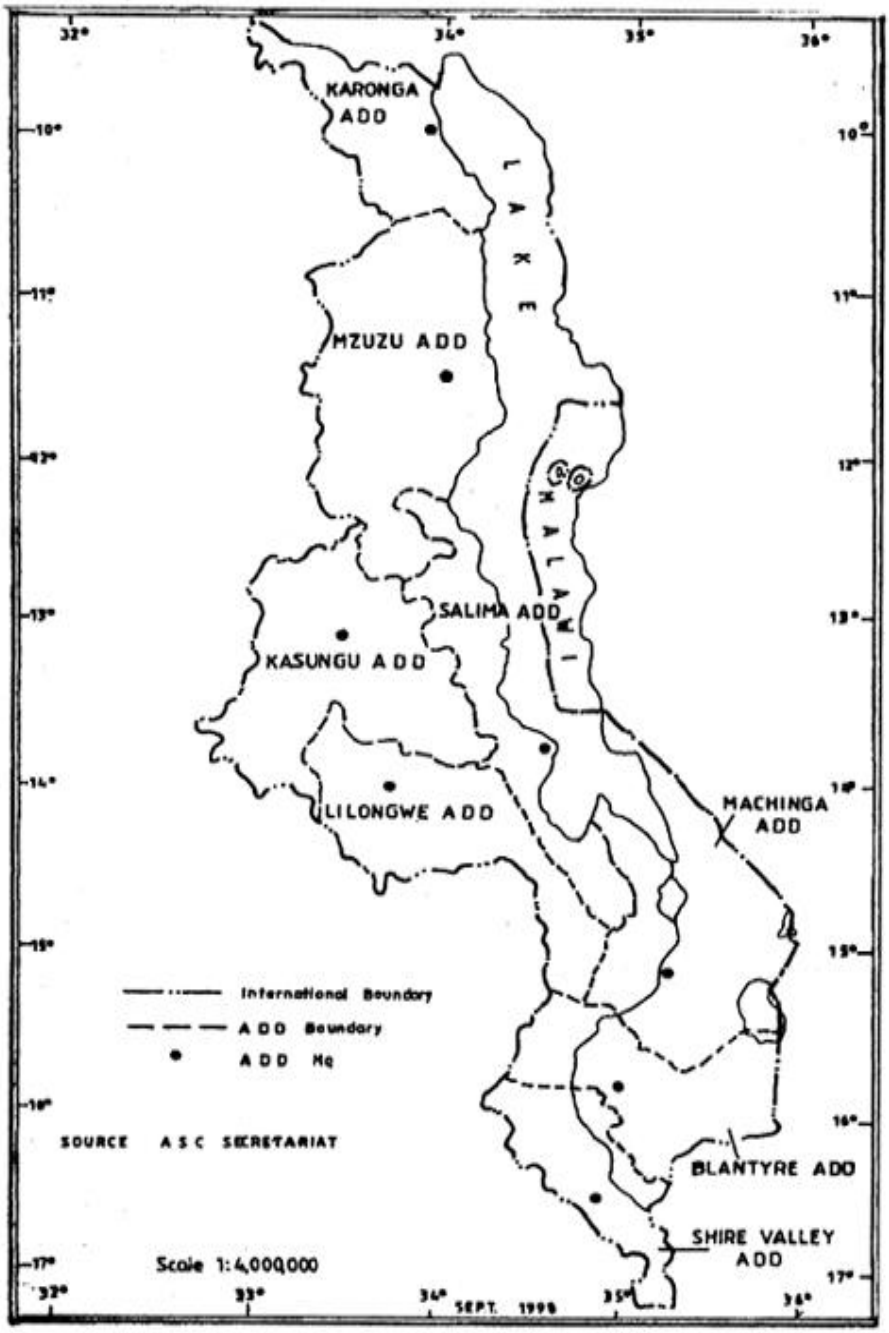

Figure 2.7: Agro-ecological zones of Malawi
Source: NRCM, 1999.

Total cultivated land area averages around 2.7 million ha with 30,000 estates occupying about 1.1 million ha with average farm size of 10-500 ha, and the remainder being held under smallholder cultivation. Average farm size for smallholder farmers is about 1 hectare. Due to severe land pressure, households in some parts of the country hold farms of sizes as low as 0.2 hectares (GOM 2005c).

Maize is the dominant food staple crop, and is being supplemented by cereals such as rice, and root crops e.g. cassava and sweet potatoes (GOM 2000a). About 10% of Malawi's food production comes from irrigation farming (GOM 2010). The main cash crop is tobacco which accounts for 60% of export earnings (FAO 2005). Other cash crops include tea and sugar. Though agriculture dominates the country's economy, productivity is still very low leaving smallholder farmers with little or no profits at all. Some factors behind poor yields are the dependence on traditional rain-fed farming which is unpredictable particularly with recent variations in climate, unreliable rainfall with extended periods of dry spells, and the low level of irrigation development (GOM 2000a; NEC 2002). In order to improve agricultural productivity, ensure food security, and enhance people's livelihoods, the government is promoting irrigation at small scale household level both formally and informally (GOM 2000b).

2.6.6.1. Evolution of irrigated agriculture in Malawi

The development of irrigated agriculture in Malawi dates back to as early as the late 1940s when the first irrigation scheme (Limphasa Irrigation Scheme) was established in Nkhata Bay District in northern Malawi which was followed by the establishment of two more schemes in the Chilwa-Phalombe Plain in southern Malawi in the mid 1950s. An irrigation research station was established around the same period at Makhanga in Phalombe District (then part of Mulanje district) to carry out research on irrigated crops. After independence from Britain in 1964, the government, through the Sugar Corporation of Malawi (SUCOMA), started growing sugar cane under irrigation in 1965, and constructed sixteen (16) smallholder irrigation schemes between 1968 and 1979 in all the five agroecological zones (FAO 2005). The schemes were established on land which was formerly customary[8] and declared public land under the Land Act (1965) to allow for a wide range of farmers to participate in irrigation schemes (GOM 1965).

The schemes, which had a total irrigable area of 3600ha (FAO 2005), included Wovwe Irrigation Scheme (WIS) and were established to meet four main objectives:

a) to utilize empty or undeveloped land in potential irrigable areas;

[8] Section 2 of the Land Act 1965 defines customary land as "… all land which is held occupied or used under customary law, but does not include public land."

b) to serve as demonstration bases of high intensity cash cropping to village farmers surrounding the schemes. Villagers were given plots in the schemes on which to practice intensive cropping. The Malawi Young Pioneers[9], a youth arm of the Malawi Congress Party under the presidency of Dr. Hastings Kamuzu Banda trained farmers and enforced discipline in irrigation schemes;

c) to achieve development of rural areas. The government felt that, by establishing irrigation schemes in rural areas, the schemes would form nuclei for rural development which would eventually lift the socio-economic status of poor rural people and then spread through and induce related economic activities; and

d) to improve rice production for enhanced food security and foreign earnings through exports.

Irrigation schemes in Malawi fall under four categories (Table 2.6).

Table 2.6: Categories of irrigation schemes in Malawi
Source: Adapted from FAO (2005)

Category of the irrigation scheme	**Description**
Private large commercial schemes	• Area: >100 ha • Mostly owned by foreigners running sugar and coffee estates
Private small commercial schemes	• Area: < 100 ha • Owned by individuals
Government-operated smallholder schemes	• These were established by government to give irrigation opportunities to local small-scale farmers at almost no cost • Farmers pay no water charges
Self-help smallholder schemes	• These are run by farmers themselves on a self-help basis or in certain cases by non-governmental organizations (NGOs)

However, in order to simplify its work, the Malawi Department of Irrigation (DoI) informally classifies irrigation schemes according to their sizes i.e. small (<50ha), medium (between 50 and 500ha), and large schemes (>500ha). Furthermore, differences exist within each class depending on the management of the scheme and the way the scheme is farmed. The schemes are, thus, further subdivided as (FAO 2005; GOM 2000a):

- informal schemes: these are irrigation establishments developed by farmers themselves with limited or no technical input to their designs. Small-holder farmers are the main operators of informal irrigation usually practiced along riverbanks and in *dambos* (wetlands). Some smallholder farmers use lands left by receding floods;

[9] Detailed information about the Malawi Young Pioneers (MYP) and the Banda regime is presented in section 4.1.

- semi-formal schemes: these are schemes which receive some government or NGO technical support but are basically initiated by farmers and self-help projects; and
- formal schemes: these are professionally planned, designed and constructed. Most public irrigation schemes including WIS fall under this category.

2.6.6.2.Irrigation status and potential

Malawi has a total of about 90,000 ha of irrigated area. Traditional or informal irrigation accounts for about 62,000ha. The remaining 28,000ha is formal and semi-formal, of which 6500 ha are smallholder schemes run through self-help, 3200 ha are run by government, and 18,300 ha are under estates often run privately (Ferguson and Mulwafu 2005). Informal irrigation accounts for the largest share of the whole irrigation system in Malawi. Potentially, Malawi can practice irrigation on a land area of between 207,300 and 500,000 ha (Ferguson and Mulwafu 2005).

2.6.6.3.Irrigation sector reform

During their early period of development (i.e. from the late 1960s to the 1980s), state established irrigation schemes received good management – though in a top-down authoritarian approach (Krogh and Mkandawire 1990 – quoted in Ferguson and Mulwafu 2005). This was due largely to financial and technical support from donors, notably the Taiwanese Agricultural Technical Mission and government commitment to supporting operations of the schemes. However, with economic and climatic constraints which the country experienced in 1980s, and the withdrawal of support by the Taiwanese Agricultural Technical Mission, the government reduced its involvement in the management and maintenance of the schemes. As a result, the irrigation infrastructure deteriorated and yield worsened further. Worse still, when the country changed its political system from authoritarian rule to multi-party democracy in the mid-1990s, farmers stopped observing farming calendars and other rules established during the Banda regime. Irrigation governance structures were considered illegitimate by local farmers who believed that all rules and regulations instituted by the Banda regime were unfair and, like the regime that imposed them, should be rejected (Ferguson and Mulwafu 2005).

Government policy before the collapse of Dr. Banda's authoritarian rule also contributed to poor patronage of irrigated agriculture. Until the mid-1990s, the government concentrated on

promoting rain-fed agriculture with very little attention on irrigation. This resulted in failure to meet the objectives for which the schemes were established (see 2.6.6.1) as villagers poorly patronized the schemes and straddled between upland cropping and irrigation farming (Chirwa 2002). But land pressure and recurrent dry spells and droughts forced the government to commit itself to revitalizing and expanding irrigation agriculture to ensure food security and improved socio-economic conditions of its citizens, especially those of the rural communities (Ferguson and Mulwafu 2005).

Like most southern African countries, Malawi reworked its policies and laws by developing new and revising old policies and enacting legislation to enhance agricultural productivity and ensure sustainability of irrigation systems (GOM 2000a; Ferguson and Mulwafu 2007). The government is adopting the IMT approach (see 2.2.3) with the hope that IMT will (Kamandani 2004):

1. relieve it from financial and management burdens of the schemes through reduced government expenditure on O&M;
2. ensure sustainability of irrigation schemes;
3. improve management performance and sustainability of irrigation systems;
4. improve agricultural production and hence food security and improved economic status for the people in and around the scheme; and
5. release surplus resources for reallocation to other initiatives e.g. regulation of water use along river basins, new irrigation developments, and addressing environmental and health concerns.

The approach is explicitly stated in the National Irrigation Policy and Development Strategy (NIPDS) whose aim is to "contribute to poverty alleviation by targeting resource poor smallholder farmers for irrigation development to enhance farm income" (GOM 2000b).

The policy also advocates for expansion and intensification of small-scale informal or traditional irrigation schemes across the country. While the responsibility for developing such schemes rests with local communities themselves, the government commits itself to playing a catalystic role by supplying farmers with appropriate information about suitable areas for irrigation, area-specific problems and constraints, and suitable and simple irrigation technologies (GOM 2000b). In order to sustain government support to local communities, the policy makes informal or traditional irrigation part of the agricultural development options at

the RDP and EPA levels. This ensures that the government still remains in contact with local farming communities on issues relating to agricultural productivity. The policy also commits government to ensuring that local farmers have access to simple and cheap irrigation equipment by proposing a review of existing tax legislation to allow for easy importation of the equipment (GOM 2000b).

Although the reform is already taking effect on a pilot basis at, for example, Wovwe, Likangala, and Kasinthula irrigation schemes (Ferguson and Mulwafu 2005), the efforts may not yield their intended purpose if not based on practical and context-specific information. Moreover, if the transfer does not meet the preconditions identified by Vermillion and Sagardoy (1999) and Shah *et al.* (2002) (see section 2.2.3.2) for any successful transfer; all efforts in the transfer process would be devastating to government's aspirations, the environment, and concerned rural communities. Unfortunately however, it is not yet known whether the IMT is delivering as planned. This study, carried out at one of the schemes under IMT i.e. Wovwe Irrigation Scheme (WIS), provides some insight into the direction of the reform.

2.6.7. The Wovwe Irrigation Scheme and surrounding communities

Though established in the boundary between Traditional Authority (TA) Mwirang'ombe and TA Wasambo, the scheme is in TA Mwirang'ombe's area in Nyungwe Extension Planning Area (EPA) in Karonga District. The Wovwe Irrigation Scheme (WIS) derives its name from the Wovwe River which is the scheme's source of water. The Wovwe River originates in the Nyika National Park (west of Karonga district) and discharges into Lake Malawi (eastern Karonga). The river supports the generation of hydro-electric power just after it leaves the Nyika National Park and feeds the WIS in its middle section (Figure 2.8). At establishment, nine villages i.e. Bunganiro, Chauteka, Gangamwale, Gonthaminga, Kanyuka, Kapiyira, Mphangwanjiri, Mwazolokele, and Mwenimambwe were considered as villages surrounding the scheme. But as time went by, the number of villages surrounding the scheme rose to thirteen (13) as some villages which were formerly not included as surrounding WIS have now been included due to their active participation in the scheme. Some of the nine old villages have split to ease administration e.g. Kanyuka Village split into Kanyuka and Mwangwala villages, Kapiyira Village split into Kapiyira, Kalimunda, and Mphangwiyanjiri villages.

The scheme is a rice scheme and covers a total irrigable land area of 365.4 ha and was developed in three phases (Lhumbey 1994). The first phase involved the development of 130 ha on the western bank of the Wovwe River with aid from the British Government between 1969/70 and 1971. This component is referred to in this study as Wovwe I. The second phase involved the development of 30 ha by farmers themselves between 1972 and 1973. This part was incorporated into the Wovwe I component together constituting the 176 ha gross and 160 net irrigable areas for Wovwe I. The last phase involved the development of 224 ha gross area of land (205.4 ha net) on the eastern bank of the Wovwe River by the Taiwanese Government from 1983/84 to early 1990s (Lhumbey 1994; Chirwa 2002). This component is referred to as Wovwe II (Figure 2.8).

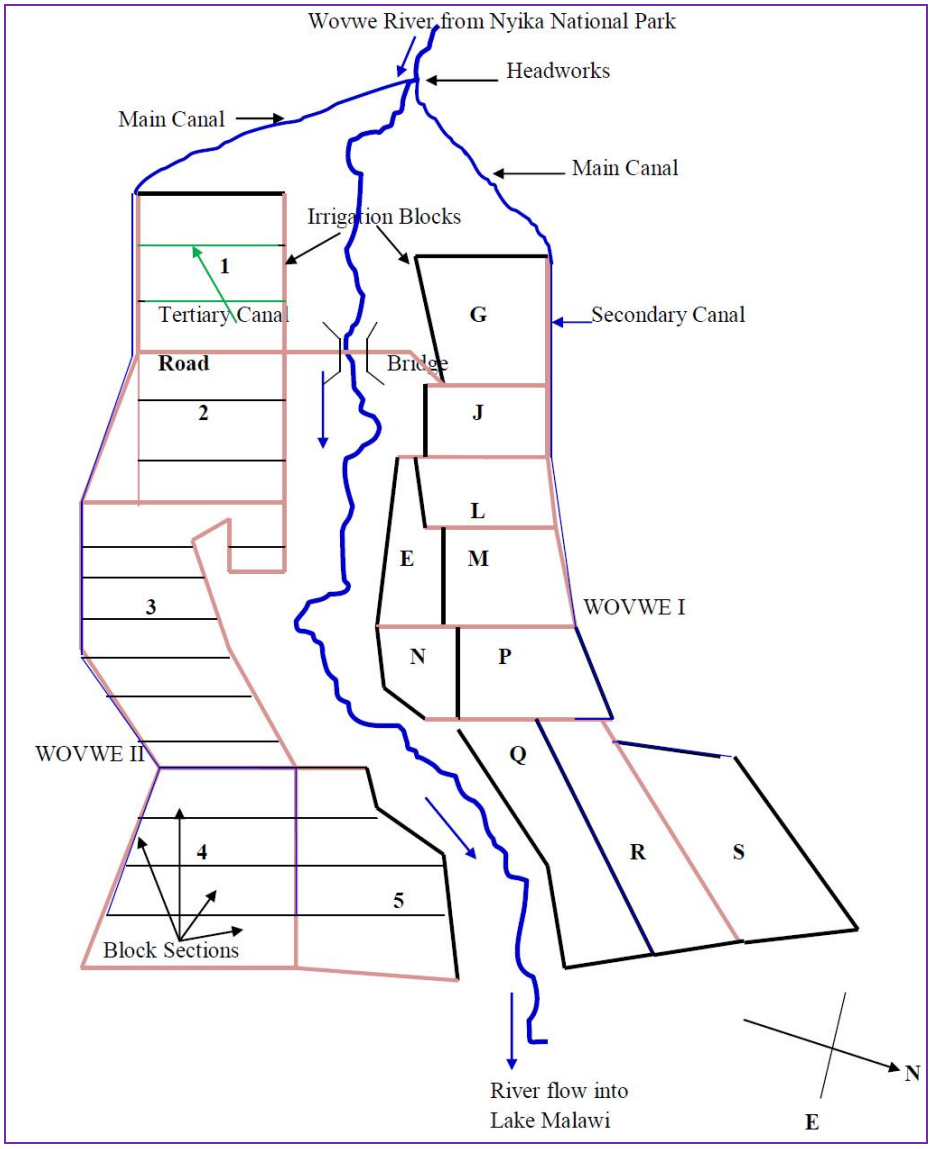

Figure 2.8: Sketch of Wovwe Irrigation Scheme Layout

Each scheme component is divided into Blocks. Wovwe I has ten Blocks while Wovwe II has five. The Block is further divided into units which are comprised of plots. The size of one plot is 0.1ha and a minimum proper land holding is 0.2 ha of which 0.1 ha lies along the feeder canal while the other 0.1 ha links the field to the drainage canal. The full design capacity of water flowing into WIS (Wovwe I and Wovwe II combined) is 35,753m^3/day of which 40% (14,301m^3/day) is distributed to Wovwe I and the remainder (21,452m^3/day) to Wovwe II (Simfukwe pers. Comm.).

Like other government established schemes, the WIS was established to: act as nuclei for rural development; enhance rice production to meet the growing internal and external market demands; provide facilities for graduates of the Malawi Young Pioneer (MYP); and enhance food security and income opportunities for rural communities (Lhumbey 1994; Kishindo 1996; GOM 2000a; Chirwa 2002). As such, farmers were both local villagers and settlers, notably MYP members, whom the government settled at the scheme's settlement camp (Lhumbey 1994). The government, through the Department of Agriculture, jointly managed the scheme with farmers and traditional leaders or their representatives from the nine villages (Lhumbey 1994).

2.6.8. Rural livelihoods and livelihood zones

Livelihood strategies for rural communities in Malawi include cultivation of plots in irrigation schemes, practicing upland rain-fed agriculture, wetland gardening, stream-bank gardening, casual labor, trading in crop produce, running small businesses, and other occupations. Some households also keep livestock, fish, hunt, gather, and/or weave as a livelihood strategy (Ferguson and Mulwafu 2005). Smallholder irrigation schemes in Malawi are the main sources of food and income. They also provide principal support to the sustenance of many rural livelihoods (Ferguson and Mulwafu 2005). Depending on what households in different parts of the country rely on for their livelihoods, the Malawi National Vulnerability and Assessment Committee (MNVAC 2005) divides the country into eleven livelihood zones (Figure 2.9) and Wovwe falls under the Nkhata Bay Cassava Livelihood zone.

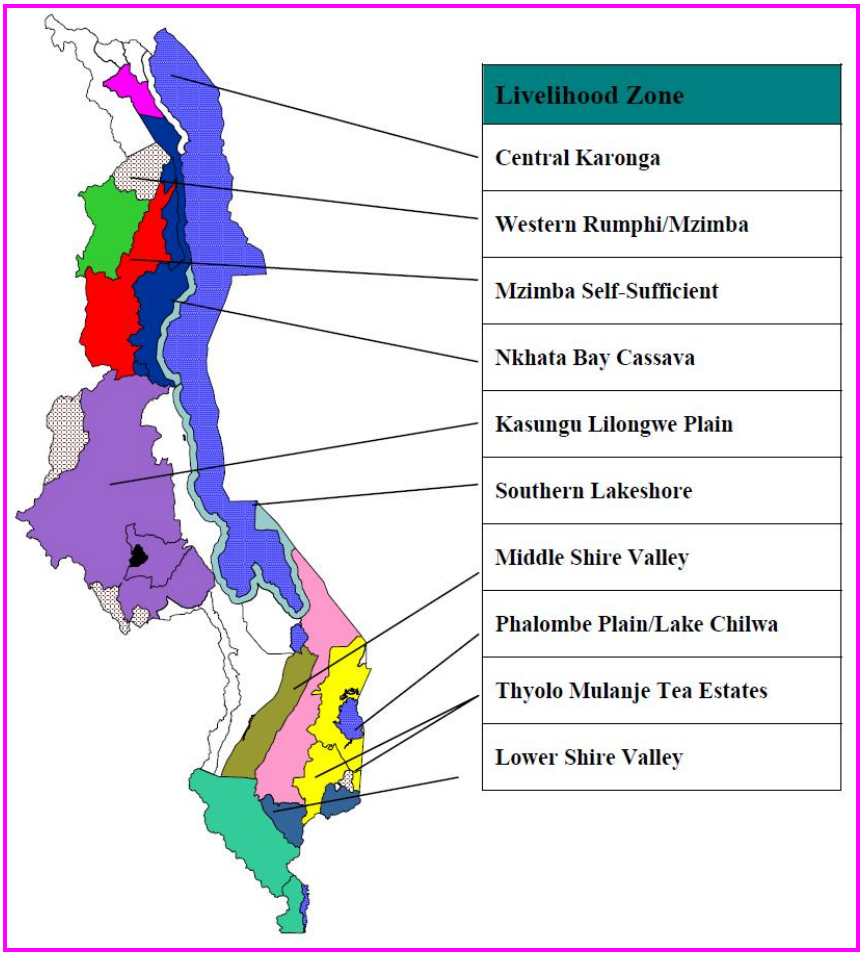

Figure 2.9: Map showing livelihood zones in Malawi
Source: MNVAC and SADC 2005

2.6.8.1.The Nkhata Bay Cassava Livelihood zone

The Nkhata Bay Cassava Livelihood Zone (Figure 2.10), within which this study was conducted, extends along the shores of parts of northern and central Lake Malawi. It cuts across four districts i.e. Karonga, Rumphi, Nkhata Bay, and Nkhotakota districts. The zone is renowned for growing cassava and maize and households realize cash from the sale of food crops and livestock (MNVAC 2005). It is characteristic of poor soils, high annual rainfall of between 801-2000mm (NSO 2006) with cassava as the dominant crop. Income sources in the zone are limited to the sale of crops hence it is referred to as the 'food-rich' but 'cash-poor' zone. Apart from cassava, the zone also grows maize, rice and bananas whose sale together with cassava forms the main income source. Some households get income from fishing and sale of livestock. The promotion of irrigated agriculture is a central pillar in transforming the economic status of the communities since the cassava variety grown in the zone is bitter and has no viable market (MNVAC 2005).

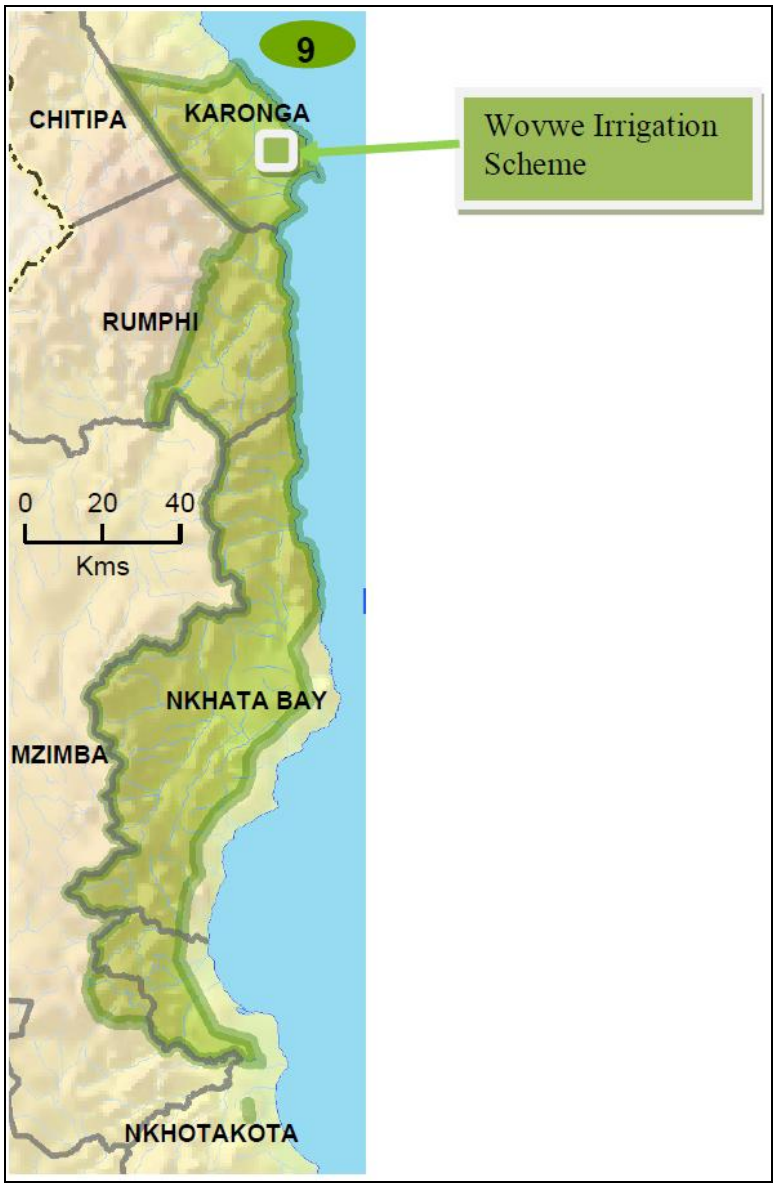

Figure 2.10: The Nkhata Bay Cassava Livelihood Zone
Source: FEWSNET 2003

2.7. Summary

This chapter has presented a summary of documented studies and underlying theories and practices on irrigation agriculture, water resources management and governance, and rural livelihoods. It has created a lens through which the significance of the research should be understood by bringing out the work of earlier studies and relating them with the prevailing context in Malawi. By giving background information on the study area i.e. Wovwe in Malawi, sub-Saharan Africa, and focusing on rural poor communities, the review has discussed some conditions on the ground with regard to governance structures and changes that have occurred and necessitate their understanding, particularly their influence on rural

livelihoods. The Water Governance and Poverty Analytical Framework (Franks and Cleaver 2007) discussed in section 2.5 of the chapter provides the guiding framework for the study.

3. METHODOLOGY

3.1. Overview

This chapter presents the approach the study took to investigate the influence of recent policy changes in irrigation farming on water resources management and rural livelihoods in the Wovwe River catchment, Malawi. It lays down the research design detailing the research type, the focus of the study, methods of data collection and analysis used, and ethical aspects pertaining to the study. The chapter, further, discusses measures the study took to ensure validity and reliability of data and findings.

3.2. Research design

3.2.1. Type of the research design: case study approach

This study employed the case study[10] approach (Yin 2003) and combined small-scale sample surveys and qualitative methods of data collection, analysis, and interpretation (Ellis 2000). The case study approach was preferred to other approaches (such as experiments, histories, etc) because of the high reliability it offers in retaining real-life, holistic, and meaningful characteristics of an event; and its utility for executing in-depth explorations of particular subjects (Burn 2000; Creswell 2003). As the Wovwe River, its water and surrounding environment are used by several stakeholders who have differing and sometimes opposing interests; a successful inquiry required investigating multiple variables, use of multiple sources of information or evidence, and use of mixed methods i.e. both qualitative and quantitative methods (see 3.2.1.1). A case study is a single approach that permits such an inquiry and further shows explanatory, exploratory and descriptive aspects in a single investigation while utilizing existing theoretical propositions to guide data collection and analysis (Yin 2003).

Several variables were investigated and a diverse range of subjects including farmers, traditional leaders, water-user groups, government ministries and departments, women, pastoralists, fishermen/fish farmers, etc, were utilized to gather information. Furthermore, theoretical insights from water governance, sustainable rural livelihoods, and poverty (see 2.5) were used to provide explanations and descriptions to the influence of policy reform on

[10] A case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and content are not clearly evident" (Yin 2003).

ecosystems (water resources) and livelihoods of rural Malawians. The study's exploration of answers to such core questions as *"how"* and *"why"* the reform is influencing the state of water resources, rural livelihoods, etc (1.2) perfectly suits the use of a case study approach (Yin 2003). Moreover, case studies have been widely and successfully used in similar studies involving, for example, water governance institutions (Meinzen-Dick 2007), rural livelihoods (Ellis 2000a), and irrigation-based livelihoods (Lankford 2003).

However, the case study design is criticized for its alleged: lack of rigor i.e. its flexibility allows researchers to exercise bias thereby making findings and conclusions prone to influence; incompatibility with generalization and inference making; taking too long to conclude and presenting bulky and non-reader friendly results. Meinzen-Dick (2007), thus, urges researchers doing case study research related to farmers to: guard against researcher's bias in selecting the case; address real issues regardless of existing conditions and employed theories; and ensure harmony between the way farmers operate and organize themselves and study designs.

This study recognized the arguments raised and provides detailed explanations of steps taken to address them (see, for example, 3.2.4 on how the case was selected). However, criticism about lack of rigor held true in the past when there was little or no literature on how to conduct case studies (Yin 2003). Also, critics should not confuse research case studies with case studies used in teaching whose content is altered to suit teaching environments. Furthermore, the study locates the investigation within existing theoretical propositions (see 2.5) in order to provide checks for issues being addressed and ensure that analyses are focused. Also, inherent in this design are aspects that act as checks and balances for ensuring that quality is the ultimate goal (see 3.2.2 and 3.2.10).

Since this study aims at informing efforts towards successful irrigation management transfer and expansion, sustainable water resources management and governance, and attainment of sustainable rural livelihoods, findings have been generalized to the same as cases are generalizable to theoretical propositions and the goal of doing a case study is to expand and generalize theories (analytical generalization) (Yin 2003). Even so, since this study employed the mixed method approach (see section 3.2.1.1), insights were gained at different levels of analysis with different units of analysis – effectively enabling even population generalization

(Tashakkori and Teddlie 1998). Field work for this study took thirteen months i.e. two months (September to October 2008) for pilot study and eleven months (December 2008 to November 2009) for actual data collection.

3.2.1.1. The mixed methods approach

A mixed-methods approach (Creswell 2003), illustrated in Figure 3.1, was utilized. The approach, also referred to as the concurrent triangulation strategy, enables the integration of quantitative and qualitative techniques; and allows for simultaneous collection, analysis and interpretation of data. Furthermore, the strategy: minimizes inherent biases of one method; allows for mutual reinforcement of methods and inter-method checking of the validity of findings; offers an opportunity for findings from one method to inform or develop findings from the other method; and allows for understanding and gaining of insight on different levels and units of analysis (Greene *et al.* 1989; Tashakkori and Teddlie 1998; Creswell 2003).

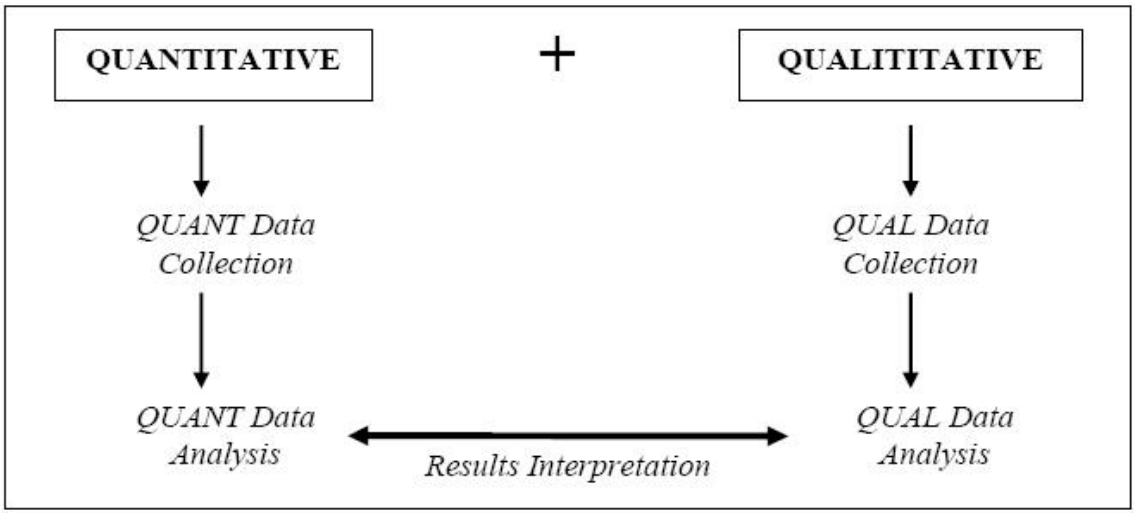

Figure 3.1: Concurrent triangulation strategy
Source: Adapted from Creswell (2003) with modifications

3.2.2. Quality assurance of the research strategy

Validity, an indication of "the degree to which an instrument measures the construct under investigation" (Rossi *et al.* 1983), ensures that exact constructs are measured or recorded and not something else, while *reliability*, on the other hand, ensures that the measurement or recording is done without error (Tashakkori and Teddlie 1998). The study is reliable if same results can be produced over time while following the same protocol – regardless of who is doing it. To ensure validity and reliability, this study applied four tests relevant to case

studies. See Table 3.1 for the tests, respective tactics used, and appropriate phases in the research when particular tactics were applied.

Table 3.1: Quality assurance tests

Test	Tactic	Phase in the research
External validity (generalisability)	• Use theory	• Research design
Construct validity	• Use multiple sources of evidence	• Data collection
Internal validity (inference quality of conclusions)	• Address rival explanations	• Data analysis
Reliability	• Use case study protocol	• Data collection

Sources: Tashakkori and Teddlie 1998; de Vaus 2002; Creswell 2003; Yin 2003

3.2.3. Research focus and units of analysis

The research was carried out in the context of water governance and socio-economic well-being of rural communities. Particular emphasis was on understanding how policy reform influences the way institutions, individual, groups, and rural communities govern and manage water resources; and how this, consequently, impacts upon water resources and rural livelihoods. Although the household was the basic unit of analysis, other research subjects included institutions of water governance (policies, rules, regulations, schedules, and organizations), irrigation infrastructure, water resources, individuals, groups, structures of governance and management e.g. the WWUA. Although water resources were the main environmental aspect under investigation, the call for a coordinated approach for successful water resources management (Mitchell 1990; GWP 2000) meant that if the *'how'* and *'why'* questions about the current state of water resources were to be answered, the study needed to also understand the state of other related resources such as soil and vegetation cover in the Wovwe River catchment (see 2.3).

3.2.4. Site selection and geography of the site

This study was conducted at Wovwe in Karonga district Malawi (Figure 2.8). Wovwe falls under the Nkhata Bay Cassava Livelihood Zone (NCLZ) (see 2.6.8). Karonga district has a total population of 223,507 of whom about 32% come from the Karonga part of the NCLZ (MNVAC 2003). The choice of Malawi was based on the importance of water resources and agriculture to the country's economy and well-being of rural communities (see 2.6.2 and 2.6.6). Furthermore, the choice was also partly influenced by the fact that Malawi is the author's home country, and conducting research in one's own country reduces problems of

culture and language (Peil 1993). The main reasons justifying the selection of the Wovwe site among other sites in Malawi include:

- the Wovwe irrigation scheme (WIS) is one of the three schemes (others being Kasinthula and Likangala) whose management system was transferred to water users on a pilot basis in 2002. No studies have been conducted yet on these schemes to draw lessons about the influence of the reform on water resources and rural livelihoods;
- the WIS together with Kasinthula is located in typical rural areas in contrast to Likangala which is close to Zomba city – this suits the investigation into rural livelihoods;
- the northern part (where the WIS is located) and southern tip (where Kasinthula is located) of the country frequently experience extreme variations in climatic and weather events; and
- about 25% (one of the highest in Malawi) of households in Karonga are dependent on water for livelihoods (see Figure 3.2). This is much higher than Chikwawa (9%) where Kasinthula is located and Zomba (1%) where Likangala irrigation scheme is located (NSO 2003).

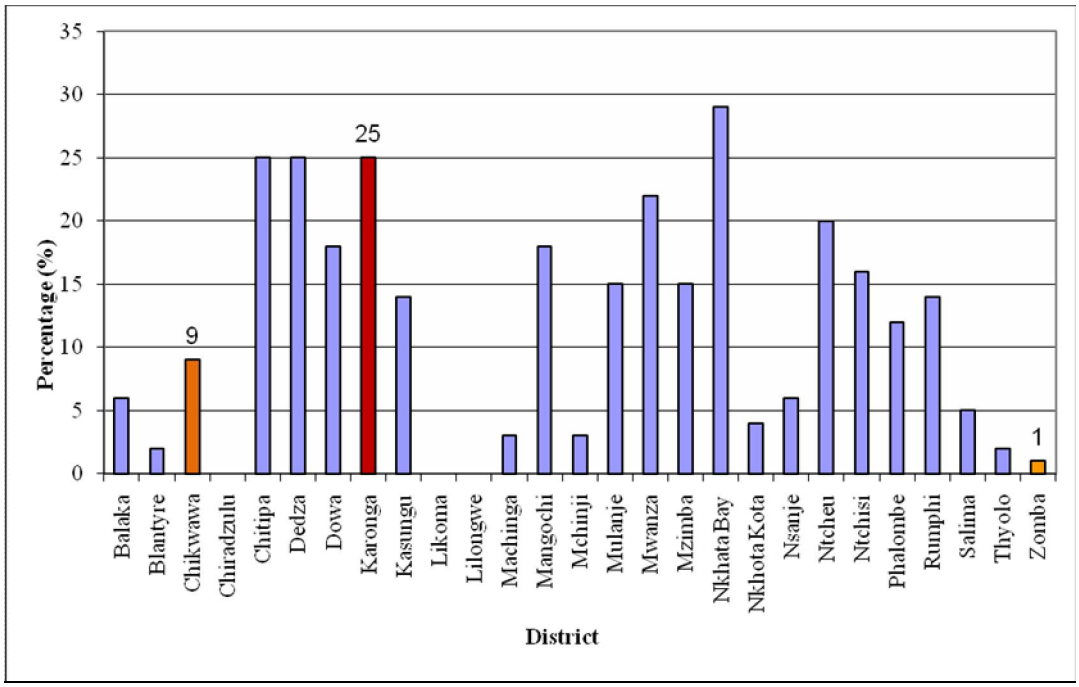

Figure 3.2: Percentage households by district depending on water for livelihoods in Malawi (2002)
Data Source: NSO 2003

The study was conducted in all 22 villages across the entire Wovwe River course (Table 3.2), 10 upstream of the WIS, 5 within the WIS (villages surrounding the WIS), and 7 downstream. The study covered the entire river basin for two reasons: a) the upstream and downstream

acted as a 'control' in identifying the impacts of IMT on WIS households; and b) to gain a complete understanding of irrigation reform and irrigation expansion (including interactions between formal and informal irrigation) across the entire river basin.

Table 3.2: Villages under study and household samples†
Data source: Village Registers

Location with respect to WIS	Village	Population			Households (HH)	Sample (HH)[11]
Upstream		**Male**	**Female**	**Total**		
	Njalayankhunda	428	552	**980**	207	**14**
	Chagoma	41	120	**161**	46	**5**
	Mtangala	209	521	**730**	105	**14**
	Zengelanjala I	209	241	**450**	112	**6**
	Zengelanjala II	256	172	**428**	70	**9**
	Mwathengere	200	208	**408**	31	**4**
	Zindili	211	364	**575**	129	**15**
	Chauteka	444	406	**850**	130	**10**
	Gonthaminga	471	433	**904**	110	**12**
	Jumbe	440	1031	**1471**	192	**15**
Within WIS	Mwenimambwe	343	450	**793**	73	**8**
	Mlangapamalo	159	290	**449**	113	**13**
	Mphangwiyanjiri	259	426	**685**	104	**16**
	Kapiyira	285	331	**616**	136	**10**
	Kalimunda	157	108	**265**	60	**3**
Downstream	Gangamwale	301	394	**695**	154	**19**
	Kanyuka	313	508	**821**	185	**18**
	Mwangwala	269	258	**527**	104	**9**
	Mwakalomba	319	381	**700**	157	**9**
	Ndatira	239	221	**460**	93	**7**
	Kayaghala	386	336	**722**	165	**20**
	Galimoto	213	233	**446**	106	**10**
Totals	**22**	**6152**	**7984**	**14,136**	**2582**	**246**

†It is worth noting at this point that when sampling farmers in the WIS, some 27 farmers were found to be cultivating in the WIS but did not come from any of the villages which were under investigation. In all data analyses and presentations that follow this chapter, these are referred as coming from a location called 'Other'.

3.2.5. Sampling

Realizing that different stakeholders or actors play a crucial role in identifying socially relevant and scientifically challenging research aspects (Welp *et al.* 2006) and in ensuring sustainability and effectiveness of development strategies (Mushove and Vogel 2005), this study utilized a cross-section of actors. Two sampling frames were used in data collection i.e. all households (2582) in all the 22 villages (Table 3.2) and all irrigators (1500) in the WIS. The two sampling frames served the purpose of ensuring that farmers in the irrigation scheme who cultivate in different locations with respect to the source of water feeding their fields i.e.

[11] The sample size at 95% confidence level and 6% confidence interval was 242. However, with the 10% oversample (see 3.2.5.1) which was intended to make up for non responses or non-participation of some respondents, the sample was increased to 266. We interviewed 246 respondents (the figure appearing as sample total in Table 3.2) representing 9.5% of the total number of households.

'Head' or 'Tail' location (see 3.2.5.2) are equally represented. The stratified random sampling followed in identifying respondent farmers in WIS is commonly followed in research designs that seek to understand water access in irrigation systems (Vermillion 1997). Hence, sampling on the 2582 households (3.2.5.1) involved simple random sampling, and both stratified and systematic random sampling procedures were used for the 1500 irrigators in WIS.

3.2.5.1. Simple random sampling

Since the 2008 Population and Housing Census data on households were not yet released by the National Statistical Office (NSO), the study could not use the 1998 data which were outdated. Instead, Village Registers (Table 3.2) from Village Heads (which are updated annually) were used to identify households. These households were assigned two unique numbers each. The first number identified the household among all the other households in the sample frame and ranged from 1 to 2582 while the second number identified the household in his or her respective village (see illustration in Table 3.3).

Table 3.3: Assigning identification numbers to households in the 22 villages

Household ID in a sample frame	Household ID in a village†	Household name
1	UCGM001	
…	…	
…	…	
2582	UZDR129	

†The first part of the ID (four letters) represents the code of the village from which the household comes while the numeric part is the number of the household within the village

A sample size was then calculated using the online Sample Size Calculator (Creative Research Systems 2008) at 95% Confidence Level (CL) and 6% margin of error or Confidence Interval (CI). The 6% CI falls within the acceptable range of 5-10% with a CL of 95% in sample surveys (Taylor-Powell 1998). A sample size of 242 was calculated. In order to make up for non responses, participants declining to participate in the survey, and failures to locate some respondents; the sample size was increased by 10% (24 households) to 266 (Table 3.2). The online Research Randomizer (Urbaniak and Plous 2008) was then used to generate a set of 266 random numbers (sample) from the 2582 unique household numbers which were then matched with numbers identifying households within their respective villages in order to identify respondent households. Household heads were the primary respondents. Refer to Table 3.2 for the sample and their village shares.

3.2.5.2. Stratified and systematic random sampling

The sample size from the 1500 farmers from the WIS, i.e. 514 from Wovwe I and 986 from Wovwe II (Table 3.4) was also generated using the online Sample Size Calculator at the same CL of 95% and CI of 6 % as in the simple random sampling (3.2.5.1). A total sample of 227 farmers was generated using the online Sample Randomizer and all farmers in the scheme were subjected to a three-phased stratification procedure in order to identify respondents. Firstly, farmers were separated according to the scheme component they had their fields in i.e. either Wovwe I or Wovwe II. Secondly, farmers were grouped according to the Block in which they had fields; and lastly, a respondent farmer was identified according to position of his or her field with respect to the source of water (tertiary canal) feeding his field. These positions were termed 'Head' or 'Tail' with 'Head' being any position of fields in the first half of the field accessing water first, and 'Tail' being the remaining position i.e. fields which were last to access water. Here, individual farmers cultivating plots were respondents (refer to Figure 2.8 for the sketch of the scheme layout).

Stratification and systematic random sampling are specifically recommended where the population under study differs in certain characteristics such as gender, age, and geographical location, among others (Taylor-Powell 1998). In this study, position of farmers' fields in relation to the headworks was the basis of stratification. Stratification and systematic random sampling are the appropriate methods of identifying respondent in irrigation studies which investigate the impacts of programs across the entire irrigation system (Vermillion 1997).

Identification of respondent farmers followed a specially designed systematic random sampling procedure as the register of farmers kept by the WWUA did not have names (but just totals) of all farmers in their respective Blocks, and where it did, did not specify the positions of farmers' field as either 'Head' or 'Tail'. Furthermore, Blocks G, J, R, and S of Wovwe I did not even have records for respective total number of farmers. The sum of farmers in these Blocks was determined by subtracting the total number of farmers in other Blocks (i.e. Blocks E, L, M, N, P, and Q) from the total for Wovwe I as provided by the WWUA i.e. 514 – 304 = 210. Sampling was done at a farmer interval which was calculated by dividing the total number of farmers per Block by the sample size for the Block (Taylor-Powell 1998). With the exception of Blocks G, J, R, and S which used the same sampling interval, specific Blocks had specific sampling intervals whose values ranged from 5.8 to 7.2

(see Table 3.4). For a detailed description about how respondents were identified, refer to Appendix 1.

Table 3.4: Farmers in the Wovwe Irrigation Scheme

Scheme Component	**Wovwe I (514 farmers)**										**Wovwe II (986 farmers)**					**Total**
Block	E	L	M	N	P	Q	G	J	R	S	1	2	3	4	5	**15**
No. farmers	43	53	35	39	69	65		210			214	226	164	243	139	**1500**
% of total farmers	3	4	2	3	5	4		14			14	15	11	16	9	**100**
Sample size	**7**	**9**	**5**	**7**	**11**	**9**		**32**			**32**	**34**	**25**	**36**	**20**	**227**
Sampling interval	6.1	5.8	7.0	5.6	6.3	7.2		6.5			6.7	6.6	6.6	6.8	7.0	**6.6**

However, it is worth noting here that unlike in the simple random sampling (3.2.5.1) where the sample size was increased by 10%, here it was not, as those who declined were replaced by farmers in a similar position within the Unit of the Block (i.e. farmers occupying the next field) to ensure that responses were gathered from both head and tail field positions.

3.2.5.3. Purposive sampling

Besides the above sampling procedures, a purposive form of sampling was employed in order to identify and utilize key informants (see 3.3.3.3). All key informants (Appendix 2) were asked similar questions which appear in Appendix 3. Purposive sampling helped the study to acquire an in-depth understanding of perceptions of different water stakeholders. Key informants are crucial in providing in-depth and informed responses about an event (Taylor-Powell 1998; Burns 2000). Since justification of any purposive sampling is crucial (Burns 2000), Appendix 2 also presents reasons for selecting specific informants.

3.3. Research techniques

Information from multiple actors is best obtained through various methods such as brainstorming sessions, focus group discussions, and questionnaire surveys (Welp *et al.* 2006). This study used a number of techniques (presented in the following sub-sections) in order to obtain information that is relevant, valid and reliable for a better understanding of:

- the particular context (policy setting, environmental, demographic, and socio-economic conditions) in which the Wovwe River water and irrigation farming are governed;
- individual or household endowment of resources or assets for water governance and how this affects their access to water and the state of their livelihoods;
- institutions and processes of water governance, management, and practice;

- mechanisms available to, and used by, different stakeholders to gain access to, and control over water resources;
- actors involved in the use, management and governance of Wovwe River water and their influence; and
- livelihood strategies employed by different households and resulting outcomes (i.e. outcomes for households and water resources) from following particular strategies.

3.3.1. Pilot study

A pilot study was conducted at the study site from September to October 2008, and marked an important step in developing questionnaires and discussing the methodology with some key informants (Rossi *et al.* 1983; de Vaus 2002). The survey questionnaires were tested on respondents in order to identify possible responses from respondents, and identify and reframe questions with high non-response rates (de Vaus 2002). Further, the pilot study helped to introduce the study to various stakeholders, and initiate contacts with some relevant figures e.g. traditional leaders, government officials, and officials from the WWUA, which proved very vital during the long field work (3.4.1).

3.3.2. Access to respondents

Ways of gaining access to various subjects depended on respective subjects and their level of involvement in irrigation agriculture, water use, and governance. Culture and traditional procedures were strictly observed, particularly when meeting with traditional leaders and entering villages. For example, access to households in villages involved asking permission to have access to the village and then to the household. A chain of steps beginning from the Traditional Authority (TA) (Figure 3.3) was followed before a household could be interviewed.

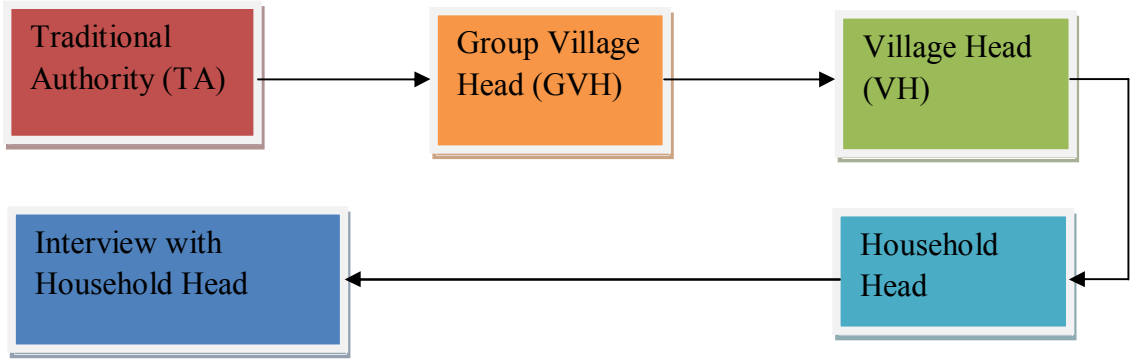

Figure 3.3: Steps followed to access households

First, the Traditional Authority (TA) was approached and introduced to the study. He had to give permission to enter and conduct the study in his area. He sent messages to Group Village Heads (GVHs) who in turn informed Village Heads (VHs) about our study visits. VHs were the final traditional leaders to give consent to our request to conduct household interviews. However, since the TA had already given consent, the rest of the leaders were approached as a matter of procedure. They would not say no to what the TA had already consented to. Real consent was to be obtained from the household heads who had the right to grant consent or not. Traditional leaders i.e. TAs, GVHs, and VHs were introduced to the study and some acted as key informants (see Appendix 2). After introducing the study, VHs had to grant permission to have access to households in the village, and acted as guides to particular households and other water stakeholders, such as livestock and fish farmers, in their respective villages. At household level, heads of households who were both contact persons and respondents, were met first and have culturally-relevant introductions before asking for their consent to participate in the study.

Farmers in the irrigation scheme were accessed by contacting offices of the Irrigation Department, Agriculture, and the WWUA at the scheme site. The Irrigation office at district levels was also contacted. The farmers were interviewed on field to ensure that respondents were identified based on the stratified and systematic random sampling procedure as presented in section 3.2.5.2 above.

3.3.3. Data collection techniques

This study used secondary sources, questionnaire surveys, key informant interviews, focus groups, semi-structured interviews, and non-participant observations to collect data.

3.3.3.1. Archival research/secondary data

An extensive review of relevant literature on irrigation reform, water resources management and governance, sustainable rural livelihoods, and agriculture (particularly irrigation agriculture) was conducted to place the study in a context that facilitated a sound and relevant analysis of data and interpretation of results. Secondary data on production, weather and climatic conditions including, rainfall, and scheme patronage were also consulted. The following sources were reviewed:

- published books in CEU library and other libraries in Malawi;
- journal articles and reports (both electronic and paper based); proceedings and briefs;
- speeches, government policies and legislation (environment, irrigation, water, land, agriculture, rural development, and decentralization);
- government development strategies and plans i.e. Malawi Growth and Development Strategy (MGDS), Poverty Reduction Strategy Paper (PRSP), National Irrigation Strategy;
- constitution, regulations, reports, and bylaws of the WWUA; and
- weather bulletins, crop production estimate reports, hydrological data, demographic and socio-economic reports and data.

The literature review also helped to: share other relevant studies; relate the study to ongoing discussion in water governance, irrigation and sustainable rural livelihoods; identify gaps that the study has attempted to fill; provide a framework for establishing the significance of the study; and offer a benchmark for comparing results with other findings (Cooper 1984; Marshall and Rossman 1999; Creswell 2003). Furthermore, data on production helped to understand the influence of the reform on the productivity of the schemes; while that on scheme patronage or membership to the WWUA and irrigated area helped to understand if the reform process yields expected international (2.2.3.1) and national (2.6.6.3) outcomes and meets the preconditions (2.2.3.2) for the reform.

3.2.3.2.1. Environmental data

Due to government withdrawal from the WIS and discontinuation of taking hydrological measurements, available hydrological data were outdated (see 6.2.6.2, Figure 6.2). As such, the study used several data sources in order to understand how water resources are being managed and the general status of the environment. Specific sources included secondary precipitation data from the Department of Climate Change and Meteorological Services (DCCMS), soil salinity and water-logging in the WIS as reported by the Division/District Irrigation Office, farmers' perceptions about the occurrence of droughts/dry spells and floods, farmers' and key informants' opinions about the observed trends in water levels in the Wovwe River, direct observations of the environment along the Wovwe River and plots in the WIS, the WWUA's observation about the state of water resources and the environment

surrounding the scheme, and taking an inventory of institutions involved in water resources management in the area.

Despite the absence of current hydrological data, a combination of several methods of data collection provided a rich understanding of water resources and the environment in general.

3.2.3.3. Questionnaire surveys

Questionnaires may cover different issues depending on the subject under investigation (Tashakkori and Teddlie 1998). In this study, surveys helped to gather information on:

(a) basic household and farmer information (e.g. age, gender, education, occupation, households asset, resource or possessions and trends in their quality and amount);
(b) changes to livelihoods over time (whether positive or negative, diversified or specialized) and their reflections on peoples' social and economic conditions;
(c) opinions about the trends in water quality, flow, availability, and agricultural productivity;
(d) opinions about occurrence of climatic shocks (droughts and floods) over time and range of coping strategies employed;
(e) perceptions about the operations of the water governance system and institutions; and
(f) perceptions of individuals about how their participation or nonparticipation is being viewed, and indications about how pleased or displeased they are with the current reform.

To capture this information, the study used a single questionnaire (Appendix 4)[12] for respondents from both the 2582 households (3.2.5.1) and the 1500 irrigators (3.2.5.2). The questionnaire combined both open- and closed-ended questions. Open-ended items allowed for respondents' greater openness and freedom to elaborate on an issue (Tashakkori and Teddlie 1998). Some questions sought one-word answers while others required explanations, some were multiple-choice, checklists, and others were Likert-type questions. Likert-type questions helped to check respondents' perceptions and their degrees of agreement or disagreement with issues (Ary *et al.* 1996; Gall *et al.* 1996). Data gathered through questionnaire surveys were also used in livelihood diversity analysis (3.3.4.2).

[12] The questionnaire was prepared in English language and translated into 'Tumbuka', the local language. The Tumbuka questionnaire appears as Appendix 5 and is the one which was used.

3.2.3.3.1. Questionnaire administration

Questionnaires for both households outside the WIS and farmers in the WIS were administered through face-to-face interviews in order to ensure a high response rate, collect reliable data (de Vaus 2002), and elicit responses from illiterate respondents (Tashakkori and Teddlie 1998). The study used five trained field assistants (Figure 3.4) to conduct the questionnaire surveys.

Figure 3.4: Research assistants ready for the field

We spent four weeks on the survey for households outside the irrigation scheme. Some villages were fully covered within a day while the longest period spent on a village was two days. These short periods effectively minimized the problem of villagers discussing questions with other unvisited potential respondents. The 10% oversample (3.2.5.1) helped to compensate for respondents who declined to participate and for failures to locate some respondents. Where a household head was not available at his/her home during our visits, we followed Anthony's (2006) procedure whereby we returned to the household at a different time in the same day or the next day. If still not present, we proceeded to another household. We interviewed 246 respondents representing about 9.5% of the households in the sampling frame.

For farmers in the WIS, the survey took three weeks to complete. Farmers were first asked if they participated in the earlier household survey (surveys outside the WIS). Those who did were dropped and replaced with another farmer in the same position of the field as described in 3.2.5.2. Those who could not be found in their fields were, like in the household survey, visited at a later time. If the farmer could still not be found he/she was replaced by another farmer from a similar location within the same Block Unit. All the planned 227 respondents were interviewed due to intensive follow-ups and replacements where necessary.

Both questionnaire surveys yielded a total of 473 respondents who, for analysis purposes, were categorized by location, whether they cultivated in the WIS, and whether they practiced informal irrigation outside the WIS (Table 3.5).

Table 3.5: Distribution of respondents by location, and whether they cultivate in WIS, and engage in informal irrigation (N=473)

Aspect	Issue	Location (%)			
		Upstream (114)	**Within WIS (200)**	**Downstream (132)**	**Other (27)**
Whether household cultivates in WIS (N=473)	Cultivates (303)†	17.5	95.0	50.0	100.0
	Does not cultivate (170)	82.5	5.0	50.0	0
	Total	**100.0**	**100.0**	**100.0**	**100.0**
Whether household engages in informal irrigation (N=473)	Engages (141)	78.9	10.0	19.7	18.5
	Does not (332)	21.1	90.0	80.3	81.5
	Total	**100.0**	**100.0**	**100.0**	**100.0**

† Of the 303 respondents cultivating in the WIS, 76 were identified through the household survey across all locations in the study area (3.2.5.1) while 227 were identified through the stratified and systematic random sampling in the WIS (3.2.5.2).

3.2.3.4. Key informants interviews

Appendix 2 presents a list of key informants who were interviewed through face-to-face interviews. Due to ethical reasons i.e. ensuring privacy, confidentiality, and anonymity of respondents (3.3.5.3), only designations or offices are presented and not names. Structured, unstructured, open-ended, and closed-ended questions (Appendix 3) were used in order to draw out different views and opinions from participants (Creswell 2003). Though some questions were unstructured, care was taken not to digress from irrigation policy reform, water governance and rural livelihoods. Responses were recorded (some audio while others through field notes) and later transcribed and analyzed (see section 3.3.4). Information gathered included:

(a) opinions on the reform and how different stakeholders work and are affected by activities of others;
(b) perceptions about the governance of water and management of the irrigation scheme and their impacts on rural livelihoods and water resources;
(c) trends in agricultural productivity, irrigated area, and benefits from irrigation;
(d) challenges for an effective water governance system and how they deal with them; and
(e) opinions on trends in the Wovwe River flow, state of the river and surrounding environment, floods, dry spells, droughts, and other shocks.

All informants, except the District Irrigation Manager (DIM) and ESCOM Distribution Engineer, were interviewed through face-to-face interviews. These two were interviewed by telephone and the DIM answered some questions through email. My initial strategy to distribute questionnaires to some members of the WWUA Executive and its committees could not be executed as the WWUA Executive was suspended throughout the entire period of my field visit due to alleged financial mismanagement (see 3.4) and I had to resort to meeting them face to face. The good rapport I had established with the WWUA President from the pilot study period proved very helpful as he had to direct me to the other members and assured them that it was not a criminal investigation but an academic research. I managed to interview the WWUA president, some members of WWUA Jury, Irrigation and Maintenance Committee, WWUA Finance Committee Secretary, the former WWUA Secretary, the WWUA Secretary, former farmers' representatives in WWUA, and selected farmers and Block Chairpersons.

In spite of face-to-face interviews being time consuming and costly, they offered several advantages such as a one-to-one interaction between the interviewer and the interviewee; an opportunity to ask for clarification by both parties if an answer is vague or if the question is not clear to the respondent; a chance to capture responses from people who cannot read and write; and an opportunity for new conceptualizations of issues. This confirmed Tashakkori and Teddlie's (1998) observations about the advantages of face-to-face interviews.

3.2.3.5. Focus group discussions and semi-structured interviews

A focus group is a group of people participating in a semi-structured discussion. Usually, participants have something in common e.g. users of the same source of water (Rossi *et al.*

1983). Four discussions were conducted as semi-structured interviews. Two focus groups of sizes 8 (6 men, 2 women) and 10 (6 men, 4 women) were conducted in Gonthaminga (upstream) and Kayaghala (downstream) villages. These group sizes were within recommended effective group sizes of 6 to 12 participants (Rossi *et al.* 1983; Babbie 1990; Morgan 1998; Creswell 2003). The third discussion of 3 participants (2 men, 1 woman) involved two officials from the Extension Department, and an official from the Irrigation Department (Copy Typist) working at the scheme site. The fourth involved four (3 men, 1 woman) WWUA officials. Although the latter two groups were of smaller sizes than recommended, they provided valuable information as these are experts working in the irrigation and/or agriculture sectors. Also bearing in mind that the WWUA was suspended at this time (3.4.1) and that the government had removed most of its staff from the site as part of the reform (1.4 and 3.4.3), having such a number to participate was great luck.

Focus groups helped to gather information on how people think about the reform, water governance, and rural livelihoods; and how different interests are being considered and affected. Focus groups ably supplemented interviews in gathering data and provided in-depth information for the study and for harmonizing views of different study subjects (Morgan 1998). Furthermore, information gathered through focus groups helped to screen responses from other data collection methods such as questionnaire surveys (Rossi *et al.* 1983). Notes were taken and later analyzed (see 3.3.4). Information was further utilized in stakeholder analysis (see 3.3.4.3). Qusetions were not different from the ones used in key informant interviews (Appendix 3) except that here more discussion was encouranged.

3.2.3.6. Non-participant/direct observations

This study used observational strategies to minimize inherent disadvantages of respondents' effects on responses such as controlled responses through self-reporting (Tashakkori and Teddlie 1998). Aware of the downsides e.g. 'objective self-awareness' – the tendency of observed persons to become more aware of their behavioral inconsistencies (Silvia and Duval 2001); and the researcher's erroneous tendencies in making inferences from observed behaviors, I observed and recorded behaviors and interaction patterns as they naturally occurred. I took notes and photographs on: how water is being allocated to different field locations (especially in the WIS) in both wet and dry seasons; how water and the river environment are being managed and used; mechanisms of water access by different users; the

availability of water in both seasons and to various water users; and the state and functioning of physical irrigation and water infrastructure (roads, canals, canal breakages, leakages, water gates, etc).

3.2.4. Data management and analysis

The study maintained a filing system, kept field-notes, and coded and summarized field-notes to ensure easiness when accessing data; sound record keeping; and retention of both data and analyses (Miles and Huberman 1994). The collected data were coded and kept electronically before being analyzed. Both quantitative (IBM SPSS Statistics 18 & Microsoft Excel) and qualitative methods were used to analyze data. Both descriptive and inferential statistics were used. Analyses focused on describing characteristics and investigating relationships between the reform and agricultural productivity, states of peoples' livelihoods and the environment. Findings are reported in form of tables, graphs, charts, test statistics, narratives, quotations, and photographs.

Specifically, quantitative analyses included:

- classifying households according to their demographic, social, economic, and livelihood characteristics;
- detecting trends in agricultural productivity;
- investigating livelihood diversity and their contributions to individual, household, and community or village income;
- investigating trends and variations through studying means, median, variances; and
- investigating the existence and strength of associations between different variables (e.g. socio-economic status and livelihood productivity, etc by performing analyses such as correlation, etc. Interpretations of associations and their analyses were based on coefficients according to de Vaus (2002) (Table 3.6).

Table 3.6: Interpreting strength of relationship coefficients
Source: de Vaus (2002)

Coefficient	Strength	Alternate description
0.00	No (linear) association	
0.01-0.09	Trivial (linear) relationship	Very small, insubstantial, tiny, practically zero
0.10-0.29	Low to moderate (linear) relationship	Small, low, minor
0.30-0.49	Moderate to substantial (linear) relationship	Medium
0.50-0.69	Substantial to very strong (linear) relationship	Larger, high, major
0.70-0.89	Very strong (linear) relationship	Very large, very high, huge
0.90+	Near perfect	

Qualitative data analysis employed the Miles and Huberman's (1994) interactive model which involves the concurrent data collection, data reduction, data display, and drawing and verifying conclusions (Figure 3.5).

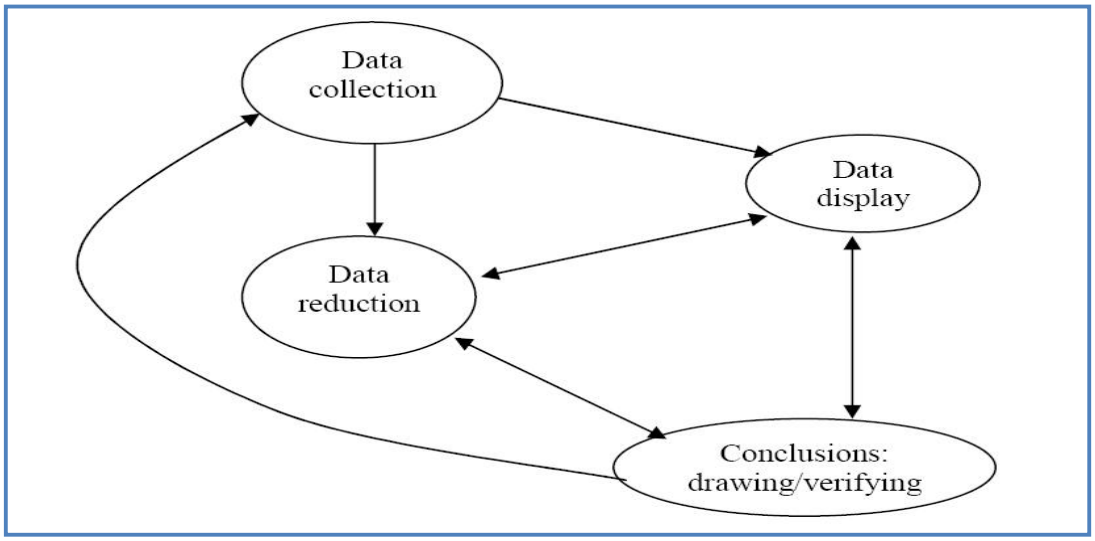

Figure 3.5: The Miles and Huberman's (1994) interactive model for qualitative data analysis

Data reduction was carried out continuously i.e. before, during, and after data collection. It involved conceptualization, case selection, deciding on research questions and procedures for data collection, making data summaries, editing, coding, and identifying themes and patterns. Data are displayed in the form of graphs, charts, tables and matrices. Finally, ***drawing and verifying conclusions*** involved continuous decision making about the meaning of data. Particular tasks involved noting patterns and explanations. Conclusions were verified by revisiting field notes and triangulation (see 3.2.1.1).

3.2.4.2. Detecting trends: moving averages

In order to understand the effects of irrigation reform on agricultural productivity (i.e. yield), this study used smoothing techniques i.e. moving averages (Smith and Smith 2006) to investigate trends. Smoothing techniques remove short-term variations and make long-term trends stand out more clearly. Moving Averages (MA), one of the simplest methods of smoothing techniques, plots averages of a research subject for a specific period of time. With regards to yield, the study investigated trends in yields by calculating and plotting the three-season and five-season moving averages. For example, five-season moving averages were calculated by averaging yields for the first five (5) seasons (first season to fifth season) to come up with the yield to be plotted for season one (1); the average for yields from season two (2) to season six (6) were averaged to come up with the yield to be plotted for season two (2); and so on. This same procedure was repeated for three-season moving averages. The formula for calculating yields to be plotted in the five-season Moving Averages (MA) would be presented by:

MA for Season, $P_1 = (Y_x+Y_{x+1}+Y_{x+2}+Y_{x+3}+Y_{x+4})/5$; $P_2 = (Y_{x+1}+Y_{x+2}+Y_{x+3}+Y_{x+4}+Y_{x+5})/5$; …
where:

$P_1, P_2, \ldots P_5$ = Yields for seasons to be plotted when detecting trends
Y_x = actual yield for season X
Y_{x+1} = actual yield for season X+1
Y_{x+2} = actual yield for season X+2; and so on.

So, consecutive MAs for yields to be plotted for the first 10 seasons would be:

$$(Y_x+Y_{x+1}+Y_{x+2}+Y_{x+3}+Y_{x+4})/5, (Y_{x+1}+Y_{x+2}+Y_{x+3}+Y_{x+4}+Y_{x+5})/5, \ldots, (Y_{x+9}+Y_{x+10}+Y_{x+11}+Y_{x+12}+Y_{x+13})/5$$

or

$$P_1, P_2, \ldots, P_{10}$$

Secondary yield data from both the Karonga District Irrigation Office and the Agricultural Extension Office at WIS were used in calculating MA. Results are presented in form of graphs (see 7.3.1.1).

3.2.4.3. Inverse Herfindahl-Hirschman Index (I-HHI): measuring livelihood diversity

Livelihoods data collected through questionnaire surveys were used to assess livelihood diversity/specialization and contributions of specific livelihood strategies to the overall economic status of individuals and rural communities (household and villages) by using the Inverse Herfindahl-Hirschman Index (I-HHI) (Carlton and Perloff 2000; Ellis 2001). The HHI, a measure of market concentration, is adopted from economics and is a function of all

the individual firm's market shares and measures (Carlton and Perloff 2000). Calculation of HHI involves squaring all the market shares (expressed as percentages) and adding up the squared numbers. This sum is a number between zero and 10,000. The smaller the number is, the less concentrated the market is (the more competition there is among firms in the market), and the less likely any one firm is able to exert much control in the market. For example, if a market has only one firm, it would have a 100 percent market share, and HHI would equal 10,000, or 100^2 x 1. If, instead, there are 100 firms in a market with 1 percent market share each, HHI would then equal 100, or 1^2 x 100. Table 3.7 is a guide for interpreting HHI values. To calculate the HHI, market shares should be determined first and the formula for calculating HHI is given by the formula:

$$H = \sum_{i=1}^{N} s_i^2$$

where

- s_i is the market share of firm i in the market, and
- N is the number of firms; and where N is the number of firms in the market, the HHI ranges from $1/N$ to one, but if percents are used as whole numbers, the index can range from 0^2 (0) to 100^2 (10,000).

Table 3.7: Interpretation of HHI values

HHI	Interpretation
<100	Highly competitive industry without dominant firms
<1000	Unconcentrated
1000-1800	Moderate concentration
>1800	High concentration

Source: Federal Trade Commission (1992)

As HHI is the sum of the squares of the market shares of all firms in the industry, the inverse of HHI is the diversity index – a measure of diversity. Thus, the diversity index is given by

Inverse HHI = 1/HHI.

Applied to livelihood diversity, the Inverse HHI is a summary statistic that helps to capture both livelihood portfolios/strategies and their income shares contributed to total household income. The index of diversity is, thus:

$$\frac{1}{\text{Sum of squares of proportional contributions to total income}}$$

The sum is calculated from the share of each source in total income squared. The maximum index value possible is equal to the number of income sources, and this would be attained if

total income was equally distributed between each source. Table 3.8 illustrates an example of how the Inverse Herfindahl-Hirschman Index (I-HHI) is used in livelihood diversity. Detailed calculations of HHI and I-HHI appear as Appendix 7.

Table 3.8: The Inverse Herfindahl-Hirschman Index (I-HHI) values

Proportional contribution to total income of each hypothetical income source				**Index Value**
Source 1	Source 2	Source 3	Source 4	
1.0				1.00
0.9	0.1			1.22
0.5	0.5			2.00
0.8	0.1	0.1		1.52
0.5	0.3	0.2		2.63
0.33	0.33	0.33		3.00
0.7	0.1	0.1	0.1	1.92
0.4	0.2	0.2	0.2	3.57
0.25	0.25	0.25	0.25	4.00

Source: Ellis 2001

Advantages of the Inverse HHI are two-fold (Chang 1997; Carlton and Perloff 2000; Ellis 2001):

1. it takes into account the total number of livelihood sources; and
2. by squaring individual contributions, the index places a proportionally higher weight on livelihood sources with higher contribution to the total income. The implication of this is that given the same number of livelihood sources per household or village; the higher the contribution of the dominant livelihood source, the more specialized the livelihood strategies and, hence, less competition for resources used to earn that livelihood among resource users. On the other hand, an increase in the number of livelihood sources will result in more diversity of livelihood strategies.

In this study, the Inverse HHI has been used to investigate the diversity of livelihood strategies of households, villages, and locations in the study area; and the contribution of livelihood strategies to incomes of individuals, households, and villages. Although some studies have shown that respondents tend to record higher expenditure values than income if asked, Ellis (2000a) notes that livelihood and income are closely related, and that the composition and level of individual or household income at a given point in time is the most direct and measurable outcome of the livelihood process. Furthermore, the use of income values has yielded important information that has informed policy on poverty reduction, sustainable livelihoods, and natural resources management in Southern Africa (Ellis 2001).

3.2.4.4. Stakeholder analysis

The stakeholder analysis was employed in order to understand the effects of policies on people (Mayers 2005). The analysis used focus groups to collect data which were analyzed to understand the relative interests and influence of different stakeholders. Though focus groups are not generalisable, and that responses may be subjective to the opinions of respondents, the discussion among participants provided checks and balances of the opinions. Data from the four focus groups (3.3.3.4) were used and results were presented in section 5.2.1.3 in a matrix form similar to Table 3.9.

Table 3.9: Stakeholder influence/power and importance attached to the reform

		Interest of stakeholder			
		Unknown interest	Little/no interest	Some interest	Significant interest
Influence of stakeholder	Significant influence	C		A	
	Somewhat influential				
	Little/no influence	D		B	
	Unknown influence				

Source: Grimble and Wellard (1997)

Boxes A, B, and C represent key stakeholders for the reform. Box A stakeholders exert high influence on the reform process while at the same time are highly affected by the reform. Their involvement and cooperation are central to the success of expanding irrigation farming and/or transferring the WIS into the hands of farmers. Stakeholders in Box B are highly dependent on the outcomes of the reform i.e. the reform has a direct impact on their livelihoods. But with little or no influence on the reform, the inclusion of their interests depends on deliberate actions by the institutions e.g. government, WWUA, and NGOs to represent them. Box C stakeholders are not directly affected by the outcomes of the reform and their high influence can bring about undesirable outcomes of the reform. Box D stakeholders are of low priority as their interests in and/or influence on the reform is insignificant.

3.2.5. Research ethics

Research ethics were observed at all levels of the execution of the study i.e. research design, questionnaire design, data collection, data analysis and interpretation, and final reporting of findings. Basic ethical considerations included ensuring free and informed consent; ensuring

no harm and risk to respondents; privacy, confidentiality, and anonymity; and research integrity and quality.

3.2.5.2. Free and informed consent

Obtaining free and informed consent ensures that quality data are obtained. To ensure free and informed consent, the following information, which also formed part of the introduction in the questionnaire, was made known to respondents before they could decide on participating in the study (Miles and Huberman 1994; de Vaus 2002):

- what was to be involved in the study;
- the purpose of the study and how findings would be used;
- that participation was free and voluntary; and
- details of who to contact in case they had questions or needed clarification.

3.2.5.3. Ensuring no harm and risk to respondents

The research avoided subjecting participants to threats and inflicting injuries or harm by minimizing suspicion through establishing sound relations/rapport with them and strictly adhering to culturally-relevant procedures for gaining access. This was done to ensure that access to data, and acquisition of quality data was achieved (Babbie 1990; Miles and Huberman 1994).

3.2.5.4. Privacy, confidentiality, and anonymity

Privacy is a way of guarding researchers from treating secrets casually (Miles and Huberman 1994). Ensuring confidentiality and anonymity protects interests and well-being of respondents (Babbie 1990). This study achieved these by:

- not identifying any responses with particular respondents in reporting;
- restricting access to documents that would aid the linking of names of interviewees with responses to myself. Since households in villages do not have marked numbers, Research Assistants had access to names of households but households were only identified on the questionnaire by the identification numbers I assigned. In the case of irrigation farmers in the WIS, no name was asked but only the line (field) number from the source of water was utilized as a way of verifying our counting; and
- avoiding making possible inferred identification by not linking a respondent's response to his or her profession and/or address.

3.2.5.5. Research integrity and quality

As a way of maintaining integrity and quality, this study:

- avoids data manipulation by presenting data as provided by respondents in as clear and transparent manner as possible;
- reports findings without bias in a non-misleading manner; and
- avoids plagiarism by appropriately citing sources.

3.2.6. Time frame

The entire study lasted 4 years. In addition to the 2 month pilot study, field data was collected during both wet and dry seasons over an 11 months period. The purpose was to capture effects of water governance as a result of the reform in both periods of 'abundant' water – rainy season and 'scarce' water – in dry season when water availability could vary significantly. Consequently, a complete picture has been drawn on the influence of the reform and water governance on rural livelihoods over the whole year.

3.3. Challenges and limitations

This study faced several challenges, some of which threatened the very prospects of its successful completion. The nature of challenges and limitations ranged from governance, time and resources, natural and technical. Below are the corresponding techniques which were employed to overcome these challenges.

3.3.3. Suspension of the Wovwe Water User Association (WWUA) Executive

My arrival in the field was greeted by news that the Karonga District Commissioner had suspended the WWUA executive, pending an audit investigation, due to misunderstandings about financial management that had arisen between the executive and farmers. The situation prevailed throughout the period of my field work. This made it difficult for me to implement my initial strategy of distributing questionnaires to members of the WWUA executive and its committees. Even my plans to observe how meetings of the WWUA executive and other committees (including water conflict resolution, plot and water distribution) were conducted could not be implemented as there were no organized meetings. Furthermore, most of the suspended members were not willing to answer any questions as they suspected my study to be a criminal investigation into the alleged misuse of finances.

However, the good rapport I had established with the President of the WWUA and agricultural officials at the site during my pilot study visit helped in assuring some members to be interviewed. The WWUA President succeeded in assuring some members that I was just conducting an educational study and not a legal enquiry. However, the strategy changed from distributing questionnaires and collecting them at their next meeting to having face-to-face interviews with them. Furthermore, I relied on key informants to clarify some issues and verify some responses from farmers.

3.3.4. Flooding and travel

Conducting questionnaire surveys to rural households was affected by poor roads which were made worse by flooding. Furthermore, floods displaced some of the households who had to seek shelter in schools, churches, and in homes of unaffected relatives (see Figure 3.6 and section 6.2.6.2) away from their homes. In addition, households are primarily farmers who spend most of the day time in the fields. This made the task of locating respondents difficult. To deal with flooding and travel problems, we executed a strategy which allowed interviewing rural households outside the WIS and farmers in the WIS to run together. When the weather could not allow travelling to villagers outside the scheme, we resorted to conducting interviews with farmers in the WIS until weather conditions improved. Accessing farmers in the WIS was relatively easy as interviews were conducted in their fields. Since the downstream was the worst affected part by floods, we started with the upstream going downstream.

Figure 3.6: Displaced villagers seeking shelter at Wovwe Primary school

3.3.5. Access to secondary data

Securing some previous information such as minutes of the WWUA, data for agricultural production and irrigation expenditure, etc, was affected by the suspension of the WWUA executive, the absence of irrigation staff at the site, and lack of available data. I, thus, used multiple sources which included the District Irrigation office and Extension Services office. However, hydrological data for the Wovwe River was not available as recording ceased even before the removal of irrigation staff at the site. To understand the state of the Wovwe River, and weather and climatic conditions, I relied on data from previous recordings, weather bulletins from the Department of Climate Change and Meteorological Services (DCCMS), and perceptions of key informants and farmers.

3.4. Summary

This chapter has attempted to lay down the research design, data collection techniques, data management and analysis procedures, quality assurance, ethical issues, and limitations and challenges to the entire research project. The design of this study emphasizes the use of multiple methods in data collection and analysis to ensure that reliable and accurate data are collected to guide the understanding of the influence of irrigation reform on water resources, the environment, and rural people's livelihoods.

4. THE REFORM

4.1. Introduction

This chapter aims to aid our understanding of how reform in the irrigation sector in Malawi has taken place; and provide an examination of the direction of the reform with respect to its stated goals. The chapter addresses the research question *"How has the irrigation sector in Malawi reformed?"* Although some aspects of the reform at national level are discussed, the chapter mainly focuses on the Wovwe Irrigation Scheme (WIS) and rural irrigation villages along the entire Wovwe River i.e. villages upstream and downstream of the WIS. Data used in this chapter were collected through a combination of questionnaire surveys, interviews, non-participant observations, focus groups, and review of secondary sources.

Findings are presented in four different but related sections, each focusing on a particular reform element and how, in the process, peoples' wellbeing and the environment are being affected. In the first section the chapter presents developments in Malawi's irrigation sector reform i.e. examining the evolution of the reform, nature and scope of the reform adopted at Wovwe, policy and legal framework, and the way the reform is being implemented in relation to other development efforts. It draws on policy changes from the end of the political dictatorship era in 1994. The next section provides a wide picture of the actual reform taking place in Malawi. It highlights specific areas affected by the reform countrywide i.e. irrigation expansion which implies a shift from rain-fed to irrigated agriculture, and actual reform in the irrigation sector (including institutional reform). The third section considers the reform at WIS i.e. set-up of irrigation management transfer (IMT). Here the establishment and operations of the Wovwe Water Users Association (WWUA) are examined in parallel to the former arrangement in order to establish which, and how, areas have been reformed. The fourth and final section presents the challenges the reform process is encountering.

4.2. Developments in irrigation reform

4.2.1. Evolution of the reform

In just about one decade (between 1970s and 1980s), land under irrigation in Malawi increased from about 3000 ha to over 50,000 ha. Expectedly, resources for management of the irrigation systems were supposed to increase in order to match the O&M costs required to sustain or improve productivity of the systems. However, the opposite happened. According

to Kamandani (2004), overall levels of funding for O&M costs remained relatively the same, or where funding increased, the rate of increase was far less than the rate at the time when public irrigation systems were established. Kamandani (2004) further reports that actual O&M costs per hectare were declining.

Consequently, conditions of irrigation infrastructure deteriorated and irrigation systems underperformed and were characterized by inefficient use of water resulting in untimely and unreliable delivery of water. Furthermore, due to deferred maintenance as a result of poor funding, irrigation infrastructure such as canal and drainage systems, water gates, and roads needed comprehensive rehabilitation in just under a decade after establishment. Even after rehabilitating some systems, training farmers, and encouraging farmers to participate in scheme management, little was achieved to improve the performance of the systems. These declining conditions of physical structures together with poor performance triggered irrigation reform in the direction of transferring ownership and management responsibilities from the government to farmers (GOM 2000b).

The reform started with an overall re-examination of the national status of irrigated agriculture. The government formed a Working Group[13] comprising members from different government ministries and departments to assess the conditions of the irrigation systems across the country and recommend an appropriate process of handing systems over to beneficiary farmers to ensure sustainability and enhanced productivity. The assessment revealed that while the private sector was able to achieve high performance, the case was opposite with government-run systems. The main reasons responsible for the downward trend in the public sector were:

1. the top-down approach previously taken by the government in operating and maintaining the schemes. The government was everything i.e. initiator, designer, establisher, and operator of irrigation schemes. Moreover, the government restricted farmer's involvement in operating and maintaining the irrigation systems to only canals and effluent drainage bounding their individual fields. As a result farmers considered government as the owner of the schemes and, thus, also the sole entity responsible for their maintenance; and

[13] The Working Group comprised members from Ministry of Agriculture and Livestock Development, Ministry of Forestry and Natural Resources, Ministry of Women and Children Affairs and Community Services, Ministry of Finance, Department of Economic Planning and Development, and Department of Lands and Valuation.

2. the government approach toward administering the schemes did not fit well with local social and cultural structures. The government moved in farmers from different parts of the country and settled them in irrigation schemes. This infused a sense of tenure insecurity among farmers and, according to Chirwa (2002), also created "fissures in the social structure and in the 'traditional' farming systems".

Responding to the situation, the government acquired a loan from the International Fund for Agricultural Development (IFAD) in late 1990s and embarked on the process of transferring the schemes into the hands of beneficiary local farmers under the Smallholder Flood Plain Development Project (SFPDP). This transfer, referred to as irrigation management transfer (IMT) had the following general prerequisites for scheme handover:

- schemes had to be rehabilitated before any handovers to farmers took place;
- farmer associations i.e. Water Users Associations (WUAs) which would be recipients of the schemes should be formed prior to handover; and
- farmers should undergo in-scheme management training before handovers.

While it is pleasing to note above that the Working Group had diagnosed problems behind the underperformance of public irrigation schemes, the government's preconditions for the transfer centered mainly on the physical conditions of the scheme and institutions established to manage the transfer. This ignored key factors or preconditions pertaining to the socio-economic interactions between the irrigation systems and the people the transferred systems are intended to serve (2.2.3.2). Perhaps, the Working Group would have broadened its assessment into such issues and incorporated some farmers in its team to ensure that fundamental issues to the success of the IMT are taken on board.

Nevertheless, based on the aforementioned situation, the government is now pursuing the transfer of its existing irrigation schemes to farmers who are currently undertaking irrigation farming in the schemes (GOM 2000a; 2000b). The process started on a pilot basis with three irrigation schemes (see 2.6.6.3 and 3.2.4) – one of which is the Wovwe Irrigation Scheme, the case in this study. Irrigation schemes are, in a phased manner, handed over to local WUAs who, upon transfer, become legal owners and assume all responsibilities for the scheme management and operations (GOM 2000b). In doing so, the government hopes to promote self-reliance where farmers will be able to operate, maintain, and manage the schemes as a

community enterprise with very limited external intervention. This, eventually, is intended to eliminate or significantly reduce government financial burden towards operation and maintenance (O&M) costs and achieve sustainability of irrigation systems (2.6.6.3).

4.2.2. Nature and scope of the reform

An examination of the current irrigation reform reveals that the country is attempting to embrace a full IMT approach where the government transfers ownership, management authority and responsibility for the schemes into the hands of beneficiary farmers who are organized through newly formed WUAs (GOM 2000b). The government is handing over to WUAs all assets of the schemes, structures including headworks and all its accessories, and all canal and drainage systems. Upon full handover, WUAs will assume all O&M responsibilities and take over all decision making powers and control over the use of structures though they will not be allowed to sell them or use them as collateral unless the government and the concerned WUA agree to remove the restriction (Kamandani 2004).

Furthermore, following the Working Group's recommendation that land on which the irrigation systems are established should still remain public to avoid any loss of authority over it by WUAs to traditional leaders once reconverted to customary status, the government made it as a policy issue for WUAs to attain a legal status in order for the land to be transferred to them. The National Irrigation Policy and Strategy (2000) states that

> "… As far as Government schemes are concerned, the details of future ownership will ensure transfer of the land and assets to local farmers' organizations. … These schemes are located on public land, as government developed the schemes, and because of this, they can only be handed over to an organization that has recognized legal status. Government will thus introduce legislation that will enable the formation and registration of small holder irrigation farmers' groups, to which the government would then hand over the ownership of the schemes. The most appropriate organizations for the schemes are either associations or cooperatives" (GOM 2000b, pp.7 & 11).

The policy direction of the government is to hand over not just management, operation and maintenance, but also ownership. This was echoed by the District/Divisional Irrigation Officer, when asked to specify what government has so far handed over to the WWWUA: *"... The irrigation field, the field canals, the field drains, and at least an office are already handed over".* All hydraulic levels with the headworks being the highest, full authority of

O&M, and the whole land area of the irrigation system are being directly transferred from the government (Department of Irrigation) to concerned associations with the facilitation of appropriate policy and legal instruments (Simfukwe pers. comm.).

4.2.3. Policy and legal framework

Since the political transition in 1994 from the dictatorship era, the government has developed new policies, revised old ones, and enacted legislation with the aim to create a conducive environment for socio-economic development, poverty reduction, sustainable utilization and management of natural resources and the environment. Relevant policies to irrigation reform include the National Irrigation Policy and Strategy (2000), the National Environmental Policy (1996), the National Decentralization Policy (1998), the Malawi Poverty Reduction Strategy Paper (2002), the National Land Policy (2001), the National Water Policy (2004), and the Malawi Growth and Economic Strategy (2006). Parliament has likewise enacted necessary legislation to back implementation of policies e.g. the Environmental Management Act (1996), the Local Government Act (1998), and the Irrigation Act (2001).

4.2.3.1. Policy framework

The National Irrigation Policy and Development Strategy (NIPDS) (2000) is the main document guiding irrigation development. With respect to reform, it calls for the withdrawal of government support from all sixteen public smallholder irrigation schemes and transfer of them into the hands of farmers' associations:

> "The intention of Government is to transfer ownership, management, operation and maintenance of existing government irrigation schemes to those farmers who are currently in these schemes" (GOM 2000b, p.11).

Under the policy, moreover, development of small-scale informal or traditional irrigation is being encouraged and expanded with government support

> "… the government will act as a catalyst for developing informal irrigation by providing information about and access to simple irrigation technologies. These technologies may include simple water harvesting techniques, hand dug wells, manual or fuel operated small pumps and simple diversion and water control structures" (GOM 2000b, p. 12).

The policy reform is being implemented in two fronts (see 4.3): 1) the transfer of existing government irrigation schemes into the hands of beneficiary farmers; and 2) irrigation expansion through provision of support to smallholder farmers which implies a shift in emphasis from rain-fed agriculture to irrigated agriculture.

The irrigation policy direction is supported by the country's overall economic growth and development policy i.e. the Malawi Growth and Development Strategy (MGDS), which regards irrigation development as a key strategy for achieving economic growth, food security, and poverty reduction (GOM 2006). The MGDS ranks irrigation development second in the country's development priorities list and puts forward two main strategies for realizing maximum benefits from the irrigation sector i.e. the establishment and promotion of small and medium scale irrigation schemes to enhance food and cash crop production; and the construction of dams for irrigation purposes (GOM 2006).

This policy direction seems good for the country's poor rural communities particularly with regards to ensuring food security and improving peoples' economic status. However, such emphasis on irrigation development needs to be cautiously received as international experiences show that irrigation development may also come with detrimental effects to the environment and even agricultural productivity it is intended to bring (see 1.1). Successful irrigation development can, thus, be achieved if there are reliable water supplies and that the use of water be properly regulated. However, the case at Wovwe shows that there are problems with water access – manifested in issues of water rights and scarcity (see 4.5.4 and 6.2.2 for further findings and 8.3.2.2 for a detailed discussion) especially between formal and informal irrigators. It is, thus, essential that national policies clarify issues of water rights particularly between customary and formal rights to avoid conflicts and frustrations to irrigation development and to poverty reduction efforts.

In this vein, the country developed the National Water Policy (2005) which establishes water institutions to regulate the use of water to ensure sustainability. One such institution is the Water Resources Board (WRB) which is charged with the responsibility to implement the water rights regimes (GOM 2005b). Under the policy, the use of water for any productive purposes is prohibited unless necessary permits are obtained from the WRB. Those using water for irrigation are required to apply for and hold water rights. However, users cannot hold water rights unless they have legal status and pay for the rights. The WRB, apart from issuing water permits, also has the duty to: ensure that water rights held by users are not adversely affected by illegal abstractions by others; oversee pricing of water for irrigated agriculture to safeguard wastage due to under-pricing and protect farmers against overpricing

by local organizations; and oversee adherence by the irrigation sector to water quality standards e.g. quality of effluent discharges from irrigation establishments and monitoring ground water pollution resulting from irrigation pollution.

Farmers in the WIS acquire rights by paying water fees to the WWUA which in turn pays for water rights to the Water Resources Board (WRB). The WWUA pays MK46,000 (US$287.50) to the WRB annually for withdrawal of the scheme design water requirements of 35,753m³/day (2.6.7). In turn the WRB is obliged to monitor water withdrawals from the river so that the rights holders are not negatively affected by abstractions by other users who do not pay for the rights see 4.4.2.3 and 5.3.1). However, informal irrigators do not pay for water rights, instead they use customary rights.

The use of two rights systems on the same water source (Wovwe River) has resulted in profound problems in the enforcement of water rights (see 6.2.2.2). Although farmers in the WIS pay for water rights, their water interests are not being protected by the WRB from 'illegal' abstractions particularly upstream (4.5.2). The WRB is caught between abiding by its obligations to protect interests of paying members and supporting government efforts to promote small-scale informal irrigation operated under the customary rights framework. As the government is supporting the development of large areas into informal irrigation establishments (4.3.1), there is need to coordinate irrigation farming across same river basins and, perhaps coordinating the work of institutions working on the management and use of water resources.

4.2.3.2. Legal framework

One of the main features of irrigation reform is the establishment of WUAs as central institutions for irrigation management. For WUAs in Malawi to be able to take ownership of public land on which irrigation schemes were developed, they need to attain a legal status. WUAs attain this by registering under the Trustees Incorporation Act (1962) as beneficiary-owned, non-profit organizations. Section 3(1) of the Act provides that

> "Trustees of any charity for religious, educational, literary, artistic, scientific or public charitable purposes or of any association of persons for any religious, educational, literary, artistic, scientific, athletic or charitable purpose which in the opinion of the Minister is for the benefit or welfare of the inhabitants of Malawi or any part thereof may apply in the

> prescribed manner to the Minister for a certificate of incorporation of the trustees of such charity or association as a corporate body" (GOM 1962).

The choice of forming WUAs as registered trustees is an important step forward in achieving sustainability of irrigation systems. Since the most important aspect of the schemes is O&M and that the main need is effective and efficient water delivery (Kamandani 2004), acquiring adequate funds is critical for the sustainability of irrigation systems. As beneficiary-owned and non-profit making organizations, the WUAs including the WWUA are supposed to use the monies they realize or collect from farmers for running the affairs of the scheme and not sharing among its members. The issues, however, becomes whether WUAs have required capacity to manage finances of the organization. At Wovwe, results show that the managing entity (the WWUA) lacks transparency and accountability in the management of finances (4.5.6). This suggests that achieving financial sustainability is not just devising effective means of soliciting fund, but also putting in place measures effective enough to ensure sound, transparent, and accountable management of finances.

Regarding the sound and orderly use and management of water resources by users, the Water Resources Act (1969) provides for water rights, transfers, and conservation. It regulates abstractions by prohibiting all unpermitted withdrawals, except for domestic purposes, and protects rights holders from any forms of interference by others. The Act stipulates that

> "Any person who, save under the authority of this Act or any other written law, interferes with or alters the flow of … any public water shall be guilty of an offence" (GOM 1969).

The Act establishes penalties which include imprisonments and fines for offenders. It further provides for measures for the conservation of water resources by giving the Minister responsible powers to suspend the right to abstract water from a public water source if the supply for the combined demand is perceived to likely become insufficient:

> "Where in the opinion of the Minister the supply of public water from any source or in any area is insufficient or is likely to become insufficient, the Minister may at any time and from time to time, by notice in writing to the holders of water rights, suspend or vary all or any rights to abstract or use water from that source, or in that area, for such period that he may deem necessary, and thereupon such rights shall cease for the period of suspension or shall be exercisable only as so varied, as the case may be" (GOM 1969).

Furthermore, the government introduced the Irrigation Act (2001) to regulate the handing over of existing government irrigation schemes to beneficiary farmers, and provide for

necessary institutional structures for their management and for future farmer-owned schemes (GOM 2001). The Act establishes a land tenure period of 10 years and a provision of removing the household before the expiry of the tenure in the event of misuse and failure to use land. To ensure fair implementation of the provision, the Act also provides for an appeal system. The Act lists a number of activities as offences in order to ensure sound management and protection of the irrigation system and the environment:

- willful damage to or failure to maintain irrigation canals;
- practices which are destructive or potentially destructive to the catchment of an irrigation scheme;
- grazing livestock in irrigation *dambo* areas or in any irrigated land in which crops are present;
- causing or refusing to assist in fighting fire on irrigated land; and
- use of prohibited chemicals or substances.

With regards to the management of irrigation systems, the Act further provides measures for checking the behaviour of farmers with regard to the use of water and management of the irrigation system. In line with the Act, the WWUA developed a constitution and by-laws which govern the management of the scheme and protection of the Wovwe River water and its catchment. Apart from the aforementioned institutional provisions, communities also govern the use and management of water resources through traditionally accepted rules, norms and practices for water access, conflict resolution, and ways of managing the environment.

However, as presented earlier on under Policy Framework (4.2.3.1), implementation of national legal instruments is a huge problem. For example, although the Irrigation Act (2001) lists as illegal all practices which are destructive to the catchment of the irrigation system, villagers at Wovwe have cleared land along the Wovwe River for gardens as evidenced by the Google Earth image of the upstream part of Wovwe River (Figure 4.1).

Figure 4.1: The upstream of Wovwe River catchment cleared for agriculture
Source: Google Earth (2005)

This suggests that the presence of legislation alone is not enough for achieving sustainability of irrigation systems. Actual implementation of legislation is essential and depends on the availability of enforcing institutions and their effectiveness in carrying out the job. Unfortunately, none is true at Wovwe. This shows that while the government has rightly put in place appropriate policy and legal frameworks for the sustainability of irrigation systems and water resources management, the absence of dedicated institutions on the ground to support national efforts is proving costly to both the environment and sustainability of irrigation systems. Effective institutions on the ground are, thus, crucial if policy goals are to be realised.

Institutionally, irrigation systems in the pre-reform period were centrally managed by the Scheme Management Committee (SMC) which during the establishment of the scheme was known as the Land Allocation Committee. The SMC at Wovwe comprised 15 members of whom 9 came from surrounding villages and the rest were farmers from the settlement camp. During the reform period, the WWUA Executive, whose members are elected after meeting the eligibility criteria (see 4.4.2.1 for details), is the main institution responsible for the scheme and irrigation management. It provides policy and administrative direction on all matters relating to the scheme.

4.2.4. Governance and implementation of the reform

Irrigation reform has adopted decentralization, particularly *devolution* – "the shift of power and authority to quasi-autonomous local units and bestowing appropriate legal mandate on the units" to discharge their functions, as a governance approach. The National Decentralization Policy (1998) and the Local Government Act (1998) provide the overall framework for decentralized governance. It is envisaged that through decentralization, the country will:

1. create democratic local level governance institutions, like WUAs, which will facilitate grassroots' participation in decision making and instill the spirit of ownership;
2. reduce poverty by promoting accountability and good governance at the local level;
3. improve efficiency and cost-effectiveness of the public service through elimination of duplicity; and
4. mobilize local populations to engage in socio-economic development activities in their respective areas.

WUAs, in the context of irrigation reform, are such local level institutions through which local farmers have a chance to exercise their rights to participate in development and decision making while at the same time promoting their livelihoods to reduce their own poverty.

However, the role of WUAs in poverty reduction, improving efficiency, and engaging locals in socio-economic development activities has mixed outcomes – some undesirable, especially when examined against current evidence from the WIS. While chapter 7 provides a detailed account of the reform outcomes, here the dissertation touches briefly on issues relating to governance. The Wovwe case reveals that the government effectively decentralized both the responsibility and authority for running the scheme. While this is good and contrary to decentralization experiences in Africa – where governments tend to devolve only responsibility and not authority (Ribot 2002), the transfer of the WIS from government hands to farmers is not impressive e.g. in promoting transparency and accountability as argued for by Crook (1994) and Ikhide (1999). Legitimacy of those holding positions in the WWUA, accountability of WWUA officers, involvement of farmers in the association's activities, and the way the government has moved to achieve cost-effectiveness of the public service raise concerns regarding the current form of decentralized governance through WUAs (see 4.5 for details).

Otherwise, the policy, legal, and institutional framework makes it clear that irrigation reform in Malawi cuts across many sectors and, consequently, involves various stakeholders such as the government, non-Governmental Organizations (NGOs), local communities, and the donor community in its implementation. This is in line with the Dublin Water Principle number 2: *"Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels"* (GWP 1999). As a key strategy for improving rural livelihoods and socio-economic status of the rural poor, achieving food security, and realizing economic growth, irrigation reform is implemented as an integral part of other development initiatives from other sectors.

4.3. Irrigation reform in Malawi

Reform in the irrigation sector involves the expansion of irrigation and institutional reform in existing government irrigation systems. As part of irrigation expansion, there is a shift from promoting rain-fed agriculture to irrigated agriculture due to unpredictable weather and climatic events. On the other hand, institutional reform involves transferring the management and ownership of existing government irrigation systems to beneficiary farmers.

4.3.1. Irrigation expansion

"In Malawi we have learned good lessons on climate change. We have now resolved to reduce extreme dependence on rain-fed agriculture to irrigation" (GOM 2009). These were the words of Dr. Bingu Wa Mutharika, President of the Republic of Malawi at the World Summit on Food Security for Heads of State and Government held in Rome, Italy from 16th to 18th November 2009. These words signal a resolute shift in the government's long-term policy of relying on rain-fed agriculture to irrigated agriculture as a result of changing climatic conditions. The implication of this shift is the increased use of land and water resources and expansion of irrigation through agricultural intensification and extensification (2.4.2). The current policy direction emphasizes the fact that agriculture remains the main enterprise for socio-economic development and that natural resources e.g. land and water will play a crucial role in achieving agricultural productivity.

Two forms of irrigation expansion are implemented. 1) New irrigation systems are being established; and 2) small-scale informal irrigation at household or community levels is being promoted. The Green Belt Program (GBP), a government initiative (currently in a pilot phase)

which aims to bring about 1,000,000 ha of land within 20km from a water source under irrigation (GOM 2010), is one of the key strategies the government uses for expanding irrigation activities. The program aims to develop a continuous stretch of irrigated crop land with expected higher than current yield returns. Though emphasis is on rice production, growing of other crops such as maize, wheat, sugarcane, legumes, beans, peas, and sunflower; and livestock rearing are also being promoted (Simfukwe pers. comm.). Lake Malawi and Lake Chirwa together with perennial rivers, including Wovwe River, across the country are the main sources of water for the program. Resources saved from IMT are designed to form part of the funds for irrigation expansion (Simfukwe pers. comm.).

The promotion of small scale irrigation at community or household levels has, since 2004, progressed on two fronts i.e. making irrigation water accessible to farming households; and ensuring that agricultural inputs are both affordable and accessible to households (GOM 2006). The government is rehabilitating existing dams, constructing small earth dams, and distributing free treadle pumps to farmers across the country through their members of parliament to make sure that farmers easily access water. Furthermore, more land is being developed for irrigation. Since the 2004/05 growing season the government has been running the Agricultural Input Subsidy Program (AISP) to ensure that agricultural inputs such as seed and fertilizers are more affordable and accessible to poor smallholder farmers by subsidizing their market price.

It is clear that the government has been at the forefront of promoting irrigation expansion. For example, land under smallholder irrigation increased by about 142% from 12,000 ha in 2004 to 29,000 ha in the 2007/08 season (GOM 2008). Furthermore, 19 of the 28 districts of the country were, in 2008, each having at least one irrigation scheme together benefiting over 300,000 Malawian. Between 2004 and 2008, the government distributed more than 98,000 treadle and motorized pumps for free to households in all constituencies (193) of the country (GOM 2008), constructed 22 small community earth dams in 20 districts, and rehabilitated 47 small community earth dams which are currently being utilized by smallholder farmers. In addition to these efforts, the government, in the 2007/08 year, embarked on constructing two new irrigation schemes, one in Lweya in Nkhata Bay District in northern Malawi, and the other in Nkopola in Mangochi District in southern Malawi (GOM 2008).

Moreover, the government, through the National Irrigation Policy and Development Strategy (GOM 2000b) further commits itself to irrigation expansion by (GOM 2000b):

- identifying areas with potential for irrigated agriculture and sensitizing farmers about them;
- acting as a catalyst for developing informal irrigation by providing information about, and access to simple irrigation technologies through Rural Development Programs (RDPs) and Extension Planning Areas (EPAs);
- providing technical guidance through the Agriculture Development Divisions (ADDs) and Rural Development Projects (RDPs), and promoting and supporting the establishment of self-help schemes;
- reviewing existing tax and excise regulations in order to simplify importation of affordable irrigation equipment for local farmers; and
- preparing and providing catchment wide development plans to ensure proper coordination of all development programs within the same river basin.

Apart from government, irrigation expansion is also being promoted by donor funded rural projects such as the One Village One Product (OVOP), and the Farm Income Diversification Project (FIDP), among others. These projects assist with the development of rural irrigation, provision of advice and loans to farmers' groups e.g. OVOP. NGOs such as World Vision International support local farmers in their engagement in irrigation farming by promoting and supporting group irrigation. They also give farmers farm inputs and provide technical advice to farmers' groups on how to do irrigation farming (Chirwa pers. comm.). This is done on a small-scale, usually village level. In addition to supported irrigation, locals themselves too develop small irrigation farms – usually on own land close to the river, in *dambos*[14], and areas where floods have receded.

4.3.2. Irrigation institutional reform: the Water Users Associations (WUAs)

The engagement of government into a wholesale transfer of its irrigation systems has necessitated the formation of WUAs as central recipient institutions. WUAs, though independent in their set-up, work with various government departments and ministries depending on issues. For agricultural issues, WUAs work with the Ministry of Agriculture, on water and irrigation with the Department of Irrigation, and with the Ministry of Trade and

[14] Dambos are permanent wetlands (GOM 2002)

Industry on issues regarding marketing of crop produce. Apart from the government, WUAs also have other stakeholders which include NGOs, dealers of agricultural inputs, and villagers surrounding the irrigation system (Mwangonde pers. comm).

The policy and legal framework (4.2.3) is the basic institutional framework of the WUAs. WUAs derive their legal status from the Trustees Incorporation Act (1962), hence have the right to own, maintain and use all the infrastructure of irrigation systems (4.2.3.2). As legal entities WUAs in Malawi can obtain credit, enter into contracts, start and own businesses for profits, and implement penalties on members who fail to abide by rules and regulations. However, according to the transfer agreement, the government forbids WUAs to use any irrigation infrastructure as collateral (Kamandani 2004). Furthermore, WUAs have rights to water for which they pay to the Water Resources Board (WRB) seasonally and their members are obliged to pay water and membership fees to WUAs and have constitutional rights to equitable access to water. Within their structures (see for example 4.4.1), WUAs have institutional establishments responsible for conflict resolution, water delivery, etc.

4.4. Irrigation reform at Wovwe Irrigation Scheme (WIS)

As one of the first three irrigation systems in Malawi on a pilot handover (2.6.6.3), the process has affected, and is manifest in institutional reform, scheme management, land tenure, land allocation, water rights, irrigation extension services, O&M, scheme patronage, social structure, farming practices, agricultural productivity, environmental management (mainly soil, forest, and water resources), livelihoods as well as rural people's economic status. The WWUA is the recipient farmer organization of the WIS and responsible institution for all O&M activities of the irrigation system.

4.4.1. The WWUA institutional establishment and governance structure

Legally the association is known as "The Registered Trustees of Wovwe Water Users Association" and is usually referred to as the Wovwe Water Users Association (WWUA). The association was established in 2002 to promote economic and social status of its members through ensuring an efficient execution of operation and maintenance (O&M) of the WIS. It operates within the Wovwe irrigation area in Traditional Authority Mwirang'ombe within the Karonga South Extension Planning Area (EPA) in Karonga District. The area falls under the

country's northern agro-ecological zone of Karonga ADD. The objectives of the WWUA include (WWUA 2001):

- ensuring efficient and equitable use of water through proper O&M;
- mediating disputes among members and with other water users;
- providing training, extension and other services for increased rice production and profits;
- identifying credit for agricultural inputs and implements;
- ensuring that all members pay membership and water fees, and other dues;
- managing and accounting for all funds of the association;
- liaising and collaborating with government and other agencies on relevant issues;
- fostering unity between the association and leadership of surrounding villages;
- promoting members' good health through proper sanitation, safe drinking water and hygiene practices; and
- maintaining efficient communication with and among its members.

The governance structure of the WWUA (Figure 4.2) has at its top the General Assembly (GA), then the Board of Trustees (BOT). The Executive Committee (EC) which is the secretariat of the association falls under the BOT. The EC functions through its departments or committees. The General Assembly (GA), which comprises all members of the association (all farmers in the scheme), has constitutional powers to elect and remove EC members; decide on major changes to policies of the association; and adopt or amend the constitution or by-laws of the WWUA (WWUA 2001).

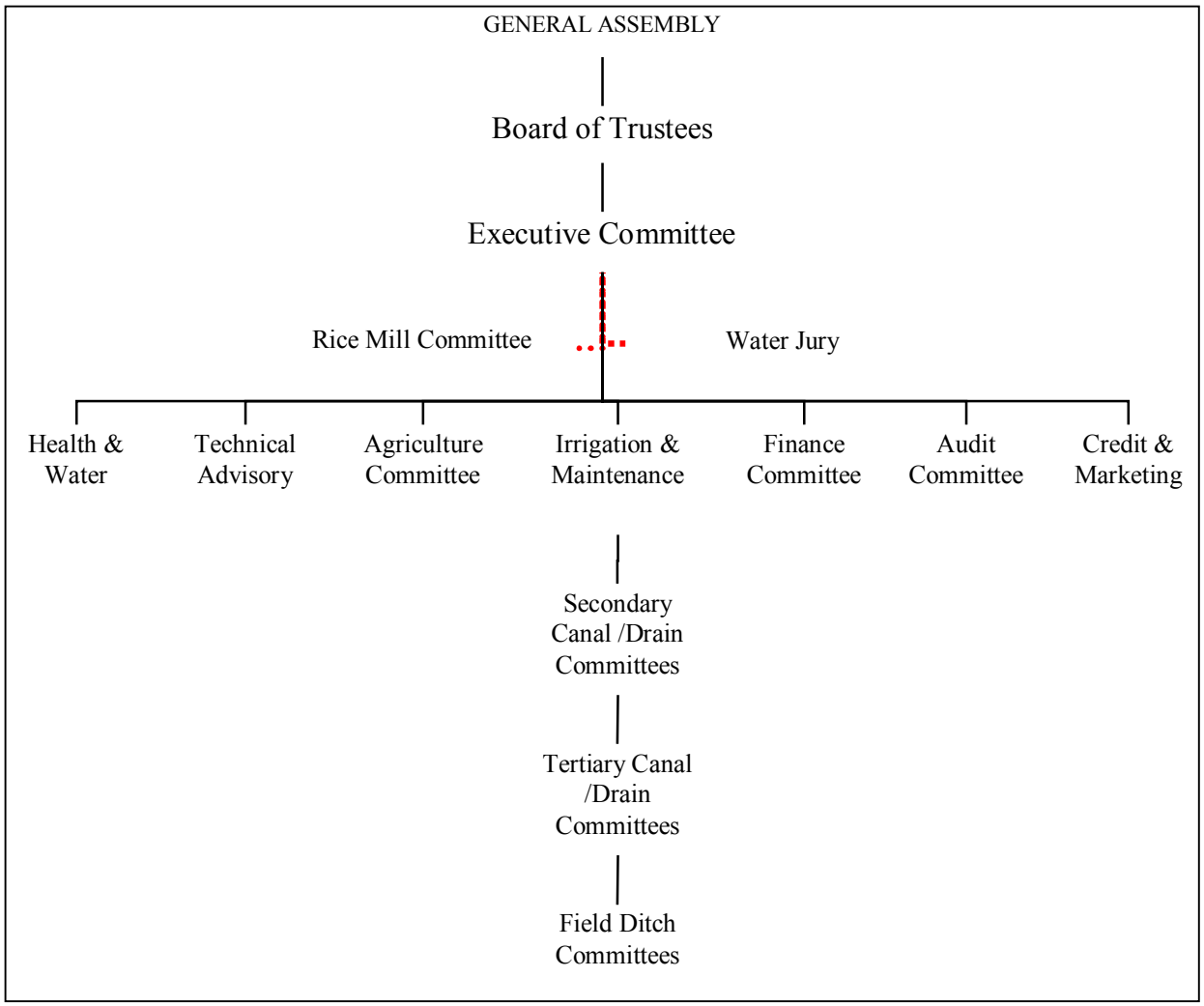

Figure 4.2: Structure of the Wovwe Water Users Association (WWUA)

The constitution of the WWUA has a set of rights and obligations for members (Table 4.1).

Table 4.1: Rights and obligations of WWUA members
Adopted from WWUA constitution (2001) with amendments

Rights	Obligations
• equitable access to water	• willingly contribute personal services towards maintenance of the irrigation system
• vote	• cooperate with other members on all matters of common interest
• stand for election for any elective positions for which they qualify	• comply with by-laws
• freely participate in, and express their ideas at meetings	• pay irrigation fees, membership fees, and other contributions on time
• examine the association's records	• attend all meetings and trainings as called by the executive committee
• call for extraordinary meetings	• abide by majority decisions
• withdraw their membership	• report any emergencies to the Irrigation Committee

The Board of Trustees (BOT) is composed of four appointed members of the clergy and/or retired officers. The Executive Committee (EC) appoints members to the BOT whose main responsibility is to provide leadership guidance to the EC and ensure that the EC functions within its mandate. The current BOT is comprised of three males and one female member.

It has to be noted, however, that despite the National Irrigation Policy and Development Strategy (2000) calling for enhanced incorporation of women in the committees of WUAs charged with scheme management responsibilities (GOM 2000b), the WWUA constitution does not explicitly provide for women's inclusion, instead it only mentions positions (WWUA 2001). This is reflected in low representation of women in management committees including Block Committees (see Table 6.1).

The EC is the main administrative unit of the WWUA. It has seven committees or departments charged with different functions and two independent committees i.e. the Water Jury – responsible for settling water and other farming disputes among farmers; and the Rice Mill Committee which manages the Rice Mill which the association bought with a loan from OVOP. Membership to the independent committees is by appointment by the EC.

When examining the membership of committees, it was observed that some officials held positions in two separate committees which revealed a conflict of interest. For example, the EC appointed the association's Auditor who happens also to be the appointed Secretary of the Rice Mill Committee, whose financial management practices he himself examines. The other observation was that the authority of the EC to appoint and remove members of the BOT who are supposed to oversee the operations of the EC is prone to abuse as the EC would choose to appoint only members whom they feel will do what it wants or the EC would remove any BOT member who objects to the EC's operations even if the member was properly doing her job. For example, one officer at the scheme claimed that the EC appointed the association's Auditor who was close to the EC leadership allegedly for it to be able to cover financial mismanagements. By giving the EC absolute powers to appoint members to various WWUA institutional establishments, the WWUA constitution provides a loophole for abuse of both powers and resources. It would have been more transparent if, for example, BOT members were elected at a General Assembly with nominations coming from villages around the scheme than is the case now.

4.4.2. Reform at Wovwe Irrigation Scheme

In order to highlight irrigation reform at WIS, this section compares the current arrangement and operations with the pre-reform status. It presents findings on various aspects on the reform including scheme management, land tenure and allocation, water rights and distribution, etc, as outlined in 4.4. The pre-reform period is represented by the Scheme Management Committee (SMC) as the establishment responsible for the overall management of the scheme during its period while the reform period is represented by the WWUA.

4.4.2.1. Scheme management

The Scheme Management Committee (SMC), which during the establishment of the scheme was known as the Land Allocation Committee (LAC), had the overall responsibility for managing the scheme with assistance from its three sub-committees (i.e. credit, cultural practices and training, and scheme maintenance sub-committees) and farmers' clubs (Figure 4.3.). It consisted of 15 elected members with the nine main villages surrounding the scheme providing one member each and the rest coming from farmers resident at the scheme settlement camp (2.6.7).

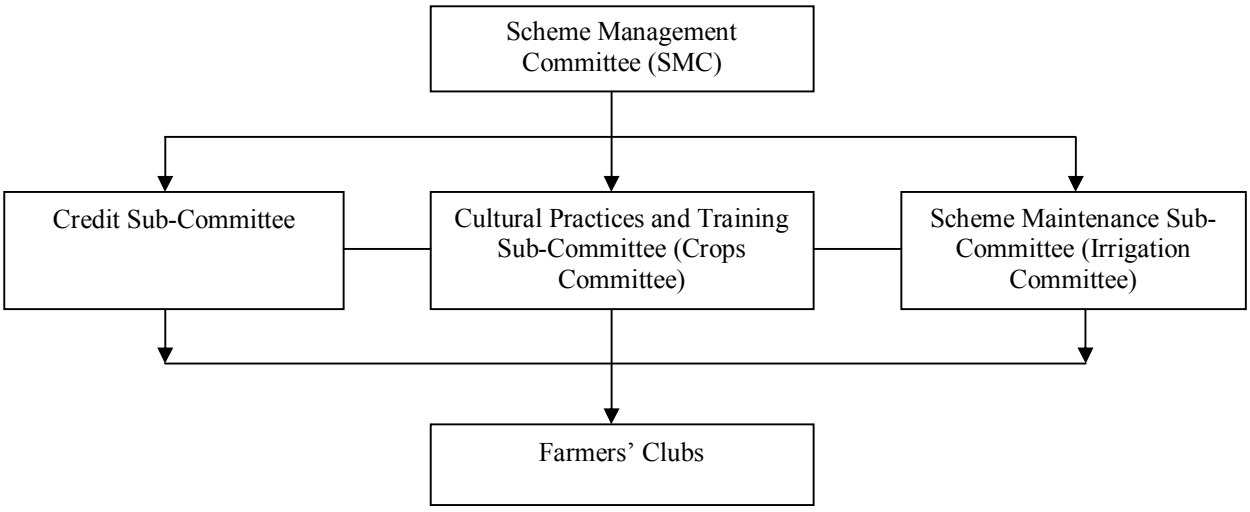

Figure 4.3: The pre-reform management structure of the Wovwe Irrigation Scheme

The Scheme Manager, an employee and representative of the Ministry of Agriculture[15], headed the committee which was supposed to meet once every month and hold joint meetings with its sub-committees once every two months.

The functions of the SMC included allocation of plots; coordinating training for farmers, including recruiting and training of trainers; settlement of land/plot disputes; assisting farmers to be self-reliant; maintaining social order (settling minor civil disputes); and linking farmers with the Extension Services section on policy issues (Lhumbey 1994; Chirwa 2002). The SMC was also responsible for ensuring that all other committees and farmers' clubs at the scheme were properly organized i.e. had bank accounts, receipt books, minute books, etc. Farmers were involved in the management of the scheme through participation in the activities of the SMC's sub-committees:

1. the Credit Sub-committee was responsible for supervising credit i.e. dealing with farmers on disbursement and recovery of farm credits on farm equipment, fertilizers and pesticides. The sub-committee was assisted and advised by the Credit and Marketing Assistant, an employee of the Department of Agriculture;
2. the Cultural Practices and Training Sub-committee (also known as the Crops Committee) supervised all crop management or agronomic activities and was responsible for establishing seasonal cropping calendars, and recruiting training participants. It was assisted and advised by the Field Assistant also from the Department of Agriculture; and
3. the Scheme Maintenance Sub-committee (or the Irrigation Committee) was responsible for all maintenance work at the scheme. Assisted by the Irrigation Assistant from the Department of Agriculture, it ensured that irrigation canals, water gates, and other infrastructure were well maintained.

The interaction of Government officials, i.e. the Credit and Marketing Assistant, the Field Assistant, and the Irrigation Assistant with farmers in these sub-committees facilitated information sharing between farmers and agriculture officials.

Farmers clubs were also an important aspect of scheme management. Clubs were created at unit level i.e. farmers with fields drawing water from the same field canal formed a club and

[15] It is worth noting that at this time, both irrigation and agriculture functions were under the Ministry of Agriculture.

membership was open to all farmers within the unit. Each club elected its own office bearers. Clubs enhanced scheme management by helping in input disbursement and credit recovery; linking farmers with the scheme management; training; and monitoring farming practices of farmers within the unit (Lhumbey 1994).

On the other hand, the reform period has the WWUA Executive Committee (EC) as the overall management unit at the scheme. It oversees and discharges its duties through nine committees (Figure 4.2). Elected at the Annual General Assembly through a secret ballot, EC members serve a term of three years with an option of serving an additional term at the maximum. The committee is composed of the President, Vice President, Secretary, Vice Secretary, Treasurer, and eight committee members. Criteria for eligibility for election are that candidates should be:

1) engaged in irrigation farming within the irrigation system;
2) members in good standing[16];
3) of good moral character and reputation in the community; and
4) non-holders of any elective position in government.

However, when asked for the criteria for eligibility that are practically followed when choosing office bearers, farmers mentioned only good behavior and ability to read and write. With 17.8% of irrigation scheme farmers (n=303) in the survey[17] indicating that they have never attended school (Figure 4.4), this means that the approximately 1 in 5 respondents do not have the opportunity to exercise their rights to compete for positions in the WWUA establishments as provided for by the association's constitution. The implication is that the illiterate farmers are denied an opportunity to directly express their views in scheme management fora including meetings which decide water access and distribution, plot allocation, and even conflict resolution (see 5.2.2.2 and 6.2.4.1 for further information on literacy).

[16] The WWUA constitution defines a member in good standing as one "who faithfully complies with the duties set forth in by-laws as well as the terms and conditions of the Membership Agreement" (WWUA 2001).
[17] See note on under Table 3.5 for 'n=303'.

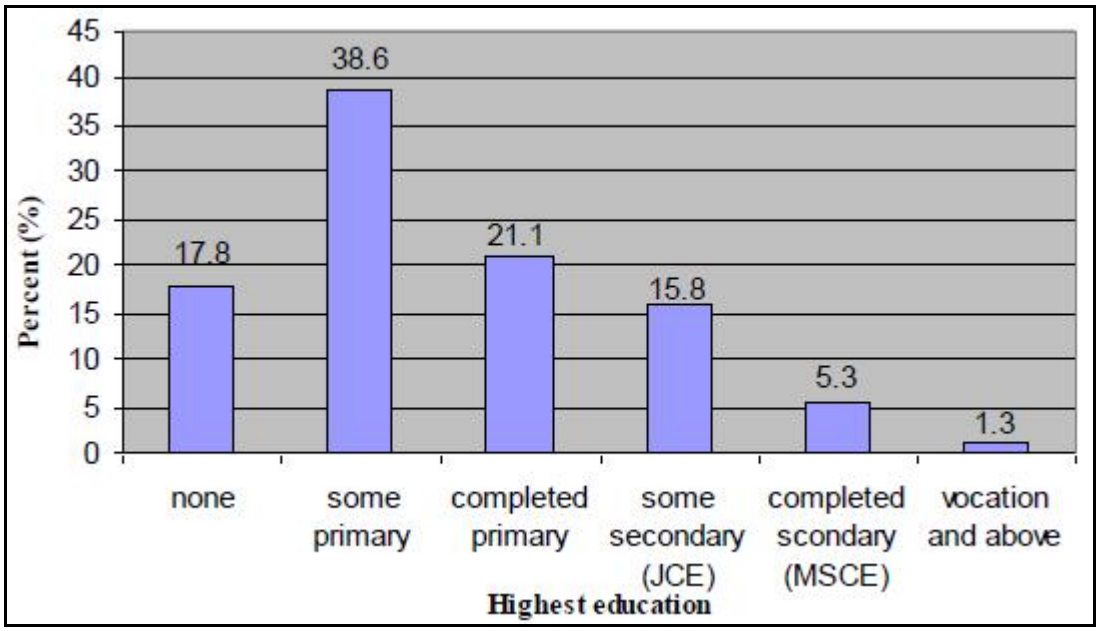

Figure 4.4: Highest education for farmers in the Wovwe Irrigation Scheme, n=303

4.4.2.2. Land tenure, plot allocation, and entry into the scheme

Land on which the WIS was established obtained public status after conversion from customary to public land prior to the establishment of the scheme. Those allocated plots in the pre-reform period were given cultivators licenses allowing them to farm in the scheme. The pre-reform constitution of the WIS called for impartiality when allocating plots to farmers allowing farmers to have land holdings of between 0.2 ha and 0.6 ha each (WIS 1995). The scheme followed a detailed procedure when allocating plots to ensure fairness. At the end of every season new farmers had to apply to the SMC which then allocated plots to farmers after a thorough assessment of their eligibility. Those who already held plots from the previous season were allowed to either retain them or change in favor of plots which were closer to their homes. As criteria, applicants were required to (Chirwa 2002):

1) provide evidence proving their places of origin within Malawi. Letters from the TA or government officials were acceptable evidence;
2) provide proof that they possessed a good past agricultural record and had acquired appropriate farming knowledge and skills;
3) satisfy the SMC that they can socially live well in a society of other farmers. Personal witnesses were needed to meet this criterion. Involvement in witchcraft were sufficient grounds for disqualification;
4) convince the SMC that they were not running away from repayment of debts or agricultural loans from other schemes in the country; and

5) convince the SMC that they can ably work and cooperate with others.

In the reform period, the land is still public and the WWUA Executive Committee is responsible for plot allocation. Conditions for membership to the association or entry into the scheme are that a person should be:

- a Malawian citizen who is not less than 18 years old and resident in the area;
- law abiding and of good conduct; and
- engaged in irrigation farming in the WIS.

All farmers in the scheme at the beginning of the transfer process were, by default, members of the WWUA. New entrants apply to the WWUA Executive Committee through the WWUA Secretary. The Executive Committee evaluates applications and determines which and how much land should be allocated to specific successful applicants. Those allocated with land undertake to cultivate all the allocated land every season and failure to do so empowers the WWUA to take the land away and reallocate it to others.

The survey revealed that farmers hold land within the range 0.1 ha to 1.6 ha (M = 0.274±0.142 ha; n=303). Since the size of one plot is 0.1ha and the minimum proper land holding is 0.2 ha (2.6.7), the landholdings of 0.1 ha not only indicate high demand for irrigation but also informal holdings. Furthermore, the maximum holding of 1.6 ha is almost 3 times greater than the maximum allowable allocation in the pre-reform period. While this may suggest unfair distribution of land during the reform period, when demand for irrigation is relatively high, farmers are almost equally split in their responses on how the reform has affected plot allocation in WIS. Of the 303 respondent farmers cultivating in WIS, 34.7% indicated that the fairness of plot allocation has improved while 35.3% suggested deterioration in fairness of plot allocation. However, 13.9% of farmers reported no difference between the former way of plot allocation and the current one, 16.2% were not sure. This suggests that the reform is still a long way from satisfying farmers in respect of how land is allocated.

4.4.2.3. Water rights and distribution

In the former period, use of irrigation water was not paid for by farmers as the government was solely responsible for all issues relating to water. In order to ensure that water was orderly and equally distributed, the Ministry of Agriculture employed a Water Guard, an

official, who was directed by the SMC to control and manage the flow of water in the main canal and field canals by opening and closing water gates. Furthermore, the SMC made sure that water distribution infrastructure such as irrigation and drainage canals, and water gates were properly maintained through its Maintenance sub-committee or Irrigation Committee which was assisted by the Irrigation Assistant.

In the reform era, farmers in the scheme acquire rights by paying water fees to the WWUA which in turn pays for water rights to the Water Resources Board (WRB) (refer to 4.4.2.5 for revenues). Similar to the SMC in the pre-reform period, the WWUA also employs Water Guards who control the water flow at the intake (headworks) and in secondary and tertiary canals. The Irrigation and Maintenance Committee has the overall responsibility for water distribution and maintenance of irrigation infrastructure. In the entire catchment, water rights include both conventional (as defined by government laws – Water Resources Act (1969)) and customary (local customs, institutions, and practices) rights.

The origins of rights in the Wovwe catchment are both the government (*de jure* rights) and water users themselves (*de facto* rights). The WWUA holds *de jure* rights which are formally and lawfully recognized by the state's legal instruments (GOM 1969). This implies that the WWUA is assured of sustaining its rights since any challenge would not threaten or alter their nature. There are also *de facto* rights held by several water users in the entire Wovwe River course with irrigation and fish farmers' clubs being notable examples. Club or group members agree among themselves to determine appropriate means of access and management of water. For example, members of a farmers' club upstream (Zengelanjala II Village) have defined conditions of membership entry, rules of access, withdrawal and exclusion. Though informal, the group operates as if they are administering formal rights. Unlike in the WWUA case where rights enforcement can be backed by formal legal means, these farmers enforce rights by themselves and in cases where enforcement is challenged by a member, the club refers the matter to traditional leaders (Village Courts) (5.5.7).

4.4.2.4. Scheme operation and maintenance

The SMC discharged its O&M work through the Maintenance sub-committee or the Irrigation Committee which ensured that irrigation canals, water gates, and other infrastructure were well maintained. The duty of farmers was to ensure that distribution and drainage canals

bounding their fields were in good condition. It was within the scheme by-laws that farmers remove weeds and silt in these canals twice each month. By the 25th of each month, every canal had to be clear of weeds and silt and the Irrigation Committee conducted routine inspections. The government through the Department of Agriculture at the scheme, apart from the Water Guard, also employed laborers to repair roads within the irrigation system, remove silt and weeds from canals and drainage, and do any emergency repairs and maintenance.

In the present setting, the WWUA established the Irrigation and Maintenance Committee (IMC) as the main committee responsible for the day to day management of the irrigation system including the headworks and the main canal. The IMC discharges its duties through its sub-committees organized according to hydraulic levels (see Figure 4.2) i.e. the Secondary Canal/Drain or Block, Tertiary Canal/Drain Committee, and Field Ditch Committee (Unit) Committee.) Each Block committee is supposed to have one member responsible for irrigation or water issues, and another for agronomic issues. Maintaining the main canal and headworks is the responsibility of the IMC which organizes farmers from all locations of the irrigation system through Block Committees to do maintenance work.

The pre-reform and reform periods differ in that during the former, the government employed laborers to desilt main canals, repair roads, and remove weeds from the drainage system, while the latter organizes its own members (farmers) to do the job. Furthermore, the staff that used to be employed by government i.e. Water Guards, are now employed by farmers themselves through the WWUA. The practice is consistent with the government policy of handing-over both management and ownership functions (GOM 2000b) and; with the IMT goal of making local farmers responsible for the irrigation systems (Norton 2004). This emphasizes the fact that the government has devolved all the responsibilities for the operations and maintenance of irrigation structures to the WWUA. The WWUA now uses its own resources e.g. labor from its members and paying Water Guards – indicative of the fact that beneficiary farmers are taking ownership responsibilities of the irrigation system.

4.4.2.5. Revenue

Before the scheme entered the transfer process, revenue from farmers was only in the form of predetermined contributions or any other sum an individual wished to contribute. Farmers

only made seasonal contributions of K20.00[18] (US$0.29)/0.1 ha landholding to the Scheme Development and Maintenance Fund which was used for meeting small costs of running the scheme (WIS 1995). Otherwise, all other revenues were fines which were instrumental in maintaining discipline in the scheme. Just before the start of the transfer process i.e. in 2001 the scheme had 1192 farmers cultivating 364.5 ha of land. This means that the final possible maximum contributions of the pre-reform period amounted to 2 x 20 x 3645 = MK145,800.00 (US$2,119.08).

The reform period has seen the WWUA introduce membership and water fees purportedly for the scheme's operation and maintenance costs. Farmers pay an annual membership fee of MK250.00[19] (US$1.69)/farmer and seasonal water fee of MK500.00 (US$3.37)/0.1ha/season (Mwangonde and Mang'umbi pers. comm.). Table 4.2 shows comparative income for the two periods at a 100% rate of collection. The WWUA pays MK46,000 (US$310.43) to the Water Resources Board to acquire rights for water use for a year leaving MK3,974,000.00 (US$26,818.55) which is 98.86% of the total collections for operations and maintenance during that year.

Table 4.2: Income realized by two management periods at 100% rate of collection
Source: WWUA (2001)†

Period	**Pre-reform**		**Reform**	
	MK	**US$**	**MK**	**US$**
Contribution	145, 800.00	2,119.08		
Membership fee	-	-	375,000.00	2,530.69
Water fee	-	-	3,645,000.00	24,598.30
Total	**145,800.00**	**2,119.08**	**4,020,000.00**	**27,128.99**

†Though contributions may differ when taking inflation into account, the figures are meant to emphasise the fact that unlike in the pre-reform period, farmers in the reform period are obliged to pay for the operations and maintenance of the scheme and to ensure continued membership.

These WWUA collections would have been very helpful to the operations of the scheme had the WWUA prudently managed the finances. Farmers allege that the WWUA Executive misuses the collections and that it fails to account for all the monies they pay. This, farmers' claim, makes them reluctant to make any further payments. Clearly, this could be the reason why the former WWUA Secretary claims that not all farmers pay their dues. Even the 2007 audit conducted by the Karonga Agricultural Development Division (KRADD 2007) on

[18] The average exchange rate for 2001 was US$1.00 = K68.8036 (http://www.oanda.com/)
[19] The average exchange rate for 2010 was US$1.00 = MK148.181 (http://www.oanda.com/)

WWUA's accounts, shows that the WWUA does not account for the monies and that their failure to report financial matters to its members is contributing to recent reluctance of farmers to pay water and membership fees: *"... members are reluctant to contribute as the executive is not making reports"* (KRADD 2007, p. 8).

During the time of my field works, the WWUA Executive was suspended by the District Commissioner following farmers' actual refusal to pay water and membership fees, and to do any maintenance work on allegations that the WWUA misuses finances. Farmers' responses and observations from the Extension Officers at the site suggest that, initially, very few farmers failed to pay and were evicted from the scheme, meaning that the WWUA collected nearly all what farmers needed to pay for the running of the scheme as the plots were reallocated to other farmers who paid. Unfortunately, records of evictions could not be accessed due to the suspension of the WWUA. Nevertheless, the reported initial willingness of farmers to pay their dues suggests that farmers accept the financial responsibility of running devolved irrigation systems. Making institutions charged with the overall management responsibilities for the systems financially transparent and accountable would positively contribute to the achievement of sustainability of irrigation systems.

4.4.2.6. Conflict resolution and discipline

The pre-reform period used the SMC to settle water, land and other civil disputes. In order to keep discipline, fines were imposed on those who failed to abide by laws governing the running of the scheme. Various offenses attracted varied forms of punishment (Table 4.3).

Table 4.3: Issues and corresponding fines in the pre-reform period

Issue	Fine (MK)	Alternative punishment
Indecent dressing and indiscipline at committee meetings	20.00	
Demonstration of un-exemplary behavior by a member of the SMC	20.00	
Joining a committee meeting after an opening prayer is made	5.00	
Deserting a meeting in motion	10.00	
Absenteeism at a committee meeting	20.00	
Livestock straying or grazing in the scheme	100.00[20]	
Failure to report at self-help activities e.g. at school, health centre, etc and at seasonal desiltation of main canal (fine per program)	30.00	Suspension from the scheme for one season
Planting noncertified rice seeds or different rice cultivars	300.00	Exemption from farming in the scheme for two consecutive seasons
Delaying repayment of loans until a repayment campaign is done	50.00[21]	
Deforming design specification of scheme infrastructure e.g. breaking canal/drain bank, access roads, ancillary works etc	400.00	Eviction of the individual culprit or the involved group from the scheme
Tapping water from the neighbor's field	100.00[22]	
Failure by a club committee to attend a meeting or training session	50.00	
Cultivation or opening new gardens along the Wovwe River banks within the scheme jurisdiction	100.00	

Additionally, there were several other offenses which, if committed, farmers were punished in a certain way. They included:

- planting later than the gazetted cropping calendar warranted the SMC to reduce the farmer's land holding by one half in the next two seasons;
- involvement in witchcraft or rivalry, resulted in dismissal from the scheme and/or the settlement camp. Surrounding traditional leaders were notified of the decision;
- failure to honor imposed penalties attracted a suspension from cultivating in the scheme for two consecutive seasons;
- failure to report to a disciplinary hearing resulted in confiscation of land holding for two consecutive seasons;

[20] MK70.00 was banked with the SMC and MK30.00 was given to the livestock guard as commission
[21] MK40.00 went to the SMF account while MK10.00 was given to the campaigners.
[22] MK70.00 was given to the victim as compensation and MK30.00 was banked in the Scheme Management Fund. Additionally, a warning letter was issued to the culprit.

- once water gates were opened for the cropping season, failure to start cultivation within the recommended period resulted in an immediate reduction of land holding by one half; and
- farmers risked being suspended from farming in the scheme for two consecutive seasons if they surrendered or lent plots to other farmers without the consent of the SMC.

While it is difficult to establish whether all the offenses were dealt with as per established penalties, what is clear is the fact that in the pre-reform period farmers were much disciplined as the MYP were very strict with discipline.

In the reform era the WWUA established the Water Jury which has the responsibility to handle issues of discipline. The main functions of the Water Jury include: settling disputes among farmers; establishing means for conflict resolution; enforcing the WWUA by-laws and regulations; disciplining law breakers; and advising all WWUA committees on matters of scheme laws and discipline. Although there are also some offenses which if committed attract disciplinary action, the WWUA's list of offenses is shorter, but with higher penalties, than the pre-reform ones (Table 4.4).

Table 4.4: Offenses and corresponding penalties during the reform period

Issue	Fine (MK)
Indecent dressing and indiscipline at committee meetings	50.00
Denying other members access to water	2000.00
Non-observance of cropping calendar (planting after the closing date)	50.00
Livestock straying or grazing in the scheme	1500.00[23]
Failure to participate in scheduled maintenance work (fine per working day)	100.00
Damage to the scheme infrastructure (individual fine)	500.00
Tapping water from the neighbor's field without consent	Money equivalent of one bag of fertilizer at the time

While both periods have similar ways of maintaining discipline and resolving conflicts, conflicts in the pre-reform period were handled by the top scheme management (SMC), while in the latter, the WWUA executive has appointed the Water Jury as the responsible body. This signifies devolution of powers to the lowest possible level. Although there is devolution of powers, under half the respondents indicated that the WWUA has improved the way conflicts are being resolved (Table 4.5). A Chi square test was performed to determine whether there were statistically significant differences in farmers' opinions about the fairness of the WWUA

[23] MK500.00 for the WWUA, MK800.00 for the owner of the field, and MK200.00 for the one who finds livestock

in managing conflicts by both the households' location and with respect to WIS and scheme component in which the farmer cultivated plots. Results show that there were no statistically significant differences in opinions by both location *(X^2 = 14.83, df = 9; p = 0.096)* and scheme component *(X^2 = 7.78, df = 3; p = 0.051)*.

Table 4.5: Farmers' opinion about the fairness of the WWUA Water Jury in managing water conflicts, n=293

Opinion	Percent (%)
Improved	45.4
Unchanged	18.1
Deteriorated	24.6
Don't know	11.9
Total	**100.0**

Those who were dissatisfied with the Water Jury (24.6%) highlighted unfair allocation and confiscation of plots. For example, while the SMC could just suspend farmers on some offenses and reinstate them later, or evict them on serious offenses such as physically deforming design specifications of irrigation structures (refer to Table 4.3), the Water Jury confiscates the land right away and permanently on issues which in the pre-reform era just warranted fines. The loss of land rights to households implies loss of livelihood.

4.4.2.7. Extension services/agronomy

Extension services formed a major part of irrigation farming at Wovwe during the pre-reform period. The Ministry of Agriculture, through its Extension Services Section, gave agronomic advice and instructions to farmers particularly on land preparation, fertilizer application and requirements; held training demonstrations; and visited farmers and gave on-farm advice and instructions. With the help of the Field Assistant, the Cultural Practice and Training sub-committee or the Crops Committee supervised crop management activities and recruitment of training participants. Farmers grew only rice varieties which were recommended by the government.

In the current setting, the WWUA has included the Agriculture Committee (AC) in its design to handle agronomic or extension issues; and the Technical Advisory Committee (TAC) to advise the WWUA on technical matters. The TAC is also supposed to assess and identify

training needs of the association; and facilitate, coordinate, and implement training of sub-committees and members. Specific responsibilities of the AC include (WWUA 2001):

- ensuring that farmers follow the cropping calendar and cultural practices;
- ensuring that farmers apply appropriate fertilizers in good time and recommended quantities;
- identifying and recommending crop varieties to be grown in the scheme;
- conducting on-farm demonstrations;
- ensuring that proper procedures for pest and disease control are followed;
- ensuring that all irrigable land is utilized;
- ensuring that labor saving techniques are available to farmers; and
- identifying and recommending crop varieties for growing during times of water scarcity.

Though the WWUA has establishments in its organization to look into issues of extension services, the actual work is still being done by government Extension Workers from the Ministry of Agriculture. According to the WWUA President and Head of Extension Services stationed at the scheme, the government will stop providing extension services once the transfer is complete and the WWUA will be contracting extension services from the Ministry. Furthermore, extension workers are not just for the irrigation scheme but also for other farming including rain-fed and irrigated agriculture in the whole Nyungwe EPA. The head of Extension Services states: *"The WWUA is independent but the link with extension workers is through the farmers to whom we give extension services. ... The extension staff is not only for the irrigation scheme, but also for the whole EPA covering an area ..."*.

In terms of the reform, the presence of government officials i.e. Agricultural Extension Officers and WWUA working in the same suggest that the reform process at Wovwe is exhibiting a 'co-management' phase (Garces-Restrepo *et al.* 2007) (see 2.2.3). To avoid constraints associated with this phase of the reform, there is need for clear division of roles between the WWUA and Extension Officers if the reform is to be successfully implemented. Fortunately, no conflicts were reported yet.

Furthermore, unlike in the former period, irrigators are now allowed to grow rice varieties of their choice. This was confirmed by farmers, WWUA officials and data from the District/Divisional Irrigation Office (Table 4.6).

Table 4.6: Trend in the varieties of rice being grown in WIS
Source: District/Divisional Irrigation Office

Time/period	Rice variety grown	Potential yield (kg/ha)	Actual yield (kg/ha)	Remarks
Before establishment of WIS	• Faya • Kilombero	6000 6000	2716	Farmers were free to grow any crop variety per season as the scheme was ran traditionally by locals
1980s	• Blue Bonnet	6000	3000	The scheme was under the control of government and only one type of rice variety was permitted to be grown per season
1989 - 1999	• IR (Changu) • IET 7094 (Senga)	6000 6000	4000 3700-4900	One rice variety per season in the whole scheme
2000 - 2010[24]	• Pussa • TCG 10 • Faya • Kilombero • Nunkhile (Pussa/ Kilombero composite) • Other local varieties	6000-8000 6000-8000	4532 4003	Individual farmers are allowed to grow a variety or varieties of their choice in a season

The freedom by farmers to grow verities of their choice confirms Rosegrant's *et al.* (2002) observation that irrigation agriculture induces crop diversification which is crucial for economic development of rural farmers. This is, similarly, consistent with worldwide experiences which show that irrigation reform, i.e. IMT, induces crop diversification (Garces-Restrepo *et al.* 2007. The Wovwe case, not only shows diversity in crop varieties, but also improved actual yield (refer to Table 4.6).

4.4.2.8. Engineering and hiring services

In the previous arrangement the scheme had an engineering services section which was responsible for maintenance of main and secondary canals, collector drains, and field access roads within the scheme. In collaboration with the extension services section, the section was also responsible for issues of water distribution and scheduling, and maintenance and management of government farm equipment including power tillers, ploughs, work oxen, and farm carts which it was hiring out to farmers (Llumbey 1994).

[24] Note: IMT was a result of the Smallholder Flood Plain Development Project (SHFPDP) which was implemented in 1999 with funding from IFAD (see 4.3.1)

Under the WWUA, the scheme has no implements to hire out and maintenance duties are carried out by farmers themselves under the leadership of the IMC. The lack of equipment shows that the WWUA lacks physical capital or resources for its members. Access to resources, including technological resources is one of the determinant factors of households' choices of types of livelihoods to follow (2.5). The implication of lack of implements to farming is that farmers will have to rely on intensive labor. Furthermore, the lack of implements and equipment also demonstrates that the WWUA has inadequate capacity to carry out maintenance work. This could be the reason why the state of irrigation infrastructure such as roads and the general quality of maintenance is poorer in the reform period than before (see 7.2.6).

4.4.2.9. Credit and marketing

The SMC, through the Credit sub-committee, ran a credit scheme for farmers in the form of seasonal and medium term loans. Seasonal credit included provision of seed and fertilizers which farmers had to pay back at the end of the season after selling their crop produce. The scheme also provided work oxen, ploughs, farm carts and harrows as medium term loans. With regard to marketing, farmers' rice was sold raw to two government institutions i.e. the Agriculture Development and Marketing Corporation (ADMARC) and the National Oil Industry Limited (NOIL). The main buyer was ADMARC and farmers reported problems of price fluctuations and inadequate flow of cash to the buyer from the government.

The WWUA has a Credit and Marketing Committee (CMC) with some of its functions being identifying and recommending lending institutions; ensuring proper use of farm inputs obtained through the association's credit scheme; identifying good markets for farmers' products; and ensuring that products supplied by farmers i.e. packaging materials and product quality meet standard requirements. Rice in the reform period is being bought by ADMARC as well as other private traders. The WWUA is free to form cooperatives and run businesses for profit. For example, with assistance from the One Village One Product (OVOP)[25] program, the association acquired a loan and bought a Rice Mill which farmers use so that

[25] OVOP is a government program whose philosophy is based on recognizing the fact that particular locations produce specific products (rice, fruits, vegetables, etc) more than others and encouraging people in such locations to be working in groups to produce in masses and processing their products would empower them to fight poverty by giving them bargaining power through their products.

they can sell processed and packaged rice as a way of added value. Moreover, the WWUA has formed a Farmers' Cooperative whose membership is open to all farmers both within and outside the irrigation scheme. The cooperative runs the business of processing rice and selling it packaged. Figure 4.5 shows a sticker and packaged rice produced by the cooperative.

Sticker

Product

Figure 4.5: A sticker and packaged product of the WWUA
Source: OVOP (2006)

The operations of the WWUA, with regards to credit and marketing, show that members have adequate access to financial capital/resources, including opportunities for access to credit or loans, for their improved farming.

4.4.2.10. Health and sanitation

The government established a clinic at the scheme camp, managed by the Ministry of Health, to deal with issues of bilharzia and malaria. The WWUA included the Health and Water Committee (HWC) in its set-up to be responsible not just for bilharzia and malaria but also for all issues relating to general health, sanitation, and potable water. The HWC also develops plans for managing and maintaining water and sanitation facilities in the scheme.

4.4.2.11. Staff-farmer, WWUA-village relations

In the former setting, management staff at the scheme had two main means of ensuring that the relationship between officials and farmers and other stakeholders was cordial. The first was to distribute copies of the scheme's main documents such as the constitution and by-laws to farmers clubs, Traditional Authorities, surrounding Village Heads, and the District Commissioner. Secondly, technical staff assumed advisory roles to management establishments at the scheme (see 4.4.2.1). Information from field officers at the camp was transmitted to farmers through technical staff members. The meetings of the SMC also ensured sound interaction between officers and farmers (4.4.2.1).

In the current era, the WWUA uses meetings (annual general meetings, extraordinary, and seasonal meetings), letters, posters, announcements, and verbal communications through Block Committees as mechanisms for maintaining contacts with farmers. The association's constitution establishes that a general meeting be held annually; extraordinary meetings – obviously, whenever there is an issue; seasonal meetings – once per season or twice per year; and EC meetings once a month. Contacts with surrounding villages are made through Village Heads who are requested to relay messages to villagers. One notable point of departure is that unlike the SMC which had representatives from surrounding villages, the WWUA does not have any. It only maintains contacts with villages through Village Heads as traditional leaders of villagers who are also irrigation farmers and members of WWUA.

4.4.3. A brief analysis of the reform at WIS

Irrigation reform at Wovwe reveals that the WWUA has assumed a broad range of responsibilities, some of which are beyond the basic purpose of establishing WUAs i.e. water and scheme management. For example, the WWUA has assumed responsibilities of settling civil conflicts (4.4.2.6) and running sanitation and health programs (4.4.2.10). Settling civil conflicts is the responsibility of traditional leaders and sanitation and health programs are also issues which are carried out by government through its community health program. The performance of the WWUA is, thus, affected as the association is overwhelmed and incapable of doing some of the tasks. Reducing the number of committees and cutting on some non-irrigation and non-water management responsibilities would positively contribute to the operations, and hence, performance of the WWUA.

4.5. Challenges of the reform

The reform process at Wovwe is encountering a spectrum of challenges such as resource scarcity, inadequate capacity and others which are natural, social and process-related in nature.

4.5.1. Weather and climate variability

Variability in weather and climate is exposing the inability of the WWUA to successfully achieve objectives of the reform. Floods, dry spells, and droughts affect equitable distribution of water, timeliness of water delivery, and quality of maintenance of irrigation structures

(presented in detail in chapter 7). Farmers' responses in the survey show that the area has frequently been experiencing floods and droughts. The WWUA President and other key informants corroborated with observations of farmers. During floods, the Wovwe River extends into the scheme destroying crops, silting canals, and destroying other infrastructure of the irrigation system such as roads. Large parts of Wovwe I (i.e. Blocks E, R, Q, and S) were, in the 2008/09 summer season, waterlogged (e.g Figure 4.6) rendering some sections uncultivable.

Figure 4.6: Part of the waterlogged section of the scheme

According to the WWUA President, lack of equipment and inadequate resources render the association incapable of carrying out maintenance work such as removing silt from canals and repairing roads. The association relies on the government to send in tractors to raise the banks of the river. Even so, work will still not start until dry season because tractors cannot reach the river and other affected areas.

During droughts and dry spells, water volume in the river drops to levels which negatively affect the intake to the scheme. This results in a stiff competition for water as water access becomes difficult to attain in some parts of the scheme, particularly tail-endings. Farmers in such areas either abandon farming or cultivate late i.e. when competition for water becomes relatively low (Figure 4.7). The problem is further compounded by numerous abstractions for

informal irrigation upstream as informal irrigators block the river flow to ensure that their fields access adequate water (see execution of water rights in 4.5.4).

Figure 4.7: Dry part of Wovwe II left uncultivated in dry season due to difficulties in accessing water

4.5.2. Maintaining social cohesion

Since the Wovwe Irrigation Scheme was established as a settlement scheme with farmers from different parts of the country settled in a camp (2.6.7), the camp site is populated with people who are of different tribes, cultural backgrounds and beliefs. Differences in managing the scheme manifest between local irrigators and settlers especially when electing office bearers for the WWUA Executive Committee. Local farmers feel that the transition is favoring settlers because all elections are conducted at the camp, which is the base for settlers. As a result, most executive positions are always held by settlers. Key informant interviews revealed that local farmers from areas other than the scheme settlement camp consider their distance from the scheme camp to be a disadvantage as they cannot effectively support one candidate as settlers at the camp do, and that it is difficult for all of them to come during the day of voting. As such, they feel that organizing voting to be taking place at the settlement camp is a deliberate mechanism of excluding them from legitimately participating in elections and holding positions.

Consequently, the WWUA Executive receives little support from a majority of farmers, some of whom consider it to be illegitimate and are calling for the former way of managing the scheme – where each surrounding village was contributing a member to the Scheme Management Committee, to be reintroduced. Farmers feel that the government was better in terms of managing the scheme and meeting farmers' needs than the WWUA (Figure 4.8).

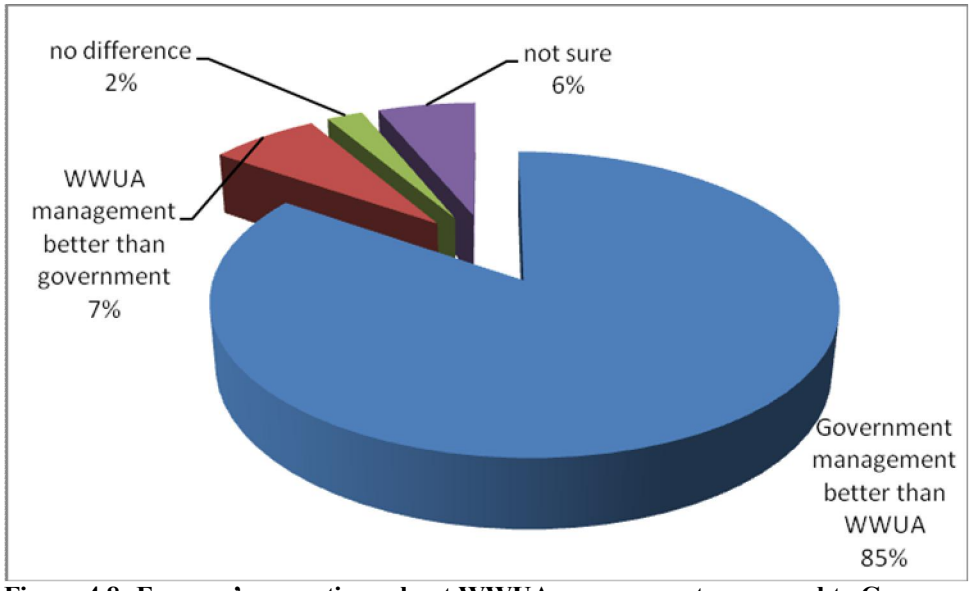

Figure 4.8: Farmers' perceptions about WWUA management compared to Government; n=306

4.5.3. Capacity to manage and maintain the scheme

The WWUA Executive points out that it lacks adequate resources to carry out O&M work effectively. With the level of resources it has, the Executive argues that it cannot hire machinery to remove silt from the river and to pay for all O&M costs. Inadequate resources combine with the rapid withdrawal of government irrigation staff to emphasize the lack of capacity by the WWUA. Immediately following the start of the IMT process, the government withdrew its entire technical irrigation staff and left behind only the Copy Typist as a way of cutting costs. This had implications on the reform as the hydrological measurements stopped from being recorded and the WWUA had no where to get technical advice. Though the transfer process is still in a pilot phase, government pull-out has not been gradual to allow for learning by WWUA officials. The Divisional Irrigation Office acknowledges that farmers fail to effectively handle major maintenance and rehabilitation works on their own (Simfukwe pers. comm.).

4.5.4. Execution of water rights

The WWUA pays for the use of water in the irrigation scheme (4.4.2.3 and 4.4.2.5) while other users upstream and downstream use water for free. When rains are normal, no user including the WWUA experiences any water shortages. But in times of drought and in winter (dry) season, water levels in the river drop leading to untimely (7.2.7) and inequitable (7.2.8) delivery of water to some sections of the scheme. The WWUA President, and several other farmers both in the WIS and outside, and upstream Village Heads confirmed that upstream villagers, who have developed informal irrigation schemes with the same river supplying water, block water with bags of sand to raise the water level in the river to allow a better flow into their irrigation canals. This further reduces flow to the WIS and other informal irrigators downstream. Attempts by the WWUA to restrict upstream villagers from abstracting water fail to achieve results as upstream users refuse to let the water go on the basis that water passes through their land and hence have rights of use or withdrawal whenever they want to. Traditional Authorities were called in to try to resolve the issue but the only solution achieved was a non-binding agreement that upstream villagers should not completely block the water.

Here are two groups, one acquiring water rights through paying while the other has customary rights by virtue of owning the land through which the river passes. To both groups water is vital for livelihoods. While one of the functions of the Water Resources Board is to ensure that water rights held by users are not adversely affected by illegal abstractions by others, it cannot be successfully argued that agricultural water use by upstream users is illegal since customary rights are well recognized and the government is encouraging local farmers to open up informal irrigation establishments at household or community levels (4.3.1). It is also the government's irrigation policy objective to encourage villagers to develop informal small-scale irrigation schemes with the aim of achieving food security and improving rural peoples' economic status. In view of these developments, the upstream-downstream water problem remains far from being solved – particularly if adverse climatic events continue to occur and irrigation development is not coordinated.

4.5.5. Credit and marketing

The handover process is not only affecting management of the scheme, but also the issue of finding market for farmers' produce. Though the WWUA reports improved market prices for their members' rice, it also acknowledges that there is competition with other rice growers

across the country to persuade the few buyers in the country to buy their rice. Both focus group discussions held with some WWUA Executive members, and with Extension Officers and an irrigation staff observed that persuading buyers has at times resulted in farmers selling their produce at a relatively lower price than they would have if competition for buyers was less stiff.

4.5.6. Financial management

The WWUA is not yet able to manage their funds prudently enough. Audit reports (KRADD 2007) show that the WWUA Executive that preceded the current one could not account for all the association's revenues. The current executive is in a similar situation. Farmers allege that it abuses the monies they pay as water and membership fees. As a result, farmers refused to pay water and membership fees for the 2008/09 summer season demanding that the executive should first account for the money it has been collecting from them (4.4.2.5). During the time this research was conducted, the District Commissioner suspended the entire WWUA executive and instituted an audit inquiry into the allegations. Financial mismanagement by authorities is, thus, a disincentive to farmers to support the reform. A majority of farmers showing disapproval of the management system of the WWUA (refer to 5.2.1.1) indicated financial mis-management as the main reason.

4.6. Summary

An examination of the evolution of irrigation reform in Malawi shows that underperformance of existing government irrigation schemes and failure of rain-fed agriculture to produce adequate food supplies to communities and the nation (especially with changing climatic and weather events) were among the factors which triggered the reform. Coupled with the country's weak economy, effective management of public irrigation schemes could not be sustained by the government as evidenced by dilapidated irrigation infrastructure and declining agricultural productivity.

The reform took off by revising old policies and legislation, and developing new ones where necessary. The direction of agricultural development changed from emphasizing rain-fed farming to promoting irrigated agriculture while not overlooking the former. The reform advocates irrigation expansion (even at household and community levels) and transfer of ownership and management of public irrigation systems from the government to local

beneficiary farmers. Water Users Associations (WUAs) are being formed as recipient organizations of the systems. At Wovwe Irrigation Scheme, the Wovwe Water Users Association (WWUA) is in the process of taking over full ownership and control of the scheme.

Results to-date indicate that while some positive reform outcomes are being registered, there are several challenges in the reform process for the WWUA to achieve desired results of improved agricultural productivity, quality maintenance, and instilling a sense of ownership in local farmers. While the government has been successful in reducing costs of O&M on its part by withdrawing irrigation staff, a significant financial and technical burden has been left on the farmers. Challenges also reveal that there are several players or interest groups whose roles in governance, water access, etc, are vital for achieving any meaningful and successful reform. The next chapter examines these stakeholders and how they govern themselves and water resources.

5. COMMUNITIES, STAKEHOLDERS AND WATER GOVERNANCE

5.1. Introduction

Following a presentation on how the irrigation sector is reforming and being governed in the preceding chapter, here the dissertation presents a detailed account of actors or stakeholders[26] affecting and/or being affected by the reform and their water governance system. By doing so, the dissertation is answering the research question *"How do the current Wovwe River water stakeholders access water and/or negotiate their access to water?"* The basis for answering this question is the realization that knowledge of stakeholders and means through which they gain and negotiate their access to water enhances the understanding of processes of water governance and the resultant effects on livelihoods. Review of secondary data, focus group discussions, direct observations, questionnaire surveys, and interviews were the primary means of gathering data. Both qualitative and quantitative (SPSS 18.0) methods were used in data analysis.

Findings are presented in four main sections. The first introduces a range of current stakeholders and their attributes with respect to the reform, water resources management and use, and household characteristics. In doing so, the section investigates suitable socio-economic factors of the reform for sustainable water resources management and attainment of sustainable livelihoods. The next section presents a case for water access negotiation in the Wovwe catchment and gives an account of how households negotiate their access to water. The section documents practices the rural people engage in to gain control over water for their livelihoods. The third section details mechanisms through which stakeholders access water. Lastly, the chapter presents processes of management and practice used by stakeholders in accessing water.

5.2. Stakeholders in the current reform process

Focus groups discussions, key informant interviews, and secondary sources revealed that there is a range of stakeholders affecting, and being affected by, decisions/actions concerning water governance and use at Wovwe in the current reform. These stakeholders, listed in Table

[26] A stakeholder is defined as "any entity with a declared or conceivable interest or stake in a policy concern" (World Bank 2005).

5.1 with their corresponding interests, roles, and responsibilities are categorized as individuals, groups, or institutions.

Table 5.1: Current stakeholders by interest

Category	Stakeholder	Interests, roles and responsibilities
Individuals	Upstream and downstream household irrigators	• Own and/or cultivate land along the river and in its catchment • Establish informal irrigation schemes and divert water from the river • Open vegetable gardens along the river and in *dambos*
	Irrigators in WIS	• Cultivate plots in the WIS • Contribute labor towards maintenance of the irrigation infrastructure i.e. canals, drains, roads • Pay membership fee for the management of the scheme • Pay water fees to acquire rights to use water • Participate in governance structures of the WWUA
	Villagers and farming households (upstream and downstream)	• Own and/or cultivate land in the Wovwe River catchment • Open vegetable gardens along the river and in *dambos* • Use river water for irrigation and domestic purposes, including livestock • Collect firewood from the catchment
	Livestock farmers	• Graze in the catchment including along the river • Use river water for watering livestock
	Fishermen/fish farmers	• Fish in the Wovwe River and Lake Malawi • Construct fish ponds along the river • Cultivate fish in fish ponds
	Weavers	• Use reeds and other vegetation growing along the river and in the catchment for weaving
	Gatherers and hunters	• Hunt along the river • Collect thatch grass (women)
Groups	Farmers' clubs	• Open crop fields and vegetable gardens along the entire river course • Draw/divert water from the river for irrigation use
	Fish farmers	• Construct fish ponds along the river • Cultivate fish in the ponds
Institutions or organizations	Water Resources Board (WRB)	• Issues water rights/permits • Monitors irrigation effluent quality • Regulates use of water • Oversees pricing of water by local associations • Ensures that rights holders are not affected by illegal abstractions
	Department of Irrigation	• Promotes irrigation • Provides policy direction on irrigation • Provides technical assistance to irrigators
	Ministry of Agriculture (Extension)	• Provides policy direction on agriculture • Provides extension services (for both crop and animal husbandry)
	The Wovwe Water Users Association (WWUA)	• Manages day-to-day operations of the scheme • Responsible for maintenance of the irrigation system • Collects water and membership fees

		• Implements the irrigation reform at the WIS • Formulates regulations and rules for water distribution and operation of the scheme
	Electricity Supply Corporation of Malawi (ESCOM)	• Uses water for electricity generation • Implements water resources management programs upstream
	Concern Universal, World Vision International - (NGOs)	• Teaches farmers about IMT (Concern Universal) • Supports farming groups e.g. provide farm inputs, farm advice (World Vision International) • Support female- and child-headed households
	The District Commissioner	• Oversees all development programs in the district including management of decentralized irrigation schemes • Oversees all local governance and mediates disputes • Settles land and other local disputes among villages
	Traditional Authorities (TAs)	• Settle disputes in the area • Advises the WWUA
	Village Heads	• Allocates land to villagers • Initiates and oversees village development plans and programs • Settles disputes within the village

Stakeholders in Table 5.1 above can, depending on interests, be classified as resource users, regulators or managers. Unless individuals work under an institutional establishment, they are dominantly resource users. For example, irrigators under the WWUA in the WIS both use and manage resources, and apart from using water for irrigation, they also take part in water management activities such as reporting to the WWUA any individuals removing reeds and/or other vegetation from the Wovwe River banks. Similarly, farmers' clubs and fish farming groups use water and run projects for water management such as engaging in agro-forestry and reforestation with technical support from Agricultural Extension Workers and NGOs.

Institutional or organizational stakeholders play regulatory, managerial, planning, policy, operational and advisory roles. For example, the WRB regulates water access through the water rights scheme; Departments of Irrigation, Agriculture, and Local Government provide policy guidance and give advice to water users on how to manage and use water resources; the Electricity Supply Corporation of Malawi (ESCOM) uses water for electricity generation and runs environmental management and protection projects such as reforestation and patrolling the river banks upstream to prevent people from removing trees, reeds, and other vegetation from the river banks. The WWUA plans all operational, maintenance, and agronomic activities of the scheme.

It is worth noting, however, that some of the roles of the WRB are according to what documents say and not what is happening on the ground. For example, although the WRB is supposed to ensure that the rights holders are not affected by illegal abstractions, the WWUA, Villages Heads, and other key informants reported no intervention by the WRB when the upstream communities blocked the water flow to the WIS where the WWUA holds access and withrawal rights (4.4.2.3).

5.2.1. Stakeholder attributes

The success of any reform largely depends on the perceptions and influence of stakeholders on the reform process (WB 2005). In order to understand key factors determining the direction and pace of any reform, three key attributes of stakeholders need to be understood (WB 2005): 1) positions on, or perceptions about the reform; 2) influence or power the stakeholders hold; and 3) interests, roles and responsibilities of stakeholders in the reform or water resources (refer to Table 5.1).

5.2.1.1. Position on, and perceptions about IMT

Regardless of their perceptions about the performance of the two management systems i.e. of the WWUA and that of the Government (e.g. 4.5.2 and Figure 4.8); 73.6% of the households which claim to have knowledge of IMT or of the existence of the WWUA (n=322) perceive the principle of transferring the scheme to farmers as necessary to their livelihoods, 13.4% feel that the reform is not necessary, while 13.0% were not sure. Those who support IMT (n=237) do so on the following qualitative explanations:

- the transfer empowers farmers to run the scheme by themselves (35.9%);
- the WWUA helps in coordinating management and maintenance of the scheme, and administering plot and water allocation (24.0%);
- the IMT allows for the establishment of a conflict resolution mechanism which involves farmers themselves (19.4%);
- farmers get good advice and guidance from the WWUA on farming practices (e.g. following farming calendar, fertilizer application, water use, and field management), ensuring food security, and taking farming as business (11.8%); and
- the WWUA helps farmers to acquire seed, inputs, and find markets for their produce (8.9%).

On the other hand, those who feel that the transfer is not necessary (n=42) base their perceptions on grounds mainly related to the management style of the WWUA. They allege that the WWUA leadership, which succeeded government and all the others which followed thereafter, manage the scheme worse than the government did (Figure 4.8). As such, they liken irrigation reform to poor scheme management and, base their reasons for not supporting IMT on the following reasons (Table 5.2).

Table 5.2: Qualitative responses why some farmers do not support IMT, n=42

Reason	Percentage (%)
I do not cultivate in the WIS so it is unhelpful	40.48
WWUA misuses finances	26.19
WWUA fails to manage the scheme properly[27]	14.29
WWUA does not communicate with us	4.76
WWUA is doing nothing to help us	4.76
I can do without WWUA	4.76
Since WWUA took over from government, my irrigation profit has declined	2.38
WWUA fails to find markets for our produce	2.38
Total	**100.0**

The afore-mentioned farmers' position on, and perceptions about the reform reveal that in the presence of good scheme management, farmers would have no reasons for not supporting the reform. The findings suggest that establishing effective, transparent, and accountable user organizations is crucial if IMT policies are to be successful and accepted by targeted beneficiary farmers.

5.2.1.2. Position on, and perceptions about irrigation expansion

Key informants and focus groups reported a general support for expansion of irrigated agriculture through the Green Belt Program (GBP) and establishment of informal irrigation schemes in *dambos* and along the river (4.3.1). However, some groups, particularly livestock farmers (96.0% of the survey households indicated that they own livestock; N=473), are reserved, fearing that the reform may seriously restrict their access to the land which they traditionally used for grazing. They observed that their pasture land is already turning into crop land and that even livestock routes or corridors from upland grazing areas to the river (watering points) are also being converted to crop lands. They fear that once the GBP comes into full implementation, their remaining pasture land and livestock routes will be lost to

[27] Failure to maintain canals, roads, and properly settle disputes

irrigation, hence a loss of their wealth and an important part of their livelihood. Already 45.6% of households owning livestock (n=454) claim that their livestock numbers have declined due to lack of adequate pasture land. This was confirmed by traditional leaders as evidenced by the following narrative of one Village Head: *"in the past, many people in my village had a lot of cattle, but now the numbers are declining. ... those with cattle have just two, three, or five except for a few who still have large herds though not as they used to have. ... The problem with those with large herds is that they are forced to relocate to hilly areas just to avoid conflicts arising from livestock destroying peoples' crops. But still they have problems when leading their animals to a water source. ... everywhere is crop land"*.

Although most villagers support the expansion of irrigation, concerns from livestock farmers expose some discord between the implementation of irrigated agriculture and livestock farming. The current pilot stage of the GBP implementation ought to honestly represent and integrate issues of livestock farming and other livelihood strategies, which the rural poor have developed over time, with irrigated agriculture. Regardless of the GBP designs to embrace a holistic approach where even livestock farming is taken on board (4.3.1), there are misunderstandings on how the program will work, especially in the face of current land pressure (see next paragraph). One more contrary view comes from some Village Heads upstream, particularly those with parts of their land earmarked for irrigation development. These leaders fear that should government develop the areas into irrigation land, they will have nowhere to relocate their people. They argue that the land is already limited for existing villagers as they recall that in the past they already gave away parts of their land to other villagers who, when evicted by government from Nyika plateau in order to establish the Nyika National Park, demanded that they maintain their leadership over their people they moved with from the plateau.

Traditional leaders' worries are supported by statistics from the National Statistical Office (NSO 1998, 2008) which show that populations for the two Traditional Authorities (TAs) i.e. TA Mwirang'ombe and TA Wasambo in which Wovwe Irrigation Scheme is established have increased by 40% and 43% respectively between 1998 and 2008. These increases are higher than the national increase of 32% within the same decade. The population density for Karonga District (where this study was conducted) rose from 58 to 80 persons per km^2 between 1998 and 2008, representing an increase of 37.9% in a decade (NSO 2008). This increase is also

higher than the national increase of 32.4% i.e. the national population density rose from 105 to 139 persons per km^2 (NSO 1998, 2008). These increases translate into corresponding increases of land pressure for livelihood purposes. Land for both rain-fed and irrigated agriculture is becoming increasingly scarce. See 5.2.2.3 for a detailed presentation of land holding.

Apart from the land issue, traditional leaders also, implicitly, bring out the issue of social structure. Recalling from chapter 4.5.2 in which local irrigators at the WIS complained about the system of governance as being biased towards settlers, here reform is similarly feared to be potentially destructive to social cohesion. If schemes are fully developed, traditional leaders foresee that farmers from other places will come to cultivate and eventually settle in the area. The Village Heads' foresight is consistent with Chirwa's (2002) findings of his study on land use at WIS i.e. that bringing in settlers creates social fissures. In this regard, irrigation expansion is a potential factor for inducing socio-cultural changes and altering the social structure. The two main factors which local leaders bring out here are land availability and preservation of social cohesion. These factors highlight natural capital (e.g. land), and social capital (e.g. social cohesion and cultural values) as important factors for irrigation policy reform – at least among communities who are keen to maintain their cultural values and whose livelihoods are largely dependent on natural resources and agriculture.

5.2.1.3. Stakeholder interest/importance and influence or power on the reform

Understanding the relative influence and importance[28] of stakeholders is crucial in identifying key factors for successfully implementing policy reforms. However, the ability of stakeholders to influence, or promote their positions on the reform depends on the quantity and type of resources and power they possess (WB 2005). Table 5.3 is a matrix showing levels of interest and influence of various stakeholders in irrigation reforms at Wovwe as highlighted by focus group discussions, key informant interviews, and secondary sources. Stakeholders were placed in their respective boxes in a matrix based on Grimble and Wellard (1997) as explained in 3.3.4.3. While the influence and interest of stakeholders in respective boxes are explained below, some important aspects e.g. interests and roles of stakeholders are provided in Table 5.1. Key stakeholders for the reform are those in boxes A, B and C.

[28] Important stakeholders are those whose needs and interests are the priorities of the reform; and influence is the power certain stakeholders have over the success of the reform (Grimble and Wellard 1997).

Table 5.3: Stakeholder influence/power and interest in the reform

		Interest of stakeholder			
		Unknown interest	**Little/no interest**	**Some interest**	**Significant interest**
Influence of stakeholder	**Significant influence**			• District Commissioner • Traditional Authorities • WWUA officials	• Upstream & downstream irrigators • Department of Irrigation • Department of Agriculture • WRB
	Somewhat influential	**C**	• NGOs	• Land owning villagers **A**	• Village Heads • WIS irrigators
	Little/no influence		• ESCOM		• Livestock farmers • Illiterate farming households
	Unknown influence	• Gatherers (weavers, hunters, thatch grass collectors) **D**		• Fish farmers **B**	

Box A stakeholders have high influence on the reform process and/or are highly affected by the reform. For example, the District Commissioner's (DC) office has powers to intervene in the affairs of the reform whenever it sees it necessary (e.g. 4.5.6). Moreover, development projects initiated at district level which require local district funding cannot be implemented unless the District Development Committee which is chaired by the DC approves of their implementation. Similarly, Traditional Authorities exert great influence on the reform and have some interest in it. They settle disputes and advise the WWUA – a central body for IMT.

It is critical to secure the involvement and cooperation of Box A stakeholders as they can highly influence the reform direction and at the same time can be greatly affected by the outcomes. For example, the policies developed by government departments i.e. irrigation and agriculture; governance of the irrigation system by the WWUA; and power over land and villagers by Village Heads are all very central to the success of expanding irrigation farming and/or transferring the WIS into the hands of farmers.

Livestock farmers, illiterate farming households, and fish farmers (Box B stakeholders) are highly dependent on the outcomes of the reform as the reform has a direct impact on their livelihoods. Despite their high dependency on water resources, their illiteracy prevents them from holding positions at least in the establishments of the WWUA which require one to be able to read and write (e.g. 4.4.2.1 and Figure 4.4). In effect, these have no decision-making

opportunities in the management of the scheme. With little or no influence at all on the reform, the inclusion of their interests depends on deliberate actions by those most influential in Box A.

Box C stakeholders are not directly affected by the outcomes of the reform, rather they work for the cause of the vulnerable through supporting group farming and supplying those groups with farm inputs (e.g. see roles of NGOs in 4.3.1 & Table 5.1). Their actions are of significant benefit to the poor and vulnerable, hence their high influence helps to influence the direction of the reform for the benefit of the vulnerable and under-represented.

Box D stakeholders are of low priority as their interests in and/or influence on the reform is insignificant. Irrigation farming has nothing to do with their livelihoods or enterprises. However, the expansion of irrigation will affect the availability of grass and weaving materials for their products. Furthermore, stakeholders like ESCOM do not suffer any consequences as a result of the reform since their hydro-power generating plant is constructed at the extreme upstream. Even so, their activities such as afforestation programs along the river, and patrolling river banks against the removal of vegetation/trees are positive developments to the sustainable management of water resources – a key resource for irrigation. The weavers, on the other hand, have a negative influence on the state of water resources as their removal of reeds from the river banks (7.3.4.3; Figure 7.29) exposes the river catchment to soil erosion and flooding.

5.2.2. Household characteristics

Factors enhancing or constraining the ability of the rural poor communities to access water can best be understood if household characteristics of the poor are understood first. Possession or lack of certain characteristics determines a household's ability to access water and participate in water governance mechanisms (Cleaver *et al.* 2005). The following subsections present findings for Wovwe communities on key household characteristics including demographics, education, and landholding, among others.

5.2.2.1. Demographics

Table 5.4 highlights the fact that the mean household size for Wovwe communities is large i.e. 5.08±1.785 but similar to the national mean of 4.6 for rural populations and 5.2 for Karonga District (GOM 2005c; NSO 2008).

Table 5.4: Demographic characteristics of household survey respondents (N=473)

Variable	Mean	S.D.	Min	Max
age of respondent	40.95	13.513	18	87
number of people in a household	5.08	1.785	1	9
number of children in a household (<18yrs)	2.74	1.605	0	7
total number of adults in the household (≥18yrs)	2.36	0.856	1	7

Nearly one-quarter (23.6%; N=473) of households in the survey indicated that some of their household members were absent due to reasons such as starting own household (41.4%), staying with relatives elsewhere (22.5%), education (22.5%), seasonal labor migration (10.8%), and seeking medical care (2.7%). Of the 111 households with absent family members, only 20.7% received different forms of assistance from their absent members i.e. 56.5% received money, 21.7% agricultural inputs, 13.0% food stuffs, and 8.7% clothes. Some households received more than just one form of assistance. For example, of those who received money (n=13), 23.1% also received clothes and 15.4% food supplies. Two-thirds of those who received food supplies also got clothes while the last third also received money; and finally, 40% of those who primarily received agricultural inputs also got food supplies, 20% money, and the other 20% received clothes.

The smaller proportion of households receiving assistance from absent members indicates that more than ¾ of households depend on their own daily activities for livelihoods. However, the absence of family members still has implications on the household's ability to engage in livelihood activities as this affects their social and financial resources. For example, households which receive assistance such as money or farm inputs from distant relatives boost their livelihoods more positively than those who receive nothing. On the other hand, the absence of members means that the social capital of the households are negatively affected, particularly when absent members are not contributing anything or are ill and/or seeking medical attention elsewhere (see 6.2.4.2). This, effectively, restricts the concerned households from engaging in multiple livelihood activities as it creates a labor vacuum (Ombe 2003).

5.2.2.2. Education

Table 5.5 summarizes literacy status of respondents for the Wovwe catchment. The literacy level for the study area (42.7%) is lower than the national adult literacy rate[29] which stands at 64% (NSO 2008). However, the national rate include all persons from the age of 15 years and older. This implies that if those as young as 15 years old were included in the Wovwe survey, illiteracy levels would be even much higher than the survey reports. Implications of illiteracy on farmers are that, due to literacy being a prerequisite for holding WWUA leadership positions, the illiterate cannot be elected into such positions (4.4.2.1). This means that the illiterate farming households lack some human capabilities (2.4.1 and 2.5) which are essential for effective participation in water governance (Franks and Cleaver 2007). Of those who have not completed any formal education (more than half the respondents), 31.0% (n=271) have never attended school with 53.6% being female. With respect to human capabilities, this means that more women than men lack in capabilities to participate in decision-making on matters of the scheme – implying that only a few women take part in making scheme governance and management decisions.

Table 5.5: Respondents' highest levels of completed education, N=473

Highest level of completed education	Percent (%)
None	57.3
Complete primary (PSLC)	23.9
Some secondary – Junior Certificate of Education (JCE)	13.5
Complete secondary - Malawi School Certificate of Education (MSCE)	4.4
Tertiary	0.8
Total	**100.0**

5.2.2.3. Land holding

The mean household land ownership outside the WIS is 3.468±2.1469 ha (Table 5.6) and with an average household size of 5.08 (5.2.2.1), the mean per capita landholding size is estimated at 0.6827±0.4226 ha which is slightly less than the 0.8 ha mean landholding for rural Malawi (Chirwa 2008). A *One-way ANOVA* was conducted to examine whether there were statistically significant differences among households in different locations with respect to land holding. The results revealed no statistically significant differences among locations, $F(3, 414) = 0.965$, $p = 0.409$.

[29] Adult literacy rate is defined as 'the percentage of individuals aged 15 years and older who can, with understanding, both read and write a short, simple statement about their everyday life" (GOM 2005).

Table 5.6: Size of land outside the WIS held by households (n = 418)

Location	N	Mean (ha)	Std. Deviation	Minimum (ha)	Maximum (ha)
Upstream	106	3.509	2.2541	1.0	15.0
Downstream	124	3.310	1.9261	.5	9.0
Within WIS	165	3.468	2.3017	.5	11.0
Other	23	4.130	1.5092	1.0	7.0
Total	**418**	**3.468**	**2.1469**	**.5**	**15.0**

On the other hand, Table 5.7 shows that the mean number of plots (of 0.1ha size each) each farmer holds in the WIS is 2.739±1.4199 with plot holding by scheme component showing that farmers in Wovwe II are holding more plots than in Wovwe I. However, an *Independent-Samples T Test* reveals that there is no significant difference in the number of plots farmers hold between scheme components i.e. between Wovwe I and Wovwe II ($t = -1.772$; $df = 301$; $p = 0.077$).

Table 5.7: Number of plots held by each farmer in WIS

Scheme component	Farmers (N)	Mean (plots)	Std. Deviation	Min. No. of plots	Max. No. of plots
Wovwe I	123	2.565	1.6017	1.0	16.0
Wovwe II	180	2.858	1.2720	1.0	6.0
Total	**303**	**2.739**	**1.4199**	**1.0**	**16.0**

In order to understand how households outside the WIS use the land they own, households were asked to indicate the location of their land with respect to the river or wetland. Most households i.e. 45.0% (N=473) own land in upland areas, 22.2% in *dambos* (wetlands) or along the river, 21.1% in both places, while 11.6% do not have land. This means that in times of water scarcity, only 43.3% of households (those with land along the river and/or in *dambos* – including those cultivating in the WIS) could still access some water by virtue of the location of their land and could also be potential victims of floods in times of excesses.

Although 11.6% of households indicated that they do not own land outside the WIS, the majority (97.3%; N=473) engage in farming outside the irrigation scheme including some of those without land. Moreover, of the households cultivating plots in the WIS (n=303), 4.6% indicated that they do not cultivate all the plots they are allocated. And, of the 303

households, 19.8% indicated that they also cultivate plots which were not allocated to them[30]. These households, like the landless outside the WIS, make special arrangements with those who were allocated plots in the scheme for them to cultivate. The majority (90.0%; n=60) rent plots from their fellow farmers, while 10.0% simply borrow the plots or use kinship (see 5.4.3). Furthermore, of these households (n=60), 23.3% (representing 4.6% of households cultivating in WIS) also practice irrigation outside the WIS; while in total, 14.2% of the 303 households also practice irrigation outside the WIS. But the majority of households (64.1%; N=473) cultivated in the WIS, 29.8% practice irrigation outside the WIS (refer to Table 3.5), and 20.9% cultivate land outside the WIS which they do not own themselves. Of those who cultivate land outside the WIS which they do not own (n=99), 76.1% make rental agreements, 20.8% borrow, while 4.1% use family kinship to cultivate land which belong to their relatives.

Findings on landholding reveal two important aspects regarding communities' livelihood practices. Firstly, there is a lack of land in the area which threatens livelihood security and forces households to seek and engage in compensatory activities such as devising means of accessing land e.g. renting, borrowing, and kinships. Lack of land translates into lack of natural resources (2.4.1 and 2.5) for households to engage in meaningful livelihoods. This could be the reason why some household members migrate for seasonal labor (5.2.2.1). Secondly, households combine irrigation farming in the WIS with upland rain-fed and/or irrigation farming outside the scheme as a strategy for spreading risks to ensure food and livelihood security. This shows that households aspire to live quality life by pursuing **'pull'** diversification (2.4.3).

5.2.2.4. Crop husbandry

The Wovwe area falls within the Nkhata Bay Cassava Livelihood Zone (2.6.8.1). In line with MNVAC (2005), that households in the zone are renowned for growing cassava and maize and, realize cash from the sale of food crops and livestock; this study finds that most households grow maize, cassava, ground nuts, and rice as their main crops (Table 5.8). However, the majority of households at Wovwe grow maize on a small scale for consumption as green maize. Groundnuts are likewise grown to provide households with a source of

[30] Some of these farmers cultivate additional plots to what they were allocated (n=52) while others cultivate only other farmers' plots (n=8).

protein. Cassava is the main food crop. Rice is grown for both household consumption and income, but constitutes the main source of income.

Table 5.8: Crops grown by households (n=458)

Crop	Households (%)	Crop	Households (%)
Maize	95.1	Cotton	4.0
Cassava	78.9	Other vegetables	3.6
Ground nuts	63.4	Other legumes	3.6
Rice	30.7	Millet	2.7
Tomatoes	17.8	Bananas	1.7
Tobacco	14.4	Beans	1.3
Sweet potatoes	9.3	Onions	0.6
Cabbage	6.3		

Furthermore, nearly all households grow at least one type of crop with the majority growing three types (Figure 5.1). Only 3.2% do not grow any crops due to lack of land, old age, and/or poor health.

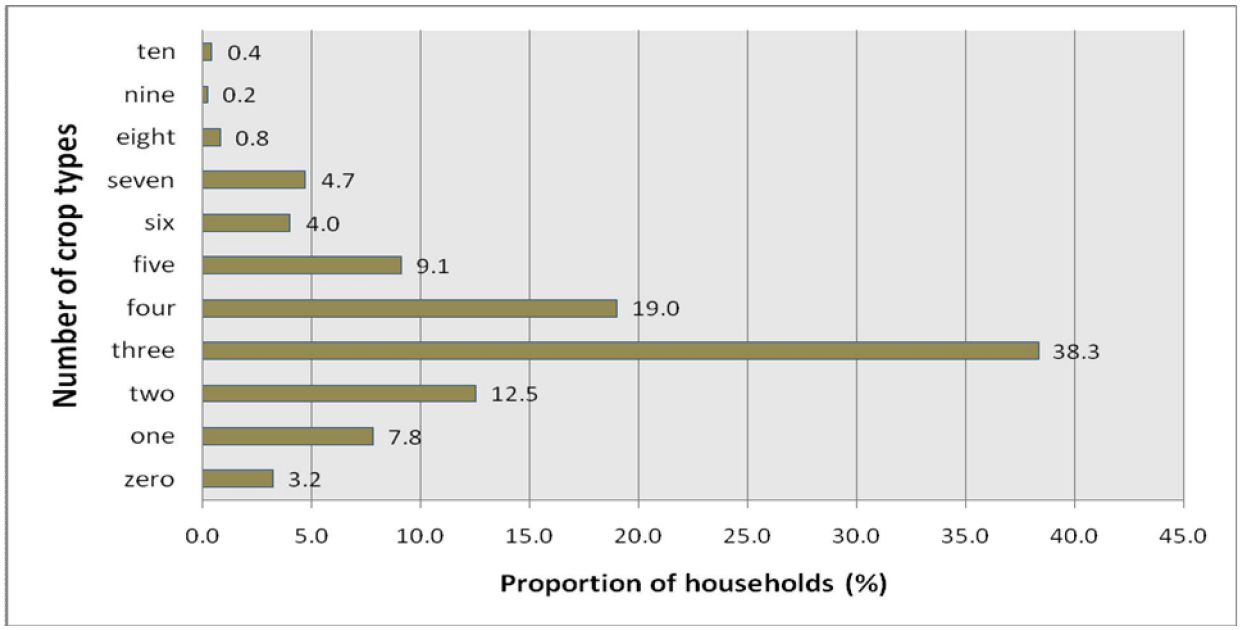

Figure 5.1: Number of crops grown by households (N=473)

Examined against the reform, the trend in the number of crop types households have been growing since the start of the reform shows an increase for the majority of households. Over four-fifths (82.9%; N=473) of respondents indicated that they are growing more types of crops now than before the start of the reform; 11.6% have reduced the number of crop types grown while only 5.5% still maintain the same number of crop types.

Crop husbandry findings suggest that households still depend on farming as a strategy for earning a living implying that the availability of land and sustainable supply of water resources are essential factors for the sustainability of peoples' livelihoods. The reported increases in the number of crops households grow, on the other hand, suggests that communities also use crop diversification as a means of securing livelihoods.

5.2.2.5. Livestock holding

Most households i.e. 96.0% (N=473) own different types of livestock with chicken, pigs, cattle, goats, and dogs being the five most popular types (Table 5.9). Of the livestock-owning households, 44.5% (n=454) come from downstream villages, 26.4% from 'Within WIS', 23.1% upstream, and 5.9% are households from 'other' locations.

Table 5.9: Livestock characteristics of households (N=473)

Variable	Household %	N	Min	Max	Mean	Std. deviation
Chicken	89.6	424	1	70	10.56	9.307
Pigs	63.6	301	1	22	2.89	2.524
Cattle	46.9	222	1	30	5.28	4.594
Goats	43.8	207	1	26	3.77	3.435
Dogs	43.1	204	1	7	1.67	1.115
Pigeons (pairs)	17.1	81	1	31	9.71	6.423
Ducks	17.1	81	1	24	4.54	4.290
Guinea fowls	11.0	52	1	40	4.94	6.001
Cats	3.6	17	1	5	2.12	1.054
Sheep	1.5	7	1	6	2.14	1.773
Rabbits	0.8	4	1	10	5.00	3.742
None	4.0	19				

Similar to crop husbandry, households own at least one type of livestock with the majority rearing three types (Figure 5.2).

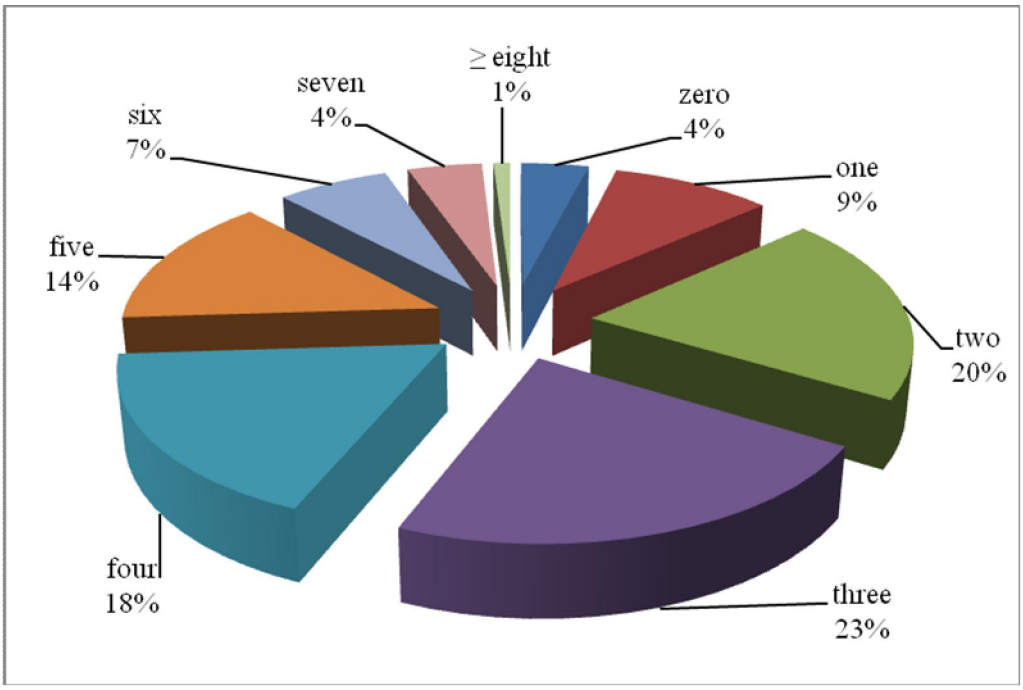

Figure 5.2: Number of types of livestock owned by households (N=473)

Livestock form an important part of livelihoods of the Wovwe communalities which they use as (i) a source of income and protein; (ii) a source of animal power for farming and pulling ox-carts for transportation (see Figure 5.3); (iii) media of exchange with other materials required in the household including food stuffs; (iv) a means of meeting cultural obligations i.e. used for marriage dowry *(lobola)*; (v) home security, particularly dogs; (vi) protection of harvested crops (cats are reared to catch mice/rats which destroy harvested crops; and (vii) a symbol of wealth in society (status). See a detailed presentation of data on the income contribution of livestock and other livelihood strategies to the total household income in 7.3.3.3.

Figure 5.3: Oxen pulling a plough (used as animal power for cultivation)

With regards to the trend in the number of livestock households have owned since the reform, responses were almost the same between those reporting increases and those reporting decreases i.e. 46.9% (n=454) reported increases, 45.6% decreases, while only 7.5% reported no changes. Those reporting 'decreased' or 'unchanged' numbers (n=241) gave the following qualitative explanations for the trends (with n-values in brackets):

- deaths due to diseases (95);
- selling to meet basic household needs (food, clothing, and school fees for children) (n=81);
- problems of grazing land (52);
- selling & problem of grazing land (38)
- problem of grazing land & killed by floods (26)
- killed by floods (17);
- loss due to predators (9); and
- theft (5).

On the other hand, those who reported increases attribute the increase to financial gains they have been making from the sales of their crop produce, particularly rice, which enabled them to buy more livestock; and good care.

However, over a quarter (26.4%; n=454) of those owning livestock indicated that they are facing varied water problems for their livestock with problems more pronounced among those keeping cattle and goats (Table 5.10).

Table 5.10: Water problems faced by those owning livestock[†]

Water problem	n	Households (%)
Difficulty to lead animals to water source due to crop fields in the way (Livestock) and Drying up of water sources (Drying)	54	44.8
The water source is far (Distance) and Drying	45	37.4
Livestock	39	32.5
Drying	36	30.0
Weather and climatic variability (Floods and Droughts) and Distance	31	26.0
Poor water quality (Quality)	22	18.3
Distance	15	12.5
Breakdown of boreholes (Borehole)	7	5.8
Floods and Droughts	1	0.8

[†] Long descriptions of water problems are represented by shortened ones in parenthesis

About 36.7% (n=120) of those facing water problems come from downstream villages, 33.3% from upstream villages, 24.1% from 'Within WIS', while 5.8% come from other villages whose households also farm in the WIS. The high proportion of households facing water problems from the downstream is explained by: the higher proportion of households owning livestock in the downstream than in other locations (see above); and the expansion of informal irrigation schemes both upstream (see 7.3.2.1) and downstream (Figure 5.4) which abstract water from the river and restrict livestock corridors to the river.

Figure 5.4: Some farm land and informal irrigation establishments downstream
Source: Google Earth 2005

Water problems also rank differently with respect to the location of households with the problems of 'Livestock' and 'Drying' being the main and common ones in all three locations (Table 5.11). However, the problem of water quality ranks third in both 'within WIS' and 'downstream' locations, and was not a major concern in the 'upstream' where distance from grazing areas to water sources is the third-ranked problem. The distance problem supports the land pressure issue faced by livestock owners as narrated by one Village Head in 5.2.1.2.

Table 5.11: Ranking of water problems by location

Upstream		Within WIS		Downstream		Other	
1	Livestock	1	Livestock	1	Drying	1	Distance
2	Drying	2	Drying	2	Livestock	2	Drying
3	Distance	3	Quality	3	Quality	3	Borehole
4	Quality	4	Distance	4	Borehole		
5	Borehole	5	Flood and Droughts	5	Distance		

5.2.2.6. Household assets

Households are endowed with different types of assets with the most common being land (Table 5.12). An analysis of trends in the amount of possessions owned by households since the reform shows that nearly two-thirds (63.4%; N=473) of households are recording increases, about a quarter (23.7%) are experiencing decreases, while the remaining 12.9% experience no changes.

Table 5.12: Household assets (N=473)

Asset	Households (%)	Asset	Households (%)
Land	88.4	Ox-cart	14.4
Radio	78.2	Treadle pump	4.7
Bicycle	69.8	Fishing nets	1.5
Cash and bank savings (52.9+9.5)	62.4	Sewing machine	1.5
Plough	35.7		

A *Chi-Square Test* was performed to examine the relationship between trends in household assets and location of the household. Results show a statistically significant relationship exists between trends in household assets and the location from which households came (Table 5.13) i.e. $X^2 = 14.997$, $df = 6$, $p = 0.020$, *Cramer's* $V = 0.126$. Downstream households showed less increases in their assets than households from other locations.

Table 5.13: Households' perceptions about the trends in household assets since reform by location (N=473)

Perception	Location (frequency)			
	Upstream	***Within WIS***	***Downstream***	***Other***
Increased	73	129	77	21
No difference	20	17	24	0
Declined	21	54	31	6
Total	**114**	**200**	**132**	**27**

The implication of these findings is that households will have varying abilities in their engagement in livelihood activities as possessions of households are an important determinant factor of the type of livelihoods household engage in (Ellis 2000a).

5.2.2.7. Occupations

A majority of households in the survey i.e. 96.6% (N=473) indicated that they depend on farming as their main occupation. Only 1.7% are self employed, 1.1% fishermen, 0.4% employed, while 0.2% are doing nothing. Though insignificant, slightly more downstream households have self employment and fishing as their main occupations. It is also only the downstream that has households with no occupation or are doing nothing (Table 5.14).

Table 5.14: Households main occupations by location; N=473

Location	Farming (%)	Self-employed (%)	Fishing (%)	Employment (%)	Nothing (%)	Total (%)
Upstream	98.2	0.9	0	0.9	0	**100.0**
Downstream	94.7	2.4	2.4	0	0.5	**100.0**
Within WIS	97.6	1.6	0	0.8	0	**100.0**
Other	100.0	0	0	0	0	**100.0**
Overall	**96.6**	**1.7**	**1.1**	**0.4**	**0.2**	

The dominance of farming as the main occupation across locations suggests that communities across the entire Wovwe area rely on natural resources i.e. land and water for their livelihood, and that there is a potential for their overexploitation. Such a potential justifies the need for putting in place effective mechanisms for their governance. On the other, the dominance of farming does not necessarily mean that households do not engage in other livelihood activities. In fact, the area has witnessed a surge in the number of supplementary livelihood activities since the reform (see 7.3.3.1 for more details). In such a case, diversification provides a potential for taking pressure off natural resources (Ellis 2001).

5.3. Negotiating water access

Water resources from the Wovwe River are used by organized entities (i.e. WWUA in the WIS, farmers' clubs, and fish farmers) and individuals (e.g. farmers, pastoralists, and individual households) across the entire catchment. Multiple water uses highlight the need for negotiating access which is central for improving water allocation and management of the resource (Bruns and Meinzen-Dick 2001; Bruns 2005). This is particularly important in the case of Wovwe where peoples' main occupations highly depend on natural resources such as water (5.2.2.7). As clearly shown in previous sections (4.5.1 and 5.2.1.2), drought, water scarcity, irrigation reform, land pressure, and an increased number of water users across the basin raise competition for the resource resulting in transformed norms and procedures for water access. In respect of the foregoing, this section gives findings on how stakeholders negotiate their access to water by identifying and highlighting three commonly used approaches or practices i.e. making agreements; use of community or village forums; and participation in decision making.

5.3.1. Agreements

While irrigation reform i.e. irrigation expansion and decentralized governance of the WIS (or IMT) has well been embraced by local communities (5.2.1.1 & 5.2.1.2), it also has resulted in increased numbers of water users. In order to continue accessing water, and doing so fairly, users make agreements with the WRB, fellow water users, and land holders.

Since the transfer of the WIS into the hands of local irrigators, the WWUA, which is the recipient organization, annually pays water fees to the WRB to acquire rights of use (4.4.2.3 & 4.4.2.5). The WWUA and the WRB agree on the withdrawal of the scheme design water requirements i.e. 35,753m³/day of water for irrigation purposes by its members. Although the WWUA reported no action by the WRB to safeguard their water rights from being infringed upon by other users, the WRB, is, in turn obliged to monitor water withdrawals from the river so that the rights holders are not negatively affected by abstractions by other users who do not pay for the rights.

Equally, water users outside the WIS also make agreements on water access among themselves and with land holders. For example, villagers who want to do irrigation but do not have land or their land holding is far from the river, agree with those owning land close to the river to either use their land or dig a through-canal to their fields. In some agreements payments are made while in others only social relations or kinships matter (5.2.2.3).

5.3.2. Community/village forums

Villagers negotiate access to water, particularly for livestock through village or community forums. For example, during discussions with Village Heads, it was learnt that access points for livestock watering, especially large herds, are established at village level to ensure orderliness and protection of crops from damage by livestock. Village assemblies designate water access points and livestock corridors through unallocated communal land. These corridors connect grazing areas to water points (designated sections of the river) or dip tanks.

However, with the current land pressure due to population growth, Village Heads pointed out that the corridors were established long time ago when more land was free. Nowadays, even some designated areas are being allocated to people as agricultural and/or settlement land.

5.3.3. Participation

Users also negotiate water access through participation in committees. For example, users from both the WIS and villages with water user groups use their committee or groups' forums to discuss and agree on means of water access. Those in the WIS use Block and Unit committees to establish how Head-enders and Tail-enders will be accessing water in a particular season. Schedules are established and implemented accordingly. Likewise, informal irrigators outside the WIS discuss and establish water access mechanisms within their groups and through their committees.

Findings on negotiating water access show that water users utilize varied resources in order to gain access to water. For example, users draw upon social resources e.g. kinships, trust – borrowing, village forums; financial resources e.g. land purchases and rents; physical resources e.g. constructing canal across other peoples' land (5.2.2.3); and institutional resources such as acquiring water rights from the WRB, rules of water access which the WWUA uses in WIS, and establishment of access schedules, among others. Similar to the varied ways of negotiating access, users also use different mechanisms for accessing water as presented below.

5.4. Mechanisms of water access

People in the Wovwe area use institutions (both formal and informal), access rights, technology and practices as mechanisms for accessing water.

5.4.1. Institutions

Institutions shape the way communities gain access to water, particularly in balancing competing demands of various users. However, institutions can also be effective mechanisms for excluding demands of other groups. Institutions involved in determining water access include the Wovwe Water Users Association (WWUA) and its rules, and the Water Resources Board (WRB). At the local level, Village Courts and families are the main institutions for water access.

The WRB issues access rights to the WWUA which in turn transfers and administers the rights to its members (4.4.2.3 & 4.4.2.5). Without access rights, the WWUA is not permitted to use water from the Wovwe River for any irrigation purposes (GOM 1969). While the

WWUA constitution gives farmers rights to access water (WWUA 2001), the WWUA established rules and regulations which determine which farmers access water, and at what frequency. Frequences of accessing water vary depending on water availability. For example, farmers' responses show that water is distributed to farmers either on a daily basis i.e. hours per days or weekly i.e. days per week (Figure 5.5).

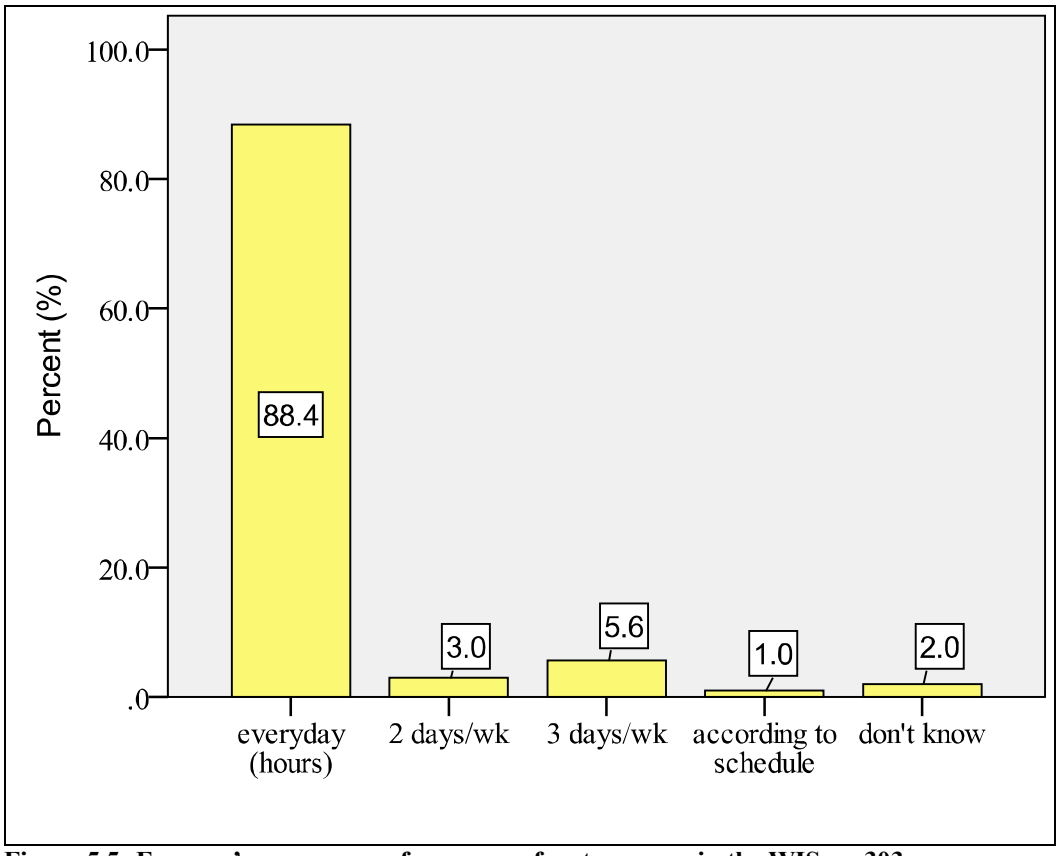

Figure 5.5: Farmers' responses on frequency of water access in the WIS, n=303

Although a majority of farmers indicated that they access water on a daily basis, WWUA officials and Extension Workers clarified that this is so in rainy season, particularly in the season when this study was conducted because of floods which destroyed parts of the scheme making water flow into scheme uncontrollable (4.5.1 & Figure 4.5). But in dry season when water is scarce, farmers are allocated water according to schedule i.e. 3-4 times a week.

In order to establish aspects of water access rules in the WIS, farmers were asked to indicate their perceptions on whether the WWUA has rules of accessing water; if they have, whether farmers: participated in their formulating; are satisfied with the way rules were made; and are satisfied with the way the WWUA uses the rules (Table 5.15).

Table 5.15: Farmers' perceptions/responses on WWUA's rules of water access, n=303

Farmer's response	Aspect of rules of water access (%)			
	Whether WWUA has rules for water allocation	**Whether farmers were involved in formulating the rules**	**Whether farmers are satisfied with the way rules were made**	**Whether farmers are satisfied with the way rules are used**
Yes	80.0	42.1	63.7	55.6
No	12.3	57.9	36.3	42.6
Not sure/ don't know	8.6			1.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

Responses show that a majority of farmers are aware that the WWUA has rules for accessing water, but only just over $^{2}/_{5}$ indicated that they participated in formulation of the rules. Nevertheless, most farmers expressed satisfaction with how the rules were made although only just over ½ the respondents are satisfied with the implementation of rules.

On the other hand, Village assemblies establish communal water access points for designated uses, e.g. brick molding for construction work for public buildings like schools, and health centers. Some village access points, however, develop unintentionally. For households, the main determining factor for water access is land. If the Village Council apportions land close to a water source or along the river, it implies that the household has customary access rights to water. Furthermore, the Village Court is responsible for resolving conflicts on the use of water or ownership of land. With regard to land, families implicitly grant their children or relatives access to water by allocating them portions of their land along a water source as an inheritance or a gift, respectively. Relatives are, in some cases, given the right to use the land freely on a temporary basis or on a permanent basis.

While institutional interventions appear to be crucial in enhancing fair access to water, one incident at Wovwe suggests that this works better when the affected are a well organised entity. For example, it was reported that upstream households at one time blocked water flow downstream in order to raise water levels in the river for easy access for their fields. The WWUA brought this to the attention of TAs who convened a meeting with the WWUA, upstream households and Village Heads. This case shows that negotiations took place after the WWUA, which was affected by the behaviour of upstream irrigators, complained to the TA. Downstream communities are continually affected by the use of water upstream,

including by the WIS, but no negotiations between them and the WWUA have taken place. This suggests that members of the WWUA can voice their concerns whenever their access rights are infringed upon but downstream households, who are not as formally organized as the WWUA, do not do so.

5.4.2. Resource user groups

Focus groups and key informant interviews reveal that when villagers engage in large water dependent projects like fish farming which initially need construction of fish ponds, they form groups as a way of distributing labor required for the construction work. Those with land close to a water source temporarily and informally lease it to a group which may comprise members owning land close to a water source or far away or even those without land. Such gatherings enable those without land close to a water source to access water and engage in water dependent livelihood strategies which they would not have engaged in by themselves. This is similar to village irrigators who organize themselves in groups and engage in vegetable growing in an effort to boost their economic status through sales of their vegetables. By doing so, those without land close to a water source and reliable access to water, gain access through joining local groups which devise rules and guidelines for the operations of the groups, and establish leadership or management structures through which its affairs are managed.

The operations of groups show that villagers are motivated by: commercial interests; prospects for labor sharing; and desire to attain food security. These motivation factors are, thus, important for breaking access barriers for those who would have otherwise been unable to access and use water productively.

5.4.3. Kinship or social relationships

Kinship or social relationships are the most common types of social resources which villagers use as mechanisms for gaining access to water or land resources (5.2.2.3). Those without land close to a reliable water source e.g. river or wetland make arrangements with their relatives who own land close to a water source in order to access the land and water. This occurs at both intra- and inter-village levels. Several key informants confirmed this to be an integral part of water access. One Village Head indicated *"here we are just one. It does not matter whether you cultivate in your village or another village. In fact, in the past this place was just*

called by one name covering the land extending from this side of the river to the other side. … my village does not have enough flat land which can be used for irrigation and most people from here cultivate fields across the river which belong to their relatives under another Village Head".

The use of kinship is even being practiced in the WIS as the WWUA encourages the practice of access transfer. Those allocated plots in the scheme can transfer the ownership to their family members and inform the WWUA about the changes. The WWUA constitution permits the transfer of plots to close family members i.e.

> "Upon the death or incapacitation (physical or mental) of the member, the membership shall be transferred to the next of kin" (WWUA 2001).

This provision by the WWUA constitution is consistent with what the National Irrigation Policy and Development Strategy (GOM 2000b) advocates for i.e. the introduction of legislation that would guarantee the inheritance of irrigation plots by women should the original owner die or is incapacitated. The aim of the policy is to achieve "[G]reater participation of women in irrigated agriculture" (GOM 2000b; p.14).

5.4.4. Access by rights

People in the Wovwe River catchment access water through both formal and informal rights regimes. Formal rights include those granted to the WWUA by WRB which are further transferred to the association's members through payment of water fees (4.4.2.3). Members hold access rights on a seasonal basis by paying seasonal water fees, annual membership fees, and contributing labor towards maintenance of irrigation infrastructure such as roads, canal and drainage systems as part of their membership obligations (4.4.2.5).

Furthermore, villagers exercise their customary rights to access water by holding access rights to land through which the river passes. Those owning land along the river have unrestricted access to water. Those without land close to the river are, however, free to access water in designated points (for domestic purposes) and make arrangements with land owners to dig canals through their land or just lease the land (5.2.2.3). This suggests that, like formal rights in the WIS, customary rights too can be transferable to another user.

5.4.5. Diversion canals

Informal irrigation establishments are fed with water by diversion canals dug from the river to irrigation fields. Farmers access this water by connecting their fields with small canals (Figure 5.6) as these informal irrigation schemes are not developed according to technical specifications (2.2.1).

Figure 5.6: Diversion canal

As such, some fields may be a single stretch of irrigated land (Figure 5.7) while others may not, although they tap water from the same diversion canal. Encouraged by government policy to promote irrigation farming as a way of ensuring food security, villagers dig canals either as individuals or groups. In years of insufficient rainfall, the competition for water results, in extreme cases, in blockages of the river to raise the flow levels for proper diversion. Though this sounds an innovative idea, the consequences are that flow levels downstream drop even further, forcing serious water shortages. The low flow levels create conflicts in the rights issue between the WWUA, holding formal water rights, and the villagers who hold customary rights (e.g. 4.5.4).

Figure 5.7: A stretch of an informal rice irrigation field

5.4.6. Flooding and recessional floods

While floods may generally be considered hazardous, households construct soil barriers to retain flooding waters for irrigation. Or, as floods recede, households utilize the flooded areas for irrigated agriculture, particularly for growing rice, maize, and sweet potatoes. Flood recessions have become an integral part of the farming system to an extent that every year villagers, at some point, expect to see some low-lying areas flood and later see water recede as explained by one village elder in Gonthaminga Village: *"... we are used to floods. ... I think villagers here would not be happy if there were no flooding in a certain year. All our rice here is grown in flooded* [areas] *and without floods we would not be able to grow rice. ... to say the truth, this year floods have been so devastating, totally different from other years."*

The explanation by the village elder suggests that although floods are hazardous, communities are used to leaving with certain degrees of flooding and have built their livelihoods around the phenomenon. Villagers utilize the moisture left behind by receding floods to grow crops, particularly winter cropping (Figure 5.8).

Figure 5.8: Winter maize crop grown on land used for rice growing during flooding

5.4.7. Technology

Throughout the Wovwe River catchment, villagers have a wide range of physical capital which they use in accessing water. These include canals, treadle pumps, and watering cans. Canals are used when irrigating large fields like rice and maize fields. Watering cans are used for vegetable gardening (usually small gardens) and are the most common type of technology (Figure 5.9) used by individuals or small groups of farmers. With government support, other villagers use treadle pumps (Figures 5.10 & 5.11) to irrigate larger areas of irrigation land.

Figure 5.9: Irrigation by watering can in Malawi
Source: FAO (http://www.fao.org/docrep/009/a0229e/a0229e08.htm)

While technology eases water access problems, very few in Wovwe have appropriate technology for irrigation (5.2.2.6). Even treadle pumps supplied by the government (for free) are inadequate as very few households have received them so far. Moreover, some females, elderly, and those in poor health indicated some limitations about using treadle pumps (see 6.2.1.1).

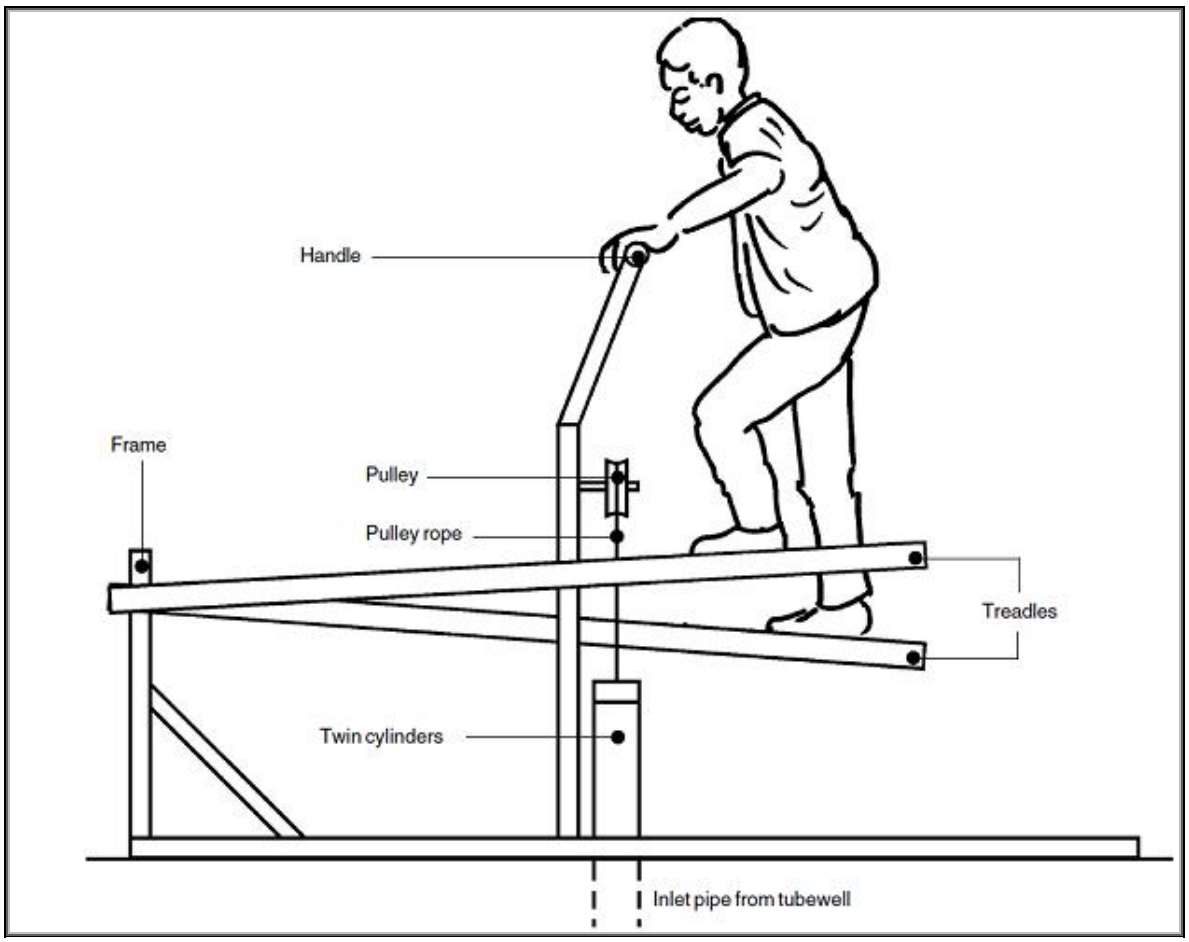

Figure 5.10: The Treadle Pump
Source: Elson and Shaw (1999)

Figure 5.11: A man demonstrating how to use the Malawi Treadle Pump
Source: SK Industries (http://www.skipumps.com/malawipump.htm)

5.4.8. Structures of water access and control

Structures of water access and control include the canal and drainage systems. Water gates are used to control water flow at the headworks (main intake), Block, and Unit intakes. In order for farmers to access water in an orderly manner, the WWUA employs Water Guards who open the gates according to the schedule established by the WWUA's Irrigation and Maintenance Committee. Farmers are allowed only one access point to the distribution canal per 0.2 ha of land size using pipes of equal diameters (see 5.5.5). One Water Guard is housed at the intake so he can promptly close the gates in cases of heavy rains and floods. However, during heavy rains, the most damaging floods occur in the section of the river between Wovwe I and Wovwe II (see Figure 2.8).

Although the WWUA uses chains and locks at the main intake at the headworks to deal with vandalism and illegal opening of the main intake, the structure is still vandalized as our visit to the headworks revealed that the locks were removed and not replaced (Figure 5.12). Notice that the apparatus is not locked.

Figure 5.12: Unlocked water gate at the Headworks intake

Water users in informal irrigation schemes construct water gates in canals and designate water access points for every farmer. However, farmers do not have pipe size specifications like those in WIS as acquiring pipes requires money which most villagers would prefer to use on other household needs. As a result, farmers access water from the diversion canal by just making an opening on the canal to the field.

5.5. Management and practice

The mechanisms of water access discussed in the preceding section do not operate in isolation, but are mediated by processes of management and practice which 'allocate' water and 'maintain' systems (Cleaver and Franks 2005). This section, apart from identifying processes of management and practice used by communities in the Wovwe catchment, also presents findings about water decision-making and how practices of water access shape the way rural poor people access water. Particular processes of management and practice discussed here include establishing water access points, scheduling, turns and rotations, fee and contribution schemes, water access regulation, labor for access, conflict resolution, and off-peak access.

5.5.1. Establishing access points

Establishing water access points is a crucial process of management and practice mediating the access of water at Wovwe. Established through negotiations in village forums (5.3.2), the practice is particularly useful in ensuring that order in the access of water is maintained and damage to livelihoods is minimized or prevented. For example to ensure that access points are utilized orderly and that livestock do not stray in crop fields, each village establishes rules which pastoralists are obliged to abide by. Through the rules, herdsmen are supposed to ensure that:

- they use only designated livestock corridors when leading their livestock to the watering point;
- livestock are led only to designated access points;
- they do not graze animals along the river banks; and
- their herds are not left unattended when passing through areas close to crop fields. If livestock stray into crop fields, the owner of the livestock is fined – paying for the damage caused.

Although rules are in place, Village Heads acknowledged that their enforcement is complex because there is no mechanism put in place e.g. patrolling, to ensure that livestock do not graze along river banks. Asked, why there is no mechanism, he simply responded: *'what are we going to pay those patrolling?'* This was openly confirmed by livestock owners and other interviewees who reported that during years of drought animals are grazed along the river or in *dambos* as these are the only places with green or suitable pasture for livestock (Figure 5.13).

Figure 5.13: A cattle herd in *dambos* along the rivers banks

Furthermore, Village Heads indicated that herdsmen usually graze their animals together (Figure 5.14) and, unless the destructive animals are brought before the village court, it is hard to determine whose livestock caused the damage – especially when the complainant's livestock were also among the suspected herd.

Figure 5.14: Boys from different families grazing cattle together in rice field outside WIS

Generally, communities appear to have good rules for ensuring that the environment is sustainably managed and their livelihoods are secure. However, three factors are contributing to the weakness in enforcing rules: lack of incentives to engage in patrols; adverse weather and climatic events forcing pastoralists to graze in fragile areas; and the cooperation of herdsmen, particularly with regards to finding pasture and grazing together.

With regards to irrigation farming in the WIS, farmers are allowed to use only one access point of water access for a land holding of 0.2 ha. This is supplemented by specifying water abstraction equipment and mechanisms (see 5.5.5). Although rules provide for penalties for noncompliance (4.4.2.6 & Table 4.4), direct observations revealed that some farmers still access water through illegally established access points (Figures 5.15).

Figure 5.15: An illegal access point on a secondary canal

5.5.2. Scheduling

Due to problems of water scarcity resulting from droughts, the WWUA makes water accessible to its members through the process of scheduling (5.4.1 & Figure 5.5). Responses from interviews with some WWUA officials, extension officers, and one Block Chairperson indicated that the WWUA, through its Irrigation and Maintenance Committee (IMC), and in consultation with Block Committees, seasonally establish a schedule for water access for all

farmers in different locations in the scheme. The WWUA implements water scheduling at several levels according to the scheme layout and water availability (2.6.7 & Figure 2.8):

1) Firstly, through the IMC, the WWUA makes schedules of water access at irrigation system level i.e. the schedule specifies how water will be distributed between Wovwe I and Wovwe II. The schedule specifies days and hours. The Water Guard opens and closes water gates at the Headworks following time allocations. This is particularly common when water levels in the river are very low.
2) Secondly, scheduling takes place at scheme component level where Blocks are similarly allocated days or hours for water access. The Water Guard opens and closes Block intake points according to the schedule. The Water Guard and Block Committees work together to ensure that water is distributed according to the established schedule.
3) Finally, beyond the scheme component level, scheduling is also done at Block level where the Block and Unit Committees agree on hours each unit should be allocated water within the given period assigned to the Block. The Water Guards assist with opening and closing of Unit intake gates. The frequency of water access at this level is the one reported by farmers in Figure 5.5 of section 5.4.1.

In general terms, a majority (54.0%) of the 303 farmers in WIS indicated that the water schedules during the reform have improved the way water is being allocated to various sections of the scheme. Only 11.7% indicated that the general water allocation has deteriorated, 17.5% felt there were no changes when compared to the pre-reform period, and 16.8% were not sure. Despite a majority of farmers reporting improvements, farmers were almost equally split between those perceiving the WWUA to be doing a satisfactory work in dealing with water problems (43.9%) and those not satisfied (41.6%). Only 4.6% indicated that the WWUA was, to some extent, doing a satisfactory job while 9.9% were not sure. Reasons for dissatisfaction are related to climatic changes which induce changes in the availability of water (see 7.2.7 & 7.2.8 for details). Although schedules were there, farmers reported that they are not always being respected, especially in dry season. Detailed results of farmers' perceptions about water delivery are presented under outcomes of the reform in 7.2.7 for timeliness of water distribution, and in 7.2.8 for fairness or equity of water distribution.

Like the WIS, farmers' groups engaged in informal irrigation also operate a scheduling system except that their scheduling is not as multi-layered as that of the WWUA, as their irrigation systems are relatively small in scale.

5.5.3. Turns or rotations

Very low water flows in irrigation canals trigger farmers at unit level to make internal arrangements designed to ensure that every farmer within the unit accesses water within the access time scheduled by the IMC. In this case, the Unit Committee decides on who between the head-enders and tail-enders should access water first. It establishes a turn system and ensures that the arrangement works according to design. Farmers who fail to abide by the established rules are fined or, in extreme cases, reported to the Water Jury of the WWUA – according to their rules.

Though such arrangements appear logical, it was reported that some farmers still do not observe the turns or rotations unless their fields are adequately watered. Moreover, several social and belief impediments such as issues of witchcraft also come into play when dealing with law-breakers. One extension officer explains: *"there is a huge problem dealing with farmers' conflicts because of fears by both those wronged and members of the Jury from being witched"*.

The issue of witchcraft in Malawi is complicated. Although the WWUA constitution stipulates that anyone found bewitching fellow farmers shall be suspended from the association (WWUA 2001), there is a problem of proving that someone practices witchcraft and determining punishment for them as the country's laws do not recognize witchcraft (GOM 1911). As a result, those wronged by someone suspected to be a witch or wizard, will never argue nor report them to the Jury for fear of being bewitched. This shows that even if farmers are paid-up members, it is not guaranteed that their access rights will not be infringed upon. Witchcraft appears to be another form of 'social capital' advantaging certain individuals with respect to control over, and access to water. Unless water flows are adequate, some members are effectively excluded from accessing water just because of the locations of their fields or the influence of social norms.

5.5.4. Fee and contribution schemes

The WWUA established membership and water fee schemes (4.4.2.5 & 4.4.2.3) in order to maintain its members' access to water and keep the irrigation infrastructure in good condition. The fee scheme is an instituted mechanism for one to claim water access rights. Irrigators or farmers' groups outside the WIS, similarly, contribute some money which they use, not for running the direct irrigation affairs of their group, but to assist each other in times of unforeseen circumstances such as bereavements and illnesses. The chairperson of one farmers' group in Mtangala Village (upstream) hailed the practice as very essential in fostering unity among members. This is consistent with Young's (1994) observation that if members are interdependent on each other for a common benefit, cooperation becomes easy to achieve (see 2.3.2). This cooperation is crucial for inculcating a sense of ownership of irrigation systems among farmers, and hence achieving proper maintenance of irrigation infrastructure.

5.5.5. Specifying water abstraction equipment or mechanisms

Equitable and fair access of water is one of the main objectives of irrigation reform (Garces-Restrepo *et al.* 2007). Apart from putting in place mechanisms such as scheduling water access (5.5.2) and turns and rotations (5.5.3), the WWUA also determines water abstraction techniques to be used by its members. Pipes of 15cm in diameter are the only permitted water abstraction equipment, other means are illegal (4.4.2.6 & Table 4.4). Government supplied the pipes at the time of scheme establishment and provided replacement supplies for damaged or lost pipes.

Although withdrawal through open access and blocking water flow to deny others access to water are considered illegal and punishable by WWUA by-laws, direct observations revealed that despite this, farmers still use illegal means when accessing water (refer to Figure 5.15 in section 5.5.1).

5.5.6. Labor for access

The WWUA included in its constitution (WWUA 2001) some obligation by members to ensure that maintenance is done (see Table 4.1 in section 4.4.1). These are attached to water access and, among other things, require members to:

- work jointly with other members in proper management, operation, use, and maintenance of the irrigation system; and
- willingly contribute personal services for the maintenance of the irrigation system and the welfare of the Association.

Confirming the call by the WWUA constitution to punish those failing to abide by the rules of the scheme, nearly all of the respondents i.e. 99.0% (n=303) indicated that those who fail to abide by the rules are punished as stipulated by the WWUA constitution (see 4.4.2.6 and Tables 4.1 & 4.4). Also 67.1% of the respondents (n=303) confirmed this by indicating that those who fail to participate in maintenance work and other labor are fined a given sum of money if they want to continue cultivating in the scheme, 5.8% indicated that offenders are evicted, 26.1% indicated that offenders are fined and evicted, while only 1.0% were not sure about what happens. Despites reports of actual evictions, it was difficult to verify how many have been evicted since the reform due to the suspension of the WWUA executive.

5.5.7. Conflict resolution

The Water Jury is responsible for resolving all farming related disputes among WWUA members. Procedurally, a wronged member lodges a complaint with the Unit Committee which first tries to settle the dispute before referring it to the Water Jury (if not resolved) through the Block Committee. The Jury summons the wronged and the alleged offender together with witnesses and representatives of the Unit Committee for hearing and determination. The convicted offender, depending on the nature of the offense, is fined or warned.

Although there seems to be a mechanism for conflict resolution, only 42.9% of respondents cultivating in the WIS (n=303) indicated that there has been an improvement in the way conflicts are being resolved, 35.8% reported decline or dissatisfaction with the way in which conflicts are resolved. Other respondents i.e. 11.3% were not sure, while 10.0% felt that there was no change from the pre-reform era in the way conflicts are being resolved. Those who reported dissatisfaction (n=108) gave the following reasons:

- the Water Jury does not listen or consider farmers' side when passing verdicts (n=38);
- there Water Jury/WWUA and Block Committees are biased in resolving conflicts (24);

- there is unfairness (20);
- the Water Jury demands money before they can hear our cases (15); and
- it takes too long before conflicts are heard (11);

On the other hand, those satisfied with the way conflicts are being resolved (n=130) highlighted the following as reasons for their satisfaction:

- those who used to be troublesome are now behaving as they fear fines and expulsions (n=69);
- we now present our side of cases without fear which was there during the MYP (31);
- the frequency of occurrence of conflicts between farmers has reduced (30).

Furthermore, although there seems to be a fair and accountable procedure of resolving conflicts e.g. provision for appeal to conventional courts, practically, there have been no reported instances where the unsatisfied offenders took the matter beyond the Traditional Authority's (TA) level. While the WWUA President acknowledged dissatisfaction of some farmers with land confiscation and reallocation issues, he also indicated that farmers usually bring their cases to TAs who, have so far, resolved the issues to farmers satisfaction.

Informal irrigators use similar channels as members of the WWUA. They first try to resolve the conflict by themselves. If they fail, they refer the matter to the Village Courts which, when hearing and determining, use the group's procedures in compliance with village norms. In both instances, whoever is not satisfied with the local verdict is free to seek further redress in conventional courts i.e. magistrate courts – though this has never happened yet.

5.5.8. Off-peak access: individual night access

The normal water access time period at WIS is between 6.00am and 6.00pm (Simfukwe pers. Comm.). Beyond this period the WWUA carries out no formal water distribution activities. However, it does not close the intake gates at the headworks. Being an open irrigation system, water flows through the canal system of the scheme into the drainage system back into the river. In times of water scarcity, farmers take advantage of this free unallocated flow at night to come and irrigate their fields. This off-peak access helps farmers to irrigate their fields which they could not during the day.

Such behavior of farmers indicates that farmers seek ways of averting competition by choosing to irrigate their fields when the resource is not under the control of the governing body. This has the advantage of extending water access beyond allocated times. But some groups or individuals e.g. female farmers, the aged, and those residing far from the scheme are disadvantaged as they indicated that it was difficult for them to come at night. Unlike irrigators in the WIS, in times of water scarcity, irrigators outside the WIS take the responsibility of irrigating their fields as a group, rather than individuals.

5.6. Summary

This chapter has shown that while there are a range of stakeholders involved in the process of water management, use, regulation, and planning, the most important factors to consider for any reform are stakeholders' positions on the reform, and how stakeholders affect and/or are affected by the reform. In the case of Wovwe, there are a majority of stakeholders who heavily depend on water resources for their livelihoods but their ability to influence the direction or outcome of the reform is not uniform. These stakeholders need careful consideration when designing policy reforms; especially when such reforms affect the rural poor, some of whom are illiterate.

A careful examination of household characteristics reveals a mixed scenario. Being a rural area, nearly all households depend on farming as their main occupation making land holding and availability of water resources very important aspects in their day-to-day livelihood activities. However, their land holding, like other assets' endowment, is very low. With relatively large household sizes, most individuals have low or no education at all. The lack of education, unfortunately, constrains their abilities to negotiate water access and participate in governance institutions in order to affect decision making. But in order to access water, stakeholders employ several strategies which are mediated by different processes of management and practices adopted in specific settings. However, without necessary and adequate resources for water governance, stakeholders cannot realize meaningful benefits from the reform. The following chapter examines stakeholders' endowment of resources for water governance and how possession or lack of specific resources affects their livelihoods and natural resources on which their living depends.

6. WATER GOVERNANCE RESOURCES AND WATER ACCESS

6.1. Introduction

Findings on the stakeholders' endowment of resources for governance address the research question: *"How does possession or lack of specific water governance resources influence the poor's access to water?"* Data were collected through questionnaire surveys, key informant interviews, focus group discussions, review of secondary sources, and direct observations; and were analyzed using both quantitative (SPSS version 18) and qualitative methods. Results, specifically, focus on understanding resource endowment by different stakeholders, identifying factors which influence whether stakeholders possess or lack and/or use some resources, and how possession or lack of specific resources is reflected on the rural poor's ability to access water and engage in different livelihood activities.

6.2. Household water governance resources

This section examines resources related to socio-politics and culture, rights, institutions, human capabilities, finances, the natural environment, and water access technologies. It is worth recalling that resources for water governance, as defined in the Water Governance and Poverty Analytical Framework (2.5), correspond to types of capital identified in the sustainable livelihoods framework (2.4.4).

6.2.1. Socio-political and cultural setting

A range of socio-political and cultural factors (gender, age, power structures, ethnicity and social relationships) determine the rural poor's access to water which, if not properly oriented, may perpetuate marginalization and vulnerability of certain individuals or groups in a community (Cleaver 2005).

6.2.1.1. Gender and age

The perception about water access at Wovwe is also dependent on what the water is used for, and cultural dimensions have an important influence on perceptions, particularly with respect to gender. Gender plays a crucial role in determining who will draw water for specific purposes. For example, females are considered responsible for collecting water for all domestic purposes (excluding livestock watering) while the responsibility for watering crops or livestock is perceived to rest solely on males. In practice, this implies that rearing livestock,

particularly cattle, by households which have only female members is harder than it is for households with only male or mixed members. This is, with respect to drawing water for household purposes, similar for households without females.

However, evidence from interviews suggests that despite the perceptions, men tend to assign their responsibilities, particularly irrigating crop fields in the WIS, to women. This is despite the fact that women are relatively poorly represented in the WWUA decision-making establishments (only 19.4%) about irrigation e.g. at Block Committees level (Table 6.1). Furthermore, women who own plots in the WIS find it particularly difficult to properly irrigate their fields during times of water scarcity. For example, some female interviewees indicated that while their male counterparts could organize themselves and return to the fields at night to irrigate their crops (see 5.5.8), they could not do so for security reasons.

Table 6.1: Gender proportions in Block Committees at Wovwe Irrigation Scheme

	Wovwe I		**Wovwe II**		**Total**	
Gender	***N***	***Proportion (%)***	***N***	***Proportion (%)***	***N***	***Proportion (%)***
Male	51	79.7	32	82.0	83	**80.6**
Female	13	20.3	7	18.0	20	**19.4**
Total	**64**	**100.0**	**39**	**100.0**	**103**	**100.0**

Gender and age also influence the use of some water abstraction technologies such as treadle pumps. Some women felt that it was difficult for them to use treadle pumps as 'riding' the technology looked culturally unsound. Furthermore, some households owning treadle pumps acknowledged that operating the technology requires a lot of energy, consequently affecting the culture-conscious, aged, and those with poor health.

6.2.1.2. Ethnicity and social relations

Since the establishment of the WIS, there has been migration of several livelihood and ethnic groups into the area (2.6.7). Notable tribes include Chewa, Ngonde, Nyakyusa, Ndali, Lambya, Sukwa, and Tumbuka. All the tribes have their own cultural norms and rules of living which manifest social fissures in the management of the scheme. Commenting on the elections of the suspended WWUA executive members, one extension officer indicated that the election process was marred by disagreements between farmers who are resident at the

camp site[31] and those from villages. Farmers from villages wanted a change of venue because they felt that holding the elections at the camp site as it has been happening in the past gives camp residents an advantage to participate in voting as they travel short distances compared to their village counterparts. This implied that there was high chance of farmers from the camp site to be nominated and elected to positions of decision-making since both nominations and voting are done on the same day. This, in part, may explain why problems of maintaining social cohesion were reported (see 4.5.2).

Another group of immigrants i.e. the Malawi Young Pioneers (MYP) was brought into the settlement camp by the dictatorship government of Dr. Banda to cultivate in the scheme and also teach local farmers rice irrigation farming. Although the MYP structure was disbanded at the scheme in 1993 (2.6.6.3), but the dominance of former MYP members is still felt since they are now integrated as locals. This is due to the fact that they were settled at the scheme after being taught irrigation farming in the MYP Training Bases, meaning that with their knowledge of irrigation, they easily meet eligibility criteria for election into positions of decision making and for holding and cultivating plots in the WIS (4.4.2.1 and 4.4.2.2). Farmers confirmed this by indicating that when nominating or electing someone into office, one of the criteria the candidate should meet is that he or she should have adequate knowledge of irrigation farming. This effectively marginalizes others who lack formal irrigation farming knowledge.

The role of social relationships in determining access to water and land is also quite visible. Individuals without land often borrow and cultivate land belonging to their relatives or friends (5.2.2.3). The practice positively alleviates the poor's land problems as they do not need to pay anything in order to cultivate land. During droughts and dry spells, the landless borrow land situated along the river from their relatives or those from within their tribe. The implication is that if one is landless, she needs to have money to rent land or relatives to lend her land on which to farm. Social relationships, hence, play an essential role in ensuring that the landless households in the Wovwe catchment access land and water for their livelihoods (5.2.2.3; 5.2.2.6).

[31] Most of the residents at the camp site are settlers whom the government brought in to teach local farmers irrigation farming and other migrated to the area to start do farming.

Some farming households with large or extended families also enjoy social benefits by way of distributing labor as other family members assist them with various field tasks such as field preparation, planting, weeding, and harvesting. For instance, nearly half the survey respondents reported that besides using own family labor; they are also helped by other family members (Table 6.2). Members rotate in fields of different households performing various tasks which would be more time-restrictive if carried out by single households than if households were helped by others.

Table 6.2: Labor arrangements by farmers along the Wovwe River catchment (N=473)

Labor arrangement	**Percentage (%)**
Own labor and helped by other family members	45.7
Own family labor	18.6
Own labor and paying	16.5
Own labor, paying, and helped by others	9.9
Pay for labor	9.3
Total	**100.0**

Findings on ethnicity and/or social relations, as capital or resources, reveal three important factors for securing livelihoods:

1) the elite, such as former MYP members who underwent training in irrigation farming, have advantage over the local poor who slowly learn about irrigation through field experience and extension services provided by the Department of Agriculture;
2) belonging to a family or having relatives who have vital resources such as land/land close to a water source is more advantageous, in terms of securing livelihoods, than belonging to a family or having relatives without such vital resources; and
3) where financial resources are inadequate, households enhance their human capabilities (social capital) by employing labor sharing strategies with other households. In this way, social capital makes up for deficiencies in finances.

6.2.2. Water rights

"Reforming water allocation depends on understanding how water rights work in practice at the local level …" (Bruns and Meinzen-Dick 2001). Rights regimes are an important means of ensuring equity in water access, determining the ability of various users to access the resource, and devising rules for access and exclusion (2.3.2.2). At Wovwe there is a mixture of both formal and informal rights. Here, with respect to water access, the study investigates

existing rights, and their enforcement arrangements. The section considers different practices of water access (some already presented) at Wovwe in a 'rights' context to try to understand which rights exist and how they are being utilized and enforced.

6.2.2.1. Existing rights

Stakeholders have rights at both operational (access and withdrawal rights) and collective-choice (management, exclusion, and alienation or transfer rights) levels (2.3.2.2). While customary and state laws allow every citizen to exercise their operational level rights, locals at Wovwe have put in place procedures which every farming household has to follow in order to have access to water resources. For example, accessing the Wovwe River at points where it passes through land belonging to another person requires that those who are not owners of the land follow established routes to the resource despite state laws granting every household free withdraw rights for domestic purposes (GOM 1969). Similarly, withdrawals for irrigation purposes require that one first obtains permission from those owning land bounding the river either to use their land or dig a through-canal to his field (5.3.1). Any withdrawal agreements made between the land owner and the one trying to access water through specified routes or from designated places are operational in nature (2.3.2.2).

Both the WWUA and user groups outside WIS exercise management, exclusion and alienation (transfer) rights (2.2.3.2). For example, the WWUA devises and implements rules for water withdrawal; makes schedules for water access; defines what lawful and unlawful withdrawal is; and determines and implements corrective measures for unlawful withdrawals. The WWUA also excludes some members from accessing water by establishing membership and water fee schemes. Furthermore, the WWUA requires every member to take part in maintenance work of the irrigation system (5.5.6) and to comply with prohibitions from removing trees, reeds, and other vegetation from the river catchment. Farmers in the WIS reported that they are punished once they fail to pay membership of water fees (Table 6.3). The suspension of the WWUA executive committee (3.4.1) was a constraint on efforts towards quantitatively verifying whether the punishments farmers reported were actually enforced. However, extension officers and traditional chiefs confirmed farmers' claims that they are fined or evicted. They reported that at one time farmers who had their plots confiscated sought redress from the TA. With regards to existing rights, the exercise of such

authority by the WWUA and user groups indicates that both the WWUA and user groups possess rights at collective-choice level.

Table 6.3: What punishment is given to farmers who fail to abide by the WWUA rules (n=303)

Punishment	**Proportion of respondents (%)**
Fined	67.1
Fined and evicted from the scheme	26.1
Evicted from the scheme	5.8
Don‘t know	1.0
Total	**100.0**

Groups or individual villagers using water for irrigation, fish farming, livestock rearing, etc outside the WIS hold informal rights. Though informal, groups make internal arrangements, accepted by members, which determine conditions of access and exclusion. Specific groups have rules for running their irrigation establishments including infrastructure maintenance. During times of water scarcity, groups devise means such as rotations and scheduling to ensure fair water distribution.

Both water users in the WIS and informal irrigators outside the scheme transfer their rights or part thereof to other users. In the WIS, rules permit rights holders to transfer their ownership rights to members of their families provided certain conditions are met (5.4.3). Likewise, it is customary that villagers transfer their rights to members of their families either as an inheritance portion to children or as a gift to a family member who has no suitable farming land. Transfer of rights is consistent with the Irrigation Policy and Development Strategy (GOM 2000b) and the WWUA Constitution (WWUA 2001). In some cases, villagers permanently transfer their rights through a sale of their land parcel, and temporaily by lending their land to others (5.2.2.3). These practices indicate the existence of alienation or transfer rights are alienation rights. The positive implication of alienation rights is that the landless have an opportunity to own land in a village whose land is fully distributed, and hence engage in livelihood activities. On the other hand, alienation rights may imply that the poor land owners sell their land in order to find money to meet their basic household needs. Such a practice may indicate ‘push’ or negative diversification (2.4.3) which is detrimental to the rural poor’s livelihood security (Ashley *et al*. 2003) and may perpetuate poverty among them.

The complexity of the rights systems is that although every household has access rights to water resources in Malawi, those with collective-choice rights hold a very significant position in determining the access of water by others who have only operational level rights. It may be particularly counter-productive if holders of collective-choice rights exercise their authority in determining access, withdrawal, and exclusion rights in a manner that is not equitable and accountable. With farmers indicating various degrees of involvement and satisfaction in the formulation and implementation of rules (Table 5.15, section 5.4.1), it is very crucial that farmers' rights are protected from those in power with effective government legal framework.

6.2.2.2. Rights enforcement

Furthermore, although water users at Wovwe possess both *de facto* and *de jure* rights (4.4.2.3), it is practically difficult to differentiate between them. Rights overlap and sometimes conflict or complement each other. For example, the government policy on irrigation promotes expansion of irrigation agriculture through encouraging communities to open up irrigation fields either as individual households or as community groups (GOM 2000b). In response, villagers have developed informal irrigation schemes both upstream and downstream of the WIS. In doing so, communities use customary rights and *de facto* rights to operate their irrigation projects. On the other hand, the transfer of ownership, operation, and management of the WIS from the government to farmers in the WIS is being implemented in the *de jure* framework as the WWUA, the recipient entity of the transferred scheme, acquires convential water access and use rights by paying for them to the WRB. While the WWUA holds *de jure* rights, its members within sections of the irrigation scheme also agree among themselves on how to access water through turns and rotations (5.5.3). This is achieved by internally devising procedures of access. By doing so, the internal cooperation within the WWUA both complements and overlaps the formally acquired *de jure* rights.

On the other hand, when upstream informal irrigators exercise their customary rights to access water by responding to government's call to expand irrigation, their abstractions negatively affect the formal rights holders in the WIS and other informal irrigators downstream, particularly in times of water shortages. Moreover, while government policy to encourage local villagers to engage in informal irrigation is a commendable strategy for ensuring food security, it may also be viewed as a recipe for conflict among resource users. Such a

conflicting scenario within one policy sector underscores the danger and complexity of simply subjecting a single common-pool resource to multi-pronged strategies of utilizing it.

6.2.3. Institutional resources

Institutions play an important role in shaping the way communities gain access to water by balancing competing demands of various users. But they can also be effective mechanisms for excluding demands of others. Recognizing this, the current section examines a range of institutional resources and how formal (organizations) and informal (generally accepted norms, rules, and practices of water access) institutions influence water access of different users.

6.2.3.1. Organizational setting

At national level, institutional roles about water resources management and irrigation are carried out by several government ministries and departments (Table 6.4). At Wovwe, institutions involved in water governance include selected government departments and institutions (e.g. Departments of Agriculture, Irrigation, Local Government and the Water Resources Board), NGOs (e.g. Concern Universal and World Vision), and local/community organizations which include the WWUA and farmers' groups or clubs (see Table 5.1 for further details). Institutions perform their roles independent of others except for government departments i.e. Departments of Agriculture and Irrigation. However, there is no established formal link between the WWUA and government departments or village governments. Their main point of contact is 'the farmer' in the irrigation scheme whom government and the WWUA work with and who is also a village member. Despite the loose link, the most important issue in the reform is that farmers who are also villagers should be able to utilize existing organizational structures to access water and voice their concerns.

Table 6.4: Institutional roles in the water sector
Source: Environmental Affairs Department, 2002

Institution	Principal roles
Ministry of Irrigation and Water Development	• Monitoring, assessment, planning, development, conservation, allocation and protection of water resources; • Planning, development and coordination of rural water supply; • Regulation of the activities of the Water Boards; • Control of irrigation development.
National Water Resources Board	• Coordinating the activities of the Catchment Management Authorities; • Regulation of water resources development and operation; • Advising on the protection and management of sensitive catchment areas; • Advising on the establishment of water users associations, especially from irrigation supply, rural piped water supply schemes, and fisheries.
Catchment Management Authorities (CMA)	• Control and development of water resources within the catchment area.
Ministry of Agriculture	• Widespread promotion of good husbandry; • Collaboration with CMAs to ensure good management of sensitive catchments, controlled areas and river banks; • Promotion of on-farm water harvesting and conservation
Ministry of Natural Resources and Environmental Affairs	• The Forestry Department: Conserves headwater catchments through the management of Forestry Reserves; • Environmental Affairs Department: Coordinates cross-cutting issues involving the water sector.
Nongovernmental Organizations (NGOs)	• Promotion of community-based water services and water resources management; • Direct investment in rural water supply and dams; • Community sensitization in water and catchment management.

The state of organizational setting at Wovwe shows a mixed picture. While it is tempting to conclude that farmers are fairly well endowed with institutional resources, very few respondents i.e. 11.2% (N=473) indicated that there existed institutions of water access or irrigation at Wovwe, 39.3% claimed that they do not know any organization, while 49.5% claimed they knew nothing about the presence of organizations. Although this excludes the WWUA, to the few who reported knowledge of the existence of organizations (n=53), only government departments and NGOs were better known than other institutions (Table 6.5). The NGOs or projects which farmers mentioned include the Farm Income Diversification Project (FIDP), One Village One Product Project (OVOP), Concern Universal, World Vision International, and the National Association of Smallholder Farmers of Malawi (NASFAM).

Table 6.5: Farmers' knowledge of existence of water access and irrigation institutions at Wovwe (n=53)

Organization	Proportion (%)
Department of Agriculture (Extension Services)	54.7
Department of Irrigation	43.4
Non-Governmental Organizations	39.6
Electricity Supply Corporation of Malawi	30.2
Village Development Committee, Village Courts	30.2
Water user groups	26.4
Community Based Organizations	13.2
Parastatal organizations	3.8

Farmers utilize these organizations in issues pertaining to water access, conflict resolution, extension services, credit, and farm inputs. For example, user groups outside the WIS receive technical assistance from Agricultural Extension Workers and NGOs. Such assistance comes in form of group loans, agricultural inputs, and equipment from NGOs and other government programs and schemes (see 6.2.5).

6.2.3.2. Policies, legislation, and rules as institutions

There are a number of relevant policies and legislation guiding the management and use of water resources (4.2.3). However, despite the Water Resources Act (1969) providing for proper conservation of water resources, and protection of legally held water rights against illegal abstractions (4.2.3.2), enforcement proves problematic. Evidence from Wovwe suggests that there is no government enforcement mechanism on the ground. For example, the Catchment Management Authorities are not yet established to carry out enforcement activities. Furthermore, a majority of local water users lack knowledge of existing legislation or policies (Figure 6.1). This, coupled with very few farmers being aware of the presence of water access and irrigation organizations (6.2.3.1), explains why local water users resort to illegal measures of water access and practices which are damaging to water resources and the environment in general (e.g. 4.5.4 & 5.5.1).

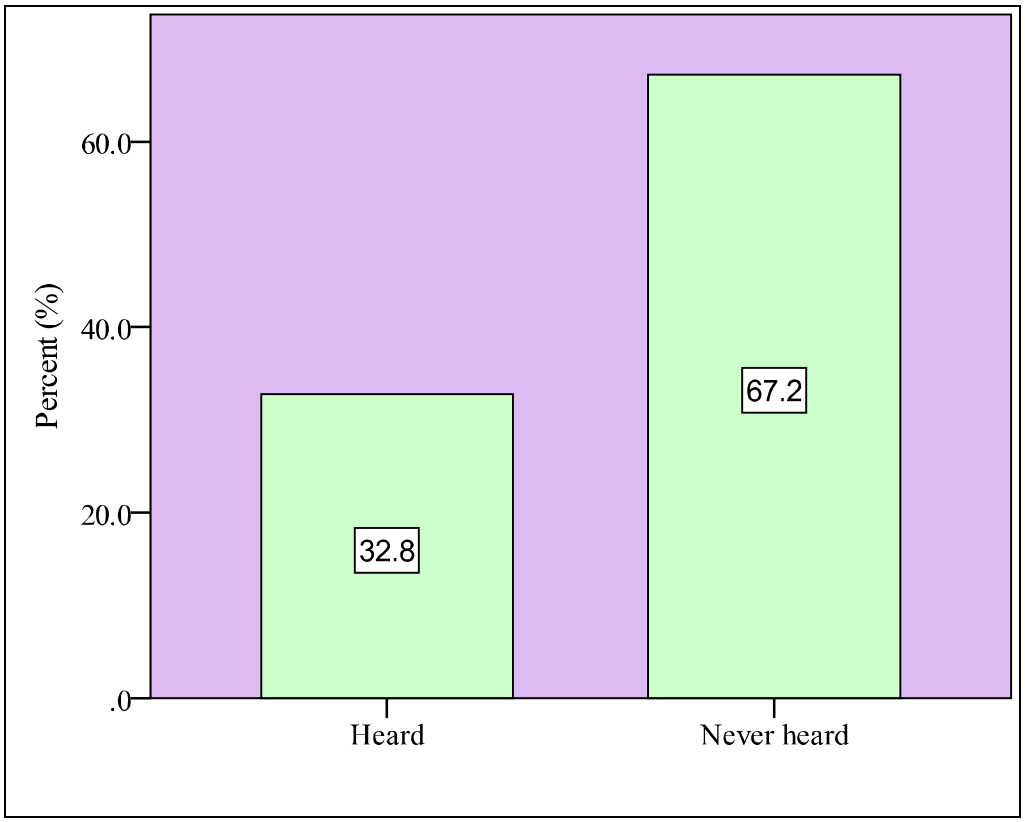

Figure 6.1: Whether local water users have ever heard about the Irrigation Policy, N=473

6.2.4. Human capabilities: education and health

Human capabilities shape people's abilities to engage with mechanisms of water access and water institutions (Cleaver and Franks 2005). Health status and level of education enable or constrain users in engaging with water access mechanisms such as participation in meetings which decide rules and procedures for water access, and using some water abstraction technologies.

6.2.4.1. Education

The relatively low level of formal education among the Wovwe communities (5.2.2.2) has four main negative implications on the illiterate households cultivating in the WIS:

(a) they cannot read and follow WWUA communications to farmers as some respondents in the WIS survey (Table 6.6) indicated that the WWUA communicates to farmers by placing posters or announcements in public places or on trees on the roadsides;

(b) they cannot hold any positions in WWUA committees as eligible holders are practically required to be able to read and write (4.4.2.1). Hence the illiterate cannot contribute their ideas towards the running of the scheme;

(c) the illiterate are unable to exercise their full membership rights as provided for by the Irrigation Act (2001) i.e. checking books of accounts of the Association. Furthermore, they cannot follow rules and regulations of the scheme since they cannot read minutes and by-laws. This makes them prone to unintentional breaking of the scheme rules; and

(d) they cannot write a letter, hence, have limited means of expressing themselves as they rely only on verbal communication which requires their actual presence or trusting someone to speak for them.

Table 6.6: Surveys responses on mechanisms the WWUA uses to inform farmers about its activities (n=284)

Mechanism	Proportion (%)
WWUA meetings	52.1
Farmers' committees	15.9
Letters and posters	12.0
WWUA announcements	3.5
Traditional leaders	2.8
WWUA officials	1.1
Agricultural Extension Workers	0.7
No communication	12.0

However, looking at the media of communication which farmers outside WIS use suggests that the illiterate outside WIS are better-off than their counterparts in the WIS. Village Heads and some key informants indicated that when there is an issue needing communication to the community, every village has people who go around announcing the message or calling villagers to a village assembly where issues are discussed openly in a language everyone understands. This reflects an important attribute of effective water governance (Table 2.2 in section 2.3.2.1) as outlined by Rogers and Hall (2003).

6.2.4.2. Health

Households reported malaria, bilharzia, and HIV/AIDS as their major health threats. There are few health facilities in the area i.e. the upstream has a health centre (Fuliwa Health Centre) but the middle and lower sections have none. Downstream communities and some communities from the middle section access the Nyungwe Health Centre which is between 7 and 25km away. However, the government is addressing this deficit by (i) mobilizing health workers to various communities, and (ii) utilizing community-based health and sanitation groups to deliver disinfectants to communities and medication to the terminally ill,

particularly those suffering from HIV/AIDS or related illnesses such as tuberculosis. The government and NGOs have also teamed up to protect children and pregnant mothers by giving out free mosquito bed nets to sleep under. The government also mobilizes Health Surveillance Assistants (HSAs) who link up with communities on various health, sanitation and nutrition issues. Furthermore, in order to deal with bilharzia and parasitic worms at the scheme, the government established a clinic at the settlement camp dedicated to conducting laboratory tests for the parasites and treating parasitic infections.

Key informants highlighted the issue of HIV/AIDS as a growing concern. They observed that once one household member falls ill, the entire household is affected as healthy members in the household spend most of their time and resources looking after their patients who, in some cases, do not even survive. Eventually, the household becomes food insecure and struggles to meet basic household needs.

6.2.5. Financial resources: income/economic status

It is widely accepted that water institutions should be financially sustainable i.e. should be able to cover their operation and maintenance (O&M) costs to ensure that water services are sustainably provided (GWP 2000). However, evidence from Wovwe suggests that the very aim of achieving financial sustainability can either support or constrain the ability of the rural poor to access water.

6.2.5.1. Household income

Findings on the levels of household income indicate that the income of the majority of households i.e. 55.4% is below MK5000 (~31 USD) per month with only 44.6% earning more than MK5000. When examined across locations, a larger proportion of downstream households earn below the K5000 level than do households from the rest of the locations (Table 6.7). More detailed analyses of the impacts of the reform on households' financial status are presented in sections 7.3.1.2 and 7.3.1.3.

Table 6.7: Household monthly income by location (N=473)

Household monthly income (MK)	Location (%)			
	Upstream	***Within WIS***	***Downstream***	***Other***
<5000	56.1	45.5	69.7	55.6
≥5000	43.9	54.5	30.0	44.4
Total	**100.0**	**100.0**	**100.0**	**100.0**

Financial capital, in part, determines a households' ability to access vital livelihood resources such as water, land, farm inputs and equipment. Improved household income implies better economic status, and hence the ability of the household to fight poverty. Some households, who have cash but no land, use their income to purchase of rent land for agricultural purposes (e.g. 5.2.2.3). To such, their financial capital enhances their abilities to engage in meaningful livelihood activities. However, those without adequate finances are constrained in their engagement in livelihood activities, and in extreme cases may be tempted to engage in negative diversifications (2.4.3) by selling even their core resources e.g. land parcels just to find cash to meet their daily needs.

The encouraging news for the cash-poor is that the government has recently established a number of programs aimed at helping them move out of their poverty. Such programs include:

- the establishment of the loan scheme for the rural poor i.e. the Malawi Rural Development Fund (MARDEF);
- the One Village One Product (OVOP) program which provides loans to rural groups to help them add value to their produce. The WWUA is one beneficiary of the OVOP loan with which the association acquired the Rice Mill (see sections 4.4.2.9 and 4.5.3); and
- the introduction of the farm input subsidy program which targets the rural poor by giving them an opportunity (fertilizer coupons) to purchase subsidized fertilizers at K500(US$3.13)/50kg bag. The market price for such a bag is over K10,000 (US$62.50). With this scheme, farmers pay about 5% of the cost price. Realizing that some poor households could still not afford fertilizers at the subsidized rate, the government introduced public works program where the rural poor work on road maintenance and can earn K200/day (US$1.25/day).

These initiatives show that although most households earn less than MK5000 (~31 USD) per month, they still have a wide range of financial opportunities to enhance their livelihood standards, hence enhance their financial capital.

6.2.6. Natural resources: water flow and availability

The ability of the poor to realize maximum benefits from water resources depends, among other things, on their location with respect to water sources and markets, availability and stability of the resource, amount of rainfall, levels of flow in the river, and how they cope in times of hazards or disasters.

6.2.6.1. Physical location

The Wovwe upstream is more remote, hence formal markets are scarcer than is the case with the lower locations. Only the downstream has a good tarmac road connecting it with trading centers where household or livelihood requirements can easily be accessed. The 'Within WIS' section is closer to the tarmac road and is connected by a graveled road which is in fairly good condition compared to the upstream. Moreover, a busy trading center has developed over the years at the irrigation scheme camp site supporting Lankford's (2003) observation that irrigation-based livelihoods develop in phases over time resulting in an emergence of several livelihood activities (2.4.5).

6.2.6.2. Water resources

Communities in the Wovwe catchment have several sources of water including ground, rain, and river water. Downstream communities also access water from Lake Malawi. However, throughout the reform period, the availability of water, particularly water in the Wovwe River has been unpredictable. Official government data on river flow and levels are outdated (Figure 6.2). However, observations by the District Irrigation Officer, perceptions of the majority of respondent households and local communities (Figure 6.3), and rainfall data for the whole Karonga District from the Department of Climate Change and Meteorological Services (DCCMS) (Figure 6.4) agree that precipitation, the main source of freshwater, is declining, implying reductions in rates of river recharge, and hence declining of the general river flow.

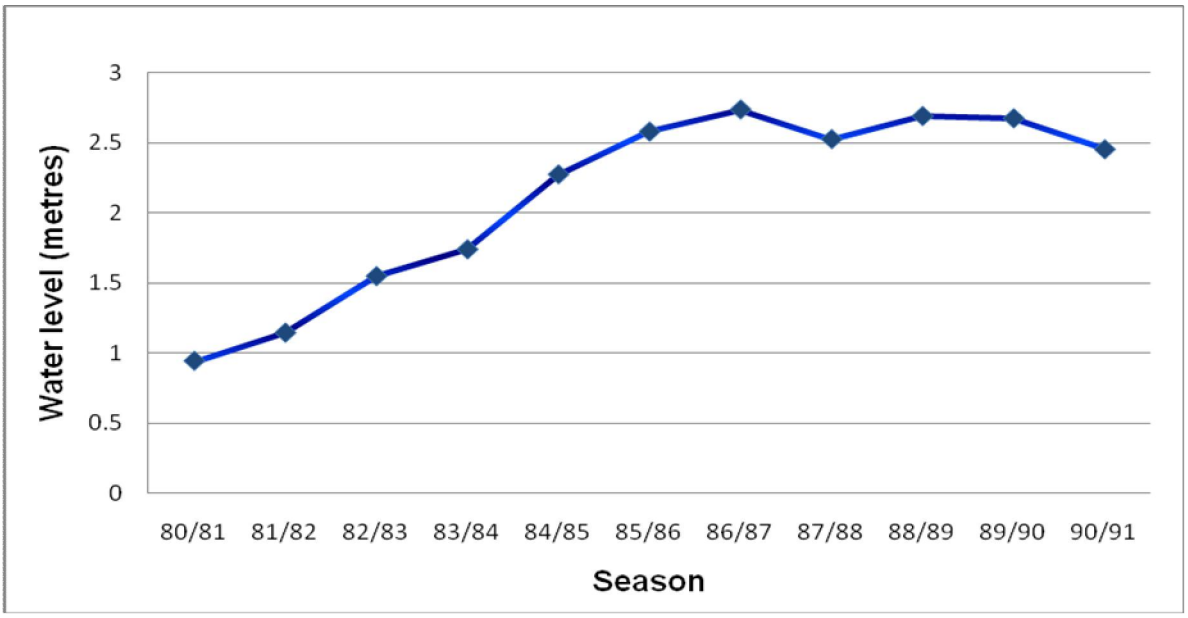

Figure 6.2: Trend in mean levels of water in Wovwe River measured at Kapiyira from 1980/81 to 1990/91
Data source: Ministry of Irrigation and Water Development

Perceptions of over half the respondents show that the volume of water in Wovwe River has declined compared to when the reform process started (Figure 6.3).

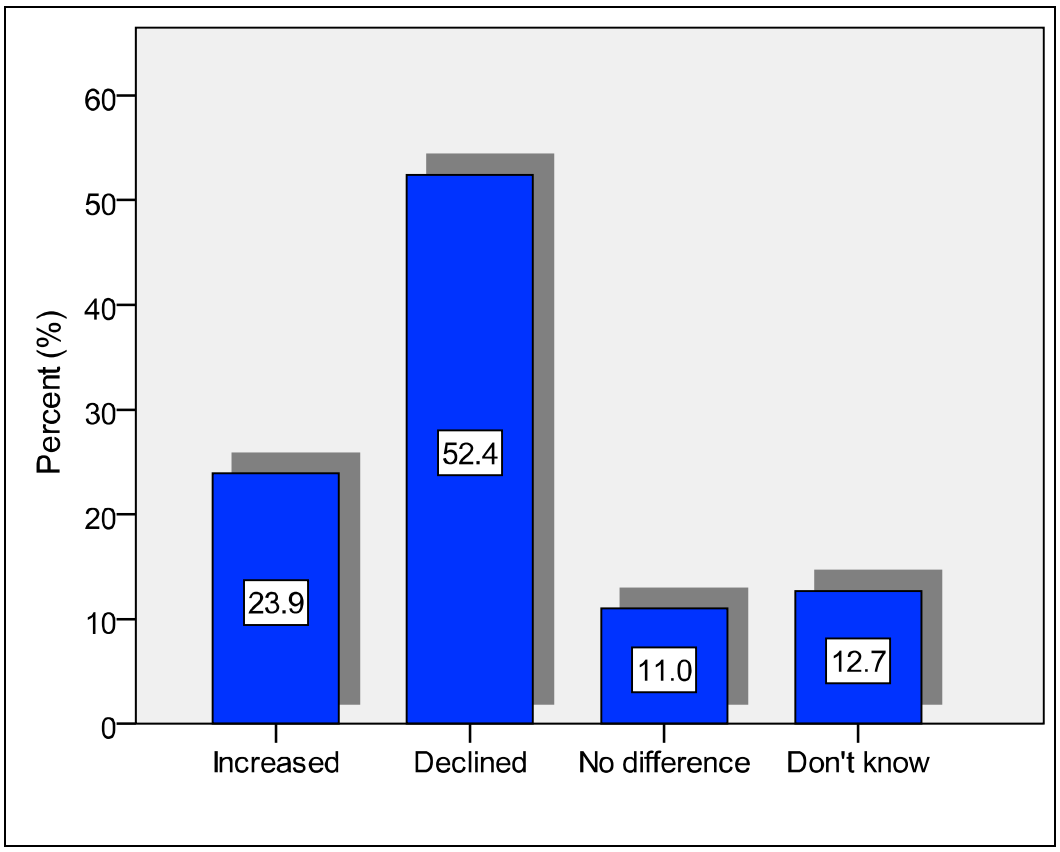

Figure 6.3: Households' perceptions about the current level of water in the Wovwe River since reform; N=473

Data from the DCCMS (Figure 6.4) show that since the 2005/06 season, average precipitation levels for the entire district have consistently remained below normal – supporting observations of the District Irrigation Officer and farmers' perceptions about the levels of water flow in the Wovwe River which could be due to low precipitation levels.

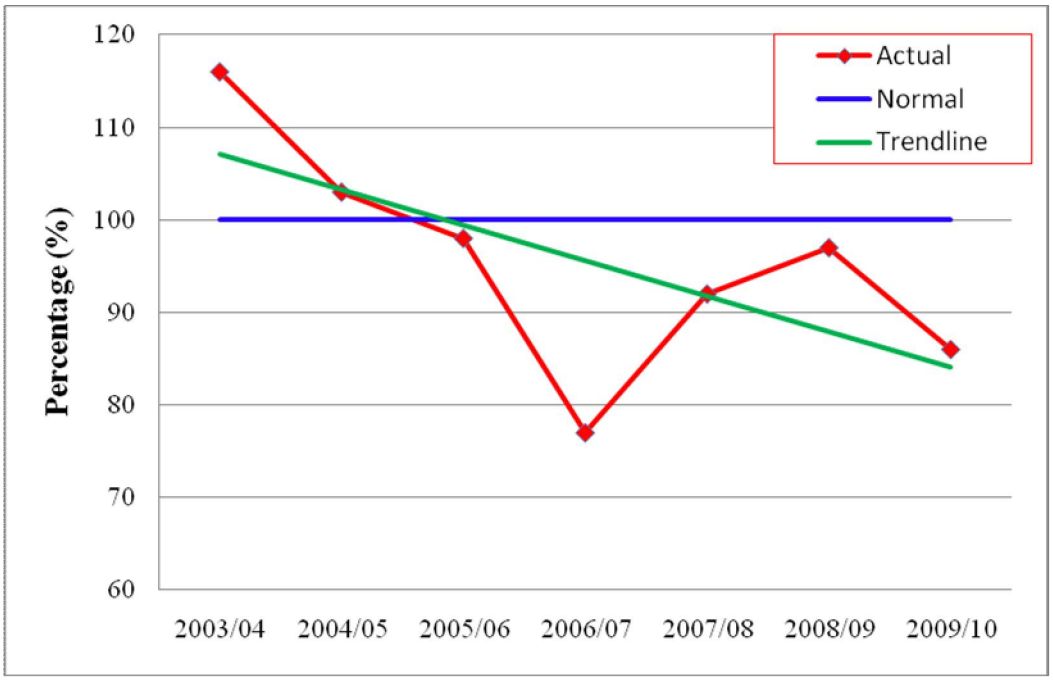

Figure 6.4: Rainfall as a percentage of normal for Karonga District from the 2003/04 season to the 2009/10 season (%)
Data source: Department of Climate Change and Meteorological Services, Malawi

While in general terms the majority of households agree that the river volume has declined, perceptions vary according to locations. Chi-square tests (Table 6.8) revealed that there is a statistically significant relationship between farmers' perceptions about water levels in the Wovwe River and the location they come from *($X^2 = 23.71$; $df = 9$; $p = 0.005$; Cramer's $V = 0.129$)*. Households from the 'Within WIS' and 'Downstream' locations reported significantly lower levels of water than those from the 'Upstream' location[32].

[32] This excludes the 'Other' location as households from this location are from different places (refer to note on Table 3.2)

Table 6.8: Households' perceptions about the level of water in Wovwe River since reform by location (N=473)

Perception	Location (frequency)			
	Upstream	*Within WIS*	*Downstream*	*Other*
Increased	30	45	31	7
Declined	45	119	70	14
No difference	18	14	20	0
Don't know	21	22	11	6
Total	**114**	**200**	**132**	**27**

Households attribute the perceived declining volumes to increased water abstraction for irrigation, poor environmental management practices, and adverse weather and climatic conditions (dry spells and droughts) as the main causes (Table 6.9).

Table 6.9: Household opinions about the main causes of declining volumes of Wovwe River, n=248

Reason	Percent (%)
Increased number of people abstracting water/digging diversion canals	39.9
Poor environmental management/removal of vegetation along the river	33.1
Drought/dry spells	16.9
No response	7.3
Don't know	2.8
Total	**100.0**

On the occurrence of droughts and floods, most respondents stated that frequencies for both have increased markedly (Figures 6.5 & 6.6). Their observations are supported by those from key informants i.e. the Divisional Irrigation Officer, Village Heads, and Extension Officers. Consistent with the assessment by MNVAC (2005), key informants indicated that dry spells and floods are a chronic hazard for the area.

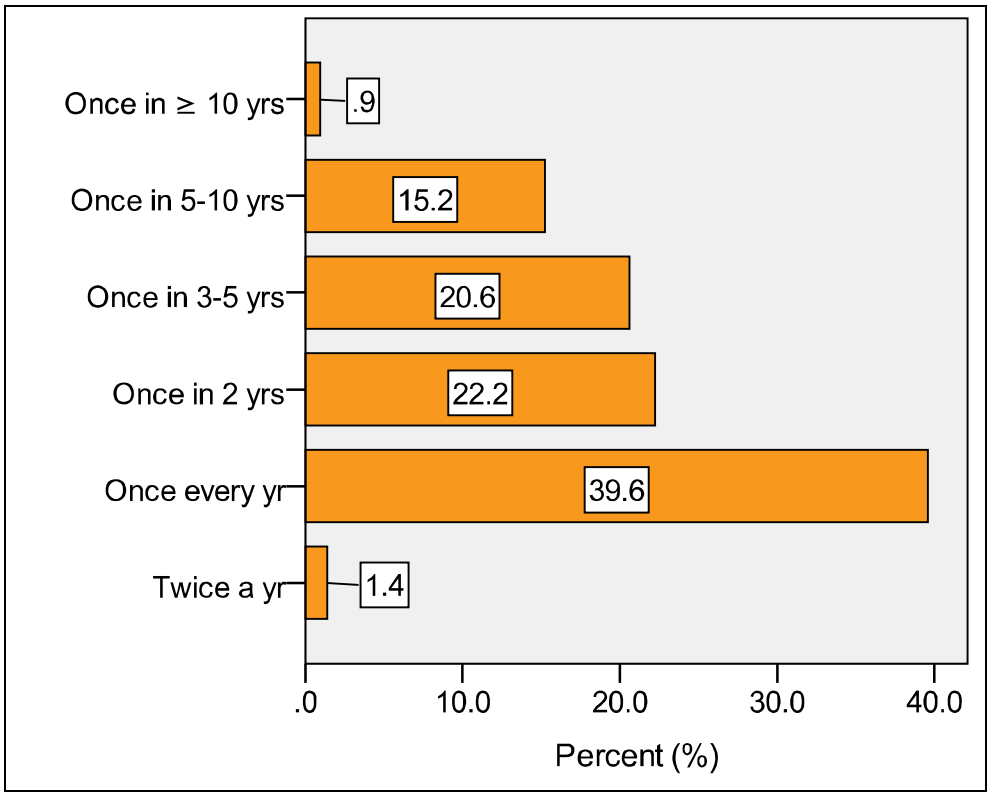

Figure 6.5: Farmers' opinions about the frequency of dry spells/droughts occurrence; n=427

Findings on water resources show that communities at Wovwe are faced with an unpredictable situation about the stability of water supply. Households may experience both dry spells/droughts and floods in a single year and spend their times in shelters such as tents, churches, and schools during floods (Figure 6.6). In terms of livelihoods, this means that the time which they could have spent on livelihood activities is wasted trying to find shelter and that the destruction caused to their homes and crops is a step backwards.

Figure 6.6: Some villagers taking shelter at Wovwe Primary School and temporary shelters after their homes were destroyed by floods during the 2008/09 season

6.2.7. Technology

The use of technology may save or consume the poor's time for engaging in other livelihood activities. However, affordability, convenience with respect to operation, and maintenance are the most important technology factors for the rural poor (Cleaver and Franks 2005). Very few households possess essential technologies for farming (see Table 5.12). Household endowment of some technologies at Wovwe varies with location (Table 6.10).

Table 6.10: Household technology endowment by location; N=473

Tchnology	**Households (%)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Plough	29.8	48.0	32.4	29.6
Ox-cart	10.5	17.6	13.5	22.2
Treadle pump	5.3	6.4	2.9	7.4

Considering that farming is the main occupation for households (5.2.2.7), Table 6.10 shows that the 'Within WIS' location seems to be better endowed with technologies than other locations. None of the households interviewed indicated that they owned motor pumps or farm tractors. But others owned timber (0.4%), and basic carpentry tools (0.2%). Findings suggest that households depend on farming as an occupation and, that they rely on manual labor when working in their fields.

Although the possession of technology at Wovwe is not impressive across households, there are a number of positive implications of having farm technologies such as a plough. Households which possess implements such as a plough are likely to complete their farming activities such as tilling faster than those using hand hoes. Besides, they may also cultivate bigger land areas. The implications are that they save on time for other livelihood activities, and financial resources which they would have used to hire labor.

6.3. Summary

Factors such as social considerations, uneven resource distribution, natural resource variability or unpredictability, seemingly contradictory policy implementation, and technology endowment; play a crucial role in determining household's ability to access water and engage in meaningful livelihood activities at Wovwe.

The social and cultural dimensions of people such as gender, age, education, health, and relationships communities build among themselves determine roles in livelihood activities,

abilities, voice, and support received from others in efforts to secure livelihoods. But the enforcement of water rights is complicated by the mix of *de jure* and *de facto* rights partly because of the lack of clarity in implementation of the irrigation reform, especially the expansion of informal irrigation versus irrigation management transfer in the WIS.

The government established well-intentioned programs aimed at assisting rural communities to acquire farm inputs and loans to assist in their livelihood activities. However, the economic status of households still shows characteristics of poverty which effectively hinders some households to escape from poverty as they cannot acquire land, technology, or other requirements by themselves. The problem is compounded by unpredictable weather and climatic conditions. Floods not only displace people, but also destroy their crops, property and also cause households to 'waste' much of their time in public shelters rather than in their respective livelihood endeavors. Droughts make it even impossible for farming-dependent households to carry on with their usual activities.

7. REFORM OUTCOMES AND IMPACTS: AGRICULTURAL PRODUCTIVITY, WATER RESOURCES AND RURAL LIVELIHOODS

7.1. Introduction

This chapter presents results on the performance of the reform, and outcomes and impacts so far observed from the reform process in areas of irrigation management transfer (IMT), livelihoods and water resources management. The findings address the research question: *"What are the reform outcomes for water resources and livelihoods of the rural Wovwe communities?"* Data were collected through document review, focus group discussions, direct observations, questionnaire surveys, and interviews including key informant interviews. Both quantitative and qualitative methods of data analysis were used.

Findings are presented in two main sections. The first concerns the performance of IMT particularly with respect to changes in irrigated areas, scheme patronage, and operations and maintenance (O&M). It highlights the role of the reform in determining who accesses water and land resources, and how it influences operations and maintenance work at Wovwe. The final section presents results on the impacts of the reform. It first outlines the impacts of IMT and informal irrigation on areas such as agricultural productivity and household income before presenting findings on the impact the reform has had so far on rural livelihoods and environmental resources, especially water resources from the Wovwe River. It, particularly, elaborates on the influence of the reform on the livelihoods of the rural poor with particular focus on livelihood diversity and/or specialization, and the contribution of livelihood strategies to the overall wellbeing of households. The section, comprehensively, examines the contribution of the reform to sustainable water resources management, and the extent to which it affects the state of water resources.

7.2. Performance of irrigation Management Transfer (IMT) at Wovwe

Irrigation management transfer (IMT) is widely adopted by several countries including Malawi because, among other things, it helps to improve agricultural productivity and water delivery (2.2.3.1 and 2.6.6.3). However, the current performance and outcomes of the reform at WIS show mixed results in a number of areas e.g. trends in land area under irrigation, scheme patronage, trends in size of WWUA membership, revenue and fee collection, cost of O&M, quality of maintenance, and timeliness and fairness of water delivery.

7.2.1. Scheme membership

7.2.1.1. Scheme composition (local vs. migrant farmers)

At the time of scheme establishment, the composition of farmers patronizing the scheme included locals from surrounding villages or from Karonga District, and migrants (notably MYP farmers) from other parts of the country (2.6.7). Although a complete set of data for composition of farmers from the time the scheme was established to the time of the study was not available, summaries of data for the fifteen earlier seasons i.e. between 1980/81 and 1987/88 summer season (Table 7.1) reveal that composition of farmers had been varying around same proportions with more farmers being locals.

Table 7.1: Proportions of local and migrant farmers patronizing WIS between 1980/81 and 1987/88 seasons
Data Source: WIS Reports, Lhumbey (1994)

Farmer category	Seasons (N)	Min (%)	Max (%)	Mean (%)
Local	15	73	87	80
Migrant	15	13	27	20

However, by 1994, the year when the one party dictatorship ended and MYP establishments disbanded, the proportion of migrant farmers from other districts had reached 30% (Lhumbey 1994). This indicates a steady displacement of locals by migrant MYP farmers who were sent to schemes to teach locals about irrigation farming and, though openly stated, to enforce the regime's oppressive political agenda. However, since the abolishment of settling MYP farmers in schemes in 1994, some settlers have now settled at the camp and others have acquired land from nearby villages. This makes it difficult to determine the current scheme composition on the basis of 'local' vs. 'migrant'. In principle, the 'migrants' have now been integrated as locals though practically, differences resurface as maintaining social cohesion still challenges proper scheme management (see 4.5.2).

7.2.1.2. Membership

Since the establishment of the WIS (2.6.7), the total number of farmers cultivating in the scheme has risen from 750 in summer 1991/92 to around 1500 at present (see Appendix 6 for a complete membership from summer 1991/92 to summer 2009/10 seasons). Throughout this period, the number of men holding plots has outweighed that of women (see 7.2.3 for details on scheme patronage). This is despite the fact that the sex ratio[33] in Malawi shows that

[33] Sex ratio is defined as the number of males per 100 females (NSO 2008).

females have consistently outnumbered their male counterparts (NSO 1998; 2008) and that the Wovwe area has more female inhabitants than their male counterparts (3.2.4 & Table 3.2).

With regards to scheme components, the WWUA records indicate that more farmers hold plots in Wovwe II than in Wovwe I (Table 7.2), a condition which could be explained by the fact that Wovwe II is larger in area than Wovwe I (2.6.7). Wovwe I has 34.3% (514) of all farmers, whilst Wovwe II has 65.7% (986).

Table 7.2: Membership of the WWUA per Block of the irrigation scheme
Data source: WWUA 2009

Scheme Component	**Wovwe I (514 farmers)**										**Wovwe II (986 farmers)**					**Total**
Block	E	L	M	N	P	Q	**G**	**J**	**R**	**S**	1	2	3	4	5	**15**
No. farmers	43	53	35	39	69	65	**210**				214	226	164	243	139	**1500**
% of total farmers	3	4	2	3	5	4	**14**				14	15	11	16	9	**100**

Although data from both the WWUA and the District Irrigation office show that the total scheme membership is 1500, the government agricultural extension workers suspiciously claimed that since the establishment of the WWUA, membership has never gone above or below 1500. Extension Workers contend that the actual number is higher than the 1500 figure repeatedly reported by the WWUA Executive to the District Irrigation office on two grounds: 1) nearly every plot in the scheme is now being cultivated; and 2) the demand for land for irrigation is very high as they encounter numerous enquiries from villagers for plots when they do extension work outside the irrigation scheme. The Head of Extension Services observes: *"[T]he number of 1500 farmers in the scheme is just cooked up* [by WWUA Executive] *as practically things are not like that. The reality is that the number of farmers now is bigger than before as most farmers who were initially given four plots* [0.4ha] *left farming and with the current increase in demand for plots, four plots would be given to two farmers instead of just one. The suspicion is that this constant number is used to* [cover] *misuse* [of] *farmers' fees because more than 1500 farmers are cultivating in the scheme and pay both membership and water fees".*

Checking the WWUA records, unfortunately, offered no outright conclusion as data for farmers for some scheme sections were not readily available and records did not indicate how many were male or female. For example, there were no records for the number of farmers for Blocks G, J, R, and S of the scheme. The figure of 210 and percentage of 14 (in Table 7.2)

were calculated based on the WWUA claims that the total membership is 1500 (see 3.2.5.2) which were supported by data from the District Irrigation Office. The other issue complicating the verification of the total patronage are the earlier presented findings revealed by the survey that some farmers, though isolated, hold land of sizes as large as 1.6ha (16 plots) while others just hold 0.1ha (one plot) (see section 5.2.2.3 and Table 5.7). While the actual number could be below or above 1500, the crucial issue for the reform is the fact that both the WWUA and the Extension Office agree that patronage has increased in recent years and that demand for irrigation is higher than before, and continues to grow.

7.2.2. Land area under irrigation

Figure 7.1 shows that since the start of the debate about IMT and studies into irrigation transfer through the Smallholder Flood Plain Development Project (4.2.1) in the late 1990s, cultivated land in the WIS has consistently reached the maximum land area developed for irrigation i.e. 365.4 ha. But in the presence of the current land pressure (see 5.2.2.3) and land ownership issues, it is unthinkable to see the WWUA expanding the irrigated land to other areas after the consequential pilot transfer in 2002. Direct observations too revealed that the scheme is surrounded by villages and that villagers own land around the scheme which they use for both rain-fed agriculture and informal irrigation.

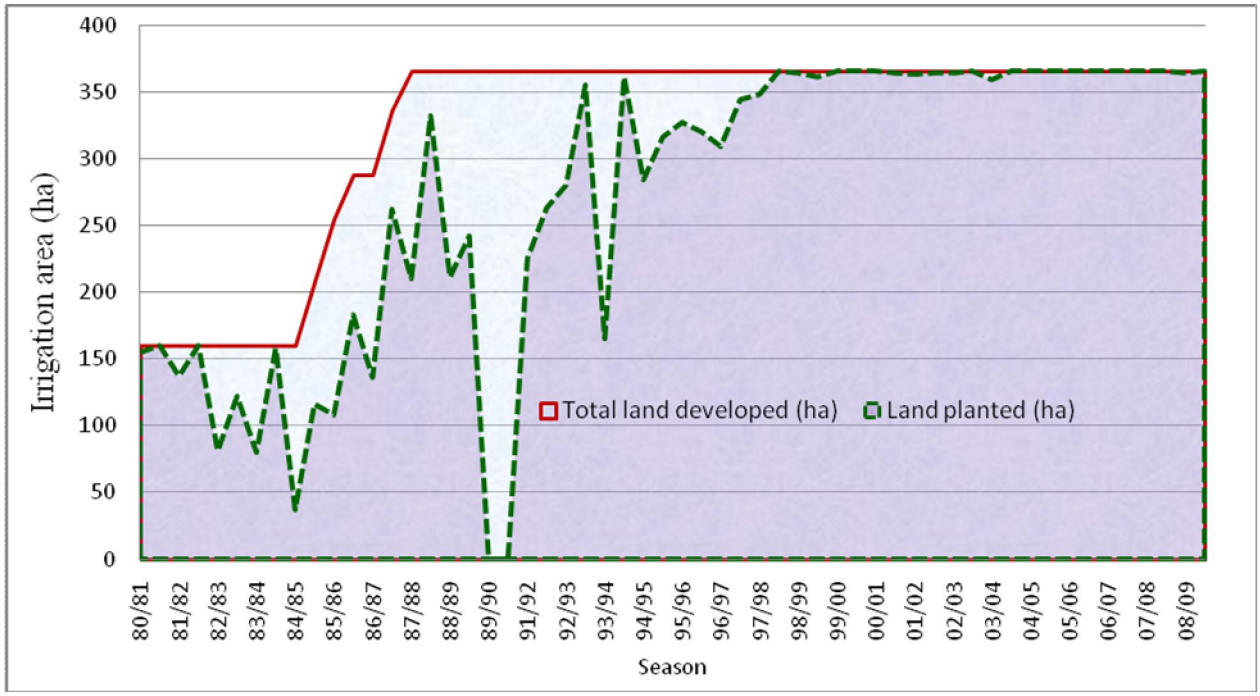

Figure 7.1: Total land area developed for irrigation and trend in cultivated area (1980/81 to 2008/09)
Note: Data for 1990/1991 were not available.
Data source: Karonga District Irrigation Office

This reveals shortfalls in the design of the WIS which did not provide for more land for purposes of possible future extensions. In this regard, the performance of the reform is only investigated with respect to whether the proportion of the current cultivated land of the 365.4 ha is increasing or decreasing. Results (Figure 7.1 above) show that the reform has been instrumental in bringing the whole irrigable area under irrigation.

7.2.3. Scheme patronage

In order to understand the performance of the reform with respect to local farmers' participation in irrigation farming and ownership of the scheme, findings on scheme patronage were, apart from scheme composition (7.2.1.1) and membership (7.2.1.2), also examined across four categories i.e. seasonal patronage, trends in land area being patronized, trends in scheme patronage by gender, and patronage by location.

7.2.3.1. Seasonal scheme patronage

Data from the Karonga District Irrigation Office (Figure 7.2) suggest that the number of farmers patronizing the scheme have varied between winter and summer seasons throughout the period of the scheme establishment. Though data from winter 1988 to winter 1991 are missing, the number of farmers patronizing the scheme in both seasons has generally been increasing since 1985. The rise from 1985 corresponds with the gradual development of the Wovwe II component (2.6.7) signifying that more farmers were being recruited.

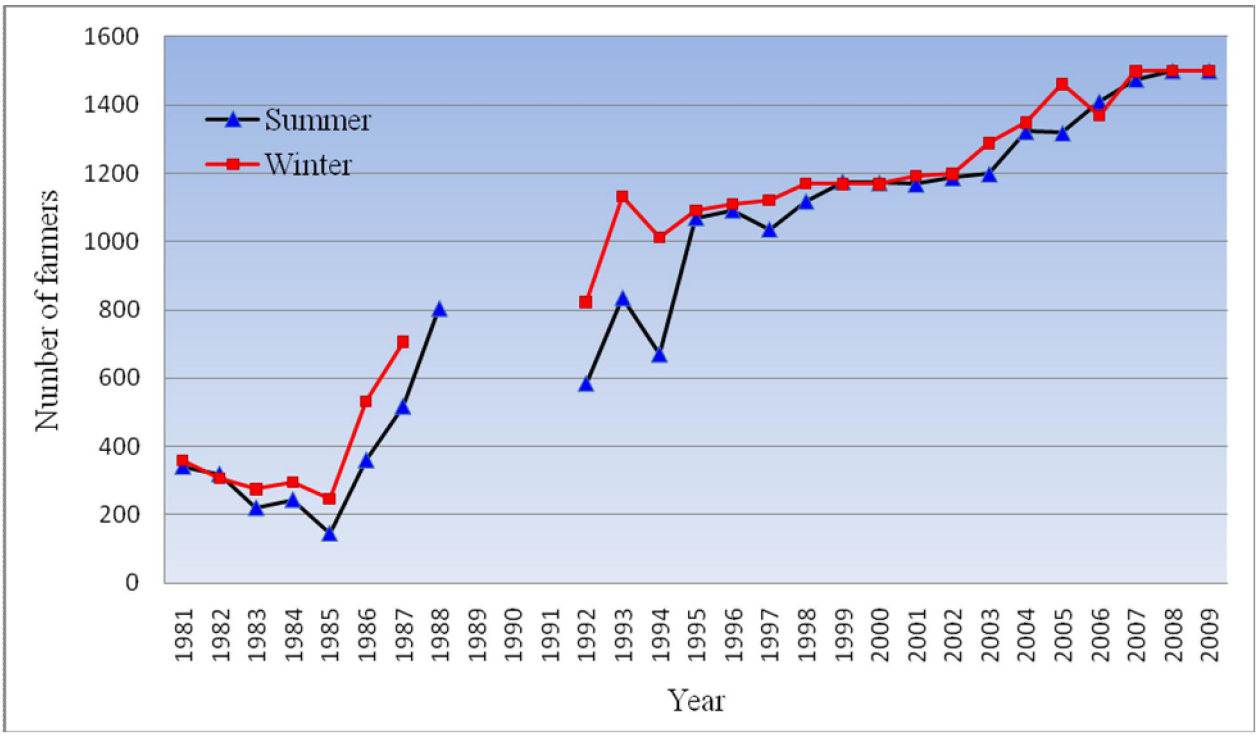

Figure 7.2: Seasonal patronage of the scheme (number of farmers)
Data source: Karonga District Irrigation Office

However, until 2008, more farmers have been patronizing the scheme in winter (dry) season than in summer (rainy) season. The main factor contributing to seasonal variations has been the farming habits of straddling between upland farming in rainy season and irrigation farming in the scheme during dry season. In line with earlier (until mid-1990s) government efforts which concentrated more on promoting rain-fed agriculture than irrigated farming (Ferguson and Mulwafu 2005), farmers put attaining food security first through upland cropping before growing rice in the scheme which was mainly for cash.

Furthermore, responses from key informants on reasons for variations are corroborated by Chirwa (2002):

- before the reform, farmers realized higher financial gains from the sale of upland crops such as cotton, tobacco, and local rice varieties (*faya, kilombero, mwashungu, etc)* which attracted superior market prices to varieties permitted to be grown in the irrigation scheme (e.g. *IET 4094*);
- labor required when doing upland farming compared to farming in the scheme was considered to be relatively low; and
- organizing household labor was easier for upland farming since gardens are nearer to farmers' homes than it was for irrigation farming in the WIS.

Consequently, winter seasons registered slightly higher numbers of active farmers than summer seasons. But the gap has been narrowing in recent years due to rising demand for irrigation farming. According to households' and key informants', factors behind the rising demand include frequent dry spells and droughts, resolute government efforts to secure food security and improve socio-economic status of rural poor households, and improved financial benefits realized from irrigation farming.

7.2.3.2. Land area patronized

Figure 7.3 shows that land area under cultivation from 1992 to 2008 has been increasing towards the scheme maximum of 365.4 ha. Similar to land area under irigation (7.2.2), the increase is clearly noticeable from the end the 1990s corresponding with the time when the country was reforming its policies (2.6.6.3). The drop in land patronised in summer 1994 would be due to some MYP farmers leaving the scheme after the fall of Dr. Banda's regime (2.6.1). It has to be noted here that the areas cultivated in winter seasons of 1993 and 1994 are contributing to the high peaks of cultivated areas between 1992/93 and 1994/95 in Figure 7.1 above.

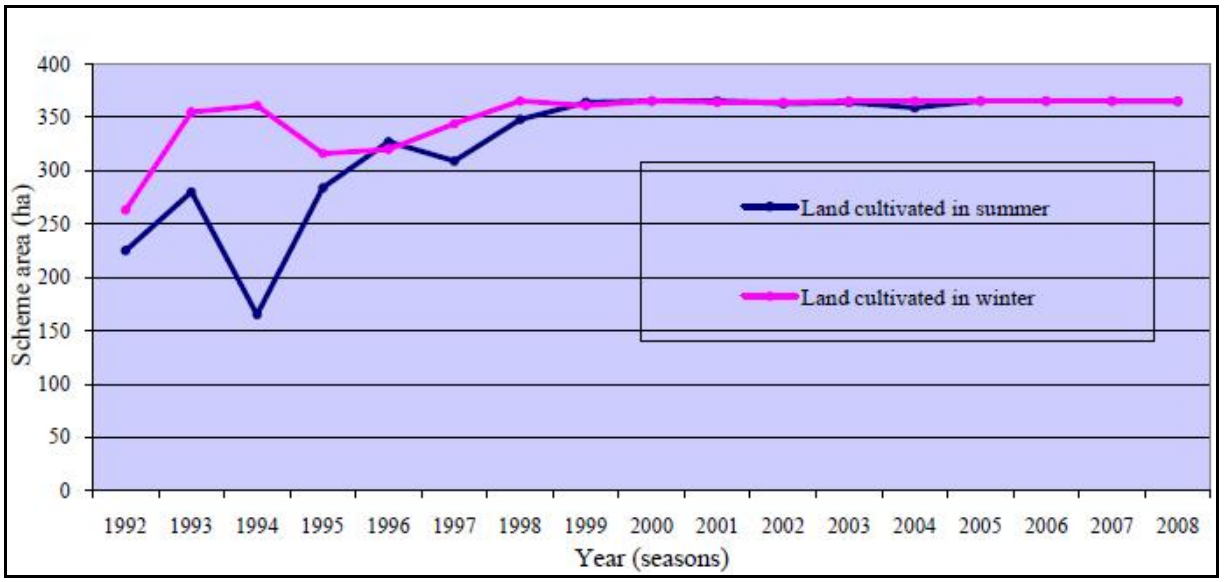

Figure 7.3: Trend in land area cultivated in WIS
Data source: Karonga District Irrigation Office

Similar to seasonal patronage, the gap in land under cultivation between summer and winter has been dwindling. Experiences of Agricultural Extension workers and farmers' responses

show that the demand for irrigation farming in the scheme in the reform era is higher than before and growing (7.2.1.2). Qualitative responses for the level of demand included:

1. now we are allowed to grow varieties that bring more money;
2. persistent dry spells and droughts force us to resort to irrigation;
3. there are more buyers of rice now than in the past; and
4. better selling prices for our produce than they were in the past.

Data from the Divisional Irrigation Office confirm farmers' claims that they now have the freedom to choose varities they want to grow (section 4.4.2.7 and Table 4.6).

Farmers' responses are further confirmed by remarks made by the former WWUA Executive Secretary and current Secretary of the WWUA Rice Mill Committee *"the problem with government was that it was only looking at production ... high yield, but not at what the market demanded. With WWUA things have changed, farmers now grow Kilombero, a variety which is in high demand both within and outside the country. ... in the WWUA shed there is a private trader who is here just to buy our local Kilombero variety for export"*. The reform also appears to have induced a positive response towards land patronage as an increased number of people now engages in irrigation as they can grow varieties of their choice.

7.2.3.3. Land patronage by gender

Figure 7.4 gives and compares trends in the proportions of famers by gender cultivating in the scheme. Although the proportions of women persistently remain smaller than those of men across the seasons, it is worth noting that from the year the reform was introduced at WIS i.e. 2002/03 summer season, the proportion of women slightly increased corresponding to the slight decrease in the proportion of men. Also, the drastic fall in the proportion of men and corresponding rise in the proportion of women in the winter season of 1993 reflect the time when Malawian voted in a referendum to reject the one party dictatorship regime of Dr. Banda and his Malawi Congress Party (2.6.1). The outcome of the refendum had remarkable consequences to the management and operations of the schemes across Malawi (2.6.6.3). The 1993 and summer 2002/03 events suggest that social and political changes, including policy refoms, influence the management and governance of systems and participation of citizes in social economic activities even at local level.

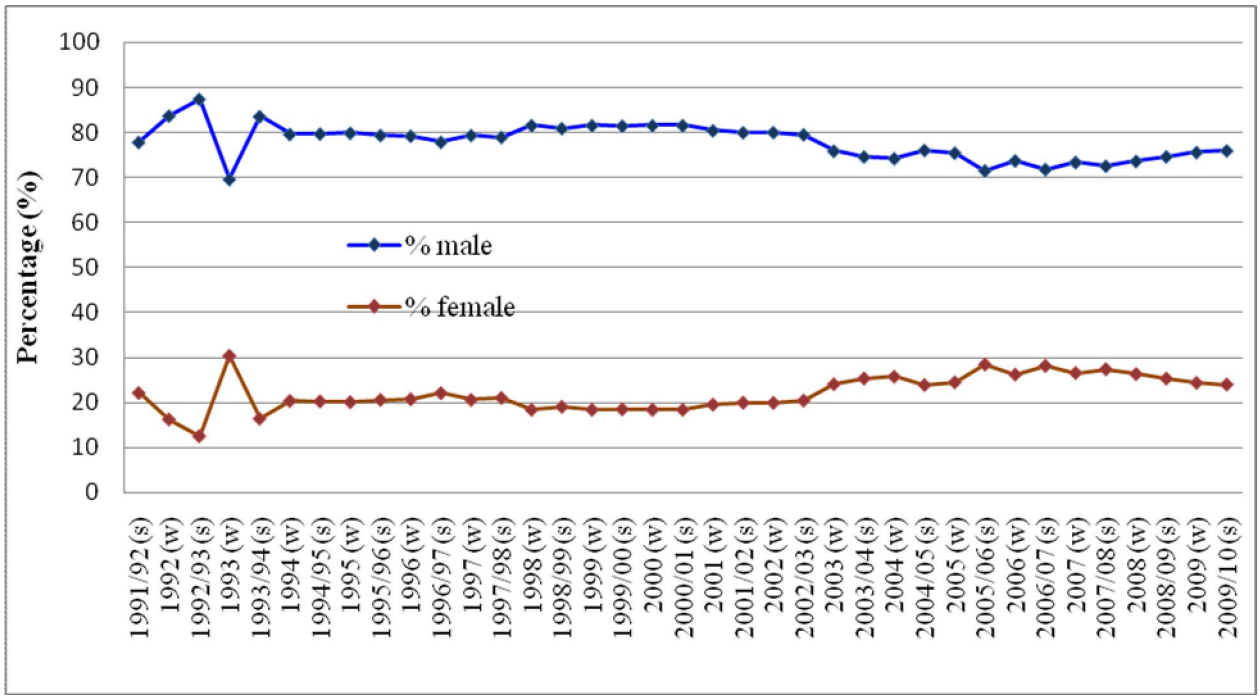

Figure 7.4: Trends in Proportions of male and female farmers cultivating plots in the WIS from summer 1991/92 to summer 2009/10
Data source: Karonga District Irrigation Office

Similar to the number of male farmers in WIS, the proportion of the total land area cultivated by males is greater than that cultivated by females (Figure 7.5). However, the gender gap has been narrowing with respect to land area cultivated by males and females since 1995. This most notable decline was in 1999 and corresponds with the period when policies were being revised (2.6.6.3), the transfer process was initiated (4.2.1)[34], and probably policy and gender awareness campaigns after the fall of the dictatorship era of Dr. Banda (2.6.1). Since the sharp decline in the gap in 1999, proportions have fluctuated minimally.

[34] The government started receiving support from IFAD for irrigation transfer around the same period.

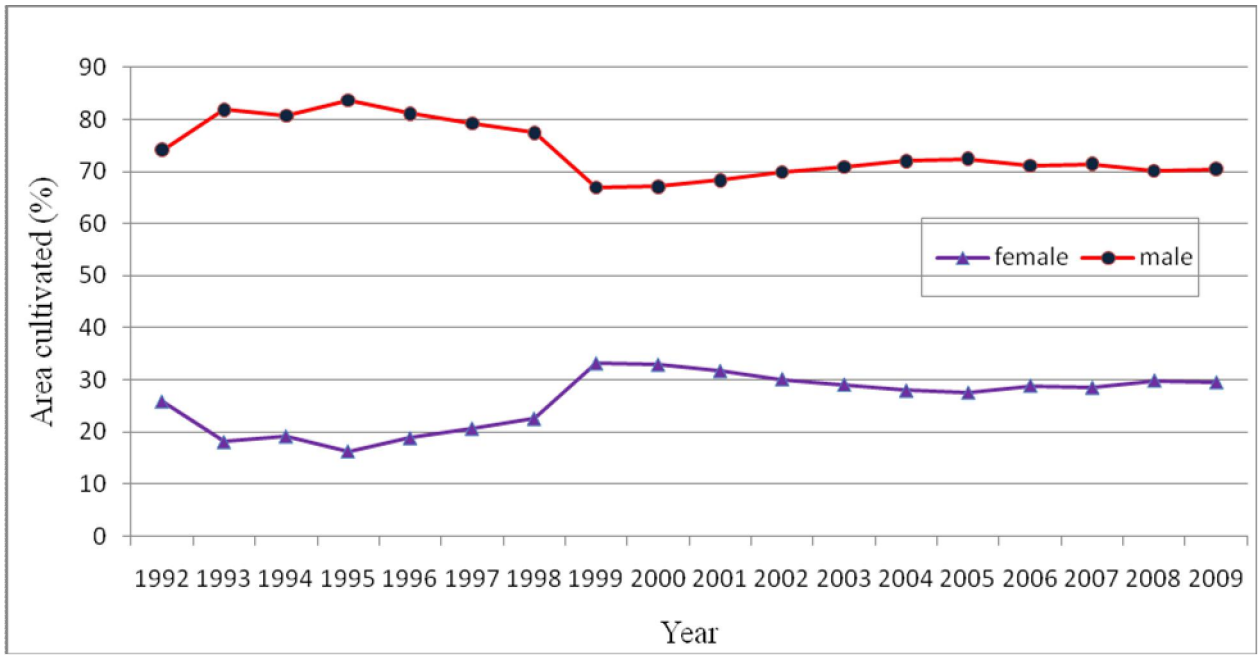

Figure 7.5: Proportion of land area cultivated by gender from 1992 to 2009
Data source: Karonga District Irrigation Office

At the time of this study, the proportion of land cultivated by women (e.g. in summer 2009) was 29% and of the 1500 farmers cultivating in WIS in the same year, only 36.6% were female. Although women participation in the scheme is low, their current proportion ranks favorably well on a national scale, especially when compared with the representation of women in decision-making positions in the public service which has increased from 19% in 2007 to 23% in 2009. Women representation in parliament has also increased from 14% in 2005 to 22% in 2009 (GOM 2010).

Furthermore, although more males patronize the scheme than females (Figure 7.4), and males cultivate bigger land area than females (Figure 7.5), data from the District Irrigation Office indicates that the avarage land holding for females (0.36 ha) is higher than that for males (0.27 ha). This remained so for $^{3}/_{5}$ of the period with recorded data before the reform (i.e. from 1992 to 2001) and is still so for all the seasons during the reform period i.e. from 2002 to 2009 (Figure 7.6). These data indicate that the average land holding for females has consistently remained higher than for males. Furthermore, both male and female average land holdings are lower than the maximum (i.e. 0.4 ha) (7.2.1.2) each farmer could be allocated – suggesting that the demand for plots in the scheme is growing. This is especially highlighted when considered together with the current mean land holding of 0.274±0.142 ha in the scheme for all farmers (4.4.2.2).

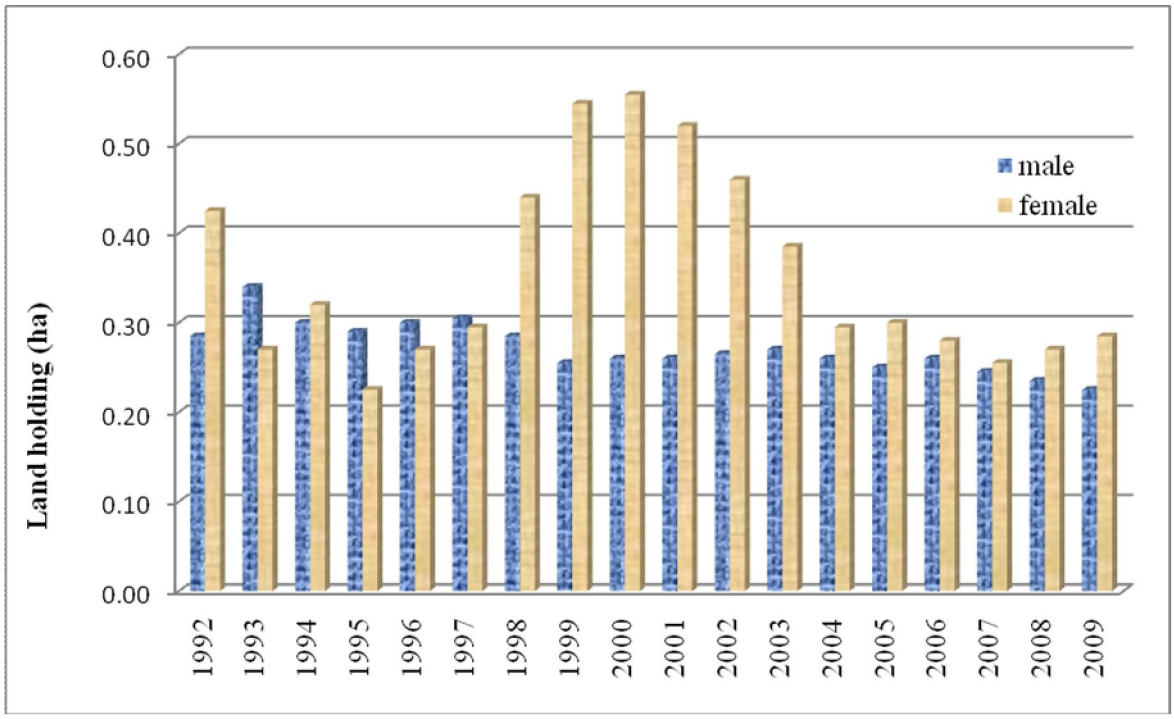

Figure 7.6: Trends in average land holding by gender from summer 1991/92 to summer 2009/10
Data source: Karonga District Irrigation Office

Figure 7.6 above also shows that during the time policies were revised, average land holding for females was much higher than that for males at any point in the data time period; and that since then, unlike in the pre-reform period, the land holding for females has never gone below the holding for males. This suggests that the reform policies could likely be behind the improved average land holding for females.

7.2.3.4. Land patronage by location

Survey results show that more households from the 'Within WIS' location of the three main locations (excluding the 'Other' location – see note for Table 3.2) possess plots in the WIS than households from other locations (Table 7.3). The Chi-square test reveals that there is a statistically significant difference between plot ownership by households and the locations from which household came i.e. $X^2 = 216.777$; $df = 3$; $p = 0.000$; *Cramer's V = 0.68*. More households from the 'Within WIS' location are likely to hold plots in the WIS than households from the other two locations.

Table 7.3: Households' possession of plots in WIS by location, N=473

Whether possesses land in WIS	Upstream	Within WIS	Downstream	Other
Possess plot(s)	17.5	95.0	50.0	100.0
Do not possess plot(s)	82.5	5.0	50.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

7.2.4. Revenue and fee collection

The WWUA receives its finances through annual membership and seasonal water or irrigation fee (4.4.2.5). Other incomes are generated through provision of rice milling services (Figure 7.7).

Figure 7.7: People accessing milling services at Wovwe
Source: OVOP (2006)

Except for the season when this survey was conducted (2008/09 summer) when farmers had refused to pay (4.4.2.5), WWUA officials indicated that almost everyone was paying. This was confirmed by observations of Extensions Officers and survey responses from farmers with respect to the levels of water fees payment within the reform period. The survey revealed that 92% of respondents (n=303) indicated that payments in water fees have increased, 4% reported no change while another 4% indicated that water fees have decreased. One farmer painfully explains: *"You wouldn't see me in the field today cultivating if I hadn't paid. This WWUA confiscates our plots and gives them to others if you don't pay"*. However, alleged non-accountability of the WWUA executive makes farmers reluctant to pay (4.4.2.5).

7.2.5. Operation and maintenance (O&M) costs

The removal of all irrigation technical staff from WIS by the government following the IMT process (1.4 & 4.5.3) was meant to cut costs on government's side (Simfukwe pers. comm.). Though drastic, the reduction means that costs for O&M are being met by farmers. This is confirmed by claims of the majority of farmers (n=303) who perceive their cash payments for irrigation to be more in the reform period than it was in the pre-reform period (Figure 7.8). Also, when asked to compare the current number of days farmers spend on canal/or scheme maintenance with those they used to spend before the transfer, 81.7% (n=303) indicated that they spend far more time now than before, while 9.8% said they spend less days now than before and 8.5% were of the view that the number of days spent on scheme maintenance is about the same.

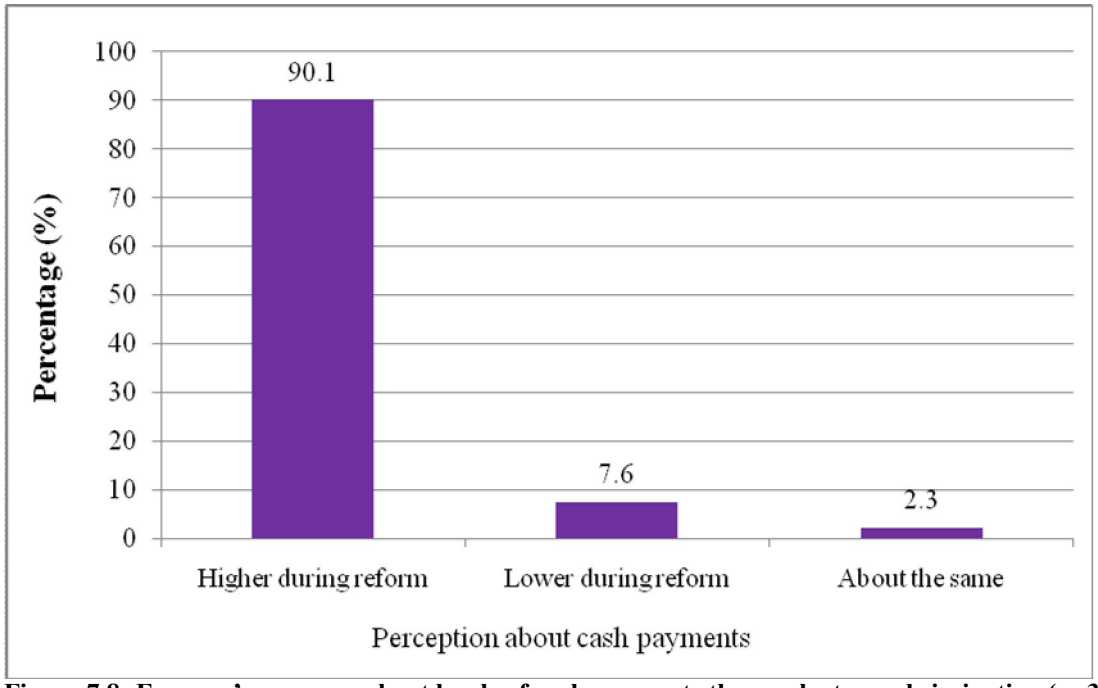

Figure 7.8: Farmers' responses about levels of cash payments they make towards irrigation (n=303)

While the reduction in costs on the side of government and increased involvement of beneficiary farmers in doing maintenance work are in line with both national and international expectation of IMT (2.2.3.1 & 2.6.5.3), the quick and wholesale withdrawal of government contradicts some of the very needed preconditions of IMT (2.2.3.2) and hence undermines prospects for improved agricultural productivity, sustainable management of the irrigation system, and sustainable water resources management. This is clear from what direct observations reveal and farmers' opinions about the quality of maintenance (7.2.6). Moreover, government withdrawal of irrigation technical staff negatively affects the scheme operation

and maintenance (O&M) as the Head of Agricultural Extension Services at the scheme states: *"... the Irrigation Department here* [at WIS] *has no technical staff. That is why there are no irrigation services. There is no one to monitor the condition of the scheme. There are no officers to look after water gauges placed in the river and canals. No one takes readings. This makes planning difficult"*.

Although the reform has managed to reduce government expenditure on operations and maintenance, the reductions have come at a cost which is detrimental to the operations of the scheme. There is no hydrological monitoring and provision of critical irrigation services including technical advice to the WWUA.

7.2.6. Quality of maintenance

Direct observations and farmers' responses reveal that the quality of maintenance at WIS is worse than before. For example over ¾ of survey respondents indicated that the condition of water distribution canals is worse now than in the pre-reform period (Figure 7.9).

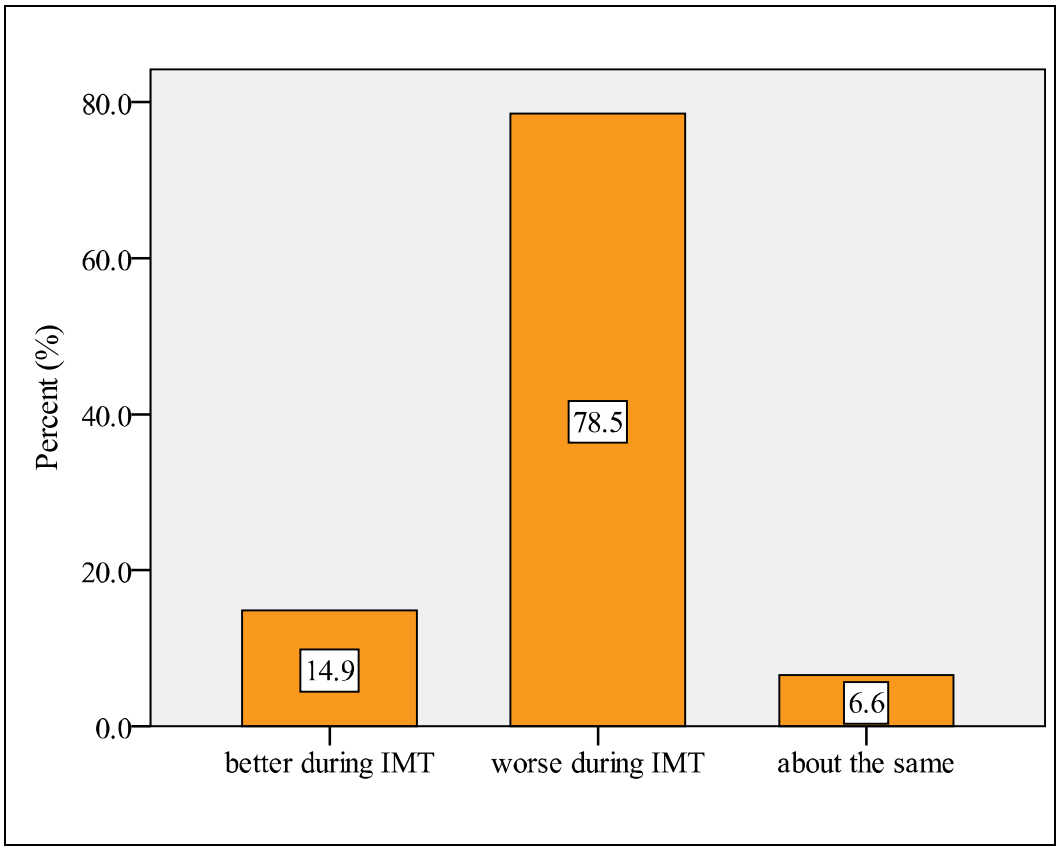

Figure 7.9: Farmers' opinions about the condition of water distribution canals (N=303)

Direct observations revealed that tree logs are left rotting in water canals, concrete canals are broken, weeds growing in canals are not cleared, canals have been deformed, and road infrastructure in the scheme are in bad state. Figure 7.10 shows some types of maintenance work being done while Figures 7.11 to 7.14 illustrate the state of the scheme infrastructure.

Even when examining farmers responses by scheme component, there is no statistically significant difference between opinions of those cultivating in Wovwe I and those cultivating in Wovwe II *($X^2 = 1.166; df = 2; p = 0.558$)*.

Figure 7.10: Maintenance work on a distribution canal

Figure 7.11: A wood log and sand in a secondary canal

Figure 7.12: Eroded, deformed and weedy canal with broken concrete

Figure 7.13: Broken concrete on a segment of a weedy main canal from headworks

Figure 7.14: A damaged section of the road within the irrigation system

Farmers' opinions reveal that the conditions of the irrigation infrastructure have deteriorated in the reform period and, that the deterioration has affected the entire irrigation system. Direct observations confirm the current poor state of irrigation infrastructure. Based on both farmers' opinions and direct observations, this indicates an undesired general direction of the reform with regard to the quality of maintenance and hence, sustainability of farmer-owned and managed irrigation systems. The worrying thing for poor rural farmers is that increased collections from farmers are not sufficient to compensate for the withdrawal of state support, which led to deterioration of the system.

7.2.7. Timeliness of water delivery/distribution

Water delivery is executed in two parts. The first concerns the opening and closing of water gates at the headworks, with dates fixed for doing so every season. After harvest water gates are closed for one month before reopening for the next season to give farmers enough time to deal with crop residues from the previous season. While isolated cases of farmer complaints about the early closure of the gates existed, the WWUA, extension officers, and other informants attributed the complaints to lateness or failure to follow the scheme farming calendar on the side of complainants. Secondly, water delivery concerns allocation of water to particular sections of the scheme i.e. scheme component, blocks, and units. Here farmers' perceptions varied according to season and scheme component.

Table 7.4 shows that overall; more farmers consider water delivery to be untimely in winter than in summer. The proportions of respondents who indicated that water delivery was timely during the reform are low and similar regardless of season i.e. 23.5% in winter and 22.6% in

summer. This suggests that timely water delivery may likely be affected by both seasonal variations in water availability in the river and operational shortfalls on the side of the WWUA. For, if seasonal variations were the main and only factor, proportions of farmers satisfied with the timeliness of water delivery would have been much higher in summer when water levels in the river are enhanced by rainfall than in winter.

Table 7.4: Farmers' perceptions about timeliness of water delivery by season (n=303)

Perception	Season (%)	
	Winter (dry)	Summer (rainy)
Timely during IMT	23.5	22.6
Timely before and during IMT	45.2	23.2
Untimely during IMT	27.4	41.6
Untimely before and during reform IMT	3.9	12.6

The Chi-square tests show that there is no statistically significant difference between the timeliness in water delivery in summer season and scheme component i.e. Wovwe I and Wovwe II *($X^2 = 2.265$, $df = 3$, $p = 0.52$)*. However, the differences are statistically significant between the two scheme components in winter *($X^2 = 9.202$, $df = 3$, $p = 0.027$; Cramer's $V = 0.176$)* (Table 7.5). These differences, apart from climatic influences, could also be partly explained by the practices in water delivery which allocate more water to Wovwe I than to Wovwe II despite the requirement by the design to allocate more water to Wovwe II (see 7.2.8 below).

Table 7.5: Farmers' perceptions about the timeliness of water delivery in both summer and winter by scheme component (n=297)

Farmers' perception	Summer (frequency)		Winter (frequency)	
	Wovwe I	Wovwe II	Wovwe I	Wovwe II
Timely during reform	28	42	36	32
Untimely during reform	29	52	39	82
Timely before and during	61	75	28	44
Untimely before and during	3	7	18	18
Total	**121**	**176**	**121**	**176**

7.2.8. Equity or fairness of water distribution

Like timeliness, equity or fairness in water distribution also varies according to season and scheme component. Overall, farmers' perceptions show that water is more unfairly distributed in winter than in summer (Table 7.6). Similar to timeliness (7.2.7), this suggests that equitable

water distribution may be affected by seasonal variations in the flow levels of water in the river due to climatic events (6.2.6.2) and performance problems on the side of the WWUA (4.5.2 & Figure 4.8).

Table 7.6: Farmers' perceptions about equity or fairness in water delivery by season (n=303)

Perception	Season (%)	
	Winter (dry)	Summer (rainy)
Fair during IMT	20.3	27.1
Fair before and during IMT	22.9	39.7
Unfair during IMT	49.4	26.8
Unfair before and during reform IMT	7.4	6.5

Similar to timeliness in water delivery, Chi-square tests reveal there was no statistically significant relationship between farmers' perceptions about the equity of water distribution and scheme component (Wovwe I and Wovwe II) in summer *(X^2 = 1.732, df = 3, p = 0.63)*. On the other hand, tests reveal statistically significant relationship in farmers' perceptions about equity in water distribution in winter between the two scheme components *(X^2 = 10.411, df = 3, p = 0.015; Phi & Cramer's V = 0.188)* (Table 7.7).

Table 7.7: Farmers' perceptions about the equity in water delivery in both summer and winter by scheme component (n=295)

Farmers' perception	Summer (frequency)		Winter (frequency)	
	Wovwe I	Wovwe II	Wovwe I	Wovwe II
Fair during reform	36	44	34	26
Unfair during reform	27	50	49	97
Fair before and during	49	71	26	43
Unfair before and during	8	10	10	10
Total	**120**	**175**	**119**	**176**

While the low river flows in winter could be exerting some pressure on water delivery by the WWUA, the higher perceived unfairness in winter than in summer could also be due to inappropriate scheme management and water governance practices followed by the WWUA. This is demonstrated by the agreement between farmers' perceptions and the remarks by the Divisional/District Irrigation Officer that according to design, more water is supposed to go to Wovwe II than Wovwe I, but practically, the opposite happens: *"By design, that should be the state of affairs* [that more water should be allocated to Wovwe II] *in terms of irrigation flows characteristics. In practice it is not so. More water is seen going to Wovwe I than Wovwe II.*

The notoriety of the main canals in the rate of siltation levels is enormous and defeats the entire conceived design abstraction and consequently irrigation flow levels."

The Divisional Irrigation Officer's observation points to two important aspects of irrigation: the misallocation of water flows; and poor conditions of irrigation canals in the scheme. These raise further questions about environmental management practices in the Wovwe River catchment (7.3.4) and also the capacity or effectiveness of the WWUA to maintain irrigation infrastructure including canals. Although conditions of irrigation canals are poor across the entire scheme (7.2.6), direct observations revealed that irrigation canals in Wovwe I are in a much poorer state than canals in Wovwe II (Figures 7.15 & 7.16).

Figure 7.15: A section of a secondary canal in Wovwe I

Figure 7.16: A section of a secondary canal in Wovwe II

From the District Irrigation Officer's observation, it could also be argued that water distribution is particularly unfair to Wovwe II because, according to the former land allocation policy at the scheme, farmers were allowed to change the location of their fields in the next season i.e. if they were far from their homes, they were given an opportunity to hold plots which were closer (4.4.2.2). This meant that most settlers owned plots in Wovwe I which is close to the settlement camp and local villagers owned plots in Wovwe II, away from the camp. Farmers' complaints that most WWUA positions are being held by settlers from the camp (4.5.2) may also support allegations that the WWUA Executive allocates more water to Wovwe I, where they could possibly be holding plots, than Wovwe II.

7.3. Impacts of the reform

Ideally, assessing the impacts of irrigation reform requires comparing the before-and-after conditions of the irrigation system; and also making with-and-without comparisons i.e. comparing areas under IMT with areas not under IMT (Vermillion 1997). Since there were no baseline data for the scheme to determine the before conditions, the study relied on information from secondary sources which was triangulated with information from several other sources including interviews. Aware of the fact that respondents could not accurately recall past information, the study triangulated such information with official data particularly on yield, precipitation patterns, and other socio-economic parameters. Similarly, in order to avoid incorrectly attributing impacts on yields, household income, and farm income to the reform; several comparisons across locations e.g. upstream, 'within WIS' and downstream were made (Vermillion 1997). Furthermore, the study compared yield data for WIS during the reform period with data from another irrigation scheme within the same district and agro-ecological zone which is not undergoing reform.

This section presents findings on the impacts of the reform so far on land area under irrigated agriculture, yields, and financial benefits farmers realize from irrigated agriculture.

7.3.1. Impacts of irrigation management transfer (IMT)

7.3.1.1. Agricultural productivity: yields and trend in yield from the WIS

Figure 7.17 shows that since the start of the reform process, yields from the WIS kept on rising with the implementation of the reform. However, between the 2005/06 summer and

2006 winter seasons yields dropped but fluctuated around same levels up to the time of this study. Despite the drop, the average yield still remained higher than at the start of the reform process.

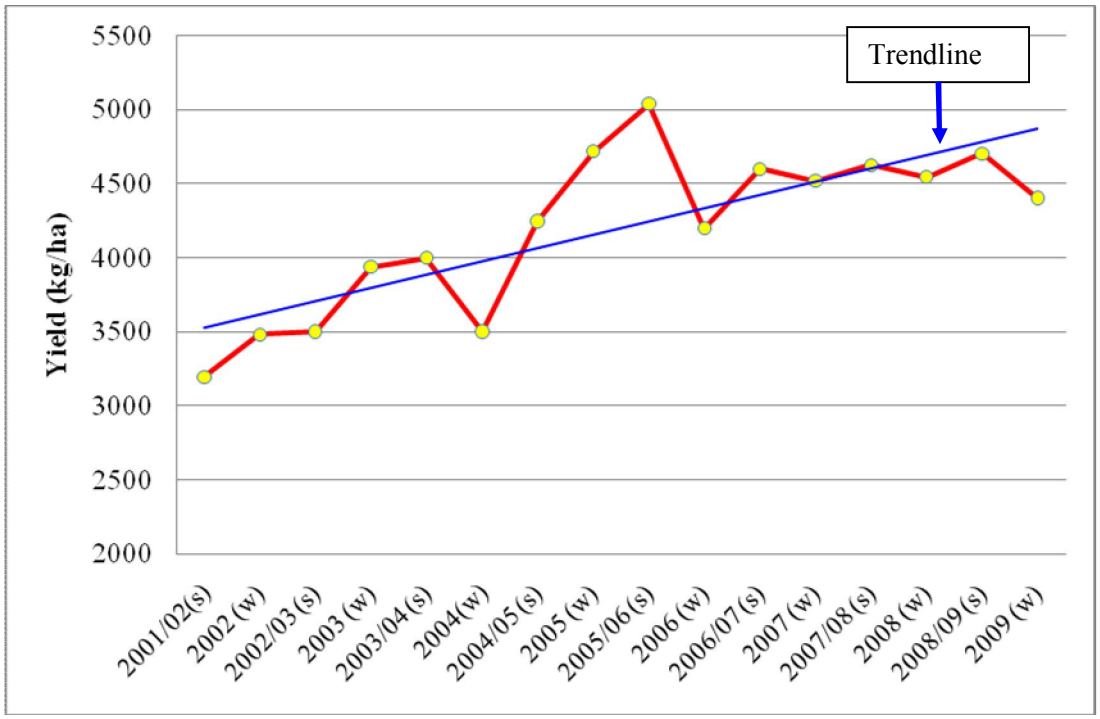

Figure 7.17: Yield levels for WIS from the start of the transfer process (2001/02) to 2009 winter season
Data source: Department of Irrigation

In order to determine whether the rise in yield could be attributable to the effects of the reform, data of yields from WIS were compared with yields data from Lufilya Irrigation Scheme, a government scheme in the same district and within the same agro-ecological zone (Karonga ADD) which is not undergoing reform (Table 7.8).

Table 7.8: Descriptive statistics for Yields from Wovwe and Lufilya Irrigation schemes between 2001/02 and 2009/10 seasons

Scheme	N	Mean (kg/ha)	Std Dev	Min (kg/ha)	Max (kg/ha)
Wovwe	8	4202	511.92	3339	4620
Lufilya	7	2473	159.15	2272	2750

The results show that yields from WIS improved considerably when compared with yields from Lufilya Irrigation Scheme. Furthermore, plotting yields from both schemes (Figure 7.18) further shows that yields from WIS kept rising with the implementation of the reform before stabilizing at levels closer to potential yield values (Table 4.6 in section 4.4.2.7). On the other hand, yields from Lufilya Irrigation Scheme consistently remained much lower than the potential values.

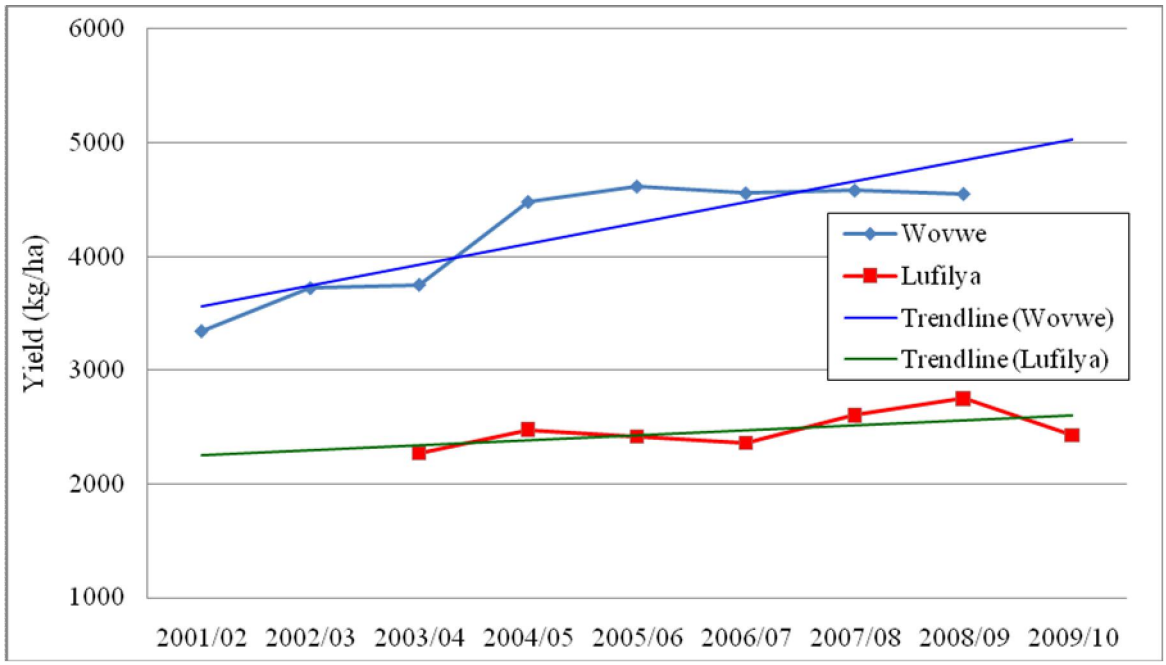

Figure 7.18: Comparison of Yield between Wovwe and Lufilya Irrigation schemes
Data source: Department of Irrigation and District Irrigation Office

Moving averages were computed using smoothing techniques (Smith and Smith 2006) in order to establish if yield improvements were not due to short-term variations but to improvements resulting from the effects of the reform. Both the three-season and five-season moving averages confirmed the same trend as the above analyses (Figure 7.19).

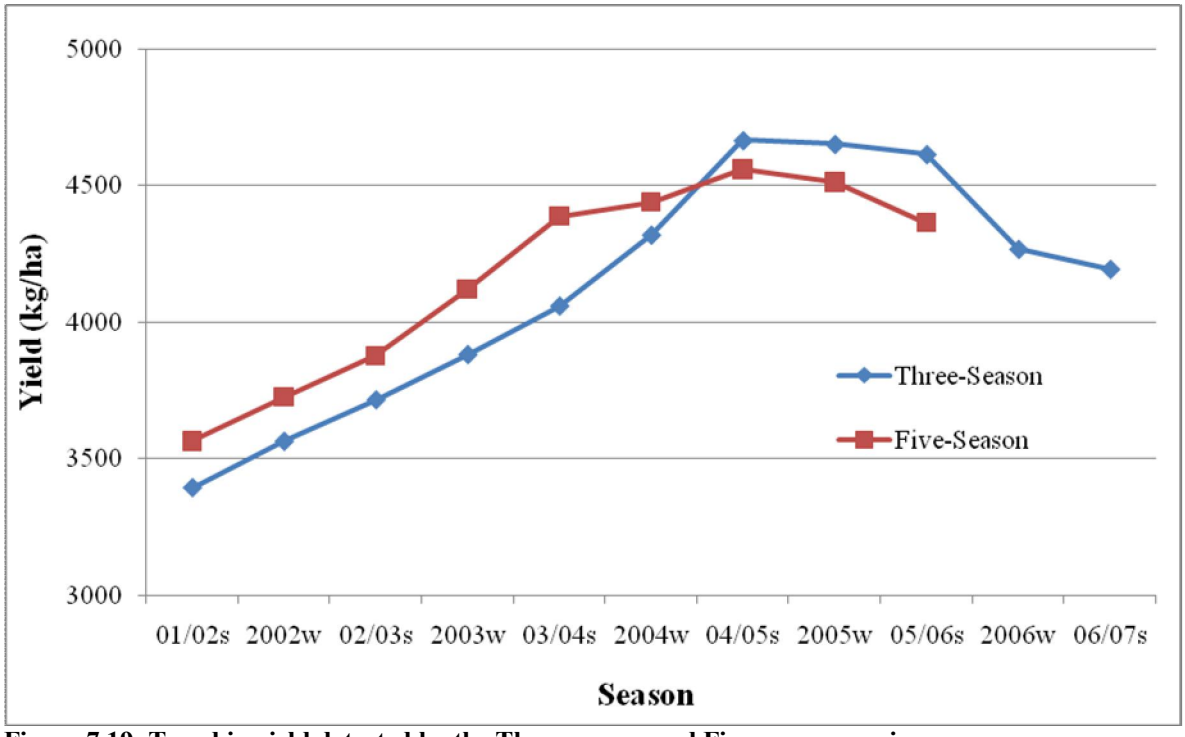

Figure 7.19: Trend in yield detected by the Three-season and Five-season moving averages
Data source: Extension Office (Wovwe)

Despite official data indicating general improvements in yields, farmers' perceptions of their yields indicate the opposite. The general perception of farmers was that yields were declining i.e. 62.2% of respondents reported declines, 22.0% improvements, and 15.9% saw no changes to their yields (N=473). Farmers attributed the perceived falling trends in harvest to the following factors (n=294):

- droughts, floods, lack of land, and lack of finances to buy fertilizers (44.9%)
- changing weather and climatic conditions (droughts and floods) (39.1%);
- inadequate land and lack of finances to buy fertilizers (35.4%);
- lack of land and changing weather and climatic conditions (32.7%)
- reduced land size due to population pressure (20.3%);
- illness and lack of finances (11.3%); and
- illnesses (5.2%).

An examination of the above factors show that a majority of farmers indicated inadequate land, extreme climatic events, and lack of finances as the main factors. Descriptive statistics reveal that about $^{2}/_{5}$ of farmers have had their number of plots reduced during the reform (Figure 7.20) with nearly the same figure reporting no changes in the number of their plots. This suggests that the reported declining harvests by farmers would be due to factors such as reduced land holding, lack of farm inputs resulting from lack of finances, and effects of extreme climatic events.

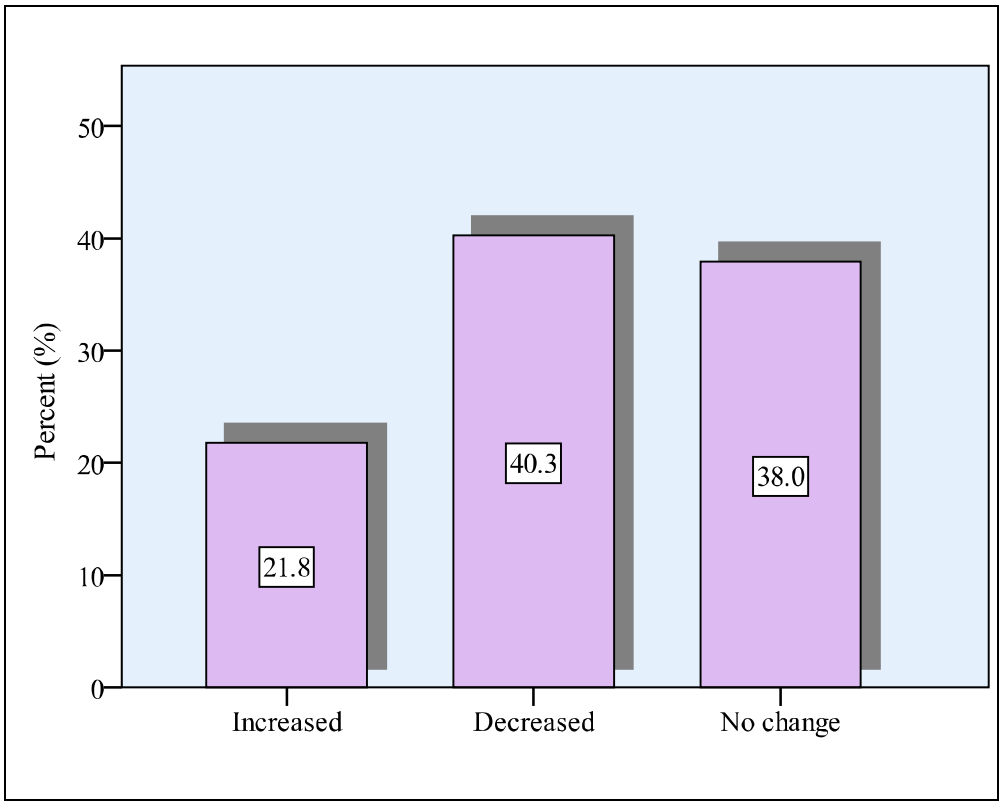

Figure 7.20: Farmers responses about the trend in the number of plots they are holding since the reform, n=303

A Chi-square test was performed to examine the relationship between the number of plots farmers hold and the harvest farmers realize. The results show that there is a moderate to substantial linear relationship between the number of plots and harvest, $X^2 = 98.468$, $df = 4$, $p < .001$; *Cramer's V = 0.403*. Farmers with reduced number of plots were less likely to show improved harvest in the reform period (Table 7.9).

Table 7.9: Farmers perception about harvest by number of plots held, n=303

Farmers' harvest	**Trend in the number of plots (%)**		
	Increased	**Unchanged**	**Decreased**
Improved	26.2	37.4	2.4
About the same	32.3	13.0	0.9
Deteriorated	41.5	49.6	96.7
Total	**100.0**	**100.0**	**100.0**

Furthermore, at the time of field research the area experienced floods which destroyed farm lands, livestock, and homes (6.2.6.2). Also, in the years preceding this study, the area experienced mixed climatic conditions i.e. floods and dry spells (e.g. GOM 2008; 2009). Farmers might also have based their responses on the immediate effects and not the long term impacts of the reform. The Chi-square tests further reveal a low to moderate relationship

between farmers' perceptions about their harvest and their location i.e. $X^2 = 17.708$; $df = 6$; $p = 0.007$; *Cramer's V = 0.137* (Table 7.10).

Table 7.10: Farmers opinions about their harvest with respect to their location from WIS (N=473)

Opinion	**Location (frequency)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Improved after reform	36	36	24	8
Deteriorated after reform	53	90	79	16
About the same after reform	25	18	29	3
Not sure	0	0	0	0
Total	**114**	**200**	**132**	**27**

Upstream households reported significantly higher harvests than both 'within WIS' and downstream households. Since the 'within WIS' and downstream locations were the worst affected by floods, this might also have affected their responses and crop harvest (refer to 6.2.6.2 & Figures 6.5 & 6.6). Additionally, this could be due to the fact that in times of drought and dry spell, upstream households still have access to the little water there is in the river for informal irrigation, and in some cases even block the flow downstream (4.5.4).

Official data for yield, thus, present a fair picture of the trend in harvest at WIS as farmers' perceptions were given at a time when some of them had lost their crops due to adverse weather and climatic events (3.4.2). It could, thus be argued that the reform is likely to have a positive influence on agricultural productivity at WIS. However, factors such as adverse weather and climatic conditions (4.5.4) and inadequate income to buy farm inputs, among others, pose challenges for the reform to improve agricultural productivity.

Furthermore, the official data are supported by findings of the perceptions of households who combine irrigation farming in the WIS with informal irrigation outside the WIS. When asked to compare yields they get from the two irrigation establishments, just over half (51.1%; n=45) the respondents indicated that they get more yield from the WIS than in informal irrigation establishment outside the WIS, 31.1% reported less yield from WIS than from informal irrigation, 8.9% saw no difference, while another 8.9% were not sure.

7.3.1.2. State of overall household income since the reform

Findings on the state of overall household income suggest that the reform is having a positive influence on overall household income. Just over half the farmers (53.5%; N=473) reported that the state of their overall household income (income from all sources, not just from farming) has improved since the reform, 33.0% reported decreases, while 13.5% said their income was unchanged. An examination of farmers' perceptions about their state of overall household income by location showed that downstream households reported fewer improvements than households from both upstream and 'within WIS' households (Table 7.11).

Table 7.11: Farmers perceptions about the state of the household income by location since the reform (N=473)

Perception about the state of overall household income	**Location (%)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Positive	55.3	63.5	34.8	63.0
No change	16.7	10.0	18.2	3.7
Negative	28.1	26.5	47.0	33.3
Not sure	0.0	0.0	0.0	0.0
Total	**100.1**	**100.0**	**100.0**	**100.0**

The Chi-Square test revealed that there is a statistically significant relationship between the state of overall household income and the location of households *(X^2 = 30.765; df = 6; p = <0.001; Cramer's V = 0.180)*. A one-way ANOVA was conducted to examine whether there were statistically significant differences among households in different locations in relation to their annual household income (in MK). The results revealed statistically significant differences among the locations, F (3, 469) = 9.767, p = <0.001. Post-hoc Gomes-Howell tests revealed statistically significant differences between downstream households (M = 49102.27, SD = 40616.13), and upstream households (M = 66857.02, SD = 60440.90) and 'within WIS' households (M = 88694.50, SD= 83468.64). 'Upstream' and 'within WIS' households are likely to realize higher annual income than 'downstream' households (Figure 7.21).

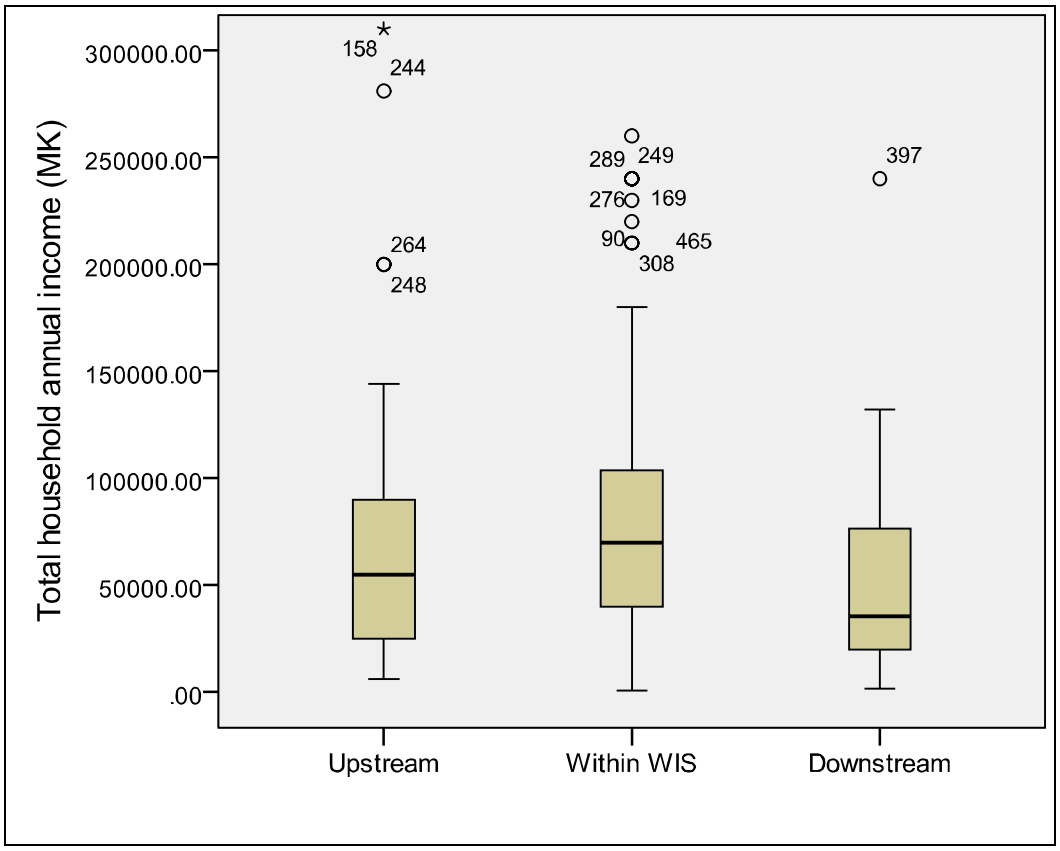

Figure 7.21: Plot of total annual household income

7.3.1.3. Household financial benefits from farming since the reform

The results show that farmers are realizing improved economic benefit from farming during the reform (Figure 7.22). A majority of the respondents reported improved household income realized from farming since the reform.

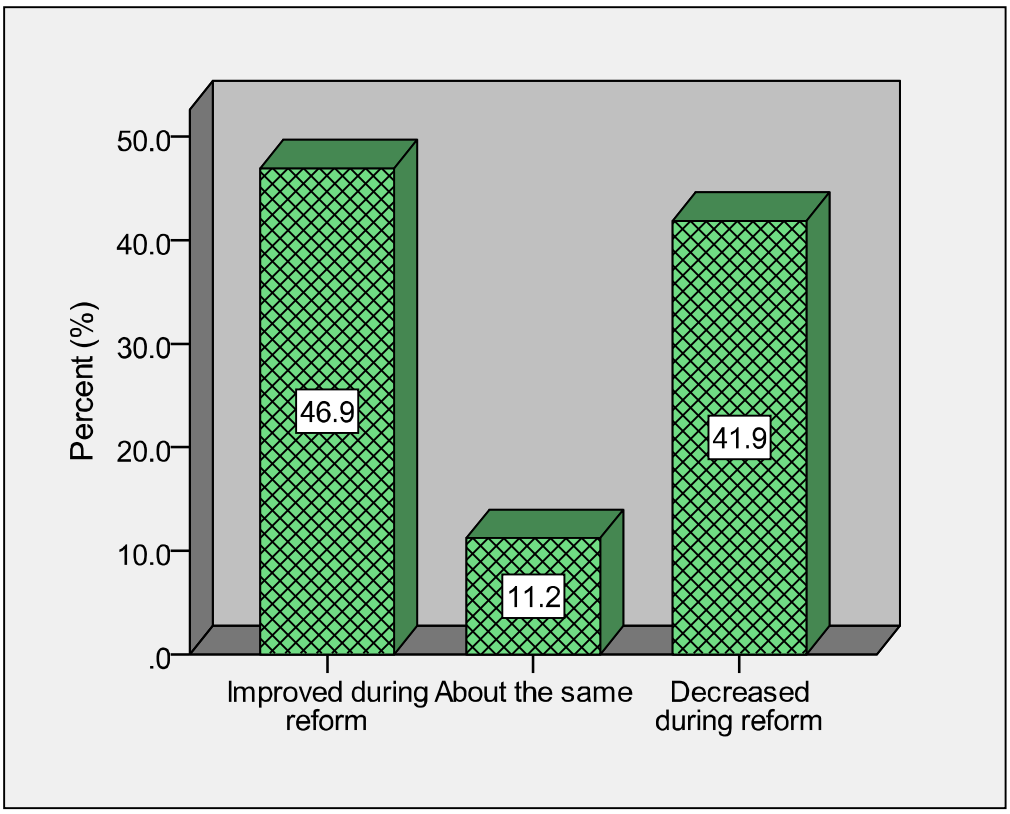

Figure 7.22: Farmers responses about their financial benefit from farming since reform (N=473)

When examined across locations, more households from 'within WIS' location reported improvements in their financial benefits from farming than households from both upstream and downstream locations (Table 7.12).

Table 7.12: Farmers opinions about their financial benefit from farming by location since the reform (N=473)

Opinion	**Location (%)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Improved	44.7	53.5	34.8	66.7
Decreased	36.0	38.5	56.8	18.5
About the same	19.3	8.0	8.4	14.8
Not sure	0.0	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

Chi-square tests show that there is a statistically significant relationship between households' perceptions about their financial benefits realized from farming and the location of the household i.e. *(X^2 = 30.141; df = 6; p = <0.001; Cramer's V = 0.18)*. A one-way ANOVA was conducted to examine whether there were statistically significant differences among households in different locations in relation to their financial benefit from farming (in MK). The results revealed statistically significant differences among households, *F(3, 469)* =

10.733, p = <0.001. Post-hoc Games-Howell tests showed statistically significant differences between the 'within WIS' households (M = 72,938.90) and 'Upstream' (M = 44,777.19), and 'Downstream' households (M = 34,806.82). Households from the 'within WIS' location are likely to realize higher financial benefits from farming than households from both upstream and downstream (Figure 7.23).

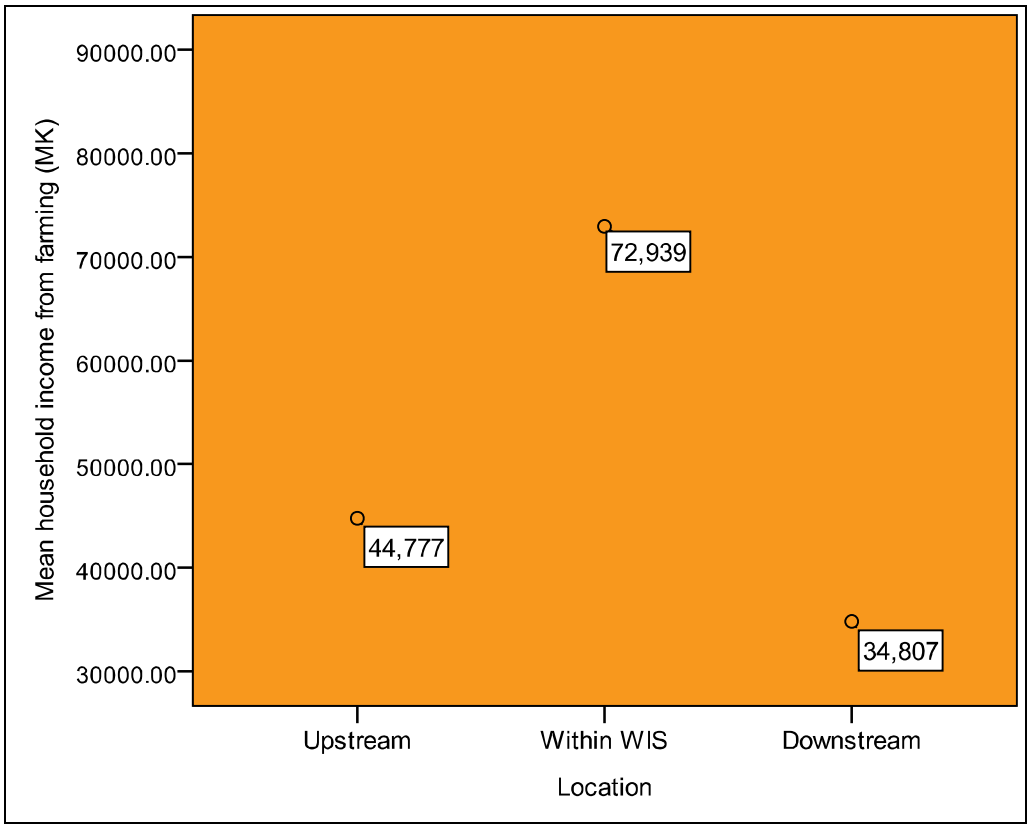

Figure 7.23: Means of financial contribution of farming (N=473)

7.3.2. Impacts of irrigation expansion: informal irrigation

In order to understand how informal irrigation expansion programs are progressing, the dissertation examines how much land has been converted into irrigation schemes and the patronage of the informal irrigation by local communities.

7.3.2.1. Land area under irrigation

The irrigation inventory from the District Irrigation Office reveals that more land in the Wovwe area has been earmarked for irrigation development and that development of the informal schemes is at different stages. Table 7.13 lists informal irrigation schemes currently being established and land coverage of each, and indicates the level of development of the schemes, irrigation type, and beneficiary villages across the entire Wovwe River course. It is worth noting that of the total land area of 245 ha being developed; only about 5% is in the

downstream location. Furthermore, although informal irrigation schemes also exist in the downstream, none of the government-supported schemes have fully been developed in the location. In terms of households' state of income and financial benefits from farming, this explains why 'Downstream' households are less likely to do better than households from other locations (7.3.1.2 & 7.3.1.3). With regards to sustainable livelihoods, this may also imply that downstream households will be less secure than households in other location (see 7.3.3 for reform and livelihoods).

Moreover, with water scarcity being an already recurring problem as a result of dry spells and droughts (6.2.6.2), it also implies that water problems for users in the WIS and other households downstream may be exacerbated as more land is developed for informal irrigation in the upstream. As a result, the occurrence of inter-location water conflicts may potentially increase. Farming in the WIS will, thus, face a mountain of potential challenges to secure water for the WIS irrigators despite the WWUA paying for water rights. As more land will be converted into irrigation land, environmental consequences ranging from depleted water resources, degraded water quality, and loss of vegetation cover may result in imbalances of ecosystems and accelerated rates of soil erosion (Rosegrant *et al.* 2002) flooding even irrigation establishments (refer to 4.5.1, Figure 4.6).

Table 7.13: Informal irrigation schemes being established with government assistance in the Wovwe Area
Source: Karonga District Irrigation Office

Name of scheme	Area (ha)	Irrigation type	Development Status (%)	Irrigation activities	Beneficiary villages	Location with respect to WIS
Kapyere	45	Pump and gravity	10	Rice and maize	• Njalayankhunda • Chauteka • Chagoma • Zengelanjala I • Zengeranjara II • Mtangala	Upstream
Mphinga Complex	188	Pump and gravity	10	Crops: Rice-85%, vegetables, maize, tomatoes, onions and sweet potatoes Fish farming	• Njalayankhunda • Chauteka • Mwathengele • Mwenimambwe • Gonthaminga • Zengeranjara II • Mtangala • Zindili	Upstream
Tilora*	12	Pump and gravity	-		• Chiyuni • Wundaninge • Mbatamira • Ndatira	Other, downstream

* The Tilora Scheme was developed by farmers. Initially, the scheme used river diversion but due to instability of the stream supplying the scheme (drying out), government is developing a pump and gravity system.

Apart from these schemes which are developed with government assistance, several households have opened up small-scale informal irrigation establishments close to the WIS and along the river banks (4.3.1). Though quantification of the areas of such schemes was hard, direct observations revealed that they are extensively developed along the Wovwe River banks and in areas surrounding the WIS (Figures 7.24 & 7.25).

Figure 7.24: Informal irrigation establishment outside the WIS

Figure 7.25: Informal irrigation establishment outside the WIS

7.3.2.2. Patronage of informal irrigation

According to the Karonga District Irrigation office, informal irrigation establishments in the Wovwe area are already benefiting a total of 695 households in surrounding villages (Table 7.14). Unlike in the WIS (7.2.1.2), the informal irrigation sector is patronized by more females (68.2%) than males (31.8%). Such patronage (where females dominate males) implies that in terms of economic enhancement, the promotion of informal irrigation could be a viable strategy for lifting the economic status of vulnerable groups. However, caution should be exercised as extensive development of informal irrigation could be at a cost to the productivity of the WIS particularly in terms of accessing adequate irrigation water, and flooding and siltation of the scheme due to clearing of land for informal irrigation upstream.

Table 7.14: Patronage of informal irrigation schemes developed with government assistance (count)
Data source: Karonga District Irrigation Office

Name of scheme	**Beneficiaries (n)**		
	Male	**Female**	**Total**
Kapyere	38	54	**92**
Mphinga complex	133	350	**483**
Tilora	50	70	**120**
Total	**221**	**474**	**695**

Furthermore, the survey revealed that despite some households engaging in irrigation in the WIS, nearly a third of respondents also engage in informal irrigation outside the WIS (Table 7.15). Refer to Table 3.5 for a detailed presentation of households' engagement in irrigation farming both in the WIS and outside the WIS – including engagement by location.

Table 7.15: Households' engagement in irrigation farming outside WIS (N=473)

Whether the household practices irrigation outside WIS	N	Proportion (%)
Practices irrigation outside WIS	141	29.8
Does not practice irrigation outside WIS	332	70.2
Total	**473**	**100.0**

Reasons for engaging in informal irrigation reveal that it is an essential part of ensuring food security and enhancing economic status of the rural communities (n=141):

- to ensure food security and enhance my household income to fight poverty (74.47%);
- to ensure food security (14.89%);
- to enhance my income (7.80%);
- to counter losses from irrigation in WIS due to floods and water scarcity (2.13%); and
- it is difficult to find plots in WIS (0.71%).

7.3.3. Reform and rural livelihoods

The establishment of smallholder irrigation schemes in Malawi was aimed at promoting rice production and stimulating rural development thereby ensuring food security and enhancing the economic status of rural Malawians (2.6.6.1). Irrigation establishments also stimulate the growth of varied livelihoods (Lankford 2003). So, any reforms in the sector will impact upon the outcomes of irrigation including rural livelihoods.

7.3.3.1. Livelihood strategies

The survey revealed that nearly all respondents (97.5%; N=473) depend on farming as their main livelihood. Only a few households rely on other activities as their primary sources of livelihoods i.e. 1.3% business, 0.8% fishing, 0.2% employment, and another 0.2% rely on livestock. The reliance on farming is in line with the MNVAC's (2005) observation about the main livelihood for households in the Nkhata Bay Cassava Livelihood Zone (2.6.8.1). Examining responses by location also showed that in all the three main locations (upstream,

within WIS, downstream), households significantly rely on farming as their primary livelihoods (Table 7.16).

Table 7.16: Household's primary livelihood activities by location (N=473)

Main livelihood activity	Location (%)			
	Upstream	***Within WIS***	***Downstream***	***Other***
Farming	97.4	99.5	93.9	100
Fishing	0.0	0.0	3.0	0.0
Employment	0.9	0.0	0.0	0.0
Business	1.8	0.5	2.3	0.0
Livestock	0.0	0.0	0.8	0.0
Total	**100.0**	**100.0**	**100.0**	**100**

The Chi-Square tests revealed that there is no statistically significant relationship between households' choices of their primary livelihood strategies and their respective locations *(X^2 = 18.872; df = 12; p=0.092)*. This implies that the reform may have had no direct influence on farmers' choices of their primary livelihood strategies.

However, despite households singling out some activities as their primary livelihood strategies, about two-thirds (66.2%; N=473) indicated that they engage in other supplementary livelihood activities as either a single supplementary activity or a combination of supplementary activities. Of these supplementary livelihood strategies, business and casual labor/piecework *(ganyu)* are the most popular with the former being followed by over three-quarters of households (Table 7.17).

Table 7.17: Households engaging in at least one specific supplementary livelihood strategy; n=313

Supplementary activity	Percentage (%)	Supplementary activity	Percentage† (%)
Business	79.6	Employment	1.0
Casual labor/piecework *(ganyu)*	21.6	Gathering/hunting	0.6
Livestock	10.2	Technical (construction)	0.6
Weaving	3.4	Fishing	0.3
Assistance from distant relatives	1.6	Farming	0.3

† Observing proportions of supplementary activities, it is clear that their sum exceeds 100%. This is due to the fact that the proportions highlight specific strategies households engage in as either a single supplementary strategy or part of a combination of strategies.

7.3.3.2. Livelihood diversity

Despite the dominance of farming as the primary livelihood strategy, the survey shows that a majority of households (59.0%; N=473) have diversified their livelihood activities during the reform period, while 23.3% maintain their traditional strategies and, only 17.8% have reduced the number of their livelihood activities. Chi-Square tests revealed a statistically significant relationship between the number of livelihood strategies employed by households since the reform and location *($X^2 = 17.285$; $df = 6$; $p = 0.008$; Cramer's $V = 0.14$)*. Post-hoc Games-Howell tests revealed statistically significant differences between the 'Within WIS' households and 'Upstream' households. 'Within WIS' households are less likely to diversify their livelihoods strategies than upstream households (Table 7.18).

Table 7.18: Trends in the number of livelihood activities by location, N=473

Trend in number of livelihood activities	**Location (%)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Increased	68.4	50.5	62.1	66.7
Unchanged	21.9	24.0	23.5	22.2
Decreased	9.6	25.5	14.4	11.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

While improved household income reported by households from both upstream and 'within WIS' locations (7.3.1.2) would imply that households from both locations are diversifying their livelihood activities, only upstream households reported significant increases in the number of livelihood activities. These findings suggest that households in the 'Within WIS' location have a stable source of livelihood i.e. farming compared with other locations (reconsider Table 7.16). This is further supported by findings that "within WIS' households are likely to realize significantly higher financial benefit from farming than households from downstream location (7.3.1.3).

Furthermore, the likelihood of upstream households engaging in more diverse livelihood strategies than 'within WIS' could be explained by the fact a large number of upstream households are involved in rural development projects supported by NGOs and other government and donor-funded projects such as the European Union-funded Farm Income Diversification Project (FIDP), World Vision, National Association of Smallholder Farmers of Malawi (NASFAM). For example, of the 71 respondents reporting involvement in such

projects through community groups, 62.0% come from upstream, 21.1% 'within WIS', and 16.9% come from downstream.

Findings on livelihood diversity at Wovwe suggest that other factors than IMT have significant impact on households' ability to diversify their livelihoods compared to IMT. So far, IMT has had very little impact on livelihood diversity and is resulting in households increasingly engaging in farming as an established livelihood strategy.

7.3.3.2.1. Non-farm livelihood activities

Households have also diversified from farm to non-farm[35] livelihood strategies. Survey results show that households are now engaging more in non-farm livelihood strategies than before i.e. 46.3% (N=473) reported increases in their engagement in non-farm livelihood activities, 27.1% reported no changes, while nearly the same proportion (26.6%) reported decreases in engagement in non-farm livelihood strategies. A Chi-Square test reveals no significant relationship between households' engagement in non-farm livelihood activities and location *($X^2 = 9.919; df = 6; p = 0.13$)* (Table 7.19).

Table 7.19: Households' engagement in non-farm livelihood activities by location (N=473)

Trend in level of engagement	**Location (frequency)**			
	Upstream	***Within WIS***	***Downstream***	***Other***
Increased	60	77	68	14
Unchanged	24	64	32	8
Decreased	30	59	32	5
Total	**114**	**200**	**132**	**27**

The general rising trend towards non-farm livelihoods indicates that households are seeking more strategies to enhance their household income and counter any risks or shocks associated with farming.

7.3.3.3. Livelihoods diversity and household income

In order to understand the economic benefits of livelihood diversification i.e. how diverse livelihoods are contributing to total household income, respondents were asked to provide estimates of their previous year's income which were used to calculate the diversity index

[35] Refer to section 2.4.2 for information on farm or non-farm and cash/income or no-cash livelihood activities.

(3.3.4.2). Results showed that different livelihood activities contributed varying proportions of income to total household income – with farming being the major contributor (Table 7.20).

Table 7.20: Income contribution of livelihood strategies to total household income by location (N=473)

Livelihood strategy	Upstream (%)	Within WIS (%)	Downstream (%)	Other (%)	Overall proportion (%)
Farming	67.7	83.4	70.2	79.8	77.1
Business	22.7	10.1	14.8	15.3	14.2
Livestock	3.3	1.5	2.3	2.5	2.1
Piecework	2.4	1.6	1.4	0.5	1.7
Weaving	2.2	1.2	3.2	0.5	1.7
Fishing/fish farming	0.5	0.4	3.9	0.0	1.0
Beer brewing	0.0	0.2	3.3	0.0	0.7
Employment	0.8	0.7	0.0	0.0	0.5
Assistance from distant relatives	0.4	0.1	0.2	0.5	0.2
Hunting	0.0	0.0	0.7	0.0	0.1
Other	0.0	0.8	0.0	0.9	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

† Although not indicated by households as a source of income, 24.0% of those with more land than they needed to farm (n=96) rented out their land for income.

Both the HHI and diversity index (the inverse HHI) (see 3.3.4.2) were computed for all livelihood strategies in order to understand the contribution of each strategy to total household income (Table 7.21).

Table 7.21: Livelihood diversity measures - I-HHI values (Total income estimates = MK34,303,480.00)

Location	Contribution of livelihood activities to overall household income (%)											I-HHI
	Farming	Business	Livestock	Weaving	Piecework	Fishing	Beer brewing	Employment	Other§	Assistance†	Hunting	Total
Upstream	67.71	22.75	3.29	2.16	2.39	0.46	0.04	0.80	0.01	0.38	0.00	1.95
Within WIS	83.39	10.11	1.53	1.18	1.64	0.37	0.20	0.69	0.76	0.15	0.00	1.42
Downstream	70.18	14.79	2.34	3.20	1.38	3.91	3.28	0.00	0.00	0.22	0.69	1.93
Other	79.85	15.27	2.50	0.51	0.48	0.00	0.00	0.00	0.92	0.48	0.00	1.51
Whole Site	**77.14**	**14.19**	**2.15**	**1.73**	**1.66**	**1.04**	**0.74**	**0.52**	**0.46**	**0.24**	**0.13**	**1.62**

§Other livelihood activities include carpentry, bicycle repair, and local transportation such as bicycle and ox-cart transportations.

†Assistance from distant relatives.

Results show that while households engage in diverse livelihood activities, income contributions of all other livelihood activities are insignificant compared to the contribution of farming (see Appendix 7 for detailed calculations of the inverse HHI). This confirms the

dominance of farming as the main livelihood strategy (7.3.3.1, Table 7.16) responsible for the state of household income.

While significantly higher income from farming in the 'Within WIS' location than in the other locations, mainly the 'Downstream' (7.3.1.3) may be likely due to the reform, the dominance of income contribution to total household income may, on the other hand, indicate that the reform has had very little influence on enhancing profitability of other livelihood activities. Furthermore, in terms of livelihood sustainability, it implies that there is an opportunity to develop other non-farm activities to ensure that rural people are not affected by shocks such as extreme weather events, and low market prices for farm produce, among other, which are associated with farming. However, from an environmental point of view, the dominance of farming implies that more land is being cleared for agriculture and water resources are being extensively abstracted to support farming. This may increase vulnerability of ecosystems to depletion and degradation which, in turn, undermines the very sustainability of livelihoods which land and water resources are supposed to support.

7.3.4. Reform and the environment

Some of the stated benefits of irrigation sector reform are that it motivates local communities into having a sense of ownership of the irrigation system, and improves the way local communities manage natural resources i.e. land and water. The survey, document analysis, direct observation, interviews and focus groups were all used to understand the effect of irrigation reform on the state of the environment at Wovwe; and results show that there is no improvement in the management of water resources and related environmental resources.

7.3.4.1. State of water resources

Due to the lack of hydrologic measurements of the Wovwe River alluded to in sections 1.4 and 6.2.6.2, findings on the state of water resources presented here are based on other secondary data, and perceptions of farmers and key informants. These findings aim to help our understanding of the conditions in which the reform is being implemented and resulting consequences on the resource.

Survey results show that the volume of water in the Wovwe River is perceived to be declining since the reform, and this corresponds with official data which show that precipitation has

been declining (see 6.2.6.2, Figures 6.3 & 6.4). However, despite the reported declines, households also indicated that the occurrence of floods in the same period has intensified (Table 7.22).

Table 7.22: Households perceptions about the occurrence of flood since reform, n=452

Frequency	**Percentage (%)**
2-3 times every year	71.5
Once every year	22.8
Once in 2 years	4.0
Once in 3-5 years	1.3
Once in 5-10 years	0.2
Once in ≥10 years	0.2
Total	**100.0**

The survey revealed that both floods and dry spells/droughts are a major problem with respect to water availability. However, the Divisional Irrigation office and key informants claimed that dry spells are the main problem. They concurred that floods occur within a very short period of time and, although they cause damage to property and crop fields, they also recede very quickly. But dry spells persist for a relatively longer time than floods, causing irreversible damage to crops and negatively affecting levels of river flows. Since precipitation is seasonal, once the season is over, households are left with massive water problems which negatively affect their ability to produce adequate food for their households and enough harvest for sale to enhance their household economic status. Official data (from the Department of Climate Change and Meteorological Services) show that actual precipitation levels averaged below normal levels (see Figure 6.4) thereby supporting claims by the Divisional Irrigation Officer and key informants that water volumes in the river have been declining.

7.3.4.2. State of soils

Reports from the District Irrigation Office indicate that the state of soils, particularly in the WIS is, with respect to water-logging and soil salinity, in good condition. The Divisional Irrigation Officer narrates: *"There is as much drainage network at Wovwe as there is canal network. ... In Malawi we receive heavy tropical rainfall, to some levels storms, which also help wash away whatever salts that would have accumulated in soils. ... Every five years full soil chemistry is carried out (samples are sent to Chitedze Research Station) for soil pH and*

salinity analysis as well as fertility exhaustion to guide recommendation on proper fertilizer levels in order to enable farmers realize high yields. Salinity problems have never been reported".

While the District Irrigation Office reports that the environment is in good state, the search for farmland is posing a major threat to the environment as well as irrigated farming in irrigation schemes. The Environmental Affairs Department (EAD 2003) reports that villagers are increasingly clearing vegetation cover for agriculture, and cultivating fragile and marginal land. Studies reported by the EAD (1998) further indicate that the 3,026,400 ha of land under cultivation in 1975 were increased by 31% in 1990, representing an annual expansion rate of 1.4%. Correspondingly, about the same period (between 1972 and 1990), total forest cover declined by 41%, representing an annual average forest loss of 2.3% (EAD 1998). From the time when these studies were conducted to the time of this study, Malawi's population has grown by 32% (NSO 2008) and continues to grow (Figure 7.26). This implies that the situation now would be worse than then due to land pressure.

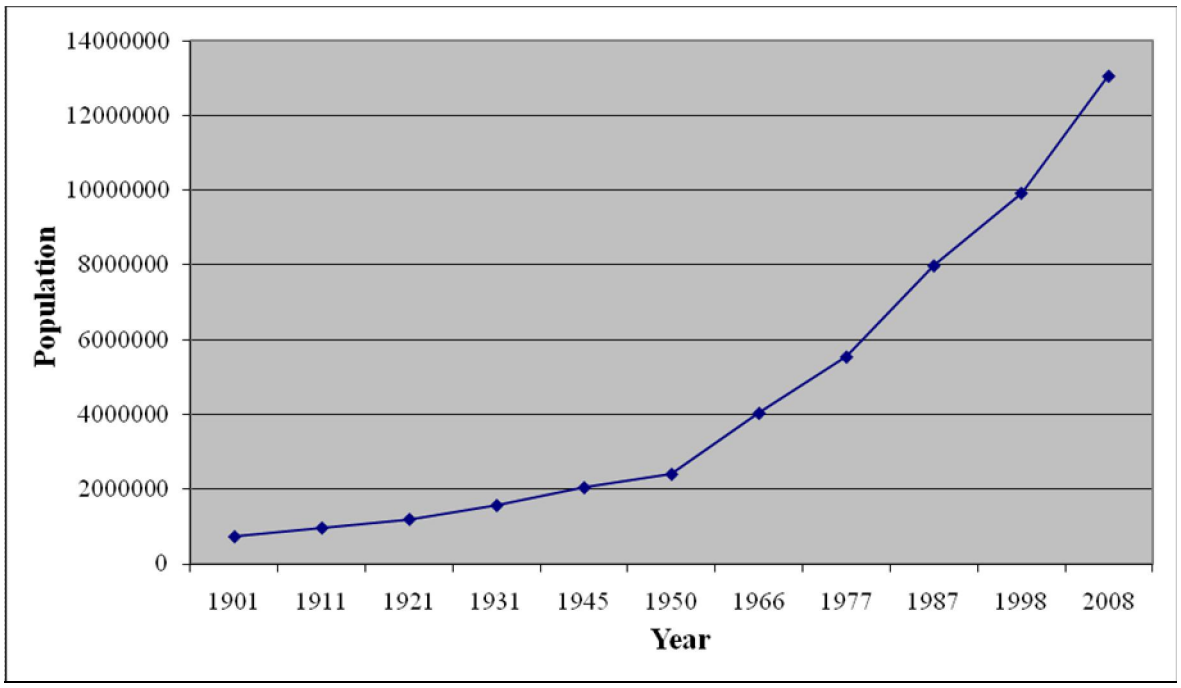

Figure 7.26: Malawi population (1901 to 2008)
Data sources: NSO 2008

The consequences of agricultural expansion and cultivation of marginal and fragile lands are significant soil losses to erosion and hence massive silt loads into the river which cause flooding. For example, soil loss through erosion in Malawi is estimated at between 13 to 29 tones/ha annually translating into an annual crop yield loss of between 4% and 11% (EAD

2003). This indicates serious problems with the management of water, soil, and forestry resources. Unsurprisingly, direct observations at Wovwe revealed that large areas of the WIS and other parts outside the WIS were flooded and silted due to the flooding river resulting in loss of some sections of the scheme to water-logging (Figure 7.27), and loss of crops and crop land.

Figure 7.27: Section of the Wovwe irrigation scheme lost to water-logging, and deformed road

7.3.4.3. Water resources management

The establishment of farmers' organizations such as WUAs is partly based on the belief that if irrigation systems and water sources supplying the systems are managed by farmers, there would be sound management of both water resources and the irrigation system (Vermillion 1997; Vermillion and Sagardoy 1999; Garces-Restrepo *et al.* 2007). However, findings at the WIS do not fully support this position.

Despite the constitutional mandate (WWUA constitution) to manage water resources, and WWUA by-laws imposing penalties on whoever destroys vegetation cover along the Wovwe River banks; execution of responsibilities and enforcement of laws is relatively weak. For example, the Irrigation and Maintenance Committee (IMC) which is the WWUA establishment responsible for water resources management (4.4.2.4) focuses only on irrigation

water delivery. It relies on farmers, who in most cases are the perpetrators of improper environmental and water resources management practices, to report cases of unsound practices. Furthermore, direct observations revealed that villagers graze their livestock along the river banks while others remove reeds and other vegetation in the river catchment for weaving (Figure 7.28).

Figure 7.28: Reeds cleared from the river banks for use in weaving

Observations confirmed remarks from one key informant, a retired Forestry Officer who described the current state of the river catchment as poorly managed. He recalled that the Wovwe River catchment was once a reserve with dense forested land. He narrates: *"The current problems of flooding are due to rampant deforestation along the river and in the river catchment. A decade or two ago there was a dense forest along the river and people could not reach some sections of the river. Now you can reach every part of the river from any direction. ... I don't think that the WWUA is serious about management of the water but water usage."*

On the other hand, the WWUA is also constrained in its water management activities by issues relating to territorial jurisdiction. As per the agreement of transfer, the WWUA is only responsible for the section of the river between the two components of the Wovwe Irrigation Scheme (Figure 2.8). Upstream and downstream sections of the river are under the control of

respective communities in the areas. The effective management of water as a common pool resource (2.3.1) requires coordinated efforts across the basin. The absence of government institutions responsible for water resources management along the entire river course underscores the difficulty in effectively managing the resource.

Furthermore, local land ownership claims frustrate the WWUA's efforts to manage land and water resources even within the river section that falls within its jurisdiction. Although the section of the river between the two irrigation components is under the WWUA, some locals still claim ownership of the land by virtue of their occupation before the scheme was established. Some locals have opened up rice, sweet potato, and vegetable gardens in these areas (Figure 7.29); while others have settled in the same area. These areas are supposed to be buffers zones for the river.

Figure 7.29: Irrigation gardens along the Wovwe River in the WWUA's jurisdiction

7.4. Summary

The outcomes and impacts of the reform process on agricultural productivity, rural livelihoods, and water resources management are mixed. While the reform has managed to bring more land within the irrigation scheme under cultivation, it has not yet done as expected in areas such as financial sustainability, diversification of households' livelihood activities, irrigation infrastructure maintenance, and equity and timeliness in water delivery. However,

the reform is playing a positive role in improving agricultural productivity, and improving farmers' farm and overall economic benefits. The contribution of farming to total household income outweighs the contribution of all other livelihood activities put together signifying that farming is the primary livelihood strategy for Wovwe communities.

On the other hand, environmental and water resources management is being negatively affected by factors such as irrigation and agricultural expansion, and absence of government institutions responsible for water resources management, among others. The WWUA has no dedicated committee to implement issues of water resources management as the IMC prioritizes water distribution to water resources management.

Furthermore, proper implementation of the reform process in the WIS is affected by the expansion of informal irrigation which appears to be a serious competitor of the WIS for water resources during water scarcity. Beside, expansion of informal irrigation induces massive clearances of land along the Wovwe River banks and other catchment areas which in turn results in siltation and flooding in the WIS.

8. DISCUSSION

8.1. Introduction

Findings presented in chapters 4 to 7 reveal varied extents of the implications of the irrigation sector reform on rural livelihoods and water resources. This chapter discusses these findings with respect to four main aspects of the reform in separate sections. The first section discusses findings on the reform practice in light of literature and experiences worldwide – including developing countries' perspectives, and the local context (political, cultural, traditional, and social economic). Issues of reform performance and impacts are discussed with respect to the objectives (2.2.3.1), assumptions (2.2.3.2), preconditions and worldwide experiences (2.2.3.2) of the reform (Rosegrant and Binswanger 1994; Vermillion and Sagardoy 1999; Shah *et al.* 2002; Garces-Restrepo *et al.* 2007). It further examines how irrigation expansion i.e. promotion of informal irrigation relates with the reforms in the formal irrigation sector. In the next section the discussion centers on the role of the reform in shaping practices of water resources management and governance by focusing on Franks and Cleaver's (2005; 2007) Water Governance and Poverty Analytical Framework (2.5), and Rogers and Hall's (2003) conceptualization of water governance (2.3.2.1). It details how characteristics of certain stakeholders enhance and/or constrain respective stakeholders from accessing water for productive purposes; and elaborates on innovativeness of water stakeholders in devising practices of water access and management.

The third section discusses the influence and implications of the reform on rural livelihoods. Specifically, it considers livelihoods diversification (Ellis 2000a) and rural economic status and how this affects the use and management of natural resources, particularly water resources (Ellis 2001). It further looks at how the reform is contributing to rural people's ability to deal with shocks and trends they encounter in their day-to-day life. Before presenting some major recommendations, the chapter draws upon discussions from preceding sections to discuss ways of achieving a balance between concerns of achieving sustainable livelihoods and water resources management.

8.2. Irrigation reform

Irrigation sector reform is an option for addressing performance gaps in the management of an irrigation system (Vermillion and Sargadoy 1999). In the Malawian context, reform was

undertaken to address problems of deterioration of irrigation infrastructure, low yields, O&M costs, and poor living standards of rural people (see 2.6.6.3). This section discusses findings on the research question **'*how has the irrigation sector in Malawi reformed?*'**

8.2.1. Reform type

Evidence from Wovwe confirms the National Irrigation Policy and Development Strategy's objective of fully transferring the irrigation systems from the government to beneficiary farmers (GOM 2000b). The reform involves transferring the entire irrigation system from government ownership and authority to the WWUA, a local farmers' organization through the process of IMT, and adopting a decentralized governance system (4.2.2). Figure 8.1 is a schematic diagram illustrating the reform process taking place at WIS.

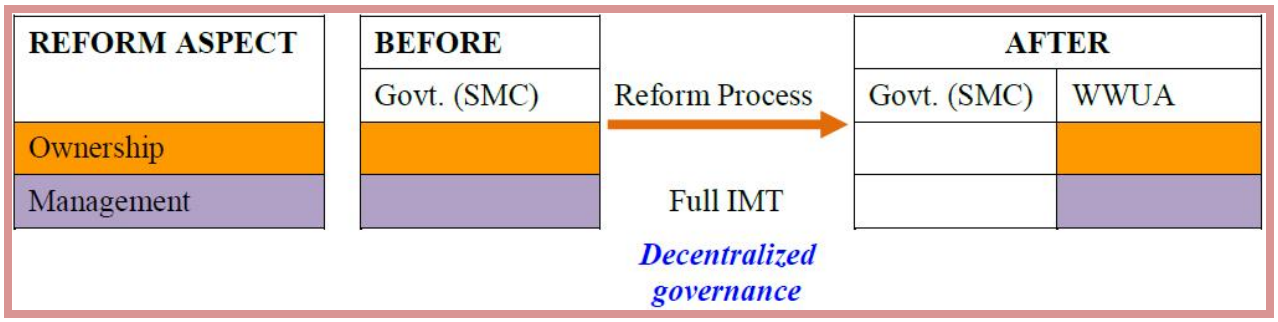

Figure 8.1: Schematic diagram of the reform type at Wovwe Irrigation Scheme
Note: Before the transfer, the government owned the scheme and managed it through the Scheme Management Committee (4.4.2). At this time the WWUA was not formed and the blank spaces under it mean that the scheme was totally managed and owned by government.

Consistent with the full irrigation management transfer (Garces-Restrepo *et al.* 2007), the process at Wovwe indicates devolved management and ownership of the WIS from the government to local beneficiary farmers. Table 8.1 summarizes the full IMT approach (2.2.3.2) as implemented at Wovwe. This state to user (local institutions) transfer reflects the decentralized governance system involving the devolution of both power and responsibilities and, according to Crook (1994) and Ikhide (1999) (see 2.3.2.1), implies that the reform at Wovwe has the potential of achieving effective governance of water resources. The advantages of this are that farmers in the WIS have the opportunity to use their local knowledge about water resources, local expertise to deal with local irrigation problems, and effectively coordinate their activities. Furthermore, by owning irrigation land, it, according to WCED (1987), implies that local communities have the potential of gaining sustainable livelihood security (2.4.4).

Table 8.1: A summary of the reformed aspects and corresponding experience at Wovwe

Reform aspect	Corresponding experience at Wovwe
Type of organization handing over the irrigation system	• The government of Malawi – Department of Irrigation
Type of organization taking over management	• Water Users Association (WUA) – the Wovwe Water User Association (WWUA)
Responsible organization for governance and management	• The Wovwe Water Users Association (WWUA)
Authority transferred	• Maintenance • Operations • Conflict resolution • Imposing sanctions • Development of cooperative businesses • Fee collection
Entity delivering water	• WWUA staff
Entity carrying out canal and infrastructure maintenance	• Farmers coordinated by the WWUA

While experience in Africa shows that it is easier for central institutions to devolve responsibilities than authority to local institutions (Ribot 2002), the experience at Wovwe shows that the government of Malawi is decentralizing both authority and responsibilities to the WUAs. This has a wide range of advantages (2.3.2.1) (Norton 2004). By transferring responsibilities to farmers, the process ensures that farmers do not defer maintenance of the scheme. Worldwide experiences show that this is not so in some systems where responsibilities still remain with the government (Vermillion 1997). However experience from Wovwe reveals that wholesale devolution needs to be cautiously implemented, particularly with respect to the capacity of the recipient local institutions, if local institutions are to perform according to expectations. The WWUA has not done as expected in providing quality maintenance of irrigation infrastructure (7.2.6).

The findings suggest the way governments choose to transfer the schemes to local beneficiary farmers has significant implications on the effectiveness of the local farmers' organizations in their operations. For example, the Wovwe case shows that while quick and wholesale withdrawal of government technical irrigation staff from transferred irrigation establishments has immediate financial benefits on the side of the government, implications to farmers are significant and negative (4.5.3). It leaves local institutions incapable of carrying out effective

maintenance of the irrigation systems. This, unfortunately, works against the very IMT objective of reversing the increasing rate of deterioration of irrigation infrastructure (Garces-Restrepo *et al.* 2007).

In respect of the type of reform implemented at Wovwe, this study, then, argues that although the irrigation transfer at Wovwe is showing positive signs, full transfer of irrigation systems cannot be effectively implemented unless the original entity managing the systems and/or providing technical services, properly coordinates hand-over activities with the recipient institution. Thus, successful full decentralization needs to be preceded by enhanced capacity of the recipient local organizations i.e. the WUAs.

8.2.2. Policy and legal framework

The Malawian irrigation reform appears to have adequate policy and legal backing. The National Irrigation Policy and Development Strategy (GOM 2000b) provides policy guidance on how irrigation is to be implemented. Legally, the transfer is supported by the Irrigation Act (2001), the Trustees Incorporation Act (1962), and the Water Resources Act (1969). By acquiring legal status, WUAs in Malawi are meeting one of the most important aspects needed for their successful operations (Garces-Restrepo *et al.* 2007). Their legal status, acquired through the Trustees Incorporation Act (1962) (4.2.3.2) enables WUAs in Malawi to: own land and any other property; acquire loans; sue and to be sued; acquire water access rights; impose sanctions on their members; and make contracts (see 4.2.3 and Table 4.1). Furthermore, the legal status provides members with necessary rights and responsibilities for their farming in the irrigation system (Table 4.1). The Water Resources Act (1969) further enables WUAs to execute water conservation programs, hence ensuring sustainable water resources management. This implies that in catchments with transferred irrigation systems, WUAs can assume a very essential role in managing water resources, especially where government institutions such as Catchment Management Authorities are not yet instituted e.g. at Wovwe.

These provisions are critical not only to the WUA executives, but also to farmers and the natural environment. They are, thus, particularly critical in meeting IMT objectives of ensuring environmental sustainability (2.6.5.3) (Vermillion 1997), and financial sustainability (Garces-Restrepo *et al.* 2007). Though the WWUA is taking advantage of this by, among

other things, establishing business cooperatives, entering into loan contracts (4.4.2.9); its demonstrated lack of financial accountability (4.4.2.5) suggests that unless a proper system to ensure sound financial management is in place, irrigation reform, with respect to financial sustainability, fails to achieve its intended goals (2.2.3.1). Unsound management of finances result in abuse of revenues realized from farmers' water and membership fees. Consequences are that the irrigation establishment lacks financial resources for running the affairs of the scheme, including maintenance of irrigation infrastructure.

Furthermore, the legal and policy framework gives WUAs the authority or legal status to apply sanctions and resolve disputes among their members. The positive implication resulting from this is that the WUA executives have legal powers to enforce their associations' bylaws. This is critical in ensuring that the WUAs achieve quality maintenance of the irrigation system, and is essential for achieving the IMT goal of reversing deterioration of irrigation infrastructure (Garces-Restrepo *et al.* 2007). However, for WUAs to effectively enforce their authority on some critical irrigation issues such as conflict resolution, plot allocation, and water distribution they need to be considered to be fair by their members and should have support and legitimacy of the members. Some practices at Wovwe, however, revealed some dissatisfaction by over a third of WWUA members about the way the WWUA executive executed its authority in determining plot reallocation as evidenced by members seeking redress from outside WWUA conflict resolution establishments (5.5.7). While having outside options for seeking redress and utilizing them is healthy for the governance of the irrigation system, it may also indicate incompetence on the part of the WWUA executive, especially when members win the appeal cases.

The legal provision of rights to water and land by local farmers is another important factor towards ensuring secure livelihoods (WCED 1987). Lack of clarity in water rights in both Africa and Asia has shown that it constrains farmers' efforts in making improvements to the irrigation system and making long-term investments in maintenance of the system (Vermillion 1997). The case at Wovwe, to some extent, demonstrates that. By promoting informal irrigation expansion and implementing irrigation management transfer in the same river basin without establishing clear ways of accessing water, the government brings into conflict conventional and customary water rights held by the WWUA in the WIS and informal irrigators outside WIS respectively (6.2.2.2). Such conflicts are detrimental to the

productivity of irrigated agriculture particularly in times of water scarcity, and further undermines some key assumptions of IMT (2.2.3.2) i.e. improving water management and delivery, land productivity, and food and livelihood security, among others (Shah *et al.* 2002; Garces-Restrepo *et al.* 2007). Negotiating water access among water users in the river basin would be critical to both agricultural productivity and sound management of water resources. This has worked satisfactorily in some parts of the world such as Sri Lanka (Bruns and Meinzen-Dick 2000). See 8.3.2.2 for a detailed discussion on water rights and negotiation.

Nevertheless, this study argues that the policy and legal framework in Malawi is conducive for the successful implementation of IMT to meet its stated objectives (2.2.3.1 & 2.6.6.3) and assumptions (2.2.3.2). However, there is need for more legal and policy clarity on the execution of formal and customary rights, especially in light of the government's promotion of informal irrigation in areas where both formal and informal irrigation are using water from the same water source (4.3.1). This becomes even more important with the current weather and climatic changes which adversely affect water supply. Furthermore, WUAs need to exercise their legal authority for the benefit of their members and need to be transparent and accountable to their members.

8.2.3. Institutional reform and mandate, purpose of the WWUA

The irrigation sector reform also concerns reforming responsible institutions by establishing WUAs to take over authority and responsibility for the schemes from the government. In response to the requirements of the reform, the WWUA was created as the legal recipient institution. This, effectively, created a way for devolving government authority and responsibility to a local institution. As a farmers' organization, the WWUA represents the main body outside government control to manage the scheme. This is in line with the IMT requirement of ensuring that local users are in control of the irrigation system (Vermillion and Sargadoy 1999).

The establishment of the WWUA as a non-profit organization is beneficial to the operations of the association, especially with regards to finances. As a non-profit organization, it can use all the revenue it collects on operation and maintenance without sharing the money among its members, thereby reducing the cost burden on government (Kamandani 2004). The implications of this arrangement are that the WWUA has the opportunity to use the revenue it

receives on scheme operations and maintenance of irrigation infrastructure. This may translate into quality maintenance work and, hence improved conditions of the irrigation infrastructure (Garces-Restrepo *et al.* 2007). Although the conditions of irrigation infrastructure on the ground may indicate otherwise (7.2.6), the arrangement offers the WWUA an opportunity to effectively reverse the rate of infrastructure deterioration (Garces-Restrepo *et al.* 2007), especially with faithful payments of fees by farmers.

Furthermore, by establishing committees with a membership of farmers, the WWUA puts farmers in control of the scheme management, hence cultivating a sense of ownership in farmers which is necessary for sustainable management of the irrigation system (Norton 2004). However, the absolute concentration of power in the WWUA executive subjects the operations of the WWUA to abuse e.g. appointment of some office bearers (4.4.1) and lack of transparency in the management of the association's financial resources (4.4.2.5). For example, by restricting the powers to appoint members of the BOT and the association's auditor to the WWUA executive, the system creates a loophole for abuse as the WWUA executive may choose to appoint only those who would not oppose its actions. This, in turn, undermines the WWUA legitimacy which is one of the basic pillars of successful transfers (Norton 2004).

The objectives of establishing the WWUA are wide-ranging (4.4.1) and go beyond the purpose for which the government adopted IMT (2.6.5.3). This has an influence on, and execution of, its mandate. For example, this implies that the WWUA should establish adequate institutional structures to ensure that its mandate is executed fully. This is reflected in its establishment which has some committees having nothing to do with core functions of irrigation and water resources management (Figure 4.2) e.g. the Health and Water Committee which is concerned with potable water and peoples' health and not irrigation water (4.4.2.10). The implication is that the WWUA also allocates resources to other non-core functions to irrigation and water management thereby constraining its resource base. While mandates of WUAs worldwide vary considerably, practice shows that WUAs which have widened their mandates, particularly in Asia, do so by focusing on issues such as marketing and developing agribusiness (Garces-Restrepo *et al.* 2007). In this respect, it would be advisable for the WWUA to shift focus from water and sanitation issues which the government is already involved in (6.2.4.2) to strengthening its newly formed farmers' cooperative (4.4.2.9) and

provision of rice milling services with the aim of adding value to the rice its members produce (7.2.4).

8.2.4. Land tenure and ownership

The WWUA has the legal mandate to own land and irrigation infrastructure (GOM 2000b; 2001). This legal mandate is essential towards bringing a sense of ownership among farmers so they can improve the management of the irrigation system. Furthermore, the WWUA's legal status (4.2.3.2) ensures that the land is safe from any claims by traditional leaders to have it reconverted to customary land after government withdrawal. Hence the benefits of ownership, some of which are discussed in section 8.2.1, are crucial to the sustainability of the irrigation system as farmers will more likely invest in long-term projects aimed at improving the scheme's infrastructure, and will not defer maintenance of the irrigation infrastructure which is theirs (Vermillion 1997). It also empowers farmers through their association to decide what is necessary for the irrigation system and take appropriate actions.

Moreover, the provision in the transfer agreement limits the WWUA to sell land within the Wovwe irrigation system or use the land or irrigation infrastructure as collateral without government approval (4.2.2). Although the limitation may seem restrictive to the WWUA's governance of land, it is of significant benefit to local farmers in the scheme, especially in the current situation where the WWUA is in a financial mess (4.4.2.5). It helps to ensure that the scheme remains a central part of the well-being of the local communities – one of the pre-requisites irrigation management transfers must meet (Vermillion and Sagardoy 1999; Shah *et al.* 2002; see also 2.2.3.2). Essentially, the limitation prevents the risks of eventually losing the scheme to financial institutions which may turn it to commercial farms where benefits to local farmers may be reduced or lost altogether.

8.2.5. Reform and irrigation staffing

The WIS was initially run by the government through the Department of Irrigation. While in some places such as Andhra Pradesh and Madhya Pradesh in India (Garces-Restrepo *et al.* 2007) government irrigation staff were deputed to work for WUAs, at Wovwe the Malawi government relocated its staff to other irrigation places. Though such staff withdrawal may be indicative of government's resolve not to interfere with the affairs of local organizations, the

absence of irrigation technical officers at Wovwe is negatively affecting the operations at the scheme, especially with regard to irrigation and hydrological services.

Moreover, the arrangement that WUAs in the transferred schemes should, after the complete handover, hire extension services which are currently provided freely by government (4.4.2.7), is clear indication that the government is determined to reduce costs for services offered by its staff. While this confirms the overall responsibility of WUAs, the WWUA seems to be ill-prepared in terms of technical, financial and managerial capacity. It is not surprising to note that unlike what international experience suggests about the resistance WUAs face from governments (Garces-Restrepo *et al.* 2007), there is no reported resistance at all from the Department of Irrigation to hand over the scheme to the WWUA.

It could, thus, be argued that when governments are determined to shed off financial and managerial burdens of irrigation systems, it offers little or no resistance to the transfer process. Clearly, the swift withdrawal of irrigation staff from the WIS by the government is weakening the operations of the WWUA particularly in terms of the association's capacity to manage the scheme and its resources (see 8.2.7.1). Hence, it could be beneficial to the farmers and sustainability of irrigation systems if the government continued to be involved in monitoring hydrological measurements, providing appropriate irrigation advice based on prevailing hydrological parameters, and strengthening the capacity of WUAs through training to manage the affairs of the scheme including O&M.

8.2.6. Management, governance, and ownership

In line with the Malawi government's transfer objectives (2.6.6.3) (GOM 2000b); the reform gives farmers at Wovwe, through the WWUA, full responsibility to manage, own, and govern the affairs of the irrigation scheme. Despite the government's goal to see local farmers not only own the irrigation systems but also manage them, practice at Wovwe suggests otherwise as the reform has altered the membership of the scheme's top management. For example, while in the pre-reform period surrounding villages took part in the management of the scheme through their representation in the Scheme Management Committee (SMC), currently, it is only the WWUA executive (elected by farmers) which is the overall management institution (4.4.2.1).

The implications of this change are highlighted by dissatisfaction of farmers who prefer the former management to the current one (4.5.2, Figure 4.8). As revealed by the global IMT evidence (Garces-Restrepo *et al.* 2007), this undermines the legitimacy of local organizations e.g. the WWUA. It would be useful to the sustainability of irrigation systems if IMT seriously considered local institutional and cultural conditions. An option to consider in the Wovwe case would be for the WWUA executive to co-opt additional members from villages surrounding the scheme. To avoid abuse in selecting representatives, such members would be elected at a village meeting from among WIS farmers in a particular village and the names of selected representatives be conveyed to the WWUA executive by the Village Head. This would quell complaints of not being represented, and eventually bring increased legitimacy to the WWUA executive.

Furthermore, the current management of the WIS exhibits some elements of co-management i.e. it is between IMT and the PIM processes (2.2.3). While the presence of government officials from the Department of Agriculture (extension services) at the scheme is meant to ensure continued provision of extension services, the hand-over agreement should clearly stipulate roles of institutions working at the irrigation system. By doing so, both the WWUA and government officials will be clear on each other's responsibilities hence ensuring that the co-management phase does not yield results which are detrimental to the successful implementation of the reform.

8.2.7. Is adopting the reform policy or IMT meeting expectations at Wovwe, Malawi?

While adopting IMT is believed to offer a number of benefits (2.2.3.1) (Garces-Restrepo *et al.* 2007), evidence from Wovwe shows mixed results with the reform meeting expectations in some areas while in others not.

8.2.7.1. Reducing financial and managerial burdens on government

One of the objectives of adopting IMT is the elimination of, or reduction in, government expenditure for O&M (2.2.3.1) (Garces-Restrepo *et al.* 2007). Findings from Wovwe suggest that the government is effectively reducing its financial and managerial burdens, although in a way that is counterproductive to farmers (7.2.5 & see also discussion on 8.2.5). By radically withdrawing technical irrigation staff from the scheme, farmers are deprived of irrigation services in which they do not have adequate capacity. Furthermore, although the costs of

irrigation to farmers have increased significantly (7.2.5) – as expected in successful IMT (2.2.3.1 & 2.6.6.3), the lack of capacity by the WWUA Executive to properly manage finances (4.4.2.5 & 4.5.6) is defeating the very objective of ensuring that the scheme is financially self-reliant (Garces-Restrepo *et al.* 2007).

The achievement of the objective of reducing financial and managerial burdens for the government needs to be understood with caution as some important lessons can be drawn from the Wovwe experience for any successful implementation of IMT:

1) *Drastic removal of irrigation staff creates a costly gap in expertise for farmers to successfully manage the scheme.*

   The removal of technical irrigation staff from the scheme meant discontinuation of crucial irrigation services to farmers including irrigation advice and monitoring of hydrological parameters of the Wovwe River. Poor irrigation practices can have detrimental effects not only to farming, but also to the environment (1.1) (Rosegrant *et al.* (2002). With such effects observed at Wovwe (see also 6.2.6.2; 7.3.4.2; 7.3.4.3), effective monitoring of hydrological measures is crucial for the sustainability of the irrigation system. This would also inform planning for irrigation expansion in the upstream and downstream and hence minimize issues of excessive river diversions and water abstractions. This would also be key to water access negotiations as discussed in 8.2.2 (Bruns and Meinzen-Dick 2000). Otherwise, Vermillion's (1997) observation that governments often adopt IMT programs because of funding constraints and not 'because of validated expectations about enhanced performance' would be true for the Wovwe case and Malawi.

2) *Failure by the government to recognize the need of balancing irrigation costs reductions on its part, and empowering farmers before the hand-over, may be costly towards achieving sustainable irrigation management.*

   Apart from the government, through its Department of Agriculture, managing the WIS in the pre-reform period, technical knowledge about irrigation farming was also with MYP farmers whom the Banda regime placed in irrigation schemes (2.6.1). This implied that local farmers lacked adequate irrigation knowledge and, with the rejection by locals of irrigation governance structures, rules, and regulations after the collapse of the Banda

regime (Ferguson and Mulwafu 2005); there was nothing on the ground for local farmers to start from.

While this background would have justified deliberate introduction of programs aimed at empowering local farmers in managing the scheme as a way of filling the gap left by MYP farmers; local farmers were, surprisingly, deprived of the services of irrigation technical staff through government's drastic withdrawal. Staff withdrawals should have been gradual and backed by trainings. Although one of the pre-requisites of the transfer was that farmers should undergo in-scheme training before hand-over (2.6.6.3), it appears that the training was not adequate enough to enable local farmers to manage the scheme by themselves. Government support for continued training is, in such cases, critical for successful implementation of the reform (Garces-Restrepo *et al.* 2007).

3) *Capacity building for farmers in areas such as irrigation O&M and financial management are crucial if recipient organizations are to be successful in managing the schemes.*

   Irrigation reform in Malawi is implemented against a background of underperformance of public irrigation systems and simultaneous deterioration of irrigation infrastructure (4.2.1), hence improving the productivity of irrigation systems and achieving sustainability of the schemes was critical.

The poor state of distribution canals and other irrigation infrastructure (7.2.6) suggests that the reform is not achieving its objective of improving the physical conditions of the scheme (2.2.3.1). The scheme's background shows that the government in the pre-reform period used the top-down approach and did everything, including maintenance of irrigation infrastructure, for farmers (4.2.1). This implies that farmers in the reform period are lacking experience and capacity to carry out irrigation maintenance work. Furthermore, the lack of farm implements and machinery by the WWUA to use in the field and for maintenance works (4.4.2.8) reveals that the WWUA is ill-prepared to handle any quality maintenance at the scheme. A way forward would be to follow the way of thinking of farmers from Indonesia and Bulgaria who consider government involvement in higher level maintenance and rehabilitation to be helpful for improved quality of maintenance (Garces-Restrepo *et al.* 2007). In the current pilot phase of the hand-over at Wovwe, the government would have continued to be responsible for

maintenance work of the headworks and main canals, and also monitoring of the state of the environment along the river banks. This would adequately compensate for the WWUA's lack of experience and equipment.

The capacity to manage the organization's finances may determine whether the reform is turning irrigation system into a sustainable entity or not. For, even reduction or elimination of government expenditure on O&M depends on how effective the WUA is in managing finances. Unfortunately, the revelation at Wovwe (4.4.2.5) suggests that the objective of establishing financially self-reliant irrigation systems through reform (Garces-Restrepo *et al.* 2007) is unlikely to be achieved. The current alleged financial mismanagement results in farmers' unwillingness to pay water and membership fees; loss of legitimacy of the WWUA; mistrust; and farmers' refusal to participate in any maintenance work. This, then, affects labor contribution on which the local organization relies for maintenance; and revenue needed for the operations of the scheme. Eventually, the very sense of ownership the reform is intended to cultivate in local farmers (FAO 1993) is lost. Training in financial management matters and ensuring transparency and accountability through regular reporting would be crucial in restoring farmers' confidence in the executive, and hence achieving sustainability of irrigation systems.

8.2.7.2. Agricultural productivity and economic benefits

The belief that farmers are primarily concerned about agricultural productivity and financial benefit is behind the hypothesis that if irrigation systems are handed over to farmers, they will be more productive and generate more financial benefits (Garces-Restrepo *et al.* 2007). However, the Wovwe case suggests that such benefits cannot be achieved simply without considering other factors which are natural, social, economic, and institutional in nature.

The improved yields (7.3.1.1) show that the reform is a good strategy for ensuring food security which is not just a challenge for Malawi, but for the whole growing human populations of the world (GWP 2000; Rosegrant *et al.* 2002). However, access to natural resources such as land and water determine the ability of the WWUA to meet the demand for irrigation (in terms of available plots) and equitably deliver adequate water supplies to its members. The significant improvements in the state of household income in the 'Upstream' and 'Within WIS' locations show that irrigation is having a significant impact on household

economic status (7.3.1.2, Table 7.11), especially when considering that it is only the upstream that has government promoted informal irrigation operational (7.3.2.1 Table 7.13) and that the WIS is the main formal irrigation establishment in the area. Furthermore, significant levels of income from farming were reported only in the 'Within WIS' location (7.3.1.3) suggesting that the reform in the WIS is positively influencing the rural communities' income status.

While it is clear that the reform demonstrates that it is able to improve and not degrade the living conditions of the majority of local farmers – one precondition for adopting IMT (Vermillion and Sagardoy 1999; Shah *et al.* 2002), the government may seriously consider introducing development programs which would help households from the 'Downstream' location to also improve their income status. Such programs may be targeted and operate in a similar way as the Malawi government's cash for work program which is intended for poor households to earn cash to buy subsidized fertilizers (6.2.5.1). The schemes may target a particular livelihood strategy which is unique to the location e.g. properly regulated fishing in Lake Malawi, and support households with loans for fishing gear. The benefits of such a scheme would not only be financial but also environmental, as diversity (see 8.4.1 for livelihood diversity and the environment) would reduce pressure on land and water resources for farming (Ellis 2001).

In respect of informal irrigation however, when affected by the consequences of frequent dry spells or droughts, local farmers positively respond to government policy and efforts by engaging in irrigated agriculture at household or community level. In this case, more land could be put under informal irrigation but achievement of agricultural productivity, in terms of yield, still depends on economic and natural factors e.g. availability of reliable water supply, and whether the household has resources to buy inputs and technology.

The findings on yield and economic benefit from farming, and the foregoing discussion show that it is possible to improve yields and household income by adopting IMT. However, availability of resources such as water and land is crucial is this is to be realized. Furthermore, the Wovwe case suggests that if farmers are allowed to decide on their own what crops to grow, they tend to choose varieties which have a high market demand hence delivering improved household income.

8.2.7.3. Governance and finances

Two of the stated assumptions for transferring irrigation schemes to farmers are that the transfer will improve the governance of the irrigation system and motivate farmers to pay more for the operations of the irrigation system (Garces-Restrepo *et al.* 2007).

The reform at Wovwe represents a devolved governance system indicating good prospects for good governance (Ribot 2002). For example, subdividing the scheme into small sections i.e. Units, brings the management of the scheme to the lowest possible level. Furthermore, the establishment of various committees to manage specific aspects of the scheme is a good example of devolved governance. However, the WWUA Executive has performed poorly on improving accountability of both finances and management of the scheme as evidenced by untimely water delivery (7.2.7), unfair water distribution (7.2.8), and accusations of financial mismanagement (4.4.2.5). Such poor governance is a disincentive to farmers to continue engaging in the affairs of the scheme e.g. making financial contributions, and engaging in maintenance work. This suggests that IMT cannot be simply accepted as a motivating factor for farmers to bear high financial responsibility and assume ownership to manage the scheme. Rather, building a genuine relationship and trust between farmers and executive members of their organization is crucial in achieving sustainability.

Aside from the 2008/09 season incident (4.4.2.5) farmers at Wovwe are now contributing more than during the pre-reform period[36] (4.4.2.5 & 7.2.5), suggesting that farmers can accept the responsibilities for meeting the cost of the scheme operations. However, increased revenues need to be coupled with proper financial management if irrigation systems are to be managed sustainably. Unfortunately, the WWUA case reveals a very serious weakness in the reform (4.5.6) indicating that the problem of corruption of financial mismanagement is not unique to government agencies, but can also be found in local user organizations.

The reform has also registered some positive changes to the marketing of farmers' rice. The market which the WWUA Executive finds for its members (4.4.2.9) is to the advantage of farmers who can now negotiate prices for their produce. This has resulted in more private buyers enlisting and state-owned organizations who were primarily the sole buyers of the

[36] It should be recalled from 4.4.2.5 that in the pre-reform period farmers made seasonal contributions of ~0.13 USD/0.1 ha which were used for small costs of running the scheme not as membership or water fees as in the reform period.

produce now competing with private traders (4.5.5). The market demand compels farmers to grow varieties of their choice which fetch higher market value than those they were restricted to before the reform.

8.2.7.4. Collective effort

True to Garces-Restrepo's *et al.* (2007) observation that IMT provides an environment for farmers to work collectively and achieve services which they would not have achieved had they worked independently, the reform at Wovwe enabled farmers to:

- acquire a financial loan from the One Village One Product (OVOP) program with which they purchased a rice mill which they are running as a business (4.4.2.9). This, like what Vermillion's (1997) studies show, indicate that the WWUA is diversifying its sources of revenue which is critical for ensuring financial sustainability and reducing water charges paid by farmers.
- demand water access when abstractions from other users affect them. For example, their collective voice enabled them to cause Traditional Authorities to intervene when upstream users blocked the water flowing to the WIS (4.5.4); and
- identify new rice buyers and negotiate prices (4.5.5).

A summary of results of IMT at Wovwe suggests that the reform has generally registered a number of positive outcomes (Table 8.2). As expected, it has reduced financial and managerial burdens on the part of the Government and improved household income, among others. However, inadequate capacity of the WWUA Executive, lack of checks and balances to ensure accountability, land pressure, extreme weather and climatic events, and rapid withdrawal of government support, are threatening the prospects of achieving sustainability in irrigation management and agricultural productivity.

Table 8.2: Summary of results of the reform at WIS

Parameter	Result	Remarks
Cost of irrigation to government		
Cost of irrigation to farmers		In the pre-reform period all irrigation costs were met by the government
Revenue		From membership and water fees. In the pre-reform period farmers were not paying for irrigation
Quality of maintenance		
Timeliness of water delivery		
Equity of water delivery		
Area irrigated		No room for expansion as the WIS is surrounded by villages and informal irrigation schemes
Yields		
Farm income		
Crop varieties		Diverse rice varieties are now grown

 = Increased  = Unchanged  = Decreased

8.3. Reform and the environment

Poor management practices of irrigation systems result in enormous environmental problems (1.1) which include water-logging, soil salinity, reductions in rivers flow, lowering of water table and hence salt water intrusion in coastal areas, and water quality and availability problems (Rosegrant *et al.* 2002). Hence, environmental sustainability is a key performance factor for measuring the impacts of IMT (Vermillion 1997).

8.3.1. Environmental and water resources management

The acceptance of IMT as a form of irrigation sector reform is also based on the assumption that it improves water management (Shah *et al.* 2002). However, worldwide experience shows that it has recorded mixed results with respect to impacts on the environment – with most reports of success being largely qualitative (Vermillion 1997). Findings from Wovwe do not

diverge from the global experience as both positive and negative environmental effects have been reported. The effects are largely dependent on underlying social, economic, and natural factors; and similar to worldwide experiences, reported environmental impacts are largely qualitative. This could be attributable to the fact that the adoption of IMT policy in Malawi is relatively recent and environmental impacts take several years to become observable and measurable (Vermillion 1997).

8.3.1.1. Institutional framework for water resources management

The development of new policies and the enactment of legislation in Malawi (4.2.3) provide a great opportunity for achieving sustainable environmental management by empowering WUAs to implement environmental management and protection programs in the river catchment (GOM 2000b; 2001). Even the WWUA constitution is based on these national instruments and obliges the WWUA to properly manage the environment and conserve natural resources (WWUA 2001). The alignment of WWUA statutes with national provisions suggests that if governments show, through policy and legislation, commitment to managing and conserving natural resources, resources users will follow the same provisions in their natural resources management practices.

However, the WWUA is finding it difficult to implement its environmental management programs as villagers are still forced to utilize the natural environment along the river banks due to land pressure, natural disasters, and economic difficulties. This could also be due to the issue of jurisdiction. Since the WWUA is only responsible for the section of the river between the two scheme components (Figure 2.8 section 2.6.7), monitoring practices of villagers in other places, particularly in the upstream is not possible as this falls under the leadership of the communities. Furthermore, the practice of some villagers to cultivate even in the Wovwe River buffer zone which falls within the WWUA jurisdiction (7.3.4.3) exacerbates the rate of environmental degradation.

These afore-mentioned factors indicate that the design of successful natural resource management programs can best be achieved only if local contexts are taken into consideration; and suggest that there is no coordination between the WWUA and villages upstream and downstream on matters relating to water resources management, and environmental management in general. The implications of lack of coordination in water use

within the same river basin are that conflicting approaches to water resources management emerge and that the interests of other water users are not adequately considered (GWP 2000). Furthermore, the cultivation of land in the river buffer zone within the WWUA jurisdiction reveals a very serious weakness in the ability of the WWUA to enforce its laws.

It is crucial that the government establishes the Catchment Management Authority (CMA) to coordinate the management of water resources within the Wovwe River basin (Table 6.4 section 6.2.3.1) as provided for by the Irrigation Act (GOM 2001). However, in the absence of the CMA, the WWUA may utilize the 'dual membership' of their farmers i.e. being WWUA members and belonging to their respective villages, as an opportunity for fostering and strengthening coordination with local villagers in water resources management. Since the WWUA has contacts with Village Heads (4.4.2.11), it can utilize the same to expand areas of cooperation from mere reporting the behavior of farmers and communicating WWUA's activities (4.4.2.11; Table 6.6, section 6.2.4.1) to coordinated water resources management across the entire river basin. This would have a positive impact not only on the management of water resources, but also on the availability of water to other users even downstream. This would be in line with the sustainable development understanding (WCED 1987) and Mitchell's (1990) third way of understanding IWRM (2.3) as it focuses on finding appropriate ways of ensuring that water enhances rural people's economic development while at the same time using and managing the resource based on long-term development thinking.

8.3.1.2. Soil salinity and water-logging

With regard to soil salinity, the reported periodic monitoring of soil quality by the Karonga District Irrigation Office i.e. assessing soil salinity every five years (7.3.4.2) indicates that the country has institutional establishments for monitoring soil quality. However, the fact that there are no such institutions at the irrigation site, or even at district and regional levels, and the absence of hydrological monitoring at the site, equally indicates that there are inadequacies in irrigation institutions in irrigation systems and raises questions as to whether the country can timely and effectively respond to such environmental concerns should they occur in irrigation establishments.

Furthermore, the absence of hydrological monitoring indicates shortfalls in the implementation of the National Irrigation Policy and Development Strategy (GOM 2000b)

which explicitly states that "… the government will act as a catalyst for developing informal irrigation by providing information about and access to simple irrigation technologies … Legislation concerning use of *dambo* areas will be reviewed and changes proposed, as needed, to allow appropriate irrigation development" (GOM 2000b, p.12). This, in turn, means that the current informal irrigation development at Wovwe is done without being informed by the current state of water resources which are a vital resource in irrigation planning. This affects irrigation planning and explains why water abstraction upstream negatively affects users downstream (7.3.2.1).

8.3.1.3. Water resources management

Efforts towards water resources management at Wovwe appear to be unsatisfactory, and are largely affected by land pressure (5.2.2.3). Villagers utilize every available parcel of land, including land along the river banks, for both rain-fed and irrigated agriculture (see Figures 4.1 & 5.4), and livestock rearing. The situation is worsened by the absence of institutions responsible for water resources management (6.2.3.1). Although some efforts to manage water resources are made by the Electricity Supply Corporation of Malawi (ESCOM) upstream (5.2), these are isolated as most stakeholders, including the WWUA are not taking part in any water resources management programs.

The implications of the current situation are that the clearing of vegetation for agriculture are leading to soil loss which result in crop loss and massive silt loads in the irrigation canals in the WIS (see 7.3.4.2 for soil erosion). Furthermore, because of overflowing waters, the canals are turned into gullies (Figure 8.2).

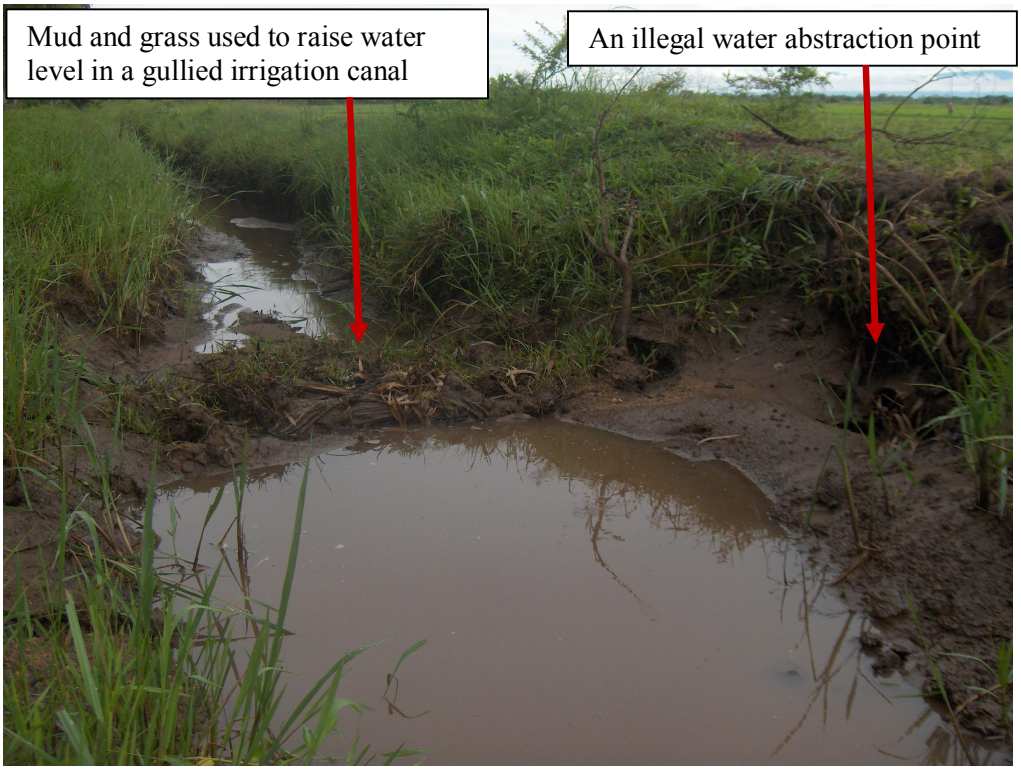

Figure 8.2: A canal in Wovwe I turned into a gully

Both silt in canals and gullied canals have negative consequences on water access. Silt reduces water flows in irrigation canals and gullied canals make it difficult to raise the level of water for access into the fields. Low water flow in canals results in some locations of the scheme experiencing untimely and inequitable water deliveries (7.2.7 & 7.2.8). Similarly, with the already poor quality of maintenance and poor condition of irrigation canals (7.2.6), gullied canals force farmers to use illegal means of water access such as blocking the flow (consider Figure 8.2).

In terms of irrigation reform, this suggests that the IMT at Wovwe is failing to achieve environmental sustainability and sound water resources management as expected (Shah *et al.* 2002). This further shows that land pressure and effects of climate change are shaping the way local communities live by shifting their agricultural practices to agricultural extensification (2.4.2). Irrigation expansion, to some extent, is contributing to the poor state of the environment as more land is brought under agriculture and more water abstracted for irrigation (4.3.1). Since water resources are also being affected by agricultural practices of local people outside WIS, adopting a local integrated approach where land and forestry resources are being managed under one comprehensive program implemented across the river catchment would be advisable. In the Wovwe context, such an approach should be based on

the recognition of the complex interaction between water resources and other resources e.g. land, forests, and socio-cultural resources which local people draw upon to construct their livelihoods. Since there is no CMA, utilizing the Area Development Committees of the two Traditional Authorities (TAs) (2.6.7) would be best suited in implementing the approach due to the important role TAs play in development activities in their areas, and their social status among villagers (2.6.3.1). The approach (see also 8.3.1.4 for more details of the approach) is consistent with IWRM (2.3), and also entails management efforts are tailored towards sustainable management of water resources e.g. controlling soil erosion, managing the river banks, and preserving wetlands, among others (Mitchell 1990). The approach would further support informed water resources planning for any irrigation expansion – especially if the targeted water source is already used for similar or other purposes.

8.3.1.4. Water availability

Water is critical to natural ecosystems, human life and livelihoods (Meinzen-Dick and Rosegrant 2001). However changes in the global climate induce variations in both temporal and spatial availability of precipitation, the main freshwater source (GWP 2000). This is also observable in Malawi (6.2.6.2) and that on a local scale; the situation is exacerbated by subjecting water resources to multiple users. The case in Malawi and Wovwe in particular, reveals variations in precipitation in both time and space (6.2.6.2). The lower than normal rainfall experienced during the reform era (Figure 6.4) suggests that climatic variations are also affecting the availability of water. Furthermore, households' perceptions that show that it is the 'Within WIS' and 'Downstream' locations that reported significant declines in the water volume also suggest that even at a local scale, water availability varies spatially. Apparently, it is the upstream that has operational informal irrigation systems (Table 7.13 section 7.3.2.1). It implies that low water volumes reported in the 'Within WIS' and 'Downstream' locations would be due to abstractions for irrigation upstream. Such abstractions would not be a problem if water needs of users in the 'Within WIS' and 'Downstream' locations were met. Unfortunately, this is not so.

Increased abstractions due to informal irrigation not only affect downstream users, but also the ability of the Wovwe River to service other ecosystem needs. While the expanding informal irrigation may be interpreted as a success on the side of government to achieve food security and enhancing economic status of rural communities, it equally means stretching land

and water resources. This underlines the need for proper water resources planning when devising policies to expand irrigated agriculture using water from a source that is also being utilized by other existing users. Otherwise, environmental consequences such as deforestation will lead to soil erosion and high silt loads causing water-logging, flooding, and siltation of irrigation fields. Some of these consequences are already experienced at Wovwe (7.3.4.2).

This calls for balancing policy needs with the resource base which is central to meeting national interests such as food security and poverty reduction. The Wovwe case suggests that for the irrigation sector reform to be environmentally sustainable, governments should have adequate knowledge of the natural resource base (i.e. water and land resources) and deliberately balance development and environmental management objectives in order to avoid subjecting a single common-pool resource to multiple strategies of utilizing it. As competition for water and land resources continues to rise, the government may consider regulating management practices of farmers and other water users in informal irrigation systems, river basins, and in both the upstream and downstream areas.

Furthermore, based on the belief and trust rural communities at Wovwe have in their Traditional Authorities (TAs) to settle water disputes, forming networks of farmers or water users across the entire river course could be a valuable strategy of promoting an integrated approach to water usage and water resources management. Such an approach, earlier discussed in 8.3.1.3, would involve the two TAs whose villagers cultivate in the WIS (2.6.7). The two TAs would appoint a committee to look into issues of water management. This would be a viable institution for water management considering that when upstream and the WWUA had disagreements on water abstractions, the TAs managed to settle the disputes (5.4.1). This is also supported by experience from Nepal where, in spite of farmers having several strategies for resolving water issues such as water disputes, favorable outcomes were achieved when community leaders worked together and established good relationships (Bruns and Meinzen-Dick 2000). This underlines the importance of incorporating management or dispute resolution mechanisms which are locally and culturally relevant into the irrigation system's arrangements.

8.3.2. Water governance at Wovwe

The way water affairs are governed by different societies has a key bearing on how those societies secure or support their livelihoods (Tropp 2007). As such, the key objective of water governance is to create an institutional and administrative framework which allows different stakeholders with diverse and differing interests to peacefully discuss issues and coordinate their actions (Rogers and Hall 2003). The discussion of the reform and water focuses on who has the right to water and/or its benefits, whose voice influences water decision-making, who gets what water, and how and when is water accessed. This brings into spotlight water institutions, processes of management and practice (Franks and Cleaver 2007), and water access negotiation (Bruns and Meinzen-Dick 2001).

8.3.2.1. Water governance institutional set-up

The Wovwe case shows that the main institutions of water governance include both organizational or institutional establishments and the enabling environment which comprises policies, legislation and mechanisms for participation. Figure 8.3 summarizes the governance system at Wovwe in relation to the Franks and Cleaver (2007) Water Governance and Poverty Analytical Framework. The government, water user organizations, and the traditional leadership are the main institutional establishments. The government, through the Ministry of Irrigation and Water Development, provides policy direction on water resources management and use. Unfortunately, the low proportion of households (about a third) who reported to have ever heard about the National Irrigation Policy (Figure 6.1 section 6.2.3.2), and acknowledged the importance of the policy to their livelihoods; indicates that most of the local people are not aware of what is happening. This, combined with another very large proportion of households (11.2%) who are not aware of organizations responsible for water access (6.2.3.1), indicates that the farming households are uncertain about who is responsible for water resources.

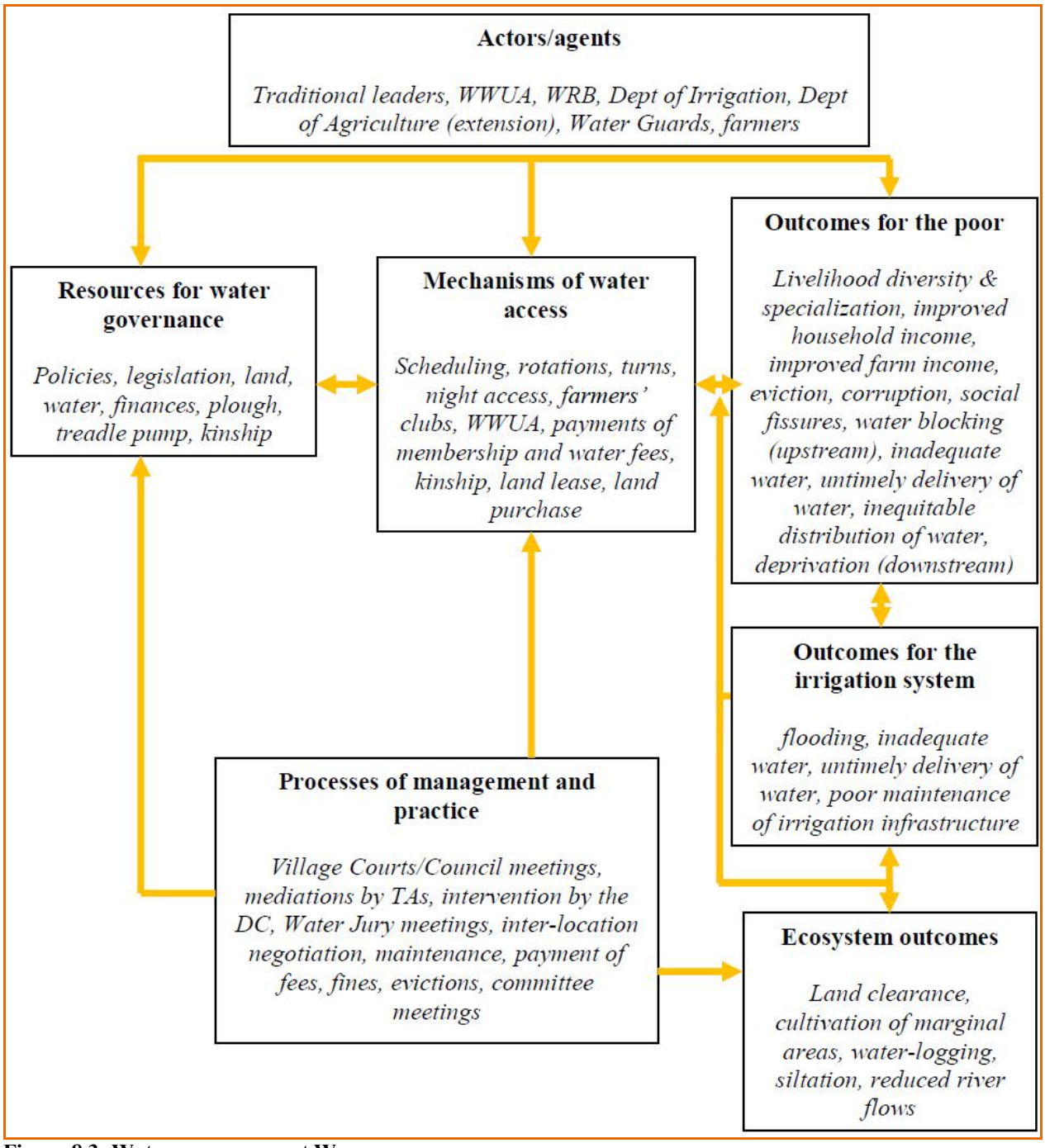

Figure 8.3: Water governance at Wovwe

The implications of this uncertainty are huge and suggest that the farmers cannot participate in the water governance decision-making. This indicates that the water governance system is neither inclusive nor communicative (Rogers and Hall 2003). Such a situation is also unproductive to the implementation of the reform as some important stakeholders may not be recognized for participation in decision-making. The consequence is that it becomes difficult to establish clear and proper roles for all stakeholders, hence affecting the legitimacy of the local organization (Norton 2004)

Furthermore, water users themselves, through farmers' clubs and committees, are also an established institution responsible for water governance. Farmers clubs (in the case of informal irrigators) and committees of the WWUA (for formal irrigators in the WIS) have the responsibility for water governance. Informal irrigation expansion has resulted in corresponding formation of farmers' clubs whose meetings provide valuable forums for farmers to voice their concerns and participate in the club's governance system. Similarly, farmers in the WIS use their lowest governance establishments i.e. Unit Committees or forums to discuss irrigation issues. Small governance units are, thus, an effective means of ensuring that the voices of farmers who are not in higher decision-making committees including the illiterate at the lowest level have a chance of being heard (GWP 1999). While such a governance system may be considered to be participative (Rogers and Hall 2003), the question is whether decisions at such a low level can influence decisions of the main committee. The case of the WIS suggests that at least a channel of taking these decisions or concerns to a higher level exists (4.4.2.11) as Unit Committees channel their concerns to the WWUA Executive through Block Committees.

The traditional leadership also plays a very important role in water governance at Wovwe, particularly on issues of access to water and land, and resolution of conflicts (5.5.7). If irrigators outside the WIS have disagreements or conflicts in running their affairs, they refer the issues to the village courts (2.6.2.1). Similarly, the running of the WIS by the WWUA relies on traditional leadership particularly in resolving witchcraft conflicts among WWUA members, and mediating between the WWUA executive and its members in cases of disagreements or dissatisfaction on issues such as plot allocation and general management system of the WWUA executive (5.5.7). This arrangement is beneficial to farmers because if they fail to get justice from farmers' clubs or the WWUA, they seek traditional means of resolving the issue. Alternatively, if irrigators in the WIS are unsatisfied with the way the WWUA executive is running the affairs of the scheme, they have a chance of referring the matter to the District Commissioner who has powers to intervene in such issues (2.6.3.1 & 4.5.6).

The involvement of traditional leadership suggests two important aspects of governance at Wovwe: 1) farmers have an option of appeal in cases where they are not satisfied with the

verdict or operations of their organization; and 2) traditionally or culturally relevant means of resolving irrigation conflicts have a significant role in both formal and informal irrigation. These aspects show that the governance system provides for accountability by ensuring that mechanisms for arbitration are in place and operational (Rogers and Hall 2003). The advantage is that decision-makers can be held accountable to their members for any decisions they make and actions they take. Furthermore, although there were no reports of practically engaging conventional courts, the provision of doing so (5.5.7) is a major step forward towards justice and ensuring equity.

8.3.2.2. Water rights and water access negotiation

The importance of properly allocating water is highlighted by the fact that the resource is repeatedly subjected to multiple users resulting in areas which once enjoyed water abundance currently facing increasing challenges of how to deal with conflicting claims for the resource (Bruns and Meinzen-Dick 2000). The fact that water is a finite resource implies that the use by one user affects the use of the other (Gardner *et al.* 1990; Bruns and Meinzen-Dick 2000) and makes reforming water allocation imperative if access can be considered to be fair. This can be achieved by understanding how water rights work practically at the local level (Bruns and Meinzen-Dick 2001; Bruns 2005).

Water rights at Wovwe include both conventional and customary rights (6.2.2.1) which in their implementation can either be operational-level or collective choice-level rights (2.3.2.2). The Water Resources Board (WRB) is the government body responsible for ensuring that the use of water, particularly for formal irrigators, is practiced according to the conventional water rights system which sets the legal basis for the WWUA to determine who gains access to water (4.2.3.1). Schlager and Ostrom (1992) call these rights collective choice-level rights (2.3.2.2). However, the situation at Wovwe reveals that the WRB implements the water rights system for formal irrigators only in the WIS. Even with WIS, the WRB only collects water fees as there were no reports of the involvement of the WRB in dealing with water shortages and abstractions (6.2.2.2). While the system forms a legal basis for the WWUA to demand payment of water fees by every member, it equally puts farmers in WIS at a disadvantage, particularly in relation to upstream users who practice informal irrigation diverting water from the same river without any obligations. This reveals an important weakness in the application of two separate systems of water rights on a single resource. The system has negative

implications to both the state of water resources in the Wovwe River and agricultural productivity of the WIS. The former has extended implications even to other natural systems. With regards to water governance, this shows that the approach of the governance system is neither coherent nor integrative (Rogers and Hall 2003) as it lacks harmony in its implementation of the rights, and fails to recognize impacts resulting from the systems on other users (2.3.2.1).

This presents a very strong case for the need for negotiating water access by different users. Water users at Wovwe negotiate their access to water through three main approaches: making agreements; community or village forums; and participation in decision-making. Water users in WIS, through the WWUA, make agreements (5.3.1) with the WRB on water usage which means that farmers in the scheme pay for the water they use and the WRB protects farmers' water interests. However, the WRB is not able to safeguard the rights of its members as seen in this study (5.3.1). Or, by enforcing its obligation, the WRB may negatively affect the livelihoods of local households who are also lawfully utilizing their customary rights.

While the rights system assigns water an economic value (Rogers *et al.* 1998), which is fundamental in sustainable water resources management, its selective application reverses or slows the achievement of sustainable water resources management gains. Water users upstream, who do not even pay for water, use customary rights to access water and in times of water scarcity, block the water flow. This not only deprives paying users, but also affects the stream flow downstream which is crucial for the health of ecosystems (GWP 2000). The problem lies in the use of two different rights systems on the same resource while trying to achieve the same results. The recognition of both formal and informal (customary) rights by the country's legal instruments needs to spell out clear procedures of resource utilization and harmonization of their use. Effective negotiation of water access would, thus, be an important strategy for water users in the Wovwe River catchment considering that negotiations yielded useful results in a similar situation in southern Sri Lanka where farmers from old and new irrigated areas negotiated mechanisms of water distribution in times of water scarcity (Bruns and Meinzen-Dick 2000). Similar to the Sri Lankan case a committee with strong user representation would be set to negotiate rules of water access. The committee should be supplied with adequate technical information from government about hydrological and

irrigation parameters. With the current absence of hydrological monitoring at Wovwe, reintroducing such monitoring activities would be imperative.

Furthermore, like in most African countries, water access at Wovwe is connected to land tenure (Shah *et al.* 2002). Water users without land depend on both social and financial capitals to access water to make fruitful agreements (5.2.2.3). This implies that the landless, without landowning relatives, find it harder to support their livelihoods than those with land or with relatives owning land. In order for the irrigation reform to deliver on its objective of improving the economic status of all the rural poor (Vermillion and Sagardoy 1999; Shah *et al.* 2002), deliberate measures which target the poor landless need to be introduced. Such measures may include the introduction of land ownership schemes where the government buys land from those with surplus land and redistributes it to the landless. Such schemes should adopt the government scheme of ***"Kudzugulira Malo Project"*** implemented in the Southern Region of the country (see 2.6.4) but here within the same area in order not to trigger other social and cultural issues (4.5.2). The way water users negotiate access to water through land tenure shows how complex the issue of water access is and strengthens the need for a coordinated approach for dealing with water problems (8.3.1.4).

8.4. Sustainable rural livelihoods

Irrigation management transfer is assumed to stimulate crop diversification and to significantly improve food and livelihood security (Shah *et al.* 2002) (2.2.3.2). Also, the World Commission on Environment and Development (WCED 1987) notes that some of the key factors enabling households to gain sustainable livelihood security include ownership of assets such as land, livestock, etc; rights, and engagement in diverse livelihood activities (2.4.4). Hence implementing irrigation reforms alone does not necessarily mean that the IMT assumptions will be met. Experience from Wovwe shows that other factors, such as social and cultural issues left behind by former establishments, population growth and accompanying land pressure, weather and climatic events, and persistent livelihood strategies, all must be considered.

8.4.1. Livelihood diversity

Contrary to Garces-Restrepo's *et al.* (2007) observation of international experience about implementing IMT, there is an insignificant contribution of IMT to livelihood diversity at

Wovwe (7.3.3.2). This means that rural households have only farming as their primary means of earning a living. The implications of this are that increased land area is being put under farming, and that the demand for water to support expansions in farming is increasing. This is detrimental to sustainable management of land, water and related environmental resources. In times of unfavorable climatic conditions and other shocks such as poor markets for farm produce, this further implies that households are incapable of spreading risks to their livelihoods. Considering the main objectives of establishing irrigation schemes in Malawi (2.6.6.1), it would be vital if the reform deliberately supported other non-farm livelihood activities such as small scale businesses in order to revive the government's objectives of stimulating rural development.

Furthermore, an examination of the livelihood strategies reveals that a majority of the strategies are dependent on natural resources and related to agriculture, confirming the description by the MNVAC (2005) of the Nkhata Bay Cassava Livelihood Zone (see 2.6.8.1). While this may mean that any shock to the agriculture sector makes vulnerable the entire livelihood system of the communities, it may also, on the positive side, mean that one household's endowment of resources or expertise in agriculture can be beneficial to others, particularly in cases where farmers work in groups. Additionally, nature-dependent livelihoods at Wovwe support Lankford's (2003) findings in Tanzania that communities base their living around diverse strategies which are, in one way or another, dependent on natural resources.

From an environmental point of view, the existence of agriculture-dependent livelihoods means that communities still depend on natural resources for their survival which translates into significant pressure on the environment resulting in potential conflicts for resources between users (Ellis 2001). This may explain farmers' opinions that water distribution is more inequitable in the reform period than was the case before the reform (7.2.8) and, the apparent existence of competition for water between the upstream informal irrigators and the downstream farmers in the WIS (4.5.4) – particularly when there are water shortages. With the improved farmers' patronage in the WIS (7.2.3), increased informal irrigation (7.3.2.1), and increased frequency of dry spells or droughts (6.2.6.2), water shortages and alleged inequity in water distribution in WIS are likely to be exacerbated.

In terms of policy reform, this suggests that implementing reform strategies which support irrigation expansion requires deliberate and thorough assessment of resources such as water and land; otherwise the natural resource base on which livelihoods depend, will be unsustainably utilized. Practices prevalent at Wovwe e.g. developing informal irrigation systems along the river banks and grazing livestock in marginal areas reveal unprecedented pressure on natural resources to support traditional livelihoods. Improved household economic status (7.3.1.2) and increased number of non-farm activities (7.3.3.2.1) in the reform era suggest that households are focused on improving their economic wellbeing. Additionally, the high demand for land in the irrigation scheme further suggests that the scheme is at the centre of people's livelihoods in the area, hence, meeting one of the key preconditions for successful implementation of IMT (Vermillion and Sagardoy 1999; Shah *et al.* 2002; also see 2.2.3.2).

8.4.2. Livelihood diversity and household income

The growing number of livelihood strategies has an influence on household income for villagers along the entire Wovwe River catchment. There is a positive correlation between the number of livelihood strategies a household engages in and the state of household income (Pearson Correlation = 0.130, p = 0.005, N = 473). Despite farming dominating financial contribution to the total household income, an increase in livelihood activities results in improved overall household income. It may confirm claims that households engage in pull diversification (Ashley *et al.* 2003) once their economic status is improved (2.4.3). Such a development shows that unlike the general trend within the Nkhata Bay Cassava Livelihood Zone, households at Wovwe are more likely to realize their income from several other livelihood activities than other households from the rest of the zone who just rely on the sale of food crops (2.6.8.1). The implication is that though the zone is classified by the MNVAC (2005) as 'food rich' but 'cash poor', deliberate introduction of programs which are aimed at improving the socio-economic status of the rural poor may play a significant role in transforming 'cash-poor' locations into a 'cash-rich' status.

Nevertheless, while more households are engaging in multiple livelihood strategies, the diversification ought also to be examined with respect to its contribution to the household's total income apart from simply the number of livelihood strategies (Ellis 2000a; Ashley *et al.* 2003). The contribution of several strategies to overall household income shows that farming

is the dominant contributor to total household income across all locations in the study area (see Table 7.20 in 7.3.3.3). The diversity indices (I-HHI) also present a similar story (see Table 7.21). It could, thus, be argued that there is still room for improvement in the performance of the reform at Wovwe, particularly with regards to improving the economic status of rural households by stimulating the growth of multiple livelihood strategies.

8.4.3. Livelihood diversity and the environment

While the dominance of the contribution of farming to the total household income (7.3.3.3) may indicate the importance of natural resources i.e. land and water in sustaining people's livelihoods, it may also imply that more land including land along the river banks is cleared for agricultural purposes. This consequently leads to erosion and flooding of low-lying areas including irrigation establishments. Coupled with population growth (2.6.4 & Figure 7.26) and extreme climate events, this may explain the opening of extensive farm lands along the river (Figure 4.1) and consequent flooding even in WIS (7.3.4, Figure 7.27).

The important lesson for governments, policy makers, and development professionals is that when designing and implementing policy reforms, the landscape of existing livelihood strategies needs to be fully understood in order to be able to determine the direction the reform would take with regard to new livelihood strategies arising from the implementation of the reform. By doing so, the reform would ensure sustainable utilization of the natural resource base and positive contribution to poverty reduction efforts.

However, the existence of the large number of livelihood activities also implies that there is potential to move rural communities from heavily depending on natural resources to other economic activities which are less dependent on natural resources than traditional ones. However, for any successful adoption of new livelihood activities, provision of appropriate and adequate support for the new activities would be essential. An examination of livelihood strategies employed by households at Wovwe in the reform period (Table 7.17) shows that communities are also diversifying into other activities which are non-farm in nature. Such diversification, as noted by Ellis (2000; 2001), has positive implications on the way natural resources and the environment are being managed:

1) engagement in non-farm-dependent businesses may reduce pressure on natural resources;

2) by spending time on other activities such as business, households would effectively reduce the time they spend on farming, hence reduced agricultural extensification (less new land will be brought under agriculture; and
3) by diversifying their livelihoods, households effectively increase the number of sources through which they can earn money. In cases where increased number of income sources also result in increased household income, Ellis (2001) reports positive implications on the use of natural resources. For example, households which before diversification relied solely on firewood as a source of energy just because collecting firewood was free, they, with relatively better economic status from increased income sources than before, can substitute firewood for paraffin as a source of energy.

Although farming dominates in contributing to households' overall incomes, the recent trend in diversification is promising towards sustainable management and utilization of natural resources.

8.5. Balancing water-livelihood concerns

One of the concerns for integrated water resources management (IWRM) is that it is counter-productive to both the poor and natural resources by not directing efforts to improve livelihoods at its centre (Merrey *et al.* 2004). This implies that balancing water-livelihood concerns would be crucial for both livelihoods and water as a natural system. Communities are faced with the challenge of either taking on board the concerns of water as a resource or utilizing the resource for livelihoods. Three main factors come into play i.e. population pressure, leadership in environmental management (including institutions), and changing climatic events (dry spells, droughts, flooding). The rise in population means that more land will be used for agricultural purposes implying clearing of forests and more water abstractions. The consequence is that while concerns for livelihoods are taken on board, water resources are being depleted resulting in massive soil erosions, siltation of the river – causing further floods and destruction of crops, and water shortages due to high levels of water abstractions. Eventually, even livelihoods are destroyed. In the absence of responsible leadership e.g. appropriate institutions to enforce policy and legislation in environmental management, a vicious cycle emerges perpetuating damage to both livelihoods and the environment.

Furthermore, as irrigation in the WIS continues in the state of dynamic equilibrium (see stage C of Figure 8.4) (Lankford 2003), water problems cease to be confined to a single location i.e. only upstream, downstream, etc (see 2.4.5 for description of the stages in Figure 8.4). But rather, the use of water in one location affects or is being affected by others in other locations. In this regard, balancing water-livelihood concerns requires that interdependent users in the entire river basin coordinate the use and management of water resources. Where this is not done, consequences are similar to water conflicts reported earlier on (4.5.4).

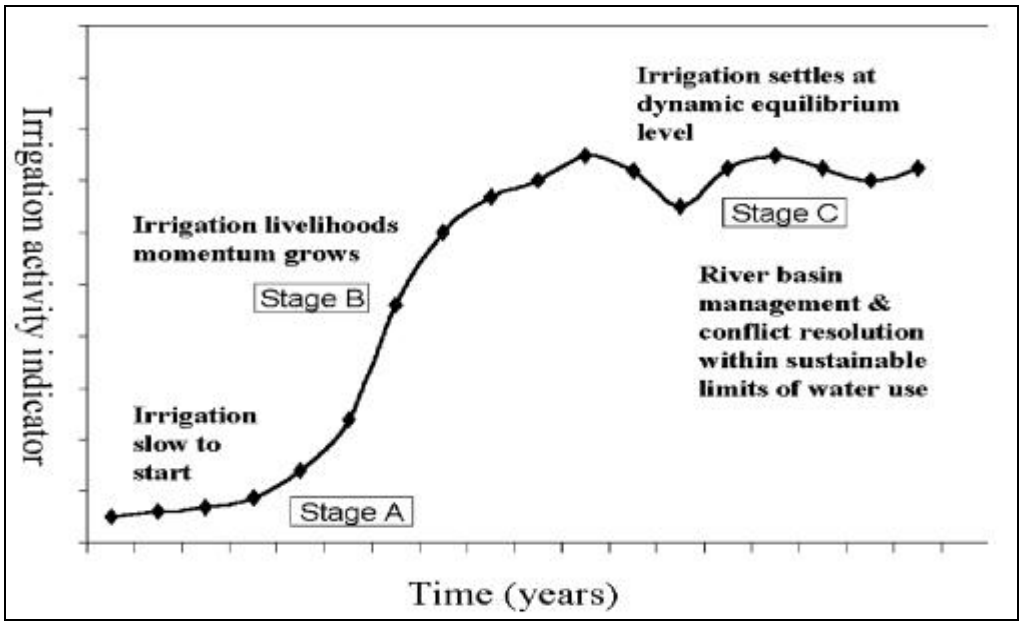

Figure 8.4: Lankford's sigmoid curve showing trends in irrigated livelihoods in a river basin
Source: Lankford (2003)

Moreover, any planning, development, or improvement of irrigation systems, should recognize that irrigation systems are not a one-place predicate, but rather exist in relation to other systems or sectors – sometimes in water-scarce environments. In such cases, maximizing output from irrigation must take into consideration the demands of other systems or sectors. Unfortunately however, maximization of irrigation potential through irrigation expansion in Malawi, especially at Wovwe where the same river supplies water to the WIS and is also being relied upon for further irrigation expansion, appears to overlook other important areas such as land availability, existing livelihoods and usage of water, sectors, and ecosystems. In this regard and drawing from Lankford's (2003) curve (Figure 8.4 above), in order to balance water-livelihood concerns, irrigation policy reform should be informed by a thorough analysis of issues common with multi-sectoral and multi-user environments. Based on the Wovwe case, such issues may include:

- spatial and temporal availability of water across the river basin;

- managerial capacity (including financial and technical capacity) of the recipient WUA (with regard to IMT);
- local social and cultural settings within the basin including historical perspectives;
- the degree to which locals depend on the irrigation system and/or the water resource;
- the range of water users and uses;
- existing social groups dependent on water and/or the irrigation system;
- institutions of water management and governance, and their effectiveness;
- power relations and conflict resolution; and
- local, irrigation, and water governance systems.

8.6. Recommendations

In view of the findings and the preceding discussion, this study recommends the following for successful implementation of irrigation reform:

For the government

1. The government should consider revisiting programs of irrigation expansion particularly in areas where both formal and informal irrigation use water from the same source. Extensive development of informal irrigation may be costly to irrigation sustainability and/or productivity in formal irrigation establishments such as WIS, hence defeating the very aims of government for adopting the IMT approach.
2. The government should introduce legislation which should clarify how customary and conventional water rights should be utilized in cases where users use different water rights systems. The legislation should charge the Water Resources Board with the responsibility to harmonize the enforcement of customary and conventional water rights and coordinate their implementation. Doing so will support the government's efforts to enhance socio-economic status of its rural communities through irrigation (both formal and informal).
3. The government should establish institutions such as the Catchment Management Authorities (CMAs) to initiate and coordinate water management programs across the entire river basin. This will ensure that water and related resources are sustainably managed. Establishing CMAs will require only government commitment in terms of resources since their establishment is already provided for by the Irrigation Act (GOM 2001).

4. The Department of Irrigation (DoI) should resume taking hydrological measurements for the Wovwe River as this is crucial for informed planning of irrigation expansion and appropriate water access negotiations among different water users across the river basin.

For the WWUA

1. With the current allegations of financial mismanagement, the WWUA assembly should elect new executive members to replace the suspended one. This will be an important step towards gaining legitimacy.
2. There 'new WWUA executive' should be regularly reporting financial matters to its members (e.g. at the end of every farming season) in order to restore trust from its members.
3. There is need for the WWUA to shed-off some of its responsibilities which do not have any direct link to irrigation and water resources management. Notable responsibilities to be shed-off include those relating to health and sanitation which are already being carried out by the government. Doing so will release some resources the WWUA uses for these activities for use on irrigation, and will also take-off unnecessary burdens which currently overwhelm the association.
4. Although one of the objectives of adopting IMT is achieving environmental sustainability, the WWUA's involvement in environmental management programs is minimal. The WWUA should consider environmental management as a priority if this goal is to be achieved.
5. The WWUA should initiate dialogue with surrounding villages (Village Heads) on establishing a coordinated approach for the management of water resources in the Wovwe River and the surrounding environment. Involving traditional leaders will help the WWUA to restore control of the land between the two irrigation systems which falls under its jurisdiction and, to implement environmental management programs in the area.

For the government and the WWUA

1. The government and the WWUA should jointly initiate and implement capacity building programs (financial, technical, and management) for the WWUA.

2. The government and the WWUA should, in the current pilot phase, be working together on some aspects of irrigation maintenance which require specialized technical knowledge and considerable amounts of finances e.g. dealing with flooding in the irrigation scheme, and maintenance of the headworks.

For the WWUA and local communities (traditional leaders)

1. In order for irrigators in the WIS and informal irrigators outside the WIS to solve their water problems amicably, there is need for the WWUA and informal irrigators to establish a coordinated approach towards water access and management. Such an approach should be established at the Traditional Authority's level in order to utilize the authority of the TA over both parties. Either the Area Development Committee (ADC) (2.6.3.1) or a separately instituted committee should be charged with the responsibility to carry out the coordination work. The committee should be under the direct guidance of the TA. Doing so would ensure the utilization of socially and culturally-relevant mechanisms for water resources management and access and harmonizing the implementation of water rights using locally available establishments. The study by Anthony *et al.* (2010) in South Africa show that adopting natural resources management and governance approaches which are locally embedded is critical for achieving good natural resources governance. Furthermore, studies in Malawi show that approaches which involve traditional chiefs are critical in achieving sustainability of natural resources management and livelihoods (Russell and Dobson 2011). They conclude that achieving sustainability of fisheries and natural resources requires a combination of both formal and informal institutions with the facilitation of local chiefs.

8.7. Summary

This study shows that the assumptions and expectations of implementing IMT cannot be generalized. While the context in which the reform is taking place is crucial, several other specific conditions, some of which are contradictory, have to be met if the reform is to yield positive and expected results. Some of the main factors worth consideration when implementing IMT and implementing irrigation expansion policy may include:

- the nature of the irrigation system under transfer;
- effective institutions of water governance;
- striking a balance between several water objectives;

- understanding categories of water users depending on water from the same source the irrigation system under transfer depends;
- the role the water source, especially the river, plays in the entire basin;
- livelihood strategies of water users across the entire basin – what stakeholders depend on for their livelihoods (both main and supplementary livelihood strategies);
- proper diagnosis of problems affecting the irrigation system before the transfer; and
- understanding social and cultural aspects relating to farming in the area.

Irrigation sector reform influences rural people's economic status and offers an opportunity for sustainable natural resources management. However, there is need to balance the concerns of water as a resource and water as a raw material for livelihoods if sustainability of livelihoods and water resources is to be achieved. Deployment of an approach which takes on board concerns of multiple stakeholders appears to be a sound proposal for achieving sustainable water resources management and rural livelihoods. Furthermore, there is need to have functioning water management institutions at the river basin level to ensure proper planning for utilization of the water resource.

9. CONCLUSIONS

9.1. Introduction

The dissertation has presented the results of the research in chapters 4 to 7, and discussed the findings in chapter 8. In this chapter, the dissertation summarizes findings by (i) briefly outlining how the research has resolved the research problem, (ii) highlighting practical and theoretical contributions of the research, and (iii) suggesting avenues for further research.

9.2. Resolution of the research problem

Primarily, this research aimed at addressing the research problem: "*How is the recent irrigation reform in Malawi influencing water resources management and governance, and rural livelihoods in the Wovwe River catchment?"* Based on the findings, the dissertation argues that the achievement of the stated objectives of irrigation sector reform cannot simply be guaranteed by mere reform, but requires deliberately taking into account several other factors some of which appear contradictory. Critical factors include spatial and temporal variations in water availability across the river basin, the capacity of recipient farmers' organizations, social and cultural aspects, historical perspectives of the transferred irrigation systems, demographics, and balancing water-development concerns.

The reform at Wovwe, while achieving reductions in financial and managerial burdens on the side of government, negatively affects local poor farmers because of the drastic withdrawal of government support without ensuring that local organizations have first acquired enough capacity to manage the irrigation system. The reform has not managed to induce diversification of livelihood activities; hence farming is still the primary livelihood strategy for households in the Wovwe River basin. However, there has been an improvement in financial benefits farmers realize from the farming. The dominance of farming implies that households practice agricultural extensification which has profound consequences on the state of environment as it leads to more land being cleared for agricultural purposes. This is the case at Wovwe where massive deforestation is resulting in flooding and high silt loads in the river and water-logging even in some sections of the WIS. Unfortunately, the WWUA has inadequate capacity to deal with such problems including the consequent deterioration of irrigation infrastructure.

Since one of the major issues in irrigation is water access, establishing sound water rights systems is essential if improved agricultural productivity is to be achieved. Based on findings from Wovwe, this thesis strongly recommends that implementation of irrigation reform should clearly specify the water rights system and the mechanism of enforcement, especially in cases where irrigation expansion is a priority and is implemented alongside IMT. This becomes especially important where one river supplies water to multiple users who access water using different rights systems e.g. customary and conventional rights. If not sorted out, spatial variations in water availability across the basin becomes a recipe for water conflicts between upstream and downstream users as is the case at Wovwe. It is, therefore, crucial for governments to clarify how customary and conventional water rights should work in a single river basin to ensure equitable and timely delivery of water to users. Alternatively, users across the basin may adopt context-specific water access and negotiation arrangements which are socially and culturally relevant. This highlights how complex it is for IMT to meet its objectives where a single water source is subjected to multiple users who access water by using different and unharmonized water rights systems.

9.3. Research contribution

This study makes profound contributions to research methods, theory, and policy and practice not only for Malawi but also for the sub-Saharan Africa, the developing world, and even the global food and water policy at large. This study is ground-breaking in its scope and nature. It is the first of its kind that combines different methods to understand the performance and impacts of the reform, combines both formal and informal irrigation, and takes a basin-wide approach. Its originality offers in-depth and rich contributions to irrigation reform, water resources management, and food production for the ever growing human populations.

9.3.1. Contributions to scope of research

While several studies on performance and impacts of IMT of the environment dwell on assessments of soil salinity and water-logging which are also done in part (Vermillion 1997), this study further incorporates water governance which is crucial for the performance of IMT especially with regards to environmental sustainability and improved livelihoods and socio-economic status of the poor. Internationally, numerous studies have been conducted and worldwide assessments of the performance of irrigation reform made (see Vermillion (1997) and Garces-Restrepo *et al.* (2007) for worldwide assessments of the performance and impacts

of IMT). This study is unique in that unlike previous studies, it does not only investigate common reform outcomes (i.e. performance of WUAs, O&M costs, quality of maintenance, revenue, and water delivery) and impacts (i.e. irrigated area, yield, farm income, soil salinity and water-logging) (see Garces-Restrepo *et al.* (2007)); but also critical, but often neglected, factors for the success of the reform such as interrelationships between the reform and people's livelihoods, water management and governance, relationship between farmers and their organizations, and adopts a basin-wide approach.

By widening the scope of the investigation beyond the irrigation system under transfer, the study provides an important window for understanding factors contributing to either success or failure of the reform. By doing so, the study avoids erroneous attribution of success or failure of the irrigation system to the reform as intervening variables are better understood and identified in an all-encompassing approach than when the study is restricted to an irrigation system.

9.3.2. Methodological contributions

This study combined multiple methods of data collection and analysis making it rich in providing quality information for both policy and theory. This is unlike international experiences as revealed by Vermillion's (1997) assessment of 29 studies conducted across the globe. His assessment indicates that most studies heavily rely on only secondary data and lack systematic sampling. Consequently, they fail to produce reliable information to inform IMT and policy and, their findings cannot be generalized hence rendering them of limited use. By adopting several methods and executing appropriate sampling procedures, this study addresses weaknesses identified in earlier studies and hence supplements the body of knowledge in irrigation and water resources management, among others. Furthermore, the adoption of methods from other disciplines e.g. I-HHI from economics, the study recognizes and underlines the fact that environmental problems are cross-disciplinary in nature and hence, their appropriate solutions can be found if studies employ multi-disciplinary approaches.

Furthermore, the research uses the Franks and Cleaver's (2007) Water Governance and Poverty Analytical Framework to understand the inter-linkages between people's social economic status and the natural environment while integrating government influence through

policy. This provides a wholistic approach in dealing with the vicious cycle perpetuated between poverty and natural resources management.

The study shows that using multiple methods in investigating the influence of policies on both the environment and society offers invaluable insights for achieving development while highlighting environmental and socio-economic concerns. The methodology used in this research could be adopted by studies in other countries particularly those implementing similar irrigation reforms to Malawi. Equally, the results could be used in other countries, mainly those whose economies are agriculture-based – most of which are in sub-Saharan Africa, and have similar economic, climatic, and technological conditions to Malawi.

9.3.3. Irrigation reform and Malawi

Although nearly a decade has passed since Malawi adopted IMT as a form or irrigation reform, there are no known studies yet on the performance and impacts of IMT. The few studies which were conducted focused on the transfer process, land use, and extension services (Chirwa 2002; McCracken 2002; Nkhoma and Mulwafu 2004; and Ferguson and Mulwafu 2005). This study goes further by providing an in-depth assessment of the direction of the reform, performance and impacts of the reform on the environment and rural people's socio-economic status. It examines side-by-side seemingly contradictory implementation of government efforts to ensure food security and enhance economic status of its rural people through expansion of irrigation (e.g. informal irrigation and the Green Belt Program) and reforming public irrigation.

By doing so, the study provides invaluable information to the Malawi government on how to proceed with the reform. This is particularly important because IMT in Malawi is still in a pilot phase. Findings will, thus, inform the transfer taking place in the other two public irrigation systems which are also undergoing the transfer on a pilot basis (1.3 & 3.2.4). Additionally, since the transfer at Wovwe is done on a pilot basis, these findings will also inform the yet-to-be initiated transfers of the remaining thirteen public irrigation systems listed for transfer (4.2.3.1). Furthermore, since the government is also expanding irrigation by supporting informal irrigation (4.3.1), findings of this study will assist the government in making informed decisions and changes (where appropriate) on how best to integrate irrigation expansion in river basins where both formal and informal irrigation are practiced.

Besides contributions to the reform, the study is crucial in shaping the Malawi food and environmental policy. By identifying agriculture-related practices which result in unsustainable environmental management, the study offers the government invaluable information which can positively shape the direction of irrigation development and ensure environmental sustainability, food security for its growing human population (5.2.1.2), and enhanced economic status of the rural poor through improved agricultural productivity.

9.3.4. Contributions beyond Malawi (regional and global food and water policies)

Beyond Malawi, this study will be useful across the African continent which is characterized by underperforming smallholder irrigation schemes (Shah *et al.* 2002), and also to other parts of the world which will strive to secure water for food production to meet the needs of growing populations (GWP 2000). Particularly, the study will be useful to the sub-Saharan Africa region whose smallholder irrigation context differs from contexts in other parts of the world where IMT works and is sustained (Shah *et al.* 2002). The Malawian context is similar to that of other sub-Saharan African countries i.e. seasonal rainfall, intermittent dry spells, recurrent drought years, dwindling per capita landholding due to high population growth rates, depletion of rivers supporting irrigation, vulnerability to impacts of climate change, low rate of technological adoption, political landscape, etc (Rothert 2000; Falkenmark and Rockström 2004; Rockström *et al.* 2007) (see 2.3.1).

Global challenges of population growth and climate change mean increased demand for food and result in several countries turning to irrigation as a strategy for ensuring food security. The implication is the increase in the use of water and land resources (Gordon *et al.* 2005) with worse implications to developing countries where agriculture is a catalyst for economic development and hunger and poverty are closely linked (World Bank 2003; Rockström *et al.* 2007). This study provides insights into how irrigation reform can be instrumental in meeting economic and food demands while ensuring sustainability of the natural resource base and irrigation systems themselves.

With current global statistics painting a gloomy picture with regards to water and food availability, i.e. rising demand for agriculture water (Gordon *et al.* 2005), rapid population growth, rising water withdrawal rates, and increased water scarcity (GWP 2000); this study

highlights context-specific water resources management approaches for sustained food production. This would help to shape policy and legislation on water resources management and agriculture water usage. The study outlines key factors which should be taken into account when designing and implementing irrigation reform or expansion programs:

- there is need to have a clear understanding of the nature of the water source to be utilized i.e. variations in water availability in time and space;
- it is crucial to understand existing livelihood strategies which communities to be affected by the reform follow;
- equally important are social, cultural, and institutional influences to the reform; hence understanding the range of water users and their power, influence, and interest in the reform or expansion across the river basin is essential;
- appropriate policy and legal frameworks to support irrigation expansion or reform should be put in place. These should clearly address issues of water rights, conflict resolution, etc; and
- local organizations to manage irrigation systems after the reform should have adequate technical and managerial capacity before irrigation systems are handed-over to them.

9.4. Further research

One of the results highlighted in this research is that Traditional Authorities play a crucial role in negotiating water access between conventional rights holders in the WIS and customary water rights holders outside the WIS. Follow-up research, in this respect, would be crucial in understanding how traditional leadership could be utilized in implementing IWRM at local levels. Other avenues for further research include:

- research of the same nature in the remaining two irrigation schemes also under pilot transfer;
- understanding the performance of the reform after the reform process is over with clear before and after conditions;
- investigating locally-relevant ways which communities can utilize where both conventional and customary rights systems exist;
- research into possible alternative livelihood strategies that local communities could adopt as a way of reducing pressure on the natural resource base; and
- a more comprehensive exploration of the vulnerability of communities to extreme climatic events such as floods and dry spells/droughts.

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APPENDICES

Appendix 1: Sampling of respondents from the Wovwe Irrigation Scheme

Since the size of the scheme is 365 ha, each plot is 0.1 ha, and the total number of farmers is 1500, the study calculated the total number of plots (3650 plots) for the whole scheme and then calculated the average number of plots each farmer held. On average, each farmer held 2.5 plots which according to the scheme layout is 1.5 lines. Each line is equivalent to two plots. Moving systematically from one respondent to another, the interviewer needed to know how many lines to count to reach the next respondent. This interval, which I have termed 'line interval', was calculated by dividing the number of lines per Block by the Block sample size. The Table A1A below shows how sampling went for specific Blocks. Taking Block E for example, if the interviewer first interviewed a farmers on position one (1), the next respondent would be the 6.1th farmer (see interval for farmers in Table A1B). This farmer owns the 9.15th line of the field (see line interval for Block E in the Table A1A) in a particular location in the Block. Emphasis was put on the location of the field and not the farmer as such. The respondent (field owner) was only identified after the field was located. This ensured that opinions about water governance, access and management were gathered from farmers from different locations from the source of water.

Table A1A: Tabular presentation of sampling in Wovwe irrigation Scheme

Scheme Component	**Wovwe I (514 farmers)**										**Wovwe II (986 farmers)**					
Block	E	L	M	N	P	Q	G	J	R	S	1	2	3	4	5	**Total**
No. farmers	43	53	35	39	69	65		210			214	226	164	243	139	**1500**
No. lines	64.5	79.5	52.5	58.5	103.5	97.5		315			321	339	291	364.5	208.5	**2250**
No. plots / farmer	2.5	2.5	2.5	2.5	2.5	2.5		2.5			2.5	2.5	2.5	2.5	2.5	**2.5**
Sample size	**7**	**9**	**5**	**7**	**11**	**9**		**32**			**32**	**34**	**25**	**36**	**20**	**227**
Line interval	9.15	8.7	10.5	8.4	9.45	10.8		9.75			10.05	9.9	9.9	10.2	10.5	**9.9**

Table A1B: Farmers in the Wovwe Irrigation Scheme

Scheme Component	**Wovwe I (514 farmers)**										**Wovwe II (986 farmers)**					**Total**
Block	E	L	M	N	P	Q	G	J	R	S	1	2	3	4	5	**15**
No. farmers	43	53	35	39	69	65		210			214	226	164	243	139	**1500**
% of total farmers	3	4	2	3	5	4		14			14	15	11	16	9	**100**
Sample size	**7**	**9**	**5**	**7**	**11**	**9**		**32**			**32**	**34**	**25**	**36**	**20**	**227**
Sampling interval	6.1	5.8	7.0	5.6	6.3	7.2		6.5			6.7	6.6	6.6	6.8	7.0	**6.6**

Appendix 2: Informants and justification for their selection

Informant	Number	Reason for selection
Traditional Authorities	2	• Advises ADC meetings • Participate in meetings of the District Assembly • Propose development projects • Set priorities for development activities • Oversee Village Heads
Village Heads Upstream (6) Downstream (6)	12	• Distribute land • Chair VDC meetings • Settle village disputes (through village courts) • Members of ADC and participate in meetings of ADC and the WWUA • Custodians of the land • Propose development projects • Set priorities for development activities
Government officials Agricultural Extension Services (3) Department of Irrigation (2)	5	• Provides policy guidance on water resources, irrigation, and agriculture • Provide irrigation and agricultural technical advice to farmers • Take part in management of the irrigation scheme • Take hydrological measurement of the river • Keep and maintain records of the state of water resources • Produces and implements irrigation and agriculture and food security policies
NGOs: World Vision International	1	• Run development programs which depend on natural resources • Promote sustainable management and utilisation of natural resources • Promote diversification in income generating activities • Assist female- and child-headed households • Distribute seed • Run HIV and Aids programs
Heads and members of farmers' clubs (upstream)	2	• Use water for agricultural production • Head farmers clubs
Fish farmers	2	• Some households fish in the river • Other own fish ponds along the river. Fish are a source of protein and income
Livestock farmers	2	• Herds of livestock are led to the river to drink water. During dry season, livestock farmers use lands along the river as grazing fields since upland they cannot find fodder. This is most common in the upstream and downstream of the scheme
Weavers	3	• Cut reeds for mat weaving • Others earn their leaving through weaving. They

		use reeds that grow along the river for weaving.
Local construction industry: brick moulding	1	• Brick moulding (they use bricks for building their houses and they sell some) • Cut trees for burning bricks
Electricity Supply Corporation of Malawi (ESCOM)	1	• Use the Wovwe River water to generate electricity • Run conservation projects
The Wovwe Water Users Association (WWUA)	4	• The recipient organization of the WIS in the reform period • Responsible for the overall policies of the scheme • Uses water for irrigation • Responsible for the management of the scheme • Settles irrigation disputes among farmers • Collects water and membership fees from farmers • Manages the finances of the association • Responsible for the operations and maintenance of the scheme • Distributes water • Allocates plots
Total	**35**	

Appendix 3: Questions for key informants

Background information

1. Can you tell me something about irrigation faming in this area?

Livelihoods

1. What do people here do to earn their living?
2. What is the main livelihood activity for villagers?
3. What other livelihood activities do villagers practice?
4. How would you compare the range of livelihood activities people have been practicing over time?
5. What do you consider to be the main threat to peoples' livelihoods here and why? What other livelihood threats do people face?
6. What do people do to deal with the threats?
7. In your opinion, what do you think should be done for villagers to effectively deal with the threat?

Water Resources and governance

1. Can you tell me something about the history of Wovwe River?
2. In your knowledge, to what use is the water from Wovwe River being put?
3. Do villagers or water users have water rights? If yes what is the nature of rights?
4. Do you or villagers pay for the water they use?
5. What water management activities are done in this area?
6. How are water management activities implemented?
7. Are all water users involved in water management activities?
8. How are they involved?
9. How does your village organize the use of water?
10. What challenges do you face in organizing the use of water?
11. When using water, do you consider those downstream?
12. How would you compare the volume of water in Wovwe River over time?
13. What water problems affect villagers and users?
14. In your opinion, what are the challenges of sustainable water resources management?

Weather and climate variability

1. Can you tell me something about the occurrence of floods and droughts in the area?
2. How often have floods and droughts been occurring in the area over the recent past?
3. What have been the effects of floods and droughts on peoples' livelihoods?
4. What do people do to sustain their livelihoods during floods and droughts?
5. What do you think should be done deal with the effects of floods and droughts?

Appendix 4: English questionnaire for households and farmers

Questionnaire No.: ……

Respondent's ID: ……..... Interviewer: …...……

Date: …… Time: ……..

Introduction

Hi, my name is …….. I am a member of a team that is conducting research to learn about the influence of the recent changes in the governance of water and management of irrigation schemes on rural livelihoods. Our team comprises an official from the National Research Council of Malawi. We have no any affiliations with the management of Wovwe Irrigation Scheme and/or any donor agency. As such, our research is purely for educational and scientific purposes and is intended to contribute to efforts towards achieving sustainable rural livelihoods in Malawi. We, therefore, are highly interested in your opinion about the influence of changes on rural livelihoods.

Your household was selected randomly from a total population of all ***farmers with plots in the Wovwe Irrigation Scheme/households that are within a distance of 5km from Wovwe River***. I wish to assure you that any information you share with us will not be revealed to any other person or organisation. We will treat all information with **highest confidentiality** and that the information will be used for educational purposes only. The questionnaire would take less than one hour and we would highly appreciate your participation in the study.

In case, after the interview, you happen to have questions on which you need clarification; or you need to know the results of the whole survey, you can contact **Jolly Wasambo** on the following address:

P.O. Box 30745, Lilongwe 3. Tel.: 01 771 550; Cell: 09 683 026

Thank you!

Section 1: Household basic information/characteristics

1. Traditional Authority: …….....
2. Village: …….
3. Gender: [ ] Male [ ] Female (Please tick [✓])

4. How old are you? ..... To which age group do you belong?
[ ] 18 – 29 [ ] 30 – 39 [ ] 40 – 49 [ ] 50 – 59 [ ] 60 yrs & over

5. What is your marital status? [ ] Single [ ] Married [ ] Divorced [ ] Widowed
[ ] Other ……

6. What is the current total number of people in your household? …….....

Children (less than 18 years): Female: ……. Male: ……
Adults (18 years and more): Female: ……. Male: ……

Note: A household consists of a person or group of persons with the following characteristics:

- *those who eat together and share resources, and reside together at least four nights a week at a specific visiting point; and*
- *include live-in domestic workers*

7. Are there any absent household members? [ ] Yes [ ] No

8. Why are they absent?
[ ] seasonal labour migration [ ] education [ ] start own household
[ ] staying with family elsewhere [ ] other ……

9. Do they send you any assistance? [ ] Yes [ ] No *(Skip to 10)*
If 'Yes', what form of assistance? (Please tick all that apply)
[ ] money [ ] agricultural inputs [ ] food stuffs [ ] clothes
[ ] other *(specify)* ……
10. If money, how much do they send you per month/year? ……...

11. When did you start your own household? ……
12. For how long has your family been living in this village? ……..……

13. What is the highest level of your completed education?
[ ] none [ ] some primary [ ] completed primary
[ ] some secondary (JCE) [ ] complete secondary (MSCE)
[ ] vocational [ ] university
[ ] other ……..

14. In terms of your current occupation, how would you describe yourself?
[ ] still at school [ ] employed (civil servant) [ ] employed (other)
[ ] self-employed [ ] retired [ ] farmer
[ ] fish farmer [ ] unemployed
[ ] Other ……..

15. What is the estimated average monthly income for your household (in MK)?
[ ] 1 – 500 [ ] 501 – 1000 [ ] 1001 – 5000
[ ] 5001 – 10000 [ ] 10001 – 20000 [ ] 20001 and more

16. Is your income sufficient for all your household expenses?
[ ] Yes *(Go to section 2)* [ ] No

17. What do you do to sustain your household?
[ ] I rely on donations from well-wishers [ ] I migrate for seasonal labour

[ ] We just have one meal per day [ ] I am assisted by my relatives
[ ] I send some of my household members to relatives [ ] farming
[ ] I depend on assistance from government and NGOs [ ] business
[ ] I forego some of the requirements so that at least we can have food
[ ] Nothing
[ ] Other …….

18. What do you consider to be your main economic activity/ main source of income?
[ ] farming [ ] employment [ ] pension
[ ] business (self-employed) [ ] fish farming [ ] donations
[ ] other ……...……...

Section 2: Land tenure and farm characteristics

Land outside the Wovwe Irrigation Scheme

19. Do you own land? [ ] Yes [ ] No *(Skip to 22)*
20. How big is the land? …… hectares
21. Where is the land located? (tick all that apply)
[ ] Along the river [ ] wetland [ ] upland
22. (a) Do you farm? [ ] Yes [ ] No
22. (b) What labor arrangements do you make when farming?
[ ] own family labor [ ] pay for labor [ ] helped by other family members [ ] own family labor and helped by other members [ ] own labor and payment [ ] own labor, payment, and helped

23. If 'Yes', do you also farm land that you do not own? [ ] Yes [ ] No *(Skip to 25)*

24. If 'Yes', under what arrangement do you use this land?
[ ] lease [ ] borrow [ ] other

25. Do you farm all the land you own? [ ] Yes [ ] No

26. If 'No', what do you do with the land you own and do not farm?
[ ] I rent it out [ ] I use it for grazing animals [ ] I practice crop rotation
[ ] I don't do anything with it [ ] other …….

27. What crops do you grow? Tick all that apply
[ ] Maize [ ] Rice [ ] Groundnuts [ ] Cassava [ ] Tomatoes [ ] Millet
[ ] Cabbage [ ] other …….

Plots in the Wovwe Irrigation Scheme

28. Do you own plot(s) in the Wovwe Irrigation Scheme? [ ] Yes [ ] No

29. If 'Yes', how many plots?
30. Do you farm all the plots that you own? [ ] Yes [ ] No
31. If 'No', what do you do with the plots you own but do not possess?

32. Do you farm plots that you do not own? [ ] Yes [ ] No
33. If 'Yes', under what arrangements do you farm these plots?
[ ] rent/lease [ ] borrow [ ] other *(specify)* ……..
34. What crops do you farm in the plots? [ ] maize [ ] rice [ ] groundnuts
[ ] cassava [ ] tomatoes [ ] cabbage [ ] other *(specify)* ……..

35. Do you also practice irrigation agriculture outside the Wovwe Irrigation Scheme?
[ ] Yes [ ] No *(Go to section 3)*
36. Why do you also practice irrigation farming outside the scheme? ……..
37. What crops do you grow outside the Wovwe Irrigation Scheme? [ ] maize [ ] rice
[ ] groundnuts [ ] cassava [ ] tomatoes [ ] cabbage
[ ] other *(specify)* ……

38. How do you compare the harvest/yield of crops from the Wovwe Irrigation Scheme and the irrigated area outside the Wovwe Irrigation Scheme? [ ] increased [ ] same
[ ] decreased
Why do you think this is happening this way? ……..

Section 3: Livestock rearing

39. Do you own animals? [ ] Yes [ ] No *(Go to section 4)*
40. Indicate the type and number of animals you own and how you use them.

Animal type	**No. of animals**	***Use***
Cattle		
Goats		
Pigs		
Sheep		
Rabbits		
Dogs		
Chicken		
Guinea fowls		
Ducks		
Pigeons		
……..		
……..		

41. Where do your animals go to drink water?
[ ] Wovwe river [ ] lake [ ] well [ ] borehole [ ] I draw them water
[ ] other ……..

42. Do you sometimes face problems with water for your animals?
[ ] Yes [ ] No *(Go to 45)*

43. What are the problems?
[ ] The water in the river dries up [ ] Poor water quality
[ ] Difficulties to lead animals to water due to peoples' gardens along the water source
[ ] Other ……

44. Are you sometimes forced to sell animals in order to buy other items for your family?
[ ] Yes [ ] No

45. In general, how would you compare the number of animals you own now with that you owned in the past years? [ ] increased [ ] unchanged [ ] decreased
Why do you think this has happened this way? …….

Section 4: Non- cash income generating activities

46. Does any member of you household work on other people's farms in exchange for food/beer or other items? [ ] Yes [ ] No

47. Apart from farming and livestock rearing, what other ways do you use to acquire food?
[ ] Fishing [ ] Hunting [ ] Weaving [ ] Gathering
[ ] Other ……..

48. Do you get any goods (including foodstuff) by exchanging them for other goods (bartering)?
[ ] Yes [ ] No *(Go to 51)*
49. Which goods do you give?
[ ] clothes [ ] farm animals [ ] grain [ ] salt [ ] rice
[ ] fertilizer [ ] ox-cart [ ] water pumps
[ ] other ……..
50. Which goods do you get?
[ ] clothes [ ] farm animals [ ] grain [ ] salt [ ] rice
[ ] fertilizer [ ] ox-cart [ ] water pumps
[ ] other ……

51. How would you describe your non-farm income since 2002/over time?
[ ] increased [ ] unchanged [ ] decreased
52. Why do you think this has happened this way? …….

53. How would you describe the number of income sources for your household since 2002/over time?
[ ] increased [ ] decreased [ ] stayed the same
54. Why do you think this has happened this way? …….....

Section 5: Possessions/Assets

55. Of the items below, which one(s) do you possess? *(Tick all that apply)*

[ ] land	[ ] bank savings	[ ] money (cash)	[ ] bicycle
[ ] radio	[ ] furniture	[ ] plough/ridger	[ ] iron sheets
[ ] treadle pump	[ ] ox-cart	[ ] fishing net	[ ] motorised pump
[ ] sewing machine	[ ] farm tractor	[ ] other ……	

56. Are you sometimes forced to sell possessions/assets because you need the cash?

[ ] Yes [ ] No *(Go to 57)*

In your opinion, what makes you sell your possessions? ……

57. How would you describe the quantity/amount of your possessions since 2002/over time?

[ ] increased [ ] unchanged [ ] decreased

58. Why do you think this has happened this way? ……..…….

Section 6: Stakeholders/actors/agents

59. In this area, who are involved in the management and use of the Wovwe River water?

[ ] Livestock farmers	[ ] Farmers' cooperatives	[ ] ESCOM	[ ] Fish farmers
[ ] hunters	[ ] Ministry of Agriculture	[ ] Ministry of Water	
[ ] construction industry	[ ] Ministry of Local Government	[ ] Gatherers/weavers	
[ ] farmers	[ ] other ……..…..……		

60. In your view, what do the ones you have ticked do? ……

61 (a) Who among the ones you have ticked are involved in water management? ……

61 (b) What specific activities do they do? ……

62 (a) Who among the ones you have ticked use water? ……..

62 (b) What do they use the water for? ……

63. In your opinion, among the ones you have ticked, are there, sometimes, conflicts in the management and use of water between user groups?[ ] Yes [ ] No [ ] I don't know

64 (a) In your opinion, do all the stakeholders work together in managing water resources

[ ] Yes [ ] No [ ] I don't know

64 (b) In your opinion, are all the stakeholders coordinated in using water?

[ ] Yes [ ] No [ ] I don't know

65. Are there established mechanisms for coordinating the management of water among different individual or group users? [ ] Yes [ ] No [ ] I don't know

66. How were these mechanisms instituted? …….....

67. Are there established mechanisms for coordinating the use of water among different individual or group users? [ ] Yes [ ] No [ ] I don't know

68. How were these mechanisms instituted? …….....

69. How are water users represented in the mechanisms for water managements? [ ] village heads
[ ] elected representatives [ ] water user groups [ ] other mechanisms …….
70. Are you satisfied with the way representatives are chosen? [ ] Yes [ ] No
71. Why do you say so? …….
72. Are you satisfied with the way representatives discharge their duties? [ ] Yes [ ] No
73. Why do you say so? …….

74. How are water users represented in the arrangements for water use? [ ] village heads
[ ] elected representatives [ ] water user groups [ ] other mechanisms …….
75. Are you satisfied with the way representatives are chosen? [ ] Yes [ ] No
76. Why do you say so? …….
77. Are you satisfied with the way representatives discharge their duties? [ ] Yes [ ] No
78. Why do you say so? …….

79. Are there other water users who are not members of any group?
[ ]Yes [ ] No [ ] I don't know
80. If '**Yes**' why are they not members of any group? ……

81. In you your opinion would you describe the way activities related to water management and use are executed? [ ] well executed [ ] poorly executed [ ] I don't know
82. Why do you say so? …….

Section 7: The Wovwe Water Users Association (WWUA)

83. Have you ever heard about the Wovwe Water Users Association? (WWUA)
[ ] Yes [ ] No *(Go to section 8)*
84. How did you hear abou the WWUA?
[ ] officials of the WWUA
[ ] officials fro the Ministry of Agriculture and Food Security [ ] through radio
[ ] officials from the Ministry of Irrigation and Water Development
[ ] fellow farmers [ ] other methods: …….

85. In your opinion, what is the main purpose of the Wovwe Water Users Association? ……
……
86. Why do you say so? ……

87. Are you or any of your household directly involved with the Wovwe Water Users Association?
[ ] Yes [ ] No

88. Is your village represented in the operations of the Wovwe Water Users Association?
[ ] Yes [ ] No [ ] I don't know
89. If **'Yes'**, how is it represented?
[ ] through Village Heads [ ] through elected members [ ] through water user groups

[ ] other ……..

90. Who is responsible for planning the activities of the WWUA? …….

91. Who makes budgets for the activities of the WWUA? ……..

92. Who implements the plans of the WWUA? ……

93. How do you/can you bring your water concerns to the attention of the WWUA? ……..
……

94. How does the WWUA inform you of its activities? ……..

95. How often does the WWUA inform you of its activities? [ ] at least once a week
[ ] at least once a month [ ] at least once every 3 months [ ] at least twice a year
[ ] at least once a year [ ] never

96. Do you think the WWUA is necessary to you and other people in your communities?
[ ] Yes [ ] No
Why do you say so? …….

97. What do you think would happen to your livelihood activities if the Wovwe Water Users Association stopped operations tomorrow? [ ] would be enhanced [ ] would stay the same [ ] would slide backwards [ ] I don't know
Why do you say so? ……...

98. In your opinion, how has the WWUA affected your living standards? [ ] improved
[ ] No change [ ] has deteriorated/worsened [ ] I don't know
Why do you say so? ……

99. In your opinion, how has the WWUA improved water allocation?
[ ] improved [ ] remained the same [ ] deteriorated [ ] I don't know
Why do you say so? …….

100. In your opinion, how has the WWUA (IMT) improved fairness of plot allocation?
[ ] improved [ ] remained the same [ ] deteriorated [ ] I don't know
Why do you say so? ……..

101. In your opinion, do you think the WWUA has improved the way conflicts are managed?
[ ] improved [ ] remained the same [ ] deteriorated [ ] I don't know
Why do you say so? ……..

102. How satisfied are you with the general performance of the WWUA?
[ ] satisfactory [ ] No change [ ] dissatisfactory [ ] not sure

Why do you say so? …….

103. In your opinion, who among the WWUA, individuals or other water user groups, do(es) good work in water issues? [ ] WWUA [ ] other water user groups

[ ] no difference [ ] not sure

Why do you say so? ……...

104. In your opinion, is there any relationship between the WWUA and other water user groups or individual in the use and management of water resources? [ ] Yes [ ] No

105. Do local people themselves have representatives in the WWUA?

[ ] Yes [ ] No [ ] Don't know

If 'Yes', who chooses the representatives? …….....

What are the criteria used for choosing representatives? …….....

106. Are you satisfied with the way representatives are chosen?

[ ] I am satisfied [ ] I am not satisfied

Why do you say so? …….

How well do you think the WWUA represent the interests of the communities?

[ ] much [ ] not at all [ ] don't know

Why do you say so? …….

107. Are water user groups represented in the Wovwe Water Users Association?

[ ] Yes [ ] No

If 'Yes', are you satisfied with the way water user groups are represented in the Wovwe water Users Association? [ ] I am satisfied [ ] I am not satisfied

Why do you say so? ……...……..

How well do you think the WWUA represent the interests of water user groups?

[ ] much [ ] not at all [ ] don't know

Why do you say so? …….

108. Do you know any community development programs delivered by the Wovwe Water Users Association? [ ] Yes [ ] No

If 'Yes', what are they? ……...

109. Are you satisfied with the way the WWUA delivers its community development programs?

[ ] I am satisfied [ ] I am dissatisfied [ ] don't know

109. Are you satisfied with the way the WWUA manages finances?

[ ] I am satisfied [ ] I am dissatisfied [ ] don't know

110. How would you describe the relationship between the WWUA and other water users or water user groups? [ ] satisfactory [ ] poor [ ] don't know

Why do you say so? ……..

111. Are there, sometimes, conflicts over water resources between the WWUA and other water user groups? [ ] Yes [ ] No

In your opinion, why do you think there are conflicts? …….

112. Do you think the WWUA is doing good water resources management work?

[ ] It is doing good work [ ] It is performing poorly [ ] I don't know

Why do you say so? ……..

113. Do you think the WWUA is doing good work on environmental education?

[ ] It is doing good work [ ] It is performing poorly [ ] I don't know

Why do you say so? …….

114. Do you think the WWUA is also helping famers outside the irrigation scheme?

[ ] WWUA helps farmers outside the irrigation scheme

[ ] WWUA does not help farmers outside the irrigation scheme

[ ] I don't know

Why do you say so? …….

115. Do you think the WWUA is also helping livestock famers and other water users outside the irrigation scheme? [ ] It helps [ ] It does not help [ ] I don't know

Why do you say so? …….

116. Do you think the WWUA is doing good work in dealing with water problems?

[ ] Yes [ ] No [ ] don't know

Why do you say so? …….

117. Do you think the WWUA is doing good work in improving the quality of water?

[ ] Yes [ ] No [ ] I don't know

118. Do you think the Wovwe Water Users Association is doing good work in achieving sustainable rural livelihoods? [ ] Yes [ ] No

119. How often does the WWUA allocate you water for irrigation? [ ] everyday (hours)

[ ] 2 day per week [ ] 3 days per week

[ ] other …….

120. Does the WWUA have rules/regulations for water allocation? [ ] Yes [ ] No

If **'Yes'** were you involved in the formulation of the rules/regulations? [ ] Yes [ ] No

121. Are you satisfied with the way rules were made? [ ] I am satisfied

[ ] I am not satisfied [ ] Not sure

122. Do you punish those who fail to abide by the rules? [ ] Yes [ ] No *(Go to 123)*

What punishment do you give them? …….
…….
123. Are you satisfied with the way rules are being used?
[ ] I am satisfied [ ] I am not satisfied [ ] other
Why do you say so? …….

125. In your opinion, how would you rate the way the WWUA functions?
[ ] satisfactory [ ] dissatisfactory [ ] I don't know
Why do you say so?

126. In your opinion, how would you compare the way Government was managing the scheme with the WWUA does? [ ] government management better than that of the WWUA
[ ] WWUA management better than that of government [ ] no difference
[ ] both management poor [ ] I don't know
Why do you say so? …….

127. Do you think the activities of the WWUA should be changed?
[ ] Yes [ ] No [ ] don't know
If you think the activities of the WWUA should be changed, how do you want them changed?

8. Water resources, communities and households

Livelihood opportunities

128. What water resources are in this area?
[ ] ground water [ ] rivers [ ] lakes [ ] rain water

129. What water resources do you use? [ ] ground water [ ] river water [ ] rain water [ ] lakes

130. What do you use the water for?
[ ] irrigation [ ] fishing [ ] cooking [ ] drinking
[ ] cleaning [ ] washing [ ] livestock [ ] bathing
[ ] other ……..

131. In your opinion, how does the growing number of people who use water from the Wovwe River affect the quality of water? [ ] the quality of water has deteriorated
[ ] nothing has happened [ ] has helped to improve the quality of water
[ ] I don't know

132. In your opinion, how does the growing number of people who use water from the Wovwe River affect the amount/quantity of water? [ ] declined [ ] nothing has happened
[ ] has helped to improve the availability/quantity of water [ ] I don't know

133. In your opinion, how would you compare the current amount/volume of water in the Wovwe River with the one in the recent past years? [ ] the volume has increased

[ ] the volume has been declining [ ] no difference [ ] I don't know

134. In your opinion, what has caused the volume of water to be like this? …….

……

Security/vulnerability

135. Have you been experiencing droughts in this area since 2002? [ ] Yes [ ] No

136. If **'Yes'**, how often have droughts been occurring?

[ ] once every year [ ] once in two years [ ] once in 3 – 5 years

[ ] once in 5 – 10 years [ ] once in 10 years or more [ ] I don't know

[ ] other (explain) …….

137. Have you been experiencing floods in this area since 2002? [ ] Yes [ ] No

138. If 'Yes', how often have floods been occurring?

[ ] once every year [ ] 2 or 3 times every year [ ] once in two years

[ ] once in 3 – 5 years [ ] once in 5 – 10 years [ ] once in 10 years or more

[ ] I don't know [ ] other (explain) ……

139. What do you do in times of droughts to sustain your lives and to protect your livestock and crops?

Your lives ..……..

Your livestock ……

Your crops …….

140. Are what you do in times of droughts to sustain your lives and to protect your livestock and crops sufficient? [ ] Yes [ ] No

141. What do you do in times of floods to sustain your lives and to protect your livestock, crops, and property?

Your lives ..……..

Your livestock ……

Your crops …….

Your property ……..

142. Are what you do in times of floods to sustain your lives and to protect your livestock, crops, and property sufficient? [ ] Yes [ ] No

143. Do you receive any assistance from government, NGOs or any other donor / well-wisher during the time of drought or floods? [ ] Yes [ ] No *(Go to 145)*

144. What kind of assistance do you receive? ……

145. Is the assistance you receive helpful in restoring your livelihood activities?

[ ] Yes [ ] No

146. If **'No'** what kind of assistance or amount of assistance would you like to receive in order to restore your livelihood activities? ……..……..……...……

147. Do you have access rights to water? [ ] Yes [ ] No

148. If *'Yes':* what is the nature of access rights? [ ] private ownership

[ ] rental [ ] common ownership [ ] free access

[ ] highly contested [ ] other ……..

149. Do you think your rights are secure? [ ] Yes [ ] No

Why do you say so? ……...…….

150. Can you defend your rights against encroachment? [ ] Yes [ ] No

151. If **'Yes'** What do you do to defend your access rights? ……...

152. How would you describe the state of water availability over time?

[ ] stable [ ] unpredictable [ ] deteriorating (scarcity)

[ ] unchanged [ ] other ……..

153. How has this availability of water been affecting your livelihood?

[ ] diversified [ ] specialised [ ] unchanged

[ ] other ……..……..…….

154. How are other water users affecting the availability of water for your use?

[ ] Have made me to find water not every time

[ ] Have made us to share water for use

[ ] Have made me to use water only during allocated times

[ ] Have made us to compete for water

[ ] Other *(explain)* …….....

Empowerment

155. Do you have local institutions here responsible for water management and allocation?

[ ] Yes [ ] No

156. Are you satisfied with the way they manage and allocate water?

The way the manage water resources?

[ ] I am satisfied [ ] I am not satisfied [ ] I am not sure

Why do you say so? ……...……..

The way they allocate water?

[ ] I am satisfied [ ] I am not satisfied [ ] I am not sure

Why do you say so? ……...……..

157. Do the local people participate in decision-making concerning the management and allocation of water?

Water management? [ ] Yes [ ] No

If *'Yes':* how do local people participate?

[ ] through elected representation [ ] represented by Village Heads [ ] through CBOs

[ ] through water user groups [ ] other *(specify)* ……
158. Water allocation? [ ] Yes [ ] No
If *'Yes':* how do local people participate?
[ ] through elected representation [ ] represented by Village Heads [ ] through CBOs
[ ] through water user groups [ ] other *(specify)* ……..

159. If through elected representatives, who chooses local representatives? ……..……..
160. Are you satisfied with the way representatives are chosen?
[ ] I am satisfied [ ] I am not satisfied
Why do you say so? ……

161. Are you satisfied with the work of your representatives? [ ] Yes [ ] No
Why do you say so? ……...……

Section 9: Transforming structures and processes

Structures

162. What organisations, groups or government departments have activities in the field of water resources in this area? ……..……

163. What activities does each carry out? …….…….....

164. Are you satisfied with the way they work? [ ] Yes [ ] No
Why do you say so? ……..……..

Policies and processes

165. Have you ever heard of the following policies?
(i) Decentralisation Policy [ ] Yes [ ] No
(ii) National Water and Irrigation Policy and Strategy [ ] Yes [ ] No
(iii) National Environmental Policy [ ] Yes [ ] No
(iv) National Water Policy [ ] Yes [ ] No

166. How would you describe the contribution of each policy to your livelihoods?
(a) Decentralisation Policy [ ] positive [ ] none [ ] negative [ ] don't know
Why do you say so? ……..…..…….....……

(b) National Water and Irrigation Policy and Strategy
[ ] positive [ ] none [ ] negative [ ] don't know
Why do you say so? ……..…..…….....……

(c) National Environmental Policy
[ ] positive [ ] none [ ] negative [ ] don't know

Why do you say so? ……..…..…….....……

(d) National Water Policy

[ ] positive [ ] none [ ] negative [ ] don't know

Why do you say so? ……..…..…….....……

Section 10: Livelihoods/strategies

167. What is the main livelihood activity for your household?

[ ] farming [ ] fishing [ ] employment [ ] business

[ ] other ……

168. What other activities/sources bring income to your household? ……..

……

169. How much money do you make per month? K _____

170. How much income does each activity/source bring to your overall household income? *(Fill the table below)*

Livelihood strategy	**Income (Mk)**
Total	

171. During what time of the year do you engage in each activity? *(Fill the table below)*

Livelihood activity	**Season**	
	Rainy season	*Dry season*

172. In your opinion, what factors enhance your livelihood productivity? ……

……

173. In your opinion what constrains your livelihood productivity? …….

……

174. How would you describe the changes in your livelihood activities in the recent past years?

[ ] I have changes crops/varieties [ ] I have added more activities [ ] No change

[ ] I have reduced the number of activities

175. Why do you think has made your activities to be so? [ ] changing weather/climate
[ ] water scarcity [ ] age [ ] it is labour intensive
[ ] conflicts over land [ ] conflicts over water [ ] other ……..…….

Section 11: Irrigation management transfer (IMT)

176. Have you ever heard of the change in the management of the Wovwe Irrigation Scheme from the hands of Government into the hands of the Wovwe water Users Association? [ ] Yes [ ] No

Farmers' perceptions on the cost of irrigation due to the change in management

Cost of irrigation to farmers

177. In your opinion, which of the following best describe the changes in the costs of irrigation to you with respect to water fees paid in kind? [ ] higher during IMT [ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

178. How would you compare the level of unpaid family labour contributions? [ ] higher during IMT
[ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

179. In your opinion, which of the following best describe the changes in the costs of irrigation to you with respect to cash payments? [ ] higher during IMT [ ] lower during IMT [ ] about the same
[ ] don't know [ ] no response

180. In your opinion, which of the following best describe the changes in the costs of irrigation to you with respect to payments made in kind? [ ] higher during IMT [ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

181. In your opinion, which of the following best describe the changes in the costs of irrigation to you with respect to water fees paid in kind? [ ] higher during IMT [ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

182. How would you compare the number of person-days of family labour contributed to canal maintenance? [ ] higher during IMT [ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

183. In your opinion, which of the following best describe the changes in the costs of irrigation to you with respect to unofficial payments made to obtain irrigation water? [ ] higher during IMT
[ ] lower during IMT [ ] about the same [ ] don't know [ ] no response

Quality of irrigation service

184. In your opinion, how would you describe the following before and during IMT?
(a) Adequacy of water supply during rainy season
[ ] better during IMT [ ] worse during IMT [ ] adequate before and during IMT

[ ] inadequate before and during IMT

(b) Adequacy of water supply during dry season

[ ] better during IMT [ ] worse during IMT [ ] adequate before and during IMT

[ ] inadequate before and during IMT

(c) Fairness of water distribution in rainy season

[ ] better during IMT [ ] worse during IMT [ ] fair before and during IMT

[ ] unfair before and during IMT

(d) Fairness of water distribution in dry season

[ ] better during IMT [ ] worse during IMT [ ] fair before and during IMT

[ ] unfair before and during IMT

(e) Timely allocation of water during rainy season

[ ] better during IMT [ ] worse during IMT [ ] timely before and during IMT

[ ] untimely before and during IMT

(f) Timely allocation of water during dry season

[ ] better during IMT [ ] worse during IMT [ ] timely before and during IMT

[ ] untimely before and during IMT

(g) Frequency of farmer conflicts

[ ] decreased during IMT [ ] increased during IMT [ ] infrequent before and during IMT

[ ] frequent before and during IMT

Impacts on maintenance

185. In your opinion, how would you describe the condition of water distribution canals before and during IMT?

[ ] better during IMT [ ] worse during IMT [ ] fair before and during IMT

[ ] poor before and during IMT

Impacts on agricultural production

186. How would you compare your harvest before and during IMT?

[ ] improved during IMT [ ] deteriorated during IMT [ ] poor before and during IMT

[ ] good before and during IMT

Why do you say so?

187. How would you compare the number of crops you grow now with that you grew before IMT?

[ ] more a during IMT [ ] less during IMT [ ] no change

188. How would you compare the number of livelihood activities you employ now with that you employed before IMT? [ ] more during IMT [ ] less during IMT [ ] no change

Economic impact on the benefits gained from the plots in the scheme

189. How would you compare your financial/economic benefits from your field before and during IMT?

[ ] improved during IMT [ ] decreased during IMT [ ] the same

190. How has your household income changed since IMT?

[ ] improved [ ] no change [ ] decreased [ ] I don't know

Why do you say so? …….....

191. How has the number of plots you have been owning changed since IMT?

[ ] increased [ ] decreased [ ] no change

192. How has the level of your engagement in non-agricultural activities changed since IMT?

[ ] increased [ ] decreased [ ] no change

193. In your opinion, what has made your level of engagement in non-farm activities to be so? ……

…….....

194. How has the number of non-cash livelihood activities changed since IMT?

[ ] increased [ ] decreased [ ] no change

195. In your opinion, why has the number of your non-cash livelihood activities changed in this way?

…….....

196. How would you compare the number of livestock you own now with that you owned before IMT?

[ ] increased [ ] no change [ ] decreased

In your opinion, why has this been so? ……..

THANK YOU!

Appendix 5: Questionnaire for households and farmers in Chitumbuka

Nambala ya pepala la mafumbo: ……..... **Chimanyisko cha wakuzgola: ……**

Zina la wakufumba mafumbo: …...……. **Date: ……...**

Nyengo: ……

Malonje

Odi, zina lane ndine …….. Ndine yumoza wa gulu la wanthu awo wakufufuza kuti wasambireko za umo kusintha kwa kendeskero ka kapwererero ka maji na kendeskero ka Sikimu ya Wovwe kakukhuzira ntchito za kapwerero ka maji na ntchito izo wanthu mu chagawa ichi wakuchita kuti wasange ndalama na chakulya. Pa gulu lithu munthu uyo wakugwira ntchito ku Bungwe la vyakusandasanda la National Research Council of Malawi. Tilije ubali uliwose na wanthu panji mawupu agho ghakwendeska ntchito za Sikimu ya Wovwe panjiso ma wupu agho ghakovwira wanthu. Ntheura, nchito yithu ni yakafukufuku basi iyo chakulata chakhe nkhusambirapo basi. Kafukufuku withu pala wamala watovwirengepo kusanga nthowa izo wina Malawi mumizi wangagwiriska ntchito kuti ntchito zawo zakusangila ndalama na chakulya ziwe zakugomezgeka. Ntheura ndise wakunweka chomene kuti tipulike maghanoghano ghino pa umo kendeskera ka ntchito za maji ya mu mlonga wa Wovwe zikukhuzira ntchito zinu zakusangira ndalama na chakulya.

Nyumba yinu yasankhika pakati pa nyumba zose izo ***walimi wakulima mu Sikimu ya Wovwe / wanthu awo wali pafupi na mlonga wa Wovwe (20 km)***. Ndipo nkhukhumba kumumanyiskani kuti vyose ivyo imwe mutitiyowoyenge vitimanyikwenge kwa imwe na ise mbwenu. Palije munthu yunji uyo watimanyenge vyakudumbiskana vithu. Kweneso, kuti tiwoneskeske kuti vyakudumbirana ivi vikumanyikwa na wanthu wanji chala, mazina ghinu titilembengepo yayi pa mazgolo agho mutitipasenge. Kumalizga kuzgola mafumbo agh kutitolenge nyengo yinadi yayi. Ola limoza kuti litikwanenge chala. Ndingawonga chomene usange mungandizomerezga kuti ndimufumbani mafumbo agha.

Pala muli na fumbo lililose panji mukukhumba kumanya vyakulata vya kufufuza uku, mungalembera kalata panji kutchaya telefoni kwa **Jolly Wasambo** pakugwirska ntchito keyala iyi:

P.O. Box 30745, Lilongwe 3. Tel.: 01 771 550; Cell: 099 9 683 026

<u>Yewo!</u>

Chigawa chakwamba: Vyakukhwaskana na nyumba yino

1. Fumu Yikulu (T/A): …… 2. Muzi (Village Head): …….....

3. Ndimwe: [ ] Mwanalumi [ ] Mwanakazi (Chonde chongani [✓])

4. Kasi vyaka vinu vili ni vilinga? ..... [ ] 18 – 29 [ ] 30 – 39 [ ] 40 – 49 [ ] 50 – 59 [ ] 60 panji kujumpha

5. Kasi mungajilongosola uli mwekha? [ ] Wambula kutengwapo/kutolapo [ ] Wapabanja

[ ] Ukwati wane ulikumala [ ] Mwanakazi wane walikupotela [ ] Mwanalumi wane walikupotela

[ ] Palije pa ivyo mwandifumba *(mwandule)*: ……..…….....

6. Kasi mu nyumba mwino mukukhala wanthu walinga? …….....

Wana (wa vyaka vambula kujumpha 18): Wanakazi: ……..... Wanalumi: ……....

Walala (wa vyaka 18, panji kujumpha): Wanakazi: …… Wanalumi: ……....

Chimanyisko: Tikati nyumba tikung'anamura munthu panji wupu wa wanthu:

- *awo wakulya pamoza, wakugawana katundu, nakukhala pamoza kwa mazuwa ghambula kuchepera folo (4) pasabata;*
- *kusazgilapo awo wakugwira ncthito ntchito ya munyumba mwino*

7. Kasi walipo wanyakhe wamunyumba yino awo panyengo yasono walikufumapo? [ ] Inya [ ] Yayi

8. Pala **'Inya'** chifukwa uli wanyakhe palije? [ ] Wali kuwaganyu (seasonal labour)

[ ] Wali kumasambiro [ ] Wakukhala na wabali kunyakhe [ ] Wali muzinyumba zawo

[ ] Vifukwa vinyakhe (longosolani) ……

9. Kasi wakumutumizgilaniko wovwiri uli wose? [ ] Inya [ ] Yayi *(Jumphani kuti muzgole fumbo 11)*

Pala **'Inya'** niwovwiri wamutundu uli uwo wakumutumizgirani? *(Chonde chongani wovwiri uliwose uwo wakumutumizgilani)* [ ] ndalama [ ] vyakulimira [ ] chakulya

[ ] vyakuvwala

[ ] vinyakhe *(longosolaniy)* ……

10. Pala wakumutumizgiraniso ndalama, wakumutumizga zilinga pamwezi panji pa chaka? ……

11. Kasi mukamba pauli kukhala pamwekha? ……

12. Kasi banja linu lakhala vyaka vilinga mu muzi uwu? ……..…….....

13. Pa ivyo vili pasi apa, kusambira kwinu kwa pachanya chomene ndi nkhu?

[ ] Ndindaluteko ku sukulu [ ] Ndilikusambirako ku primary

[ ] Ndilikumalizga masambiro gha primary [ ] Ku secondale sukulu (JCE)

[ ] Masambiro gha sekondale sukulu (MSCE) [ ] Ndilikusambira nchito za luso

[ ] Masambiro gha ku college (university)

[ ] Masambiro ghanyakhe *(mulongosole)* …...…….....

14. Pala mwekha mukujisandula, ntchito iyo mukugwira ni nji?

[ ] ndichali pa sukulu [ ] nkhugwira mu Boma [ ] nkhugwira kuwalo kwa Boma

[ ] nilikujilemba ndekha [ ] ndilikupumula [ ] mulimi

[ ] nkhuweta somba/mlovi [ ] nili pantchito chala

[ ] Palije pa ivyo mwalemba *(mulongosole)*: ……

15. Kasi munyumba mwinu mukusanga ndalama zilinga pamwezi (Malawi Kwacha)?

[ ] 1 – 500 MK [ ] 501 – 1000 MK [ ] 1001 – 5000 MK [ ] 5001 – 10000 MK
[ ] 10001 – 20000 MK [ ] 20001 MK panji kujumpha

16. (a) Kasi ndalama izo mukusanga zikukwanira vyakukhumba vinu vyose mu nyumba?
[ ] Inya *(Lutani chigawa chachiwiri)* [ ] Yayi

17. Mukuchita vichi kuti vyakukhumba mubanja linu vikwaniskike?
[ ] tikovwirika na vyawanangwa kufuma kwa wanthu wakukhumba kuwemi
[ ] nkhufumapo kanyengo pachoko kukapenja maganyu
[ ] wanthu wanyakhe mu nyumba mwane nkhuwatumizga kwa wabali
[ ] wovwiri wakufuma ku Boma na ma wupu agho nga Boma chala
[ ] vyakukhumba vinyakhe tikufiska chala kuti chakulya pela chisangikenge
[ ] tikulya kamozi pa dazi
[ ] nkhovwirika na wabali
[ ] palije icho nkhuchitapo
[ ] vinyakhe *(mulongosole)* ……

18. Kasi ntchivichi icho mukuchita icho mukuchigomezga kuti ndicho chikumupasani ndalama?
[ ] ulimi [ ] ntchito [ ] nkhupanga business (yandekha) [ ] ganyu

[ ] ndalama za pension [ ] ulimi wa somba/ulovi [ ] vyawanangwa
[ ] vinyakhe *(longosolani)*: ……...…….……

Chigawa chachiwiri: Vyakukhwaska chalu/minda na ulimi

<u>Minda kuwalo kwa Wovwe Scheme</u>

19. Kasi muli na chalo/minda? [ ] Inya [ ] Yayi *(Jumphani kuti muzgole fumbo 22)*
20. Chalu chino ntchikulu uli ? …… maekala
21. Chalu chino chilli malo nga? [ ] mudambo/m'mphepete mwa mlonga
[ ] mumalo ghakukwera [ ] mumalo ghose ghawiri

22. (a) Kasi mukulima? [ ] Inya [ ] Yayi
22. (b) Kasi mukuchita uli kuti kagwiriro ka ntchito zinu kawe kakukwaniskika?
[ ] tikulima tekha mubanja lithu [ ] tikulipira waganyu [ ] tikovwirika na wabali [ ] tikulima tekha mubanja lithu na kovwirika na wabali [ ] tikulima tekha na kulipira waganyu [ ] tikulima tekha, tikulipira, na kovwirika na wabali

23. Pala 'Inya' kasi mukulimaso na minda muchalo icho ndi chinu chala? [ ] Inya [ ] Yayi *(Lutani kufumbo 25)*
24. Pala 'Inya' pali kukolelerana uli na weneko wa minda kuti mulimenge? [ ] nkhubwereka
[ ] lenti [ ] vinyakhe ……

25. Kasi mukulima chalu chinu chose? [ ] Inya *(Lutani ku fumbo 27)* [ ] Yayi

26. Kasi chalu chino icho mukulima chala mukuchita nacho vichi? [ ] nkhubwerekeska
[ ] nkhupangiska lenti [ ] nkhupandamo makuni [ ] palije
[ ] Vinyakhe ……

27. Kasi nimbuto uli izo mukulima? *(Chonde chongani vyose vyakwenerera)*
[ ] Ngoma [ ] Mpunga [ ] shawa [ ] hona [ ] thonje [ ] mayawo [ ] mphatata [ ] makombwe [ ] mapuno [ ] kabichi [ ] anyezi [ ] Malezi [ ] ntchunga [ ] zinykhe ……..

Maplot mu Wovwe Scheme na ulimi wakuthilira kuwalo kwa Wovwe Scheme

28. Kasi muli na ma plot ghinu mu Wovwe Scheme? [ ] Inya [ ] Yayi *(lutani ku fumbo 32)*
29. Maplot ghinu ni yalinga? .....
30. Kasi mukulima maploti ghinu ghose? [ ] Inya *(lutani ku fumbo 32)* [ ] Yayi
31. Maploti ayo mukulima chala mukuchita nayo vichi? [ ] nkhubwerekeska [ ] nkhupangiska lenti
[ ] palije [ ] vinyakhe ……....
32. Kasi mukulima paploti agho nginu chala? [ ] Inya [ ] Yayi
33. Pali kukolelerana uli na weneko wa maploti? [ ] nkhubwereka [ ] lenti
[ ] kukolelerana kunyakhe *(longosolani)* ……
34. Kasi mbuto yeniyeni iyo mukulimamomu ma ploti ni mbuto uli? .....
Mbuto zinyakhe *(longosolani)* ……

35. Kasi mukupangaso ulimi wa kuthirira kuwalo kwa sikimu?
[ ] Inya [ ] Yayi *(lutani ku chigawa chachitatu)*
36. Chifukwa uli mukulimaso ulimi wakuthirira kuwalo kwa sikimu? ……
……
37. Kasi mukulima mbuto uli kuwalo kwa sikimu? [ ] ngoma [ ] mpunga [ ] mayawo [ ] mapuno [ ] kabichi [ ] anyezi [ ] shawa
Mbuto ziinyakhe *(longosolani)* ……..

38. Kasi mukuyananiska uli vuna ya mu Wovwe Irrigation Scheme na ya musikimu zakuwalo kwa Wovwe Irrigation Scheme? [ ] niyikulu musikimu ya Wovwe kujumpha musikimu yakuwalo
[ ] niyikulu musikimu ya yakuwalo kujumpha musikimu ya Wovwe
[ ] vikuyana waka

Chigawa cha chitatu: Ulimi wa viweto

39. Kasi muli na viweto? [ ] Inya [ ] Yayi *(lutani ku chigawa cha chinayi)*
40. Lembani unandi wamtundu wuli wose wa viweto ivyo muli navyo na ntchito iyo mukuvigwiriska.

Mtundu wa chiweto	**Unandi wa viweto**	***Ntchito iyo mukuvigwiriska***
Ng'ombe		

Mbuzi		
Mberere		
Nguluwe		
Kalulu		
Nkhuku		
Nkhunda		
Nkhanga		
Ntchewe		
Pusi		
Mabaka		
……..		
……..		

41. Kasi viweto vinu maji vikumwa nkhu? [ ] mumlonga wa Wovwe [ ] pachiziwa
[ ] munyanja [ ] nkhukateka nakuzipasira pa nyumba [ ] pa mupope
[ ] kunyakhe ……

42. Kasi nyengo zinyakhe mukukumanapo na masuzgo gha maji gha viweto?
[ ] Inya [ ] Yayi *(Lutani ku fumbo 45)*

43. Nimasuzgo uli agho mukukumana nagho? [ ] Mlonga ukukamuka [ ] kunangika kwa maji
[ ] kwenda na viweto kukafika uko kuli maji kukusuzga chifukwa cha vyakulima vya wanthu
[ ] vinyakhe .....

44. Kasi nyengo zinyakhe mukukhuwirizgika kuti muguliske viweto kuti musange ngala zakumovwirani panyumba? [ ] Inya [ ] Yayi

45. Kasi pala mukuwona unandi wa viweto vyinu sono, mukuyananiska uli na viweto ivyo mukwa navyo mu vyaka vyakunyuma? [ ] vyawa vinandi [ ] palije kusintha [ ] vyachepa
Mukughanghana kwinu, nichifukwa uli vyawa ntheura? ……

Chigawa cha chinayi: Zintchito zambula kukhwaska ndalama zinyakhe zakusangira ukhaliro

46. Kasi muli munthu munyumba mwinu uyo wakugwira ntchito muminda ya wanthu wanyakhe pakusinthiskana na chakulya panji phere? [ ] Inya [ ] Yayi

47. Kupatulako ulimi na kusunga viweto, kasi ni thowa uli zinyakhe izo imwe mukugwiriska ntchito kuti musange chakulua?
[ ] ulovi wa somba [ ] kuwinga [ ] vyakulukaluka [ ] kusola vyamuthontho
[ ] vinyakhe ……..

48. Kasi mukusanga katundu waliyose panji chakulya pakusinthana nakatundu munyakhe?
[ ] Inya [ ] Yayi *(Lutani kufumbo 51)*

49. Imwe mukupereka katundu uli? [ ] vyakuvwala [ ] viweto vyakulimila [ ] chakulya (mpunga, ngoma, etc) [ ] mchere [ ] feteleza [ ] ngolo [ ] injini ya maji [ ] vinyakhe ……

50. Ndipo mukupokera katundu uli?

[ ] vyakuvwala [ ] kugwiriska ncthito ng'ombe zakulimira [ ] chakulya

[ ] mchere/sugar [ ] feteleza [ ] kugwiriska ncthito gileta [ ] water pumps

[ ] vinyakhe ……

51. Kasi kagwiriro kinu kantchito izo nizaulimi chala kwasintha uli kufuma muvyaka vyakunyuma?

[ ] Kakula [ ] kachepa [ ] palije kusintha

52. Mukuganiza kuti nichifukwa uli icho chapangiska kuti kagwiriro kinu ka ntchito kakhale ntheura?

……

53. Kasi unandi wa nthowa zambula kukhwaska ndalama izo mukusangira wovwiri munyumba mwino kwasintha uli kufumakale? [ ] zaya zinandi [ ] zachepa [ ] palije kusintha

54. Mukuganiza kuti nichifukwa uli icho chapangiska kuti nthowa za kusangira ndalama zikhale ntheura? ……

Chigawa cha chinkhonde: Katundu uyo muli nayo

55. Pa katundu tamulemba pasi uyu, ni nju uyo muli nayo? *(Chongani vyose vyakwenerera)*

[ ] chalu (minda) [ ] ndalama kubank [ ] ndalama (cash) [ ] njinga

[ ] radio [ ] katundu wa munyumba [ ] plough [ ] malata

[ ] treadle pump [ ] gileta [ ] vilepa/mkwawo [ ] motorised pump

[ ] makina yakusonera [ ] farm tractor [ ] munyakhe ……

……

56. Kasi nyengo zinyakhe mukukhuwirizgika kuti muguliske katundu uyo muli nayo?

[ ] Inya [ ] Yayi (*Lutani kufumbo 57)*

Kasi icho chikupangiska kuti muguliske katundu theura ntchivichi? ……

……

57. Kasi kufuma kuvyaka vyakunyuma kufika sono, unandi wa katundu winu wawa uli?

[ ] wasazgikirako [ ] wachepako [ ] wandasithe

58. Mukughanaghana kwinu, ntchivichi icho chapangiska kuti unandi wa katundu winu wawe ntheura? ……

Chigawa cha chinkhonde na chimoza: Awo wakugwiriska ntchito maji na awo wakukhwaskika na ncthito za maji

59. Muchigawa ichi, kasi awo wakugwiriskaso ntchito maji gha mwa Wovwe na awo wakukhwaskika na ncthito za maji mbanjani? [ ] Mawupu gha walimi ghachokoghachoko [ ] ESCOM

[ ] awo wali na viweto [ ] walimi wa somba [ ] wakudumula matete

[ ] walimi wamphangwi

[ ] awo wakuwinga (viwinda) [ ] unduna wa ulimi [ ] unduna wa maji [ ] wakuwumba mabuliki [ ] unduna wa maboma ghachoko [ ] wavyakulukaluka [ ] walimi

[ ] wanyakhe …….....

60. Umo imwe mukuwonera, kasi awa mwawazunula wakuchita vichi? ……

……

61 (a). Kasi pa awo mwawazunula, mbanjani awo wakugwiraso ntchito zakupwererera maji? …

……

61 (b). Ni ntchito uli izo iwo wakuchita? ……

62 (a). Kasi pa awo mwawazunula, mbanjani awo wakugwiriska ntchito maji? ……

62 (b). Wakugwiriska ntchito uli? ……

63. Umo imwe mukuwonera, kasi pa awo mwawazunula palije kwambana chifukwa chamaji?

[ ] kulipo [ ] palije [ ] nkhumanya chala

64 (a). Umo imwe mukumanyira, kasi wose awo mwawazunula wakugwirira pamoza ntchito zakupwererera maji? [ ] Inya [ ] Yayi [ ] nkhumanya chala

64 (b). Umo imwe mukumanyira, kasi wose awo mwawazunula wakugwiria pamoza ntchito zakugwiriska ntchito maji? [ ] Inya [ ] Yayi [ ] nkhumanya chala

65. Kasi pali nthowa zakukhazgikika izo awo wakugwiriska ntchito maji wakulondezga pa kapwererero ka maji? [ ] Inya [ ] Yayi *(lutani ku fumbo 67)* [ ] nkhumanya chala

66. Kasi nthowa izi zikakhazikiskika uli? ……

67. Kasi pali nthowa zakukhazgikika izo awo wakugwiriska ntchito maji wakulondezga pa kagwiriskiro ntchito maji? [ ] Inya [ ] Yayi *(lutani ku fumbo 69)* [ ] nkhumanya chala

68. Kasi nthowa izi zikakhazikiskika uli? ……

69. Kasi wanthu wakwimilirika uli mu nthowa zakendeskero ka ntchito <u>zakupwerera</u> maji?

[ ] mafumu [ ] tikusankha wakutimilira [ ] magulu

[ ] nthowa zinyakhe ……

70. Kasi ndimwe wakukhutira na umo wimiliri wakusankhikira? [ ] Inya [ ] Yayi

71. Chifukwa uli mwayowoya ntheura? ……

72. Kasi ndimwe wakukhutira na umo wimiliri wakugwirira ntchito? [ ] Inya [ ] Yayi

73. Chifukwa uli mwayowoya ntheura? ……

74. Kasi wanthu wakwimilirika uli mu nthowa zakendeskero ka ntchito <u>zakugwiriska</u> ntchito maji?

[ ] mafumu [ ] tikusankha wakutimilira [ ] magulu

[ ] nthowa zinyakhe ……

75. Kasi ndimwe wakukhutira na umo wimiliri wakusankhikira? [ ] Inya [ ] Yayi

76. Chifukwa uli mwayowoya ntheura? ……

77. Kasi ndimwe wakukhutira na umo wimiliri wakugwirira ntchito? [ ] Inya [ ] Yayi

78. Chifukwa uli mwayowoya ntheura? ……

79. Kasi walipo wanthu awo wakugwiriska ntchito maji kweni ni ma membala chala wa wupo uliwose?

[ ] Inya [ ] Yayi [ ] nkhumanya chala

80. Pala **'Inya'** mumaghanoghano ghinu, ni chifukwa wuli iwo ni mamembala chala ya mawupu? …

……

81. Kasi ntchito za kagwiriskiro ntchito na kapwererero ka maji zikwenda uli pakati pa awo ni mamembala gha mawupu na awo ni mamembala chala? [ ] zikwenda makola [ ] zikwenda makola chala [ ] nkhumanya chala

82. Chifukwa uli mukuyowoya ntheura? ……

Chigawa cha chinkhonde na chiwiri: Wovwe Water Users Association (WWUA)

83. Kasi mulikupulikapo za bungwe la Wovwe Water Users Association? [ ] Inya [ ] Yayi

84. Pala mukulimanya bungwe la Wovwe Water Users Association, kasi mukapulikira kochi/uli za bungwe ili? [ ] kwa awo wakugwira ntchito ku bungwe la Wovwe Water Users Association

[ ] kuwakugwira ntchito ku unduna wa vyaulimi (agriculture) [ ] pa radio

[ ] kuwakugwira ntchito ku unduna wa maji [ ] wanyithu mumizi na walimi wanyithu

[ ] nkhapulikira ku nthowa zinyakhe ……

85. Mumaghanoghano ghino, kasi ntchito yeniyeni ya WWUA njakuti uli? ……

……

86. Chifukwa uli mukuyowoya ntheura? ……

87. Kasi imwe panji waliyose mu nyumba yino wakugwira nawo ntchito za Wovwe Water Users Association? [ ] Inya [ ] Yayi

88. Kasi muzi winu wukwimilirika mu ntchito za kendeskero ka Wovwe Water Users Association?

[ ] Eya [ ] Yayi [ ] Nkhumanya chala

89. Pala **'Inya'**, kasi muzi winu wukwimilirika uli? [ ] Fumu (Village Head)

[ ] munthu uyo tikamusankha [ ] tumagulu twa wanthu awo wakugwiriska ntchito maji

[ ] nthowa zinyakhe ……

90. Kasi ni njani uyo wakupanga dongosolo la zintchito za WWUA? ……

91. Kasi ni njani uyo wakupanga ndondomeka ya ndalama (budget) ya ntchito za WWUA? ……

……

92. Kasi ni njani uyo wakugwira zi ntchito za WWUA? ……

93. Kasi madandaulo ghinu pa nkhani za maji ghakufika uli ku WWUA? ……

94. Kasi wa WWUA wakumumanyiskani uli za ntchito zawo? ……

95. Kasi wa WWUA wakumumanyiskani pafupipafupi uli za ntchito zawo?

[ ] kamozi panji kujumpha pa sabata [ ] kamozi panji kujumpha pa mwezi

[ ] kamozi panji kujumpha pa myezi itatu [ ] kawiri panji kujumpha pa chaka

[ ] kamozi panji kujumpha pa chaka [ ] wakutimanyiskapo chala

96. Kasi mukughanghana kwinu, WWUA njakukhumbikwa ku wanthu wa mumuzi winu pankhani ya kasangilo ka ndalama na chakulya? [ ] Inya [ ] Yayi

Chifukwa uli mukuyowoya ntheura? ……

97. Kasi pala WWUA yingaleka kugwira ntchito zake, ntchito zinu za dazi na dazi zakasangilo ka chakulya na ndalama zingakhwaskika uli? [ ] zingaluta panthazi [ ] palije icho chingachitika

[ ] zingawerera nyuma [ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? ……

98. Mumaganizo ghino, kasi moyo wino wakwera uli chifukwa cha ntchito za WWUA?

[ ] wakwera [ ] palije icho chachitika [ ] wawelera nyuma [ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? ……

99. Mumaganizo ghino, kasi WWUA wakwezga uli ntchito za kagawiro ka maji?

[ ] ntchito zakagawiro ka maji zakwera [ ] ntchito zakagawiro ka maji zili chimozimozi

[ ] ntchito zakagawiro ka maji zawerera nyuma [ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? ……

100. Mukughanaghana kwinu, kasi WWUA yakwezga uli ntchito zakagawiro ka maplot?

[ ] Ntchito zikwenda makola [ ] palije icho chasinthapo [ ] ntchito zawerera nyuma

[ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? ……

101. Mumaghanoghano ghinu, kasi ntchito zakeluzgiro milandu ya maji zikwenda uli muulamuliro wa WWUA? [ ] zapita panthazi [ ] palije chakusintha [ ] zawerera nyuma

[ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? ……

102. Kasi mukawonero kino, ncthito za WWUA mwakhutiskika nazo uli?

[ ] nakhutira nazo chomene [ ] nindakhutire nazo [ ] ningamanya makola chala

Chifukwa uli mukuyowoya ntheura? ……

103. Pakati pa WWUA na wanthu panji magulu agho ghali muno, mbanjani awo wakwendeskako makola ntchito za maji? [ ] WWUA [ ] magulu ghanyakhe [ ] wakuyana waka

[ ] ningamanaya chala

Chifukwa uli mwayowoya ntheura

104. Kasi pali kukolelerana pakendeskero ka ntchito za maji pakati pa WWUA na wanthu panji magulu agho ghakugwiriska ntchito maji panji kepwererera maji? [ ] Inya [ ] Yayi

105. Kasi wanthu wamumizi wali na wimilili mu WWUA?

[ ] Inya [ ] Yayi [ ] nkhumanya chala

Pala **'Inya'**, uyo wakusankha wimilili ni njani? …….....

Kasi vyakumweneleska munthu kuti wasankhike ni vichi? …….....

106. Kasi imwe ndimwe wakukhutira na umo wimilili wakusankhikira?

[ ] niliwakukhutira [ ] niliwakukhutira chala

Chifukwa uli mukuyowoya ntheura? ……

107. Kasi magulu gha wanthu awo wakugwiriska ntchito maji wali na wimilili mu WWUA?

[ ] Inya [ ] Yayi

Pala '**Inya'**, muliwakukhutira uli na umo magulu gha wanthu awo wakugwiriska ncthito maji wakwimililikira mu WWAU? [ ] nili wakukhutira [ ] nindakhutire

Chifukwa uli mwayowoya ntheura? ……

108. Kasi palizintchito izo mukuzimanya za chitukuko izo WWUA ikuchita? [ ] Inya [ ] Yayi

Pala 'Eya', mukumanyapo ntchito uli? ……

109. Kasi ndimwe wakukhutira uli na umo WWUA ikwendeskera ntchito za chitukuko?

[ ] niliwakukhutira [ ] nindakhutire [ ] nkhumanya chala

109. Kasi ndimwe wakukhutira uli na umo WWUA ikwendeskera ntchito za ndalama?

[ ] niliwakukhutira [ ] nindakhutire [ ] nkhumanya chala

110. Kasi ubale pakati pa WWUA na wanthu wanyakhe awo wakugwiriska ntchito maji mukuwuona kuti uli uli? [ ] nguweme chomene [ ] uhene [ ] ningamanya chala

Chifukwa uli mukuyowoya ntheura? ……

111. Kasi nyengo zinyakhe pakuwa kwambana chifukwa cha maji pakati paWWUA na magulu ghanyakhe agho ghakugwiriska ntchito maji? [ ] Inya [ ] Yayi

Mukughanaghana kwinu, nichifukwa uli pakuwa kwambana? ……

112. Kasi mukuganiza kwinu WWUA yikugwira ntchito yiweme uli pantchito yakupwererera maji?

[ ] ntchito yiweme chomene [ ] ntchito yiweme chala [ ] ningamanaya chala

Chifukwa uli mukuyowoya ntheura ……

113. Kasi mukuganiza kwinu WWUA yikugwira ntchito yiweme uli pantchito yakumanyiska wanthu pa vyakulengiwa? [ ] yiweme chomene [ ] yiweme chala [ ] ningamanaya chala

Chifukwa uli mukuyowoya ntheura ……

114. Kasi mukuganiza kwinu WWUA yikovwiraso walimi kuwalo kwa sikimu ya Wovwe?

[ ] yikovwira [ ] yikovwira chala [ ] ningamanaya chala

115. Kasi mukuganiza kwinu WWUA yikovwiraso awo wali na viweto?
[ ] yikovwira [ ] yikovwira chala [ ] ningamanaya chala

116. Kasi mukuganiza kwinu WWUA yikugwira ntchito yiweme pakulimbana na masuzgo gha maji?
[ ] Inya [ ] Yayi [ ] ningamanaya chala
Chifukwa uli mukuyowoya ntheura ……..

117. Kasi mukuganiza kwinu WWUA yikugwira ntchito yiweme pakuwoneskeska kuti maji gha mu Wovwe ngawemi? [ ] Inya [ ] Yayi [ ] ningamanaya chala

118. Kasi mukuganiza kwinu WWUA yikugwira ntchito yiweme pakuwoneskeska kuti kasangilo ka chakulya na ndalama ka wanthu nkhakukhazgikika?
[ ] Eya [ ] Yayi [ ] ningamanaya chala

119. Kasi maji yakuthilira wakumupasani pafupipafupi uli? [ ] dazi lililose (Hours)
[ ] madazi ghawiri pa sabata [ ] madazi ghatatu pasabata
[ ] kanyakhe .....

120. Kasi WWUA ili na malango gha kagawilo ka maji? [ ] Inya [ ] Yayi
Pala ***'Inya'*** Kasi namwe mukapanganga nawo malango? [ ] Inya [ ] Yayi

121. Kasi muli wakukondwa na uma malango ghakapangikila? [ ] Inya [ ] Yayi

122. Kasi awo wandalondezge malango mukuwapasa chilango? [ ] Inya [ ] Yayi
Chilango ckake chikuwa chamutundu uli? .....
123. Kasi ndimwe wakukhutira na umo malango ghakugwiriskikira ncthito?
[ ] nili wakukhutira [ ] niliwakukhutira chala
Chifukwa uli mwayowoya ntheura? .....

125. Kasi umo mukuwonera, kagwiriro ka ntchito zake zose ka WWUA kali uli?
[ ] kali makola [ ] kali makola chala [ ] ningamanaya chala

126. Mukawonero kinu, kasi umo boma likendeskeranga sikimu na umo WWUA yikwendeskera sikimu, awo wendeska makola mbanjani? [ ] boma [ ] WWUA [ ] wakuyana waka
[ ] palije [ ] ningamanya chala
Chifukwa uli mwayowoya ntheura? ……

127. Umo mukuwonera, kasi mungakondwa kuti ntchito za WWUA zisinthe? [ ] Inya [ ] Yayi
Pala **'Inya'**, kasi zisinthe uli? ……

Chigawa cha chinkhonde na chitatu: Maji, mizi/wanthu ndi manyumba

Mpata wakasangilo ka ukhalilo

128. Maji ghamumuzi uwu ghakufuma nkhu?
[ ] Ghapasi panthaka [ ] maji gha mumlonga [ ] nyanja [ ] Vula

129. Kasi maji agho imwe mukugwiriska ntchito ni nga?
[ ] Ghapasi panthaka [ ] maji gha mumlonga [ ] nyanja [ ] gha vula

130. Kasi maji mukughagwiriskira ncthito uli?
[ ] ulimi wakuthirira [ ] tikukolamo somba [ ] tikuphikira [ ] tikumwa
[ ] tikusukira viwiya [ ] tikuchapira [ ] tikumweska viweto
[ ] tikugwiriska nthito pa kugeza [ ] ntchito zinyakhe …….....
……..

131. Mumaghanoghano ghinu, kasi unandi wa wanthu awo wakugwiriska ntchito maji gha mwa Wovwe ukukhuza uli uweme wa maji? [ ] maji ghakunangika [ ] palije chakuchitika
[ ] unandi wa wanthu wovwira kuti maji ghawe ghaweme [ ] nkhumanya chala

132. Mumaghanoghano ghinu, kasi unandi wa wanthu awo wakugwiriska ntchito maji gha mwa Wovwe ukukhuza uli unandi wa maji? [ ] maji ghakuchepa [ ] palije chakuchitika
[ ] unandi wa wanthu wovwira kuti maji ghawe ghanandi [ ] nkhumanya chala

133. Mumaghanoghano ghinu, kasi unandi wa maji mu mlonga wa Wovwe mungauyerezgera uli kufuma muvyaka ivyo vyajumpha? [ ] Maji ghawa ghanandi [ ] Maji yakhala yakucheperachepera
[ ] Palije kusintha kulikosa [ ] Nkhumanya chala
134. Mukughanaghana kuti icho chikupangiska kuti unandi wa maji uwe ntheura ncthivichi? ……
……

Chivikiliro/kusowa wuvikiliro

135. Kasi kufuma mu chaka cha 2002, mwakumanapo na chilala/lulanga? [ ] Inya [ ] Yayi
136. Pala mwakumanapo na chilala/lulanga vyachitikanga pafupipafupi uli?
[ ] kamoza pachaka [ ] kamoza muvyaka viwiri
[ ] kamoza muvyaka vitatu panji vinkhonde [ ] kamoza pakati pavyaka vinkhonde na khumi
[ ] kamoza muvyaka khumi [ ] nkhumanya chala
[ ] kanyakhe (longosolani) ……

137. Kasi kufuma mu chaka cha 2002, mwakumanapo na kutula kwa mulonga/kusefukira kwa maji?
[ ] Eya [ ] Yayi
138. Pala mwakumanapo na kusefukira kwa maji, kwachitikanga pafupipafupi uli?
[ ] kamoza pachaka [ ] kawiri panji katatu chaka chili chose
[ ] kamoza muvyaka viwiri [ ] kamoza muvyaka vitatu panji vinkhonde
[ ] kamoza pakati pavyaka vinkhonde na khumi [ ] kamoza muvyaka khumi

[ ] nkhumanya chala [ ] kanyakhe (longosolani) …….....

139. Kasi mukuchita vichi kuti muponoske moyo winu, viweto vinu, na vyakulima vinu ku ukali wa chilala/lulanga?

Mmoyo winu ……

Viweto ……..

Vyakulima? ..……

140. Kasi ivyo mukuchita kuti moponoske moyo winu, viweto vinu, na vyakulima vinu ku ukali wa chilala/lulanga vikukwanira? [ ] Inya [ ] Yayi

141. Kasi mukuchita vichi kuti moponoske moyo winu, viweto vinu, vyakulima vinu na katundu winu ku kututuka panji kusefukira kwa maji?

Mmoyo winu ……..

Viweto ……

Vyakulima ..……

Katundu winu ……

142. Kasi ivyo mukuchita kuti moponoske moyo winu, viweto vinu, vyakulima vinu na katundu winu ku kututuka panji kusefukira kwa maji vikukwanira? [ ] Inya [ ] Yayi

143. Kasi mukupokerapo wovwiri uliwose kufuma ku boma, mawupu, panji wali yose nyengo ya chilala/lulanga panji yakusefuka kwa maji? [ ] Inya [ ] Yayi *(Pitani ku fumbo 145)*

144. Ni woviri wamutundu uli uwo mukupokera? ……

145. Kasi wovwiri uwo mukupokera ngwakovwira kuti zintchito zino zakusangira chakulya na ndalama ziweleremo? [ ] Inya [ ] Yayi

146. Pala *'Yayi'*: Niwovwiri wuli panji wovwiri unandi uli uwo mungakondwa kuwupokera kuti zinthcito zinu ziwerelemo? ……..……

147. Kasi ndimwe mfulu pakugwiriska ncthito maji? [ ] Inya [ ] Yayi

148. Pala ***'Inya'***: ufulu winu ngwamtundu uli? [ ] tose ndise wenecho pamoza [ ] maji ngaulele

[ ] ndine mwenecho wa malo agho maji ghakujumpha [ ] ndili kubwereka (rent)

[ ] Tikulimbirana wenecho [ ] ufulu unyakhe ……

149. Mumaghanoghano ghino, ufulu wino kumaji ngwakukhazgikika? [ ] Inya [ ] Yayi

Chifukwa uli mukyowoya ntheura? ……..……

150. Kasi ufulu winu mungawuvikirira kwa wanji awo wangakhumba kunjirirapo? [ ] Inya [ ] Yayi

151. Pala ufulu winu mungauvikilira, kasi mukuchita vichi kuti muvikilire ufulu winu? ……

……

152. Kasi usangikiro wa maji mchigawa ichi mukuwuwona kuti uli uli?

[ ] ngwambula kusinthasintha [ ] ngwakusinthasintha (wambula kugomezgeka)

[ ] maji ghakusowasowa [ ] palije kusintha

153. Kasi usangikiru uwu, wakhuza uli ntchito zinu zakusangila chakulya na ndalama?

[ ] wanipangiska kuwa na nthowa zinandi zakusangila ndalama na chakulya

[ ] wanipangiska kuti nikoleske nthowa yimozi yakusangila chakulya na ndalama

[ ] palije icho chasinthapo

[ ] vinyakhe *(longosolani)* ……..……..……

154. Kasi wanthu panji mawupu ghanyakhe agho naghoso ghakugwiriska ncthito maji wakhuza uli kasangikiro ka maji kwa imwe? [ ] wapangiska kuti maji niyasangenge munyengomunyengo

[ ] wapangiska kuti maji kagwiriskiro kanctito tigawanennge

[ ] wapangiska kuti ndisangenge maji munyengo yakupika pera

[ ] wapangiska kuti tilimbiranenge maji

[ ] wunyakhe *(longosolani)* …….....

Kupereka nkhongono zakujovwirira wekha kwa wanthu

155. Kasi muli an mawupu gha mumuzi agho ghakugwira ncthito yakupwererera na kugawa maji?

[ ] Inya [ ] Yayi

156. Kasi kagwiriro kawo ka ntchito nkhakukhutiriska?

Umo wakupwererera maji? [ ] nkhakukhutiriska [ ] nkhakukhutiriska chala [ ] ningamanya chala

Chifukwa uli mukuyowoya ntheura? ……...…….……

Umo wakugawila maji? [ ] nkhakukhutiriska [ ] nkhakukhutiriska chala [ ] ningamanya chala

Chifukwa uli mukuyowoya ntheura? ……...…….……

157. Kasi wanthu wa mumuzi wakuperekapo maganizo ghawo pa ntchito zakapwererero na kagawiro ka maji?

Pa ntchito zakupwererera maji? [ ] Inya [ ] Yayi

Pala ***'Inya'***: wanthu wa muzi wakuperekapo uli maganizo ghawo?

[ ] wanthu mu muzi wali na wakwiwimirira wawo [ ] mafumu ghakwimirira wanthu wa mumuzi

[ ] kwizira mu mawupu gha chitukuko gha mumuzi (CBOs)

[ ] kwizira mumagulu gha awo wakugwiriskntchito maji

[ ] nthowa zinyakhe *(longosolani)* ……..……

158. Pantchito zakagawilo ka maji? [ ] Inya [ ] Yayi

Pala ***'Inya'***: wanthu wa muzi wakuperekapo uli maganizo ghawo?

[ ] wanthu mu muzi wali na wakwiwimirira wawo [ ] mafumu ghakwimirira wanthu wa mumuzi

[ ] kwizira mu mawupu gha chitukuko gha mumuzi (CBOs)

[ ] kwizira mumagulu gha awo wakugwiriskntchito maji

[ ] nthowa zinyakhe *(longosolani)* ……..……

159. Pala wanthu wamumuzi wali na wakwiwimirira wawo, uyo wakusankha wimilili ni njani? ……
……

160. Kasi ndimwe wakukhutirwa na umo wimilili wakusankhikira? [ ] nili wakukhutirwa
[ ] nili wakukhutirwa chala
Chifukwa uli mukuyowoya ntheura? …….....

161. Kasi imwe muli wakukhutirwa na ntchito ya wimilili winu? [ ] Inya [ ] Yayi
Chifukwa uli mukuyowoya ntheura? ……...……

Chigawa cha chinkhonde na chinayi: Vyakukhazikika (maofesi) na ma dongosolo

Vyakukhazikika (maofesi)

162. Kasi ni ma wupu panji ma department gha boma nga agho ghakugwira ntchito za maji mumchigawa ichi? ……

163. Ni ntchito uli izo mawupu panji ma department ghakugwira? ……..……

164. Kasi ndimwe wakukhutirwa na kagwiriro kawo kanthcito? [ ] Inya [ ] Yayi
Chifukwa uli mukuyowoya ntheura? ……

Madongosolo na machitilo

165. Kasi madongosolo (policies) agha gha boma mulikughapulikakpo?
(i) Nkhongono ku wanthu (National Decentralisation Policy) [ ] Eya [ ] Yayi
(ii) Dongosolo la nthilira (National Irrigation Policy and Strategy) [ ] Eya [ ] Yayi
(iii) Vyakulengeka (National Environmental Policy) [ ] Eya [ ] Yayi
(iv) Maji (National Water Policy) [ ] Eya [ ] Yayi

166. Kasi dongosolo lililose likovwirapo uli pa ntchito zinu zakusangira ndalama na chakulya?
(a) Dongosolo la nkhongono ku wanthu
[ ] ntchito zane zaluta panthazi [ ] palije chakuchitikae [ ] ntchito zane zawerera kunyma
[ ] nkhumanya chala
Chifukwa uli mukuyowoya ntheura? ……...…..…….....……
(b) Dongosolo la nthilira
[ ] ntchito zane zaluta panthazi [ ] palije chakuchitikae [ ] ntchito zane zawerera kunyma
[ ] nkhumanya chala
Chifukwa uli mukuyowoya ntheura? ……...…..…….....……
(c) Dongosolo la Vyakulengeka
[ ] ntchito zane zaluta panthazi [ ] palije chakuchitikae [ ] ntchito zane zawerera kunyma
[ ] nkhumanya chala
Chifukwa uli mukuyowoya ntheura? ……...…..…….....……
……
(d) Dongosolo la maji

[ ] ntchito zane zaluta panthazi [ ] palije chakuchitikae [ ] ntchito zane zawerera kunyma
[ ] nkhumanya chala
Chifukwa uli mukuyowoya ntheura? ……...…..…….....……

Chigawa cha khumi: Nthowa zakusangila ukhalilo

167. Kasi ntchito iyo yikumupasani chakulya na ndalama kujumpha zinyakhe ni nji?
[ ] ulimi [ ] ulovi (panji ulimi wa somba) [ ] nilipantchito [ ] malonda
[ ] ntchito zinyakhe *(longosolani)* ……

168. Kasi nthito zinyakhe izo zikumupasani chakulya na ndalama ni ntchito uli? ……
……

169. Kasi pa mwezi mukupanga ndalama zilinga? K _____

170. Kasi ni ndalama zakukwana zilinga izo ntchito ili yose ikumupasani pa ndalama zinu zose izo mukusanga? *(Lembani pasi apa)*

Ntchito	**Ndalama**
Ndalama zose pamoza	

171. Kasi ntchito izo mwazunula mukuzigwira nyengo uli? *(Lembani pasi apa)*

Ntchito	**Nyengo**	
	Chifuku	*Chihanya*

172. Kasi ni vichi ivyo vikupangiska kuti ntchito zinu zimupinduliranai chomene? ……
……

173. Kasi ni vichi ivyo vikupangiska kuti ntchito zinu zitondenke kumupindulirani? ……
……

174. Kasi kagwiriro kinu ka zintchito kwasintha uli mvyaka ivyo vyajumpha? [ ] nasintha mbuto zakulima
[ ] nasazgilapo ntchito zinyanke [ ] zindasinthe [ ] nachepeska zintchito
175. Kasi ntchivichi icho chapangiska kuti kagwiliro kinu ka ntchito ka sinthe?
[ ] kusintha kwa nyengo [ ] kusowa kwa maji [ ] kukula mumsinkhu

[ ] ntchito zikukhumba kukgwira chomene (labour intensive) [ ] Kulimbirana malo
[ ] kulimbirana maji [ ] vifukwa vinyakhe *(longosolani)* ……..……
……

Chigawa cha khumi na chimoza: Kusintha kwa kendeskero kwa sikimu ya kuthilira ya Wovwe

176. Kasi mulikupulikapo zakusintha kwa kendeskero ka sikimu ya Wovwe kufuma mumawoko ya boma kuluta ku WWUA? [ ] Inya [ ] Yayi

Maganizo gha walimi pa mtengo waulimi wakuthilira chifukwa chakusintha kendeskero ka sikimu

Mtengo wakhe kwa walimi

177. Mumaghanoghano ghinu, ndalama za msonkho wa maji izo mukulipira zakwera panji zakhira uli munyengo ya sono pakuyelezgera na nyengo iyo wendeskero wa sikimu wukawa mumawoko ya boma?
[ ] zakwera sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] zakhira sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] palije kusintha
[ ] ningamanya chala
[ ] nilije zgolo

178. Kasi mukuyanayaniska uli kotondeka kwinu ngati mulimi pakugwira zintchito za musikimu sono napala boma likendeskanga sikimu?
[ ] nkhuchita makola sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] nkhutondeka chomene sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] palije kusintha
[ ] ningamanya chala
[ ] nilije zgolo

179. Pakuyananiska na nyengo iyo boma likendeskanga sikimu, kasi ni ntchi pa ivyo vili pasi apa icho nichaunenesko pa ndalama izo mukulipira kuti ulimi winu wakuthilira wendenge makola?
[ ] ndalama zakwera sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] ndalama zakhira sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] palije kusintha
[ ] ningamanya chala
[ ] nilije zgolo

180. Mumaghanoghano ghinu, kasi ni ntchi pa ivyo vili pasi apa icho nichaunenesko pawovwiri wamtundu uliwose (kupatulapo wa ndalama) uwo mukupereka kuwendeskero wa sikimu?
[ ] wovwiri wakula sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] wovwiri wakhira sono kujumpha apo wendeskero ukawa mumawoko gha boma
[ ] palije kusintha
[ ] ningamanya chala
[ ] nilije zgolo

181. Mumaghanoghano ghinu, kasi ni ntchi pa ivyo vili pasi apa icho nichaunenesko pamsonkho uwo mukupereka (kupatulapo msonkho wa ndalama) kuwendeskero wa sikimu?

[ ] msonkho wakula sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] msonkho wakhira sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] palije kusintha

[ ] ningamanya chala

[ ] nilije zgolo

182. Kasi unandi wa mazuwa agho mukugwira ntchito zakunozga mifolo musikimu sono mungaghayanayaniska uli na nyengo iyo kendeskero ka sikimu kakawa mumawoko gha boma?

[ ] mazuwa yawa yanandi sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] mazuwa yachepa sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] palije kusintha

[ ] ningamanya chala

[ ] nilije zgolo

183. Mumaghanughano ghinu, kasi malipiro ghanyakhe agho mwakhala mukupereka kuti musange maji ghakuthirira minda yinu yasintha uli?

[ ] malipiro ghakwera sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] malipiro ghakhira sono kujumpha apo wendeskero ukawa mumawoko gha boma

[ ] palije kusintha

[ ] ningamanya chala

[ ] nilije zgolo

Uweme wa ntchito za ulimi wakuthilira

184. Mukawonero kinu, kasi zintchito izi mungaziyanayaniska uli sono na apo wendeskero wa sikimu ukawa mumawoko gha boma?

<u>(a)Kukwanira kwa maji munyengo ya chifuku</u>

[ ] maji yakukwanira makola sono kujumpha munyengo iyo boma likendeskanga sikimu

[ ] maji niyambula kukwana sono kujumpha munyengo iyo boma likendeskanga sikimu

[ ] maji yawa yakukwana nyengo zose ziwiri

[ ] maji yawa yambulakukwana nyengo zose ziwiri

<u>(b) Kukwanira kwa maji munyengo ya chihanya</u>

[ ] maji yakukwanira makola sono kujumpha munyengo iyo boma likendeskanga sikimu

[ ] maji niyambula kukwana sono kujumpha munyengo iyo boma likendeskanga sikimu

[ ] maji yawa yakukwana nyengo zose ziwiri

[ ] maji yawa yambulakukwana nyengo zose ziwiri

<u>(c) Kagawiro ka maji nyengo ya chifuku</u>

[ ] maji yakugawika mwambula kutemwera sono kujumpha apo boma likendeskanga sikimu

[ ] maji ghakugawika mwakutemwera sono kujumpha apo boma likendeskanga sikimu

[ ] munyengo zose ziwiri maji yawa yakugawika makola
[ ] munyengo zose ziwiri maji yandagawike makola

(d) Kagawiro ka maji nyengo ya chihanya
[ ] maji yakugawika mwambula kutemwera sono kujumpha apo boma likendeskanga sikimu
[ ] maji ghakugawika mwakutemwera sono kujumpha apo boma likendeskanga sikimu
[ ] munyengo zose ziwiri maji yawa yakugawika makola
[ ] munyengo zose ziwiri maji yandagawike makola

(e) Kagawiro kamaji munyengo yakhe nyengo yachifuku
[ ] maji yakugawika munyengo yake sono kujumpha apo boma likendeskanga sikimu
[ ] maji yakagawikanga makola nyengo iyo boma likendeskanga sikimu kujumpha sono
[ ] sono na apo boma likendeskanga sikimu posepose maji yawa yakugawika munyengo yake yiwemi
[ ] sono na apo boma likendeskanga sikimu posepose maji yawa yakugawika munyengo yiwemi chala

(f) Kagawiro kamaji munyengo yakhe nyengo yachifuku
[ ] maji yakugawika munyengo yake sono kujumpha apo boma likendeskanga sikimu
[ ] maji yakagawikanga makola nyengo iyo boma likendeskanga sikimu kujumpha sono
[ ] sono na apo boma likendeskanga sikimu posepose maji yawa yakugawika munyengo yake yiwemi
[ ] sono na apo boma likendeskanga sikimu posepose maji yawa yakugawika munyengo yiwemi chala

(g) Kachitikilo ka kwambana chifukwa chamaji pakati pa walimi
[ ] kwambana kwachepa sono kujumpha nyengo iyo boma likendeskanga sikimu
[ ] kwambana kwakula sono kujumpha apo boma likendeskanga sikimu
[ ] kwambana kwawa kwakuchepa nyengo zose ziwiri
[ ] nyengo zose ziwiri kwambana kwakula chomene

Chakulata chakusintha kendeskero ka sikimu pa kunozga ntchito za musikimu

185. Kasi kagwiliro ka ntchito kamifolo sono na nyengo iyo boma likendeskanga sikimu mukuyanayaniska uli?
[ ] mifolo yilimakola sono kujumpha apo boma likendeskanga sikimu
[ ] mifolo yanangika sono kujumpha apo boma likendeskanga sikimu
[ ] munyengo zose ziwiri mifolo yili makola
[ ] munyengo zose ziwiri mifolo yilimakola chala

Chakulata chakusintha kendeskero ka sikimu pa vyakukolora

186. Kasi vyakukolola vinu vyawa uli kwamba apo sikimu yikafuma mumawoko ya boma kuluta mukendeskero ka sikimu na WWUA?
[ ] vuna yikukula chaka na chaka kujumpha apo boma likendeskanga sikimu
[ ] vuna yikuchepa chaka na chaka kujumpha apo boma likendeskanga sikimu
[ ] vuna nyengo yasono na kale yikuyana waka
[ ] munyengo zose ziwiri vuna kuti yili makaola chala

[ ] munyengo zose ziwiri vuna yili makola chomene

Chifukwa uli mwayowoya ntheura?

187. Kasi unandi wa mbuto zinu nyengo ya sono na apo boma likendeskanga sikimu mungaviyanayaniska uli?

[ ] nkhulima mbuto zinandi sono kujumpha kale

[ ] kale nkhalimanga mbuto zinandi kujumpha sono

[ ] unandi wambuto izo nkhulima sono zikuyana waka na umo nkhalimulanga kale

188. Kasi unandi wa nthowa izo mukusangila vyakuti vimovwilaninge paukhalilo mukuwuyanayaniska uli sono na kale?

[ ] sono nili na nthowa zinandi kujumpha kale

[ ] kale nkhawa na nthowa zinandi kujumpha izo nili nazo sono

[ ] unandi wa nthowa ukuyana waka

Chakulata chakusintha kendeskero ka sikimu pa phindu la chuma ilo mukusanga pa munda

189. Kasi mukuyayaniska uli phindu linu la chuma ilo mukulisanga pa munda uwo mukulima sono na phindu ilo mukalisanganga kale?

[ ] phindu lane lakula sono kujumpha kale

[ ] phindu lane lachepa sono kujumpha kale

[ ] phindu lane sono na kale vikuyana waka

190. Kasi chuma chino panyumba mukuchiona kuti chasintha uli muvyaka ivyo vyajumpha kwambira apo kendeskero ka maji na sikimu kukasintha?

[ ] chasintha makola [ ] palije kusintha [ ] chasintha uheni [ ] nkhumanya chala

Chifukwa uli mukuyowoya ntheura? …….....

.....…….....

191. Kasi unandi wa maplot agho mwakhala mukulima kwamba apo wendeshero wa sikimu ukasintha wasintha uli? [ ] ghawa ghanandi [ ] ghachepa [ ] palije kusintha

192. Kasi kagwiriro kinu kantchito izo nizaulimi chala kwasintha uli kufuma apo wendeskero wa sikimu ukasintha (mchaka cha 2002)? [ ] Kakula [ ] kachepa [ ] palije kusintha

193. Mukuganiza kuti nichifukwa uli icho chapangiska kuti kagwiriro kinu ka ntchito kakhale ntheura? …….....

194. Kasi unandi wa nthowa zambula kukhwaska ndalama izo mukusangira wovwiri munyumba mwino kwasintha uli kufumakale? [ ] zaya zinandi [ ] zachepa [ ] palije kusintha

195. Mukuganiza kuti nichifukwa uli icho chapangiska kuti nthowa za kusangira ndalama zikhale ntheura? ..…….....

196. Kasi pala mukuwona unandi wa viweto vyinu sono, mukuyananiska uli na viweto ivyo mukwa navyo mu vyaka vyakunyuma? [ ] vyawa vinandi [ ] palije kusintha [ ] vyachepa

Mukughanghana kwinu, nichifukwa uli vyawa ntheura? ……

……

YEWO CHOMENE!

Appendix 6: Scheme membership between summer 1991/92 and summer 2009/10

Data source: Karonga District Irrigation Office

Season	Total number of farmers	Male	Female
1991/92 (s)	750	584	166
1992 (w)	823	689	134
1992/93 (s)	835	730	105
1993 (w)	1133	789	344
1993/94 (s)	670	560	110
1994 (w)	1012	806	206
1994/95 (s)	1070	853	217
1995 (w)	1090	871	219
1995/96 (s)	1092	867	225
1996 (w)	1109	879	230
1996/97 (s)	1036	807	229
1997 (w)	1121	890	231
1997/98 (s)	1118	883	235
1998 (w)	1168	953	215
1998/99 (s)	1175	951	224
1999 (w)	1168	953	215
1999/00 (s)	1172	955	217
2000 (w)	1168	953	215
2000/01 (s)	1168	953	215
2001 (w)	1192	959	233
2001/02 (s)	1187	950	237
2002 (w)	1198	959	239
2002/03 (s)	1198	953	245
2003 (w)	1288	978	310
2003/04 (s)	1322	987	335
2004 (w)	1348	1001	347
2004/05 (s)	1318	1003	315
2005 (w)	1461	1103	358
2005/06 (s)	1410	1009	401
2006 (w)	1369	1010	359
2006/07 (s)	1475	1060	415
2007 (w)	1498	1100	398
2007/08 (s)	1500	1089	411
2008 (w)	1500	1105	395

2008/09 (s)	1500	1120	380
2009 (w)	1500	1134	366
2009/10 (s)	1500	1140	360

Appendix 7: Livelihhod diversity calculations – Inverse Herfindahl-Hirschman Index (I-HHI) Calculations

A. CALCULATIONS FOR THE WHOLE STUDY SITE

	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means	Total
Total income (MK)	26461880	4867800	569500	592600	356000	253000	736700	45000	82500	180000	158500	**34303480**
Share (%)	77.140512	14.190397	1.660181	1.727522	1.037796	0.737535	2.147596	0.131182	0.240500	0.524728	0.462052	**100.000000**
Squares of shares	5950.658544	201.367367	2.756202	2.984331	1.077020	0.543957	4.612167	0.017209	0.057840	0.275340	0.213492	**6164.563469**
Proportional contributions	0.771405	0.141904	0.016602	0.017275	0.010378	0.007375	0.021476	0.001312	0.002405	0.005247	0.004621	**1.000000**
Squares of proportional contributions	0.595066	0.020137	0.000276	0.000298	0.000108	0.000054	0.000461	0.000002	0.000006	0.000028	0.000021	**0.616456**
I-HHI												**1.622175**

B. CALCULATIONS BY LOCATION

Total income from livelihoods by location (MK)

Location	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means	Total
Upstream	5104600	1714800	180000	163000	35000	3000	248300	0	29000	60000	1000	7538700
Downstream	4594500	968000	90300	209800	256000	215000	153400	45000	14500	0	0	6546500
Within WIS	14587780	1769000	286200	205800	65000	35000	267000	0	26000	120000	132500	17494280
Other	2175000	416000	13000	14000	0	0	68000	0	13000	0	25000	2724000
Total	**26461880**	**4867800**	**569500**	**592600**	**356000**	**253000**	**736700**	**45000**	**82500**	**180000**	**158500**	**34303480**

Shares (%)

Location	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means		Total
Upstream	67.7119	22.7466	2.3877	2.1622	0.4643	0.0398	3.2937	0.0000	0.3847	0.7959	0.0133	100.0000	7538700
Downstream	70.1825	14.7865	1.3794	3.2048	3.9105	3.2842	2.3432	0.6874	0.2215	0.0000	0.0000	100.0000	6546500
Within WIS	83.3860	10.1119	1.6360	1.1764	0.3716	0.2001	1.5262	0.0000	0.1486	0.6859	0.7574	100.0000	17494280
Other	79.8458	15.2717	0.4772	0.5140	0.0000	0.0000	2.4963	0.0000	0.4772	0.0000	0.9178	100.0000	2724000

Squares of shares and HHI values

Location	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means	HHI
Upstream	4584.9068	517.4091	5.7010	4.6750	0.2155	0.0016	10.8483	0.0000	0.1480	0.6334	0.0002	5124.5389
Downstream	4925.5890	218.6414	1.9026	10.2705	15.2919	10.7860	5.4908	0.4725	0.0491	0.0000	0.0000	5188.4937
Within WIS	6953.2247	102.2500	2.6764	1.3839	0.1380	0.0400	2.3293	0.0000	0.0221	0.4705	0.5736	7063.1086
Other	6375.3542	233.2236	0.2278	0.2641	0.0000	0.0000	6.2317	0.0000	0.2278	0.0000	0.8423	6616.3714

Proportional contribution

Location	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means	HHI
Upstream	0.6771	0.2275	0.0239	0.0216	0.0046	0.0004	0.0329	0.0000	0.0038	0.0080	0.0001	1.0000
Downstream	0.7018	0.1479	0.0138	0.0320	0.0391	0.0328	0.0234	0.0069	0.0022	0.0000	0.0000	1.0000
Within WIS	0.8339	0.1011	0.0164	0.0118	0.0037	0.0020	0.0153	0.0000	0.0015	0.0069	0.0076	1.0000
Other	0.7985	0.1527	0.0048	0.0051	0.0000	0.0000	0.0250	0.0000	0.0048	0.0000	0.0092	1.0000

Squares of proportional contributions

Location	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance†	Employment	Other means		I-HHI
Upstream	0.4585	0.0517	0.0006	0.0005	0.0000	0.0000	0.0011	0.0000	0.0000	0.0001	0.0000	0.5125	1.9514
Downstream	0.4926	0.0219	0.0002	0.0010	0.0015	0.0011	0.0005	0.0000	0.0000	0.0000	0.0000	0.5188	1.9273
Within WIS	0.6953	0.0102	0.0003	0.0001	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0001	0.7063	1.4158
Other	0.6375	0.0233	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0001	0.6616	1.5114

C. CALCULATIONS BY VILLAGE

Income from livelihood strategies by village (MK)

Village	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance	Employment	Other means	Total (MK)
Njalayankhunda	683000	183000	42000	5000	0	0	40000	0	11000	36000	0	1000000
Zengelanjala I	283000	32000	12000	0	20000	0	0	0	0	0	0	347000
Zengelanjala II	500000	145000	5000	6000	0	0	18000	0	0	0	0	674000
Gonthaminga	560000	292200	50000	5000	0	0	179000	0	8000	0	1000	1095200
Zindili	1068000	328000	0	42000	0	0	0	0	3000	0	0	1441000
Mtangala	537000	345000	20000	15000	15000	0	11300	0	0	0	0	943300
Mwenemambwe	3154200	182400	7200	20000	0	0	119000	0	9000	120000	108200	3720000
Gangamwale	1583000	284000	28000	13000	0	5000	20000	0	9000	0	0	1942000
Kayaghala	408500	103000	33000	36000	12000	0	30000	0	3000	0	0	625500
Galimoto	158000	116000	4000	15000	70000	0	0	0	2500	0	0	365500
Ndatira	240000	66000	0	0	85000	0	0	0	0	0	0	391000
Mwakalomba	274000	20000	0	123000	89000	0	30000	0	0	0	0	536000
Kanyuka	1566000	244000	25300	22800	0	60000	71000	0	0	0	0	1989100
Mwangwala	365000	135000	0	0	0	150000	2400	45000	0	0	0	697400
Kapiyira	3616000	31800	45000	99000	0	35000	0	0	6000	0	700	3833500
Mlangapamalo	2455780	514800	46000	19800	0	0	90000	0	0	0	21600	3147980
Jumbe	1071000	128000	30000	70000	0	0	0	0	0	0	0	1299000
Mwathengele	96000	30000	6000	0	0	0	0	0	0	0	0	132000
Chagoma	108600	147000	15000	0	0	0	0	0	0	0	0	270600
Chauteka	198000	84600	0	20000	0	3000	0	0	7000	24000	0	336600
Kalimunda	501000	32000	0	20000	0	0	0	0	0	0	0	553000
Mphangwanjiri	1899000	295000	102000	46000	65000	0	40000	0	0	0	2000	2449000
Bunganiro	2961800	713000	86000	1000	0	0	18000	0	11000	0	0	3790800
Mweseleka	230000	20000	1000	12000	0	0	0	0	8000	0	5000	276000

Yakumutu	340000	8000	0	0	0	0	0	0	0	0	0	348000
Mjaliwana	248000	144000	12000	0	0	0	20000	0	0	0	20000	444000
Chiyuni	597000	100000	0	2000	0	0	0	0	0	0	0	699000
Mumwera	120000	144000	0	0	0	0	48000	0	0	0	0	312000
Mwazolokele	40000	0	0	0	0	0	0	0	0	0	0	40000
Kaswela I	600000	0	0	0	0	0	0	0	5000	0	0	605000
Total	**26461880**	**4867800**	**569500**	**592600**	**356000**	**253000**	**736700**	**45000**	**82500**	**180000**	**158500**	**34303480**

Shares (%)

Village	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance	Employment	Other means	Total
Njalayankhunda	68.3000	18.3000	4.2000	0.5000	0.0000	0.0000	4.0000	0.0000	1.1000	3.6000	0.0000	100.0000
Zengelanjala I	81.5562	9.2219	3.4582	0.0000	5.7637	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Zengelanjala II	74.1840	21.5134	0.7418	0.8902	0.0000	0.0000	2.6706	0.0000	0.0000	0.0000	0.0000	100.0000
Gonthaminga	51.1322	26.6801	4.5654	0.4565	0.0000	0.0000	16.3440	0.0000	0.7305	0.0000	0.0913	100.0000
Zindili	74.1152	22.7620	0.0000	2.9146	0.0000	0.0000	0.0000	0.0000	0.2082	0.0000	0.0000	100.0000
Mtangala	56.9278	36.5737	2.1202	1.5902	1.5902	0.0000	1.1979	0.0000	0.0000	0.0000	0.0000	100.0000
Mwenemambwe	84.7903	4.9032	0.1935	0.5376	0.0000	0.0000	3.1989	0.0000	0.2419	3.2258	2.9086	100.0000
Gangamwale	81.5139	14.6241	1.4418	0.6694	0.0000	0.2575	1.0299	0.0000	0.4634	0.0000	0.0000	100.0000
Kayaghala	65.3078	16.4668	5.2758	5.7554	1.9185	0.0000	4.7962	0.0000	0.4796	0.0000	0.0000	100.0000
Galimoto	43.2285	31.7373	1.0944	4.1040	19.1518	0.0000	0.0000	0.0000	0.6840	0.0000	0.0000	100.0000
Ndatira	61.3811	16.8798	0.0000	0.0000	21.7391	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Mwakalomba	51.1194	3.7313	0.0000	22.9478	16.6045	0.0000	5.5970	0.0000	0.0000	0.0000	0.0000	100.0000
Kanyuka	78.7291	12.2666	1.2719	1.1462	0.0000	3.0164	3.5695	0.0000	0.0000	0.0000	0.0000	100.0000
Mwangwala	52.3373	19.3578	0.0000	0.0000	0.0000	21.5085	0.3441	6.4525	0.0000	0.0000	0.0000	100.0000
Kapiyira	94.3263	0.8295	1.1739	2.5825	0.0000	0.9130	0.0000	0.0000	0.1565	0.0000	0.0183	100.0000
Mlangapamalo	78.0113	16.3533	1.4613	0.6290	0.0000	0.0000	2.8590	0.0000	0.0000	0.0000	0.6862	100.0000
Jumbe	82.4480	9.8537	2.3095	5.3888	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Mwathengele	72.7273	22.7273	4.5455	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000

Chagoma	40.1330	54.3237	5.5432	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Chauteka	58.8235	25.1337	0.0000	5.9418	0.0000	0.8913	0.0000	0.0000	2.0796	7.1301	0.0000	100.0000
Kalimunda	90.5967	5.7866	0.0000	3.6166	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Mphangwanjiri	77.5419	12.0457	4.1650	1.8783	2.6541	0.0000	1.6333	0.0000	0.0000	0.0000	0.0817	100.0000
Bunganiro	78.1313	18.8087	2.2687	0.0264	0.0000	0.0000	0.4748	0.0000	0.2902	0.0000	0.0000	100.0000
Mweseleka	83.3333	7.2464	0.3623	4.3478	0.0000	0.0000	0.0000	0.0000	2.8986	0.0000	1.8116	100.0000
Yakumutu	97.7011	2.2989	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Mjaliwana	55.8559	32.4324	2.7027	0.0000	0.0000	0.0000	4.5045	0.0000	0.0000	0.0000	4.5045	100.0000
Chiyuni	85.4077	14.3062	0.0000	0.2861	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Mumwera	38.4615	46.1538	0.0000	0.0000	0.0000	0.0000	15.3846	0.0000	0.0000	0.0000	0.0000	100.0000
Mwazolokele	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000
Kaswela I	99.1736	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8264	0.0000	0.0000	100.0000

Squares of shares and HHI values

Village	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance	Employment	Other means	HHI
Njalayankhunda	4664.8900	334.8900	17.6400	0.2500	0.0000	0.0000	16.0000	0.0000	1.2100	12.9600	0.0000	5047.8400
Zengelanjala I	6651.4131	85.0435	11.9592	0.0000	33.2201	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6781.6359
Zengelanjala II	5503.2623	462.8244	0.5503	0.7925	0.0000	0.0000	7.1322	0.0000	0.0000	0.0000	0.0000	5974.5617
Gonthaminga	2614.5032	711.8255	20.8427	0.2084	0.0000	0.0000	267.1279	0.0000	0.5336	0.0000	0.0083	3615.0496
Zindili	5493.0625	518.1073	0.0000	8.4951	0.0000	0.0000	0.0000	0.0000	0.0433	0.0000	0.0000	6019.7083
Mtangala	3240.7752	1337.6378	4.4953	2.5286	2.5286	0.0000	1.4350	0.0000	0.0000	0.0000	0.0000	4589.4005
Mwenemambwe	7189.3988	24.0416	0.0375	0.2891	0.0000	0.0000	10.2331	0.0000	0.0585	10.4058	8.4600	7242.9244
Gangamwale	6644.5164	213.8643	2.0788	0.4481	0.0000	0.0663	1.0606	0.0000	0.2148	0.0000	0.0000	6862.2493
Kayaghala	4265.1027	271.1564	27.8338	33.1246	3.6805	0.0000	23.0032	0.0000	0.2300	0.0000	0.0000	4624.1312
Galimoto	1868.6993	1007.2591	1.1977	16.8425	366.7932	0.0000	0.0000	0.0000	0.4678	0.0000	0.0000	3261.2597
Ndatira	3767.6363	284.2275	0.0000	0.0000	472.5898	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4525.1536
Mwakalomba	2613.1934	13.9229	0.0000	526.5997	275.7087	0.0000	31.3266	0.0000	0.0000	0.0000	0.0000	3460.7513
Kanyuka	6198.2670	150.4757	1.6178	1.3139	0.0000	9.0989	12.7410	0.0000	0.0000	0.0000	0.0000	6373.5143

Mwangwala	2739.1880	374.7172	0.0000	0.0000	0.0000	462.6139	0.1184	41.6352	0.0000	0.0000	0.0000	3618.2728
Kapiyira	8897.4572	0.6881	1.3780	6.6693	0.0000	0.8336	0.0000	0.0000	0.0245	0.0000	0.0003	8907.0510
Mlangapamalo	6085.7623	267.4319	2.1353	0.3956	0.0000	0.0000	8.1737	0.0000	0.0000	0.0000	0.4708	6364.3696
Jumbe	6797.6788	97.0961	5.3336	29.0387	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6929.1473
Mwathengele	5289.2562	516.5289	20.6612	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5826.4463
Chagoma	1610.6607	2951.0671	30.7275	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4592.4553
Chauteka	3460.2076	631.7024	0.0000	35.3046	0.0000	0.7944	0.0000	0.0000	4.3248	50.8387	0.0000	4183.1725
Kalimunda	8207.7702	33.4850	0.0000	13.0801	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8254.3352
Mphangwanjiri	6012.7391	145.0997	17.3469	3.5281	7.0445	0.0000	2.6677	0.0000	0.0000	0.0000	0.0067	6188.4327
Bunganiro	6104.4946	353.7670	5.1468	0.0007	0.0000	0.0000	0.2255	0.0000	0.0842	0.0000	0.0000	6463.7187
Mweseleka	6944.4444	52.5100	0.1313	18.9036	0.0000	0.0000	0.0000	0.0000	8.4016	0.0000	3.2819	7027.6728
Yakumutu	9545.5146	5.2847	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	9550.7993
Mjaliwana	3119.8766	1051.8627	7.3046	0.0000	0.0000	0.0000	20.2906	0.0000	0.0000	0.0000	20.2906	4219.6250
Chiyuni	7294.4795	204.6660	0.0000	0.0819	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7499.2274
Mumwera	1479.2899	2130.1775	0.0000	0.0000	0.0000	0.0000	236.6864	0.0000	0.0000	0.0000	0.0000	3846.1538
Mwazolokele	10000.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10000.0000
Kaswela I	9835.3938	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6830	0.0000	0.0000	9836.0768

Proportional contributions

Village	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance	Employment	Other means	Total
Njalayankhunda	0.6830	0.1830	0.0420	0.0050	0.0000	0.0000	0.0400	0.0000	0.0110	0.0360	0.0000	1.0000
Zengelanjala I	0.8156	0.0922	0.0346	0.0000	0.0576	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Zengelanjala II	0.7418	0.2151	0.0074	0.0089	0.0000	0.0000	0.0267	0.0000	0.0000	0.0000	0.0000	1.0000
Gonthaminga	0.5113	0.2668	0.0457	0.0046	0.0000	0.0000	0.1634	0.0000	0.0073	0.0000	0.0009	1.0000
Zindili	0.7412	0.2276	0.0000	0.0291	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	1.0000
Mtangala	0.5693	0.3657	0.0212	0.0159	0.0159	0.0000	0.0120	0.0000	0.0000	0.0000	0.0000	1.0000
Mwenemambwe	0.8479	0.0490	0.0019	0.0054	0.0000	0.0000	0.0320	0.0000	0.0024	0.0323	0.0291	1.0000
Gangamwale	0.8151	0.1462	0.0144	0.0067	0.0000	0.0026	0.0103	0.0000	0.0046	0.0000	0.0000	1.0000

Kayaghala	0.6531	0.1647	0.0528	0.0576	0.0192	0.0000	0.0480	0.0000	0.0048	0.0000	0.0000	1.0000
Galimoto	0.4323	0.3174	0.0109	0.0410	0.1915	0.0000	0.0000	0.0000	0.0068	0.0000	0.0000	1.0000
Ndatira	0.6138	0.1688	0.0000	0.0000	0.2174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Mwakalomba	0.5112	0.0373	0.0000	0.2295	0.1660	0.0000	0.0560	0.0000	0.0000	0.0000	0.0000	1.0000
Kanyuka	0.7873	0.1227	0.0127	0.0115	0.0000	0.0302	0.0357	0.0000	0.0000	0.0000	0.0000	1.0000
Mwangwala	0.5234	0.1936	0.0000	0.0000	0.0000	0.2151	0.0034	0.0645	0.0000	0.0000	0.0000	1.0000
Kapiyira	0.9433	0.0083	0.0117	0.0258	0.0000	0.0091	0.0000	0.0000	0.0016	0.0000	0.0002	1.0000
Mlangapamalo	0.7801	0.1635	0.0146	0.0063	0.0000	0.0000	0.0286	0.0000	0.0000	0.0000	0.0069	1.0000
Jumbe	0.8245	0.0985	0.0231	0.0539	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Mwathengele	0.7273	0.2273	0.0455	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Chagoma	0.4013	0.5432	0.0554	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Chauteka	0.5882	0.2513	0.0000	0.0594	0.0000	0.0089	0.0000	0.0000	0.0208	0.0713	0.0000	1.0000
Kalimunda	0.9060	0.0579	0.0000	0.0362	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Mphangwanjiri	0.7754	0.1205	0.0416	0.0188	0.0265	0.0000	0.0163	0.0000	0.0000	0.0000	0.0008	1.0000
Bunganiro	0.7813	0.1881	0.0227	0.0003	0.0000	0.0000	0.0047	0.0000	0.0029	0.0000	0.0000	1.0000
Mweseleka	0.8333	0.0725	0.0036	0.0435	0.0000	0.0000	0.0000	0.0000	0.0290	0.0000	0.0181	1.0000
Yakumutu	0.9770	0.0230	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Mjaliwana	0.5586	0.3243	0.0270	0.0000	0.0000	0.0000	0.0450	0.0000	0.0000	0.0000	0.0450	1.0000
Chiyuni	0.8541	0.1431	0.0000	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Mumwera	0.3846	0.4615	0.0000	0.0000	0.0000	0.0000	0.1538	0.0000	0.0000	0.0000	0.0000	1.0000
Mwazolokele	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Kaswela I	0.9917	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0083	0.0000	0.0000	1.0000

Squares of proportional contributions

Village	Farming	Business	Piecework	Weaving	Fishing/fish farming	Beer brewing	Livestock	Hunting	Assistance	Employment	Other means	Total	I-HHI
Njalayankhunda	0.4665	0.0335	0.0018	0.0000	0.0000	0.0000	0.0016	0.0000	0.0001	0.0013	0.0000	0.5048	1.9810
Zengelanjala I	0.6651	0.0085	0.0012	0.0000	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6782	1.4746
Zengelanjala II	0.5503	0.0463	0.0001	0.0001	0.0000	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.5975	1.6738

Gonthaminga	0.2615	0.0712	0.0021	0.0000	0.0000	0.0000	0.0267	0.0000	0.0001	0.0000	0.0000	0.3615	2.7662
Zindili	0.5493	0.0518	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6020	1.6612
Mtangala	0.3241	0.1338	0.0004	0.0003	0.0003	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.4589	2.1789
Mwenemambwe	0.7189	0.0024	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0010	0.0008	0.7243	1.3807
Gangamwale	0.6645	0.0214	0.0002	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.6862	1.4572
Kayaghala	0.4265	0.0271	0.0028	0.0033	0.0004	0.0000	0.0023	0.0000	0.0000	0.0000	0.0000	0.4624	2.1626
Galimoto	0.1869	0.1007	0.0001	0.0017	0.0367	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3261	3.0663
Ndatira	0.3768	0.0285	0.0000	0.0000	0.0473	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4525	2.2099
Mwakalomba	0.2613	0.0014	0.0000	0.0527	0.0276	0.0000	0.0031	0.0000	0.0000	0.0000	0.0000	0.3461	2.8895
Kanyuka	0.6198	0.0150	0.0002	0.0001	0.0000	0.0009	0.0013	0.0000	0.0000	0.0000	0.0000	0.6374	1.5690
Mwangwala	0.2739	0.0375	0.0000	0.0000	0.0000	0.0463	0.0000	0.0042	0.0000	0.0000	0.0000	0.3618	2.7637
Kapiyira	0.8897	0.0001	0.0001	0.0007	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.8907	1.1227
Mlangapamalo	0.6086	0.0267	0.0002	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.6364	1.5712
Jumbe	0.6798	0.0097	0.0005	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6929	1.4432
Mwathengele	0.5289	0.0517	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5826	1.7163
Chagoma	0.1611	0.2951	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4592	2.1775
Chauteka	0.3460	0.0632	0.0000	0.0035	0.0000	0.0001	0.0000	0.0000	0.0004	0.0051	0.0000	0.4183	2.3905
Kalimunda	0.8208	0.0033	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8254	1.2115
Mphangwanjiri	0.6013	0.0145	0.0017	0.0004	0.0007	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.6188	1.6159
Bunganiro	0.6104	0.0354	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6464	1.5471
Mweseleka	0.6944	0.0053	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0003	0.7028	1.4229
Yakumutu	0.9546	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9551	1.0470
Mjaliwana	0.3120	0.1052	0.0007	0.0000	0.0000	0.0000	0.0020	0.0000	0.0000	0.0000	0.0020	0.4220	2.3699
Chiyuni	0.7294	0.0205	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7499	1.3335
Mumwera	0.1479	0.2130	0.0000	0.0000	0.0000	0.0000	0.0237	0.0000	0.0000	0.0000	0.0000	0.3846	2.6000
Mwazolokele	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
Kaswela I	0.9835	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.9836	1.0167