Innovations to Promote Growth in Small-scale Irrigation in Africa

Malawi Report

November 2015

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About this Project

This report is an output of the DFID/ESRC funded project "Innovations to Promote Growth among Small-scale Irrigators in Africa: An Ethnographic and Knowledge-Exchange Approach". The project was part of the Growth Research Programme funded by DFID, which focuses on understanding (1) the conditions under which agricultural growth contributes to overall economic growth and support structural transformation for a modern, high value-added economy; (2) how agricultural productivity can be raised at the level of households, farms and farming communities; and (3) how the potential of irrigation can be exploited in those countries where current use represents a small fraction of what may be possible.

The project was led by the University of Sussex, UK, with partners at Bunda College of Agriculture, Malawi; Mzumbe University, Tanzania; and Jahangirniagar University, Bangladesh. The project team included Elizabeth Harrison, Canford Chiroro, and Dom Kniveton at Sussex, Katy Gardner, now at the LSE, Anna Mdee at Mzumbe, Joseph Chidanti Malunga at Bunda and Zahir Ahmed at Jahangirnagar.

Ethnographic fieldwork was undertaken in three countries: Bangladesh, Malawi and Tanzania. This report pertains to the Malawi case study.

In all the three countries the research focused on four principal questions:

1. How do different groups get access to and use of agricultural water resources?
2. What are the moral economies of water and how do these vary between different contexts?
3. What is the role of knowledge and information in small-scale irrigation?
4. How are the various processes and practices at play in the management and use of water in irrigation influencing wellbeing and livelihoods?

Outputs from the project include internal reports, academic articles and policy briefings. These are available from the project webpage at
http://www.sussex.ac.uk/global/research/researchprojects/small_scale_irrigation

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Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

Small-scale irrigation is seen as key to improving agricultural productivity and adapting African agriculture to climate change. But attempts to induce or develop small-scale irrigation have apparently had limited 'success' due to a myriad of challenges, including the over-emphasis on technical fixes at the expense of understanding the social and institutional dimensions in irrigation schemes. Recent literature on global environmental change predicts that climate change will exacerbate water scarcity, thereby constraining the development of small-scale irrigation in most parts of Africa.

We adopt an ethnographic approach to explore the impacts of, and institutional responses to water scarcity in two small-scale irrigation schemes in Nsanje district in Malawi. In seeking an understanding of why some irrigation schemes have operated successfully while others have failed, we analyse the systems of access and entitlement to both land and water for irrigation; explore the moral economies of water and how institutions governing agricultural water are responding to increased water scarcity as a result of climatic stresses; and examine how innovations for improving productivity in irrigation are produced, shared and utilised. Our research seeks to contribute towards policy thinking and action around improved productivity in agriculture. To this end, we focus our analysis on what the findings mean in terms of shaping vulnerability and resilience in livelihoods.

Findings from our field study show that irrigation as a solution to improving productivity in small-scale agriculture is inadequate if it fails to address the general constraints facing rain fed farming and is done at the expense of other livelihood strategies. Further, some of the measures aimed at building resilience through promotion of irrigation are unintentionally exposing other groups to multiple stressors, both climatic and socioeconomic. Most irrigation development interventions are apparently being implemented at the scale of the irrigation scheme, and this often takes little regard of the relationship between these schemes and other livelihood systems within the catchment. Within the various localities of our research, it was found that power relations and the influence that individuals can exert on institutions is relevant in shaping access to both land and water, and ultimately in determining who grows and by how much. Despite the limited evidence of planned adaptation of irrigation to climate change, farmers have developed and are exchanging innovations and knowledge aimed at fostering improved performance at lower labour cost.

1 INTRODUCTION

How can small-scale irrigation work for food security and poverty reduction in Africa? This report examines how institutions responsible for the management of agricultural water in small-scale irrigation are responding to increased pressures of water scarcity due to climate change. It is based on ethnographic research in Southern Malawi and with institutions and individuals at the national and international levels. Particular attention is paid to understanding how the rules, norms, practices and values that shape access and entitlement to land and water are changing or being changed in response to these changes. In this aspect of the study, we focus on unravelling how moral economies of water shape outcomes in irrigation schemes; the role of, and process through which, social and technical innovations produce improvements and sustainability in small-scale irrigation; and also, how internal and externally driven measures impact on vulnerability and resilience and for whom. The resilience perspective is particularly useful in this study as it ensures an understanding of the whole system, rather than the common focus on the technical dimensions of irrigation development. In this study we apply resilience thinking to examine the impact of construction or rehabilitation of irrigation schemes on livelihoods and livelihoods change, with particular interest in mapping the winners and the losers. Central in our approach is an understanding of how relations of power and politics at different scales, from household to the national, are at play in shaping livelihood outcomes under small-scale irrigation.

This report is part of a wider research project that was conducted over a period of two years in Malawi, Tanzania and Bangladesh. It is envisaged that the outputs from this study will contribute towards an evidence base for supporting policy thinking with regards to planning and operationalizing agricultural growth policies in African countries.

1.1 The challenge of food insecurity and poverty in Africa

Achieving economic growth in the predominantly agro-based economies of Sub-Saharan Africa is constrained by inadequate growth in agricultural production and increasing water scarcity, which is exacerbated by climate change (Falkennark, 1990; Rosegrant and Cline, 2003). As shown in **Figure 1** (WRI, 2012 after Alexandratos and Bruinsma, 2012), the region has the lowest per capita food production. Crop yields in developing countries in Asia were almost three times higher than those attained in Africa for the period 1961-2011. Low agricultural production in Africa has historically been blamed on poor adoption of technology by farmers, weak market linkages, poor access to cheap finance, lack of extension support and constraints in accessing appropriate seed and fertiliser (Nicolas Depetris Chauvin, Francis Mulangu and Guido Porto, 2012; Christiaensen and Demery, 2007; Morris et al., 2007, among others). While production is expected to increase at least marginally across the various regions of the world, Rosegrant et al (2001) predict that SSA will most likely experience a decrease in both per capita food production and consumption resulting in an increase in both absolute and proportion of undernourished children. Food production would have to increase from a baseline of 9 million metric tonnes in 1990 to 29

million to meet the population demand in 2020, and most economies in the region are too poor to afford this (Rosegrant and Perez, 1997).

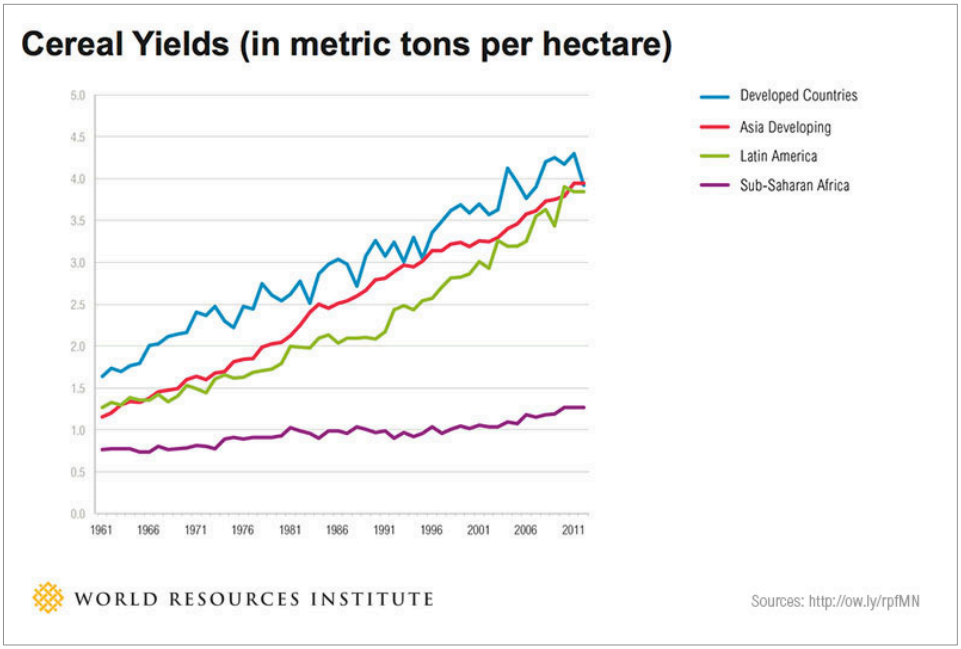


Figure 1: Comparison of crop yields among developing regions, 1961 to 2011

Facilitating agricultural growth in African countries is widely perceived to be the most appropriate strategy for ensuring food security stability and economically viable livelihoods (The Montpellier Panel, 2012). The World Bank estimates that gross domestic product (GDP) growth originating from agriculture raises the income of the poorest households by at least 2.5 times as much as growth in other sectors. To deal with its current and future chronic food insecurity while addressing widespread poverty and malnutrition growth in Africa's agriculture will have to increase from its current rate of 1.9% to outpace that at which its population is expanding, estimated at about 3% per annum (FAO, 1996). The African Development Bank suggests that African agriculture is growing at less than 1%, much lower than 3% in Asia and 2% in Latin America (AfDB, 2010). Such agricultural growth, however, will have to be negotiated from within a milieu of constraints, including growing competition over land, water and energy to meet the growing demands of a rapidly expanding population with changing dietary preferences, and the uncertainties associated with climate change and food markets (Godfray et al., 2010; Licker et al., 2010). The need for changes in policy decisions and social change cannot be over-emphasised. The Comprehensive African Agriculture Development Programme (CAADP) that emerged from the African Union's 2003 Maputo Declaration on agriculture and food security, in which African countries pledged to commit 10% of GDP towards agriculture and rural development policy implementation over a five year period (NEPAD 2003), demonstrates, at least in principle, the policy direction and political will needed to stimulate sufficient agricultural growth in pursuit of food security improvements and poverty reduction objectives. Out of a population nearing a billion, about 240 million Africans are food insecure (Brenmer, 2012).

1.2 Irrigation as a privileged solution to African agriculture

The challenge of raising agricultural production in Africa is chiefly constrained by water scarcity. 22 of the 28 countries classified as likely to experience water scarcity by 2025 are in Africa (UNECA, 1999; FAO, 2014). You et al. (2013) among others, argue that low production levels in African agriculture are a consequence of underutilization of irrigation. With only 6%, compared to 37% in Asia and 14% in Latin America, Africa has the lowest proportion of land under irrigation (amounting to13million hectares), despite the continent receiving 124mm less rainfall per annum than the global average (FAOSTAT, 2009; Svendsen et al. 2009). For a majority of African countries especially in SSA, irrigation only covers a few thousand hectares. Two thirds of the irrigated 6% is concentrated on five countries: Egypt, Madagascar, Morocco, South Africa and Sudan, with each one of them commanding about a million hectares.

Food production on a continent with untapped groundwater resources and highly variable (often low) rainfall remains almost entirely rainfed; irrigation plays a rather insignificant role (You et al., 2010). Regardless of its size, irrigation produces about 50% of all food produced and irrigated farming is 2.5 times more productive than rainfed farming (Stockle, 2001). This makes plausible the argument for further expansion of irrigation across the continent. If Africa increased land under irrigation by 29%, for example, IWMI suggests that the continent would be able to meet food demand by 2025 (Rijsberman, 2001). The Commission on Africa (2005) argues that doubling the area under irrigation in Africa is needed to achieve global development goals for food security and poverty reduction. It is not surprising that policy makers are privileging irrigation development as a solution to Africa's current and future food and economic growth needs- the logic and the numbers are all convincing. The CAADP, with support from major donors, is calling for an African Green Revolution with irrigation development at its centre (AU, 2009). Irrigation has the potential to boost agricultural production by about 50 per cent (You et.al 2010)).

A growing body of evidence, however, argues that climate change and changed climate variability are exacerbating water scarcity in small and large irrigation (Mendelsohn and Seo, 2007; Fischer et al., 2007). Cooper et al. (2008) argue that rainfed farming, which is contributing 90 per cent of all food in SSA, will remain important in the future because the combined effect of climate change and population growth will exacerbate water scarcity to such an extent that irrigation will be curtailed. Voortman (2013) in examining why the Green Revolution bypassed Africa argues that irrigation potential is slightly modest in comparison with Asia, due to lack of extensive tracts of flat alluvial deposits under easy command of large rivers. Like Cooper et al (2008), he suggests that the future of African agriculture lies on increasing production under rainfed conditions.

The green revolution in the US Eastern Corn Belt, Pampas of Argentina and cerrado in Brazil were not driven by irrigation, but rather by favourable rainfall, deep soils with large water storage capacity to support high and consistent yields of soybean, maize and wheat. Even without application of irrigation, it appears that African agriculture is constrained seriously by the problem of poor soils. According to the Africa Fertiliser Summit of 2006, 16 per cent of surface land in Africa is classified as having very low nutrients (compared to 4 per cent in Asia). With fertiliser costing about three times the price in Asia, African farmers typically

apply only 8kg per hectare against a recommended 50kg per ha. Nutrient loss from soils is consequently very high, amounting to about $4 billion annually (AfDB, 2010).

Promoting irrigation without addressing the underlying constraints affecting agriculture in SSA will not therefore necessarily yield any production and poverty reduction benefits. In Senegal, under pressure to respond to the global food crisis in 2008, the government introduced the National Rice Development Strategy. Under this strategy rice production was stimulated to the point of surplus, but there was no mechanism in place to absorb this surplus. This led to a slumping of rice prices and fall in production in subsequent seasons (Demont and Rizzotto, 2012). Thus, irrigation development needs to be considered along with other necessary reforms in the agricultural sector.

The history of irrigation is littered with tales of failure and collapse. Reference is often made to the large government irrigation schemes implemented in the 70s and 80s, most of which fell into disrepair and were abandoned, or were run down by poor management structures in place (Shah et al., 2002; Easter, 2000). The ongoing drive in agricultural development for economic growth has embraced irrigation as its engine despite these tales of failure. It is not clear whether there has been any active learning based on past failures, except of course, for the standard rhetoric around capacity building and community involvement.

Eyebrows have been raised on the motivations of the different parties promoting irrigation development. Recognizing the high costs associated with irrigation development, and under the spell of remarkable economic growth, albeit without much industrialization, some African governments have made deliberate efforts to open their agriculture to external investment. Mehta et al. (2012) argue, however, that most of the associated large land transactions involving multinational corporations in fact constitute 'land grabs' motivated by the desire to control agricultural water for cash crop production. Far from stimulating rural economies, it has been argued that the result has been reallocation of water in favour of large-scale commercial interests thereby undermining the locals' rights to land and water, and disrupting environment sustainability (Franco et al., 2013; Woodhouse, 2012). Unfortunately the privileged status enjoyed by irrigation among policy makers in Africa explains why they may choose to continue to support irrigation despite evidence of high costs and poor performance (Moris, 1987). If irrigation is to contribute to food security and poverty reduction, it has been argued that efforts should be directed at supporting the small family farms from which most of the food consumed actually comes. The 2014 report on the State of Food and Agriculture makes a point that such family farms should "be supported to innovate in ways that promote sustainable intensification and improvements in rural livelihoods" (FAO, 2014). Commercial interests in agriculture, such as that of Illovo in Malawi and Zambia, are concerned with production of water intensive cash crops-often taking advantage of unclear valuation of water in these water stressed and drought prone countries, in favour of the export market. The separation of land and water rights in Ghana, for example, created a loophole for large corporations to grab water for agricultural purposes (Franco et al. 2013).

The survival and sustainability of small-scale family farms depends on their innovation capability (FAO, 2014). In the context of SSA, small-scale farmers are under pressure to innovate socially, to enable them to deal with the political pressures associated with rights and access to land and water within the context increased government promotion of large-

scale commercial agriculture targeted at export products, and technically, to devise appropriate tools and practices for allocating resources, adapting institutions for resource governance to challenges including water scarcity due to climate change and population growth; market uncertainty, and harnessing knowledge to drive progress in small-scale farming. Irrigation is one of several approaches that most governments in SSA are looking to for adapting agriculture to climate change (Kurukulasuriya & Mendelsohn, 2008a,b; Smit and Skinner et al. (2002).

This introductory chapter has provided a brief overview of contemporary issues facing agriculture in Sub-Saharan Africa and highlighted on some of the constraints to growth in this sector. Irrigation was identified as one of the favoured options for growing African agriculture through ensuring access to water and enabling farmers to adapt to climate stresses. At continental level there has been very limited progress in scaling up irrigation, but renewed efforts to revive irrigation based farming will now have to contend with a milieu of issues, including rights over land and water, growing water scarcity due to climate change and the pressure of a growing population. In the next chapter we go a step further to examine all these issues at country level. With reference to Malawi, one of three project countries covered by this research, we provide the context within which smallholder agricultural outcomes are located; and discuss the various policy responses and interventions aimed at improving agriculture, particularly irrigation, in Malawi.

2 THE RESEARCH CONTEXT: PROMOTING GROWTH IN SMALLHOLDER AGRICULTURE IN MALAWI

2.1 Introduction

The need to promote innovation and foster transformative change in agriculture has been on Malawi's development agenda since independence from Britain in 1964. Despite the numerous positive changes that have taken place in the agricultural landscape, the same bottlenecks that mattered in 1964 persist. Policy makers are still grappling with the challenge of growing an economy through agriculture, but with mixed feelings on whether this growth should be or could be driven by smallholder farmers or whether investing in commercial farming could be more appropriate. In a speech on land reform in 1967 the then Minister of Land Matters and state president Dr Hastings Kamuzu Banda said that:

> "…our custom of holding land in this country; our methods of tilling the land…are entirely out of date and totally unsuitable for economic development of this country … Our country is essentially an agricultural economy … Development in this country must mean development of agriculture to the highest possible degree … Under the present method of land holding or land tillage … we can never hope to develop this country economically with agriculture as the backbone of our economic development" (GOM, 1967).

Forty years on Malawi is still struggling with its land laws, agriculture is still the backbone of the economy, and questions still persist on 'appropriate models' that should be adopted to enable agriculture to lift millions of Malawians out of poverty and create a prosperous nation. This chapter serves to highlight some of the contentious issues in contemporary Malawi to serve as a background into understanding the role of smallholder farmers, particularly under irrigation, in delivering growth in agriculture in Malawi.

2.2 Agriculture and Economic Performance

The performance of the economy in Malawi is linked to the performance of the agricultural sector given the latter's significant contribution to the economy. The government has since independence invested in agriculture initially through support towards the establishment of state-owned enterprises engaged in both agricultural production and marketing of smallholder agricultural produce and in the construction of irrigation schemes, provisioning of extension services, and improving farmers' access to of subsidised credit, inputs and farm machinery.

The agro-based strategy positively impacted on the economy and on food security in the 1970s with the economy growing steadily at 6 per cent per annum on average, but going into crisis between 1979 and 1981 owing to a combination of exogenous factors, namely the Mozambican war which undermined Malawi's links with international markets, the oil shock of 1979, and internal structural rigidities of the Malawian economy. As a consequence of these factors the real growth rate of GDP fell from 8.3 per cent in 1978 to 3.9 per cent in 1979 and thereafter a negative growth rate of-1.1 in 1980 and -4.7 per cent in 1981 creating an impetus for the adoption of stabilisation measures by the World Bank structural adjustment (Harrigan 1991; Chirwa et al. 2008).

According to the World Bank (2013) Malawi experienced uninterrupted solid growth averaging 7.4 per cent of GDP between 2006 and 2010 as a result of the government's sound macroeconomic policies. The FISP, in combination with relatively good rainfall seasons, improved the food security situation but the recent (2013) loss of donor confidence particularly including as a result of revelations of corruption within the government system, persistent external imbalances, low proceeds from tobacco, among other factors, contributed to the weakening of the economy's performance in mid-2012. Since mid-2012 the government has implemented a range of measures aimed at restoring macro stability and is showing signs of recovery. There is also a felt need to improve the public expenditure tracking (World Bank, 2013).

Malawi's dualistic agricultural sector exports sugar and tea from the estates, and food crops such as rice and maize from the smallholder sector, including under irrigation. Much of smallholder farming is sensitive to climate fluctuations and extremes. In fact there exists a strong positive correlation between drought and flood occurrence and agricultural productivity. Between 1970 and 2009 Malawi experienced 40 weather related disasters, 16 of which were experienced after 1990 (GOM, 2009). Weather shocks have had a significant impact on the Malawian economy, with Pauw et al. (2010) estimating an average 1.7 per cent loss in Gross Domestic Product annually due to drought and floods, an equivalent of US$22 million in 2005 prices. Such economic loss is particularly significant for Malawi's economy which derives 34.7 per cent of its income from agriculture (NSO, 2008). The need to address climatic variability and climate change is therefore critical for addressing inter-annual volatility in the economy. The high poverty levels have in turn rendered a larger proportion of the national population vulnerable to subsequent shocks, further reinforcing poverty.

2.3 The need to promote growth in agriculture

Malawi's economy is agriculturally based. The country derives between 30 and 40 per cent of its gross domestic product (GDP) from agriculture, and this sector employs about 85 per cent of the population (Chirwa et al.2008; World Bank, 2012). Given the relatively high

profile of agriculture in the economy, the government has prioritised agriculture as the engine for driving economic growth. The Malawi Growth and Development Strategy 2011-2016 emphasises agriculture, food security, irrigation and water development as being central to growth. Additionally, the Presidential Initiative on Poverty and Hunger (PIPH 2012) and the Economic Dialogue of 2012 all identify agriculture as one of the top five priorities for stimulating and sustaining economic growth in Malawi. The rationale for a focus on agriculture is premised on the fact that agricultural growth impacts positively on rural incomes, lowers costs of food especially for the poor, and stimulates the non-farm sector while sustaining economic transition from primary industries to manufacturing (DFID, 2004). The renewed impetus to promote economic growth through agriculture, the sector in which most of the poor depend on food and income security, should in theory address the gradually worsening poverty situation. The Malawi Integrated Household Survey (2013) states that general poverty in rural areas increased from 55.9 per cent to 56.6 per cent between 2004/05 and 2011 while urban poverty decreased from 25.4 per cent to 17.3 per cent over the same time period (NSO, 2013).

The need for innovations for promoting growth in smallholder farming is driven by several other factors. Malawi's population currently at 16.3 million and growing at 2.8 per cent per annum is likely to reach at least 22.8 million by 2025 and this will present a doubled demand for food from agriculture (NSO, 2014). This population is mainly rural with more than 85 per cent based in rural areas and relying on agriculture, forestry and fisheries. With the slow place of industrialisation and urbanisation, the population density will continue to increase thereby placing pressure on land that is declining in both quality and quantity. In the southern region, for example, the population density averages 234 people per square kilometre and, according to Ricker-Gilbert et al (2014)'s work based in Malawi, such high population densities are associated with decreased productivity and lower viability of agriculture. In fact their findings suggest that in low external input systems as common in Malawi, maize cultivation is unsustainable considering the shrinking farm sizes and declining soil fertility.

The slow pace of the development of the land policy and sheer rate of increase in population has culminated in reduced sizes of land used by smallholder farmers, with average holdings decreasing from 1.53 hectares per household to 0.8 hectares between 1964 and 2000 (GOM, 2001, Chirwa et.al 2003). On the basis of realisation of extant land scarcity, the government's strategy appears to be increasingly focused around intensification of production. The System for Rice Intensification that the government is promoting particularly under smallholder rice production systems is an example of this, but this well-intended action suffers a handicap in that development of effective value chains and markets to support higher productivity has been weak or lacking and poor farmers have failed to escape poverty.

The need for innovative approaches to smallholder-focused agricultural development is also necessitated by a host of other drivers, chief among them the threats that climate change poses for agricultural water availability and how this plays out in the context of competing demands for water with other sectors, and limited progress in improving water use efficiency. Many farmers involved in irrigation lack reliable supply of water, and recycling of water across economic sectors is either too expensive or not prioritised in other sectors. Smallholder farmers tend to be poorly integrated in the marketing systems for agricultural inputs, produce and value addition (World Bank, 2013) with most of them lacking access to affordable credit. The NACAL reports states that only 30 per cent of villages had a gravel road and 8 per cent a tarmac road passing through them (NSO, 2008). Transport availability was also reported to be a challenge. 53 per cent of villagers transported their produce by head, 35 per cent by bicycle, 6 per cent by animal back and 6 per cent by public transport. In addition, farmers are poorly supported by extension system with most of these lacking specialist knowledge in irrigation management. The average extension officer to farmer ratio is 1:3000 (Mpaka, 2010). Most farmers suffer from limited market infrastructure and lack of skills and facilities for postharvest management of crops cannot be overemphasised. In addition to these challenges, the majority of Malawi's farmers operate within or in combination with rainfed farming systems where water availability is unreliable and agricultural produce or income are therefore not guaranteed. Building capacity to irrigate within smallholder farming systems in Malawi is therefore a priority action for any strategy that seeks to grow agriculture in the country.

2.4 Promotion and performance of irrigation

A historical analysis of the promotion and performance of irrigation in Malawi reveals mixed fortunes for smallholder farmers. In the period immediately after independence the new government embarked on a pro-capitalistic irrigation policy which favoured estate farmers at the cost of smallholder and mainly subsistence farmers. According to Veldwisch et al. (2009) and Kydd and Christiansen (1982), the introduction of sharecropping and tenant farming, in addition to the heavy taxation of smallholders via government grain marketing boards, unlocked cheap labour in favour of the estates by undermining the real rate of return for labour in smallholder farming sector. Unfortunately, as with other interventions elsewhere on the continent where the plight of smallholders has been ignored, the productivity gains achieved through estate oriented farming were enough to convince institutions such as the World Bank to cite Malawi as a case that had to be emulated and replicated by other countries seeking growth in their agricultural sector (Veldwisch et al. 2009).

Kamuzu Banda's government arguably sought to transform and modernise smallholder farming by borrowing from the estate farming model (Chambers, 1969). The strategy was to set up large scale irrigation schemes, that Veldwisch et al. (2009) refer to as 'irrigation factories', but this model appears to have been unsuccessful as a consequence of several

implementation related issues. For example, the sixteen irrigations schemes constructed by the government between 1967 and 1975, with size ranging from 20 and 505 hectares, were constructed on public land, and importantly, their introduction ignored local traditional leadership structures and the productivity achieved was far below expectation as a result of lower than expected land use intensity (Danida, 1988). According to Danida (1988), these schemes faced challenges ranging from water shortages, faulty design, siltation, incomplete land levelling and poor maintenance by farmers. However, despite these constraints, these irrigation schemes, including Likangala and Domasi in the Chilwa Basin, were transferred to communities through a decentralisation process marred with internal conflicts, operational challenges and lack of funds (Nkhoma and Mulwafu, 2004). The land, water and irrigation laws and policy direction in the multi-party democracy since 1994 sought to formalise resource access and use practices and decentralise the management of these schemes (Peters and Kambewa, 2007). This has resulted in a binary classification of irrigation schemes as either formal or informal, and this classification has been problematic for irrigation development.

Historically, formal irrigation schemes were those that had been established by the government established schemes and their 'revised version, the self-help schemes; while informal irrigation has been widely used to refer to *dimba* cultivation normally on customary land and frequently in the dry season. *Dimbas* are irrigated gardens in wetlands or *dambos*, along banks of rivers and streams, and in areas below small earth dams. While the majority of irrigation takes place in these informal irrigation arrangements, (GOM, 2000) most of which have been around even before independence and have relied on diverting rivers, the government strategy has ignored this group and instead focused resources on the formal irrigation schemes, most of which are too large and cannot be realistically managed or maintained by farmers on their own. Clearly, if government failed to manage these schemes, how could farmers on their own (Mulwafu and Ferguson, 2007). However, as Mulwafu and Ferguson (2007) demonstrate, innovations and interventions for promoting growth in irrigation have ignored lessons from past failures.

The government is rehabilitating these schemes, and the approach has been to transfer management responsibilities to the farmers through establishment and capacity building of water user associations. The assumption is that lack of ownership was among the chief reasons for the failure of these large schemes. Crop choices have been retained in the newly rehabilitated schemes, curtailing opportunities for crop diversification and transitioning towards more economically viable farming.

Reflections on the collapse of these irrigation schemes by various local stakeholders, including farmers in the schemes visited, intimated that the reduction in government presence within the schemes that followed the coming of democracy, as well as misinterpretation of democracy led to lawlessness and drove schemes into collapse. Dimba cultivation upstream intensified with increasing frequency of droughts, and coupled with rapid deforestation increased land degradation and siltation and led to damage of canals and ineffectual water distribution. Further, these interviews seem to suggest that informal irrigation has been intensifying, and that these informal schemes are seeking to register in order to benefit from government interventions including access to treadle pumps and extension support, among other things. Cultivation in the wetlands has grown driven by recurrent droughts and floods and declining soil fertility (FAO, 1996), Malawi experienced

food crises in 2002 and again in 2005, and these episodes of food deficit were also associated with further intensification of informal irrigation. To hedge farmers against droughts, the FAO, Danish International Development Agency (DANIDA) and the government mobilised and supported wetland use, streams and rivers for wetland production , with the DFID targeted input programme (TIP) being targeted specifically for dimba crop production. Government and NGOs have been providing treadle pumps, manual and motorised, to facilitate irrigation from close water bodies. Uptake has been high, and impact too, especially where farmers are connected to high value markets (IFAD, 1995).

Recently, government and non-governmental organizations (NGOs) have introduced both treadle pump and motorized pumps in selected areas. Treadle pumps are a potentially high-return intervention. Treadle pumps are suitable where there is a water source close to the surface (less than 7 m) and close to the field to be irrigated (less than 200 m), and they will be especially profitable when farmers have access to markets where they can sell high-value fruit, vegetables and green maize. Impediments to their rapid uptake, however, include the high capital expense, high maintenance costs and expertise requirements, and limited markets for high value produce in Malawi. Irrigation development in Malawi has suffered from factors common in other states in the region, which include the failure to develop and link irrigation schemes to markets and value add on their output, leading to over-supply of grain in the market and deflated prices (Cassman and Grassini, 2012). Mutiro et al. (2015) also support this view by arguing that structured markets enhance irrigation scheme performance substantially, and also reduce price volatility and ensure an outlet for produced goods. Njoloma et al. (2009) argue that irrigation has failed to bear fruit because measures have been dismally implemented to such an extent that agricultural production has remained low thereby causing serious food insecurity and upsetting the national economy.

2.5 Innovations and Interventions for promoting growth in agriculture in Malawi – the case of irrigation

The government of Malawi has implemented a range of interventions for promoting growth in smallholder farming with a specific focus on irrigation development. Approaches appear to be shifting from targeting a few households in selected districts to a more countrywide scale, as well as a shift from production alone towards addressing a whole range of challenges facing agriculture, including the marketing of commodities. In this section, some of the flagship irrigation development projects that have been implemented by the government are reviewed.

2.5.1 The Smallholder Irrigation Project

The Smallholder Irrigation Project (SHIP) established 4600 hectares of irrigated land in the Blantyre and Shire Agricultural Development Divisions for the benefit of 12,000 households. Under funding from both the government of Malawi and the African Development Fund, and approved in 1998 the

project built irrigation management capacity in the targeted areas, including in the areas of processing, storage, marketing and provisioning of rural microfinance to farmers through establishment of Savings and Credit Unions (SCCBU). Treadle pumps for water abstraction to assist in irrigation were also introduced. An innovative approach to ensuring sustainability of benefits was to incorporate a cost recovery element to the design, in which farmers were expected to pay in full for any farm inputs, irrigation equipment and services required. The funds for this were expected to come from the employment opportunities for income earning that would have been created as a consequence of the highly labour-intensive nature of the designed project. Additionally, users were expected to pay a fee towards operation and maintenance costs, and for product marketing. However, an evaluation of the project reflected that in addition to the costs being unaffordable, the interest charged on loans for equipment distributed, such as treadle pumps, was often too high and non-viable for smallholders thereby constraining productivity and growth (Africa Development Fund, 1998).

2.5.2 Smallholder Floodplains Development Programme

The Smallholder Floodplains Development Programme (SFPDP) was a US$15million programme jointly funded by the International Fund for Agricultural Development (IFAD), the Irish Trust Fund, and the governments of the Kingdom of Denmark and Malawi between 1998 and 2006. An area of 4,400 hectares and supporting 14,700 households in Karonga, Nkhotakota and Machinga districts was targeted with interventions that included providing assistance to water user associations in managing irrigation schemes, improving water use efficiency, and promoting environmentally sustainable irrigation. Capacity was also built around crop production and catchment management. Most importantly, this programme facilitated the establishment of autonomous water user associations (WUAs) as institutions for governing water and management of irrigation schemes, and assisted these WUAs in developing irrigation scheme by-laws as part of efforts to enable farmers to participate fully in the planning, decision making and implementation of operation and maintenance of irrigation schemes. All government schemes, with the exception of Muona scheme in Nsanje District, which was constructed on customary land, were given leasehold tenure status and granted water use rights. The impact of this programme came from improvements in water management and yields, running of farmer field schools and establishment of crop demonstrations and trials.

2.5.3 The Green Belt Initiative

The implementation of the Green Belt Initiative (GBI) has been controversial in Malawi. The intervention is seen by some as facilitating land grabs by multinational corporations at the expense of local smallholders through land deals associated with an approach to promote investment for stimulating sector growth. From the government's viewpoint, the GBI seeks to increase production and productivity of crops, livestock and fisheries; promote diversification in agriculture; and facilitate private sector participation in agriculture, among other objectives. Through irrigation development and rehabilitating existing irrigation schemes, the government envisages creating some agricultural green belts to support its economic growth initiatives (GOM, 2009). The Green Belt Initiative (GBI) was conceived as an engine for rejuvenating efforts in support of the country's agricultural development plan or Malawi's version of a Green Revolution.

The challenges associated with the GBI should be considered in light of the protracted or perhaps stalled land reform laws and high inequality in land access countrywide. The GBI seeks to promote commercial or estate-type modern farming on the assumed grounds that things will have to be done differently since under smallholder agriculture growth has been sluggish or inconsistent, and the GBI offers an opportunity for higher returns as a result of taking advantage of economies of scale. Under the GBI large-scale commercial farmers engage with local assemblies to relocate villages in order to make room for intensified and mechanised large farms. In components of the GBI that include smallholders, however, the government has ensured viability through creation of a window for linking farmers with finance, farm inputs, machinery and labour (Chinsinga and Chasukwa, 2012).

The provision of the 2013 Land Bill which reclassifies customary land into public land enables the government to confiscate land for the GBI, and sets a tone of resource grabbing. Chingaipe et al. (2011) highlight some examples of land transactions that constitute a grab, such as the 55,000 hectares of irrigable farmland signed off to the government of Djibouti in 2009 in exchange for unspecified support for the construction of Malawi's inland port in Nsanje and the 2,000 hectares of land acquired by UK Farmland Investment Fund for the production of paprika for export to Europe. In addition, contract farming such as in sugar cane is also seen as an indirect land and water grab. To ensure viability of the GBI the government has created a window for linking farmers with finance, farm inputs, machinery and labour (Chinsinga and Chasukwa, 2012). The Initiative works on the basis of the displacement of smallholder farmers, and as such has been very unpopular especially among smallholder farmers who view this intervention as a land and water grab.

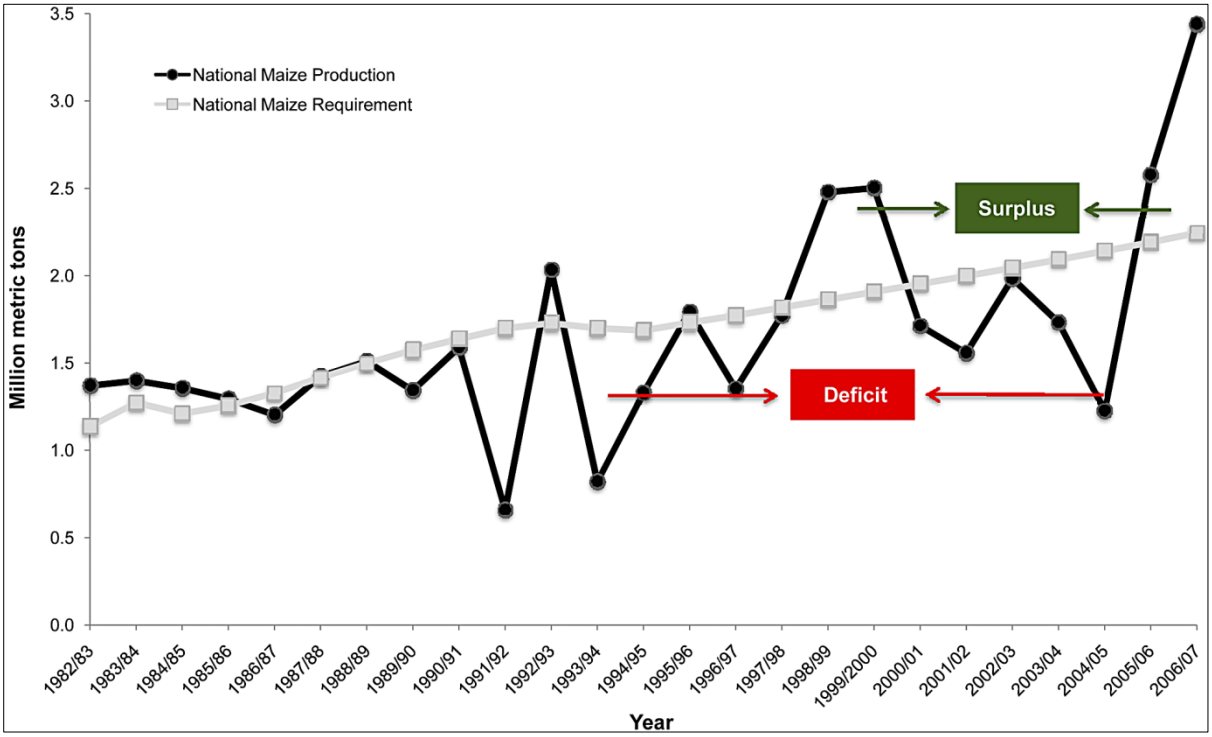
2.5.4 Irrigation, Rural Livelihoods and Agricultural Development Project (IRLADP)

The IRLADP project is an initiative co-funded by the World Bank, International Fund for Agricultural Development (IFAD) and the government of Malawi and is being implemented under the Ministry of Agriculture, Irrigation and Water Development. Unlike the previous initiatives, the IRLADP programme was more ambitious in its coverage and targeted 196,550 rural households (representing 827 000 people) in 11 target districts of Malawi compared to an average of 10,000 with previous interventions. The programme aimed at raising agricultural productivity and incomes through building institutional capacity for long-term irrigation development and strengthening agricultural and irrigation advisory services and marketing, among other services. This project targeted some of the government irrigation schemes for rehabilitation and also developed some small and mini irrigation schemes. Land for the schemes was leased from the government following attainment of a legal status of the Water User Associations (WUAs) (GOM, 2009). Our research project targeted Muona Irrigation Scheme, one of the sites rehabilitated under the IRLADP project, as well as Chitsukwa Irrigation Scheme that has been supported through the SHIP and other government initiatives. The details of these are discussed in depth later.

2.5.5 Farm input subsidy programme

The Farm Input Subsidy Programme (FISP) was introduced by the government in 2005 with strong support from the president who at the time argued on moral justification that if rich farmers in Europe and America were being given subsidies, how wrong was it to subsidise poor Malawian farmers? The introduction of FISP followed a food crisis in 2005, and was meant to boost agricultural production and productivity through providing the very ingredients that the farmers were lacking. Donors initially argued against the programme on the grounds that such support was too expensive for a country relying on donors for almost 40 per cent of its GDP.

In their evaluation, however, Dorward and Chirwa (2011) point out that the FISP led to significant increases in national maize production and productivity and improved national food security and resulted in higher real wages. Malawi produced surplus maize to the extent of exporting to regional member states such as Zimbabwe, Lesotho and Zambia. According to Denning et al. (2009), Malawi's national input subsidy programme coincided with a good rainfall season, doubling production levels in 2006 and almost tripling in 2007. They report that Malawi had a 53 per cent surplus in 2007, compared to a deficit of 43 per cent in 2005. Figure 1 shows the trend in maize production between 1982 and 2009.



Source: Denning et al. 2009

Figure 2: Maize production in Malawi 1982-2009

The dips in maize production in 1991-92 and 2004-05 both coincide with drought episodes. The trend is positive after 2005. The gains made in the early years of FISP were, however, eroded by the high international fertiliser prices and high price of maize, as well as the high volatility

of maize prices undermined food security especially for the vulnerable groups. There were issues with targeting of beneficiaries- the programme was targeted at the most vulnerable groups but this group also had the least capacity to use these inputs. According to Ricker-Gilbert and Jayne (2008) and Dorward et al. (2008), FISP was marked with uneven rollout and widespread leakage and has been to the benefit of agro-dealers and urban consumers more than the smallholder farmers. While others saw the increased food security situation as positive, some argued that the programme was unstainable in the long term, did not address the real issues in agriculture, and reinforced the maize production and consumption culture by giving inputs targeted primarily for maize production.

2.5.6 Shire Valley Irrigation Project

Like the GBI, the Shire Valley Irrigation Project has been viewed with scepticism especially by those concerned that the project will worsen the plight of land-poor smallholders who are already struggling under decreasing land holdings of low soil fertility. The Shire Valley Irrigation Project (SVIP) is a project jointly funded by the World Bank, Africa Development Bank and the Government of Malawi. The focus of the project is to develop 42,500 hectares of irrigated land in the Lower Shire Valley, and provide associated irrigated services. It is envisaged that this land will be sourced from the smallholder farmers who are presently using the land under rain fed production systems, while some of the land has already been developed by the sugar company Illovo (World Bank, 2013). The irrigation will derive its water from the Shire River and this water will be pumped under gravity, thereby replacing the current electricity-dependent pump system. With Nchalo estate being the largest energy consumer in Malawi a shift from electricity driven to gravity fed irrigation system would inevitably affect the power utility in revenue terms, and this shift is being strongly resisted. In fact the government through the Ministry of Natural Resources, Energy and Mining is in the process of restructuring the power market by unbundling Escom, the national power utility, and privatising the strategic stake and management rights of the company (Nyasa Times, 28th July, 2015) but it is not clear whether this is related to the situation with sugar plantations in Nchalo. It also appears as though in changing the system for irrigation to a gravity one, the project will directly benefit a private company and one that does not seem to be obliged to pay for these improvements that will ultimately raise its profits significantly. Civil society groups such as CISANET have argued that the problem lies in the lack of a regulatory framework in such sectors as the sugar industry, which gives corporations in this sector to operate in their interest and without regard of costs of their actions on smallholder farmers (BNL Times, 2014). With respect to the SVIP it is envisaged that an apex organisation composed of WUAs and government institutions will be set up, and the approach to the management of the irrigation schemes will be through a public-private partnership (PPP) arrangement. Considering that energy costs are the highest in the sugar production at Illovo, the new gravity fed system will potentially serve to benefit Illovo the most.

2.6 Climate change impacts and adaptation

95 per cent of the smallholder farming sector in Malawi happens under rainfed conditions. With the high prevalence of poverty, most smallholder farmers find it particularly difficult to cope when faced with these hazards, resulting in low production and productivity in agriculture and decreased opportunities for casual employment. Sensitivity to these climatic stressors, include excessive heat, unclear season start dates and irregular rainfall patterns, is highest especially under rainfed conditions, but irrigation schemes also suffer because most of them depend on seasonal rivers that recharge as a consequence of rainfall events. While water scarcity for most of the country is economic in nature as a result of limited investment in irrigation infrastructure, there are predictions that the country will experience physical water scarcity, whereby water is physically available in inadequate amounts, as a consequence of increased climate variability and climate change (Ohlsson, 1995; Niasse, 2011). A study by Sadoff et al. (2015) demonstrates strongly the need for Malawi to adapt to climate change in order to protect its economic growth. By calculating the cumulative effect of drought over the period 1980 to 2012, the study showed that if Malawi reduced the effect of drought through adaptation and mitigation by 50 per cent then the GDP per capita would increase by 20 per cent.

Malawi is increasingly turning to irrigation to mitigate the impacts of dry spells and droughts in order to both ensure and raise production and productivity. The National Adaptation Programme of Action (NAPA), which is the framework for facilitating climate change adaptation actions in the country, outlines building resilience in smallholder farming sector through promoting use of wetlands, dambos, dimbas and areas along river valleys for agricultural purposes, restoration of forests in the Upper and Lower Shire Valley catchments to reduce siltation and associated water flow problems, water harvesting irrigation promotion in general (GOM, 2006). While this strategy can be applauded given the gravity of the risks associated with climate change on Malawi's agriculture sector, a missing dimension in current efforts appears to be ensuring that irrigation itself is adapted to climate change. The government's strategy on the GBI does not provide an explicit plan for addressing climate change risks and water scarcity associated with droughts and dry spells within irrigated agriculture. If climate change risks are not incorporated in the planning and design of such large scale irrigation projects as those associated with the GBI, there is a danger of escalating excessive consumption, maintaining inefficient water usage, and concentration on low value but water-intensive crops, all culminating in conflicting demands over water. There is growing evidence pointing towards this:

A sensitivity analysis of the water balance model of Lake Malawi to climate change has shown that the water level will continue to drop following a decrease in the rainfall season and an increase in evaporation rates from the lake. In fact the models show that it is unlikely that the water level will increase to a maximum height of 477 metres above sea level as was the case in 1980 (Chelys, 2013). The assessment calls for sustainable water resource

development based on a thorough assessment of the impact of climate change on future water levels of Lake Malawi, which is the source of the Shire River on which most irrigation activities are dependent (Chelys, 2013). Clearly any fluctuation in the lake's hydrological and ecological behaviour will have consequences for agriculture and the national economy. The drying up of Lake Chilwa in 1995 and subsequently in 2013 was a consequence of rainfall failure. Such events reflect likely trends in a changing climate and the Lake Chilwa Lake Water Monitoring report by Jama et al. (2012) recommended that on the basis of conclusions of likely lake drying, policy makers and local governments should draw up and implement disaster management plans that would mitigate against short term impacts of lake drying on livelihoods of riparian communities while strengthening capacity for diversifying livelihoods away from lake dependent options under conditions of future lake drying. Specific to Lake Chilwa, scientists also argue that the problems faced by the lake are as a result of accelerated environmental degradation in the catchment area causing siltation leading to reduction in lake levels. The same case applies to Lake Malawi (ENS, 2012).

2.6.1 Land Availability and Access

Niasse (2011) asserts that limited land access and insecurity of tenure act as hindrances to production and productivity improvement. In Malawi evidence suggests that farm sizes have not only been declining with an increase in population but soils are increasingly more degraded and, in the case of the Lower Shire it appears that land degradation particularly driven by charcoal production has resulted in siltation of major rivers supporting irrigation schemes in the south of the country, often contributing to lower water yield. Countrywide, land scarcity is a problem given that 20% of the country's surface is covered by water (Lake Malawi) and a substantial portion of the land is mountainous. The land scarcity problem appears to be more magnified in the southern region, where population densities are the highest, and also ironically a region earmarked for expansion of irrigation both large and small-scale, by the government because of the elevation and deep soils.

Smallholders occupy about 2.2million hectares of land shared over 2.5 million holdings. 70 per cent of smallholders have command over less than one hectare of land (NSO, 2009; World Bank, 2013). Chirwa and Chinsinga (2008) point to massive land inequalities in Malawi when they question the political economy of land grabs. They note that in contrast to this glaring land scarcity situation there are about 30,000 estates of between 10 and 500 hectares occupying 1.1 million hectares of land. According to the National Census of Agriculture and Livestock (NSO, 2010) three quarters of all land under smallholder farming in the country is held under customary tenure, while in the estate subsector land is held under either freehold or leasehold tenure. In the smallholder sector, it appears that most of the land has remained unchanged over the decade to 2010 and there is very limited evidence of land development e.g. through canal construction or building terraces. It may

well be that such developments may make little economic sense in the very tiny plots that most smallholders control. Soils in the smallholder subsector are generally thought to be poor and of low fertility as a consequence of low affordability of fertiliser compounded by high intensity of soil use and lack of knowledge on soil fertility management.

The combination of growing population in the context of very slow rates of urbanisation, declining soil fertility coupled with limited opportunities for expansion of agricultural land for smallholder farming is intensifying land pressure and scarcity. Of the households surveyed by the NACAL in 2006/07, only 10 per cent were renting out land and there was very limited evidence of land sales. In addition, owing to land scarcity and lack of security of tenure, 15 per cent of surveyed households had been involved in a dispute over land and 20 per cent feared that their land would be encroached on or taken away (NSO, 2010). Within the smallholder farming subsector there are substantial inequalities in land access by gender of household. The NACAL estimates that on average one in three male headed households had land less than 0.5 hectares as compared to one in two for female headed households. The Comprehensive Food Security and Vulnerability Assessment (CFSVA) reports that household food security in Malawi tended to decrease with the size of land owned or accessed by a household. Competition over degrading land and land degradation is surprisingly lower on the priority list of interventions in agriculture perhaps because the impacts are not direct and conspicuous unlike with use of fertiliser, better seeds and improved farming methods.

2.6.2 Land Policy and Land Rights

The seeds for land policy reform, seen as a necessary precondition for transformation of the agricultural sector, were sown as far back as independence, as highlighted in the introduction. President Dr Banda's statement appears to have been a call for modernisation of agriculture as smallholder farmers were seen to be rooted in inefficient and low productivity systems, as well as a need to privatise land. Regardless, there has been very limited change in the land policy since 1967 despite a felt need for transformation. According to CEPA (2013) the Land Bill of 2013 maintained the same approach as that of 1965, in which the latter merely provided for procedural and administrative matters and assumed the applicability of received English property law as it stood at that date, with less attention to incorporation of substantive property law provisions. The Land Policy of 1965 is seen as being influenced strongly by English property law and, therefore, when used as a basis for the 2013 Land Bill fails to address the social, economic and political concerns that are relevant to contemporary Malawi. In fact the Land Bill of 2013 inadequately accommodates the country's constitutional and development framework, proffers less attention to principles of land management, and the roles and responsibilities of various stakeholders across levels (CEPA, 2013). It has been argued that the new Land Bill gives full power to the minister or local government to grant leases over public land without neither

requiring public consultation nor placing limits on the amount of land an individual or company can be allocated (Chinsinga and Chasukwa, 2012).

In support of Banda's vision, the Land Bill of 2013 has re-categorised land from public, customary and private to only public and private (GOM, 2013). According to the 2013 Land Bill, all customary land now falls under public land and can be acquired compulsorily for development purposes by the state. Such categorisation of land appears to undermine the land rights and security of land of smallholders, and gives the government the power to convert such land to private. According to Kanyongolo (2004) the individualisation and privatisation of customary land by the government works to the advantage of a few elites such as foreign businesses, parastatal estates, retired and active top civil servants, and other formerly non-agrarian business people. Further, by considering the state as the owner of customary land this framework is insensitive to the land alienation that indigenous communities suffered under colonial rule (Silungwe, 2009). Land is more than a factor of production. Access to, and control over, land contributes to the empowerment and political emancipation of beneficiaries, and to their dignity and social inclusion. Secured access to land plays an important role in strengthening the resilience of rural people in the increasingly uncertain physical and socio-economic global and local environment. Lack of clear rights and security over tenure in customary tenure means that poor people are incapable of 'selling' their land or converting their 'physical capital' in favour of alternative investments e.g. for non-agricultural livelihoods or investing in children's education. From independence in 1964 up to 1994, when the country adopted multiparty democracy, ending 30 years of Banda's autocratic rule, farmers under the smallholder customary land tenure system were barred from growing commercial crops, and only confined to food crops. The estate sector was and largely remains comprised of an elite class with associations with the top government leadership, most of which was involved in the production of cash crops such as tobacco (USAID, undated). The three generations of non-commercial crop production represents a lost generation in farming knowledge and an agricultural capacity gap, including in attitudes. Smallholders are seen as failing to drive profitable agriculture by policymakers, but without taking into account the historical factors that restrained them from engaging in and developing fluency in market-oriented farming.

Contrary to the assertion in favour of private property as legislated in the 2013 Land Bill, evidence presented by the World Bank (2003) shows that formal title had little or no impact on investment or farm income as land tenure was secure under most customary land rights, and that formal land titles do not necessarily equal to higher tenure security. A separate study by Place and Otsuka (2001) showed that customary land in Malawi is secure, and under patrilineal systems was associated with improvements in the land, investment and adoption of technology. Larger landholdings were associated with commercialisation of food crops, technology adoption and lower poverty levels (Chirwa, 2006; Green and Ng'ong'ola, 1993) thereby suggesting that land reforms would have a significant effect on livelihoods and wellbeing (World Bank, 2003). Reforms such as the introduction of the

Water User Associations as institutions operating locally for the management of water and operations within the 'schemes' replaced, at least within the confines of the formal irrigation, the 'traditional' systems in place for both land allocation and presiding over land-related disputes. The realisation that government funding is earmarked for formally registered irrigation activities ahead of the informally constituted has the danger of driving the formalisation process for those operating informally, with yet unclear outcomes for water rights.

2.7 Water development and irrigation

2.7.1 Water availability

Ensuring sufficiency of water resources for the agricultural sector is at the centre of irrigation development, stimulation and sustenance of an agriculture driven economy. As discussed earlier, the substantial risks posed by climate change pose a real threat to rainfed farming systems particularly for resource poor farmers who have few resources with which to cope. Ohlsson (1995) and Niasse (2011) among others have argued that water scarcity will be exacerbated in the near future with climate change, with detrimental effects on agrarian economies. A study by Sadoff et al. (2015) demonstrates strongly the need for Malawi to adapt to climate change in order to protect economic growth.

20 per cent of the country is covered by water. However, despite such 'abundance', the country's water resources are increasingly strained by competing demands from various economic sectors, such as agriculture, tourism, mining, industrial and domestic consumption, energy and hydropower, among many others, within the context of growing population and resultant increase in water demand (GoM, 2007). Presently, Malawi suffers from both economic and physical water scarcity. The total irrigable land available reflects limited investment in infrastructural development in support of irrigation based farming. The estimated area currently equipped with irrigation estimated at 72,000 hectares, of which 48,000 hectares is under estates from which the major crops such as sugar cane, tea, and coffee are produced. The remaining 24,000 hectares are under different forms of smallholder irrigation (World Bank, 2013). In addition to these figures, an estimated 62,000 hectares is classified as being under informal water management mainly conducted in wetlands and informal self-help schemes. Despite this so-called informal irrigation sector covering a larger area than the formal sector, the government's efforts appear to be centred on strengthening irrigation development in the latter, where water user groups or associations have been constituted to manage water and other affairs within these schemes.

Niasse (2011) has argued that in the context of water scarcity, attention should be paid to water rights and how these are integrated with land rights. Further, securing water rights also secures land rights, implying that water and land rights are mutually reinforcing. In the case of Malawi, irrigation management transfer to WUAs has led to transfer of land rights held under customary tenure under group village headmen or headwomen to these new

institutions (WUAs). Water, however, is a 'fugitive' and mobile resource which at times appears to lack clearly defined rights of use in Malawi. It has been argued that challenges with establishing and exercising clear ownership rights over water are due to limited progress in the formulation and implementation of water rights especially for productive use. It appears that land rights are much more developed than water rights, because historic abundance of water has traditionally allowed open access, with people not caring much about other users within their catchment (Meinzen-Dick and Nkonya, 2009; (Cotula, 2006; Hodgson, 2004; Ghezae, 2009). In contrast to smallholder systems in Malawi, large scale estate producers appear to enjoy, by virtue of land rights, rights over water which in most cases is not paid for. By contrast, the establishment of water user associations which in principle should be paying for water rights appears to be excluding poor rural in informal irrigation and dependent on similar water sources as the formal schemes, from accessing their rights to water on the basis of illegality of such, as they are not formally recognised. In other terms, informal irrigation schemes are seen as having lesser rights to water than formal irrigation schemes, despite being more important in terms of total number of farmers supported.

2.7.2 Institutional framework for irrigation management

The newly elected government has, since 2014, merged the ministries of Agriculture and Food Security and that of Water and Irrigation Development to form a new ministry, the Ministry of Agriculture, Irrigation and Water Development. Prior to this merger, all the affairs relating to irrigation development were being managed under the Department for Irrigation, with the handicap that the department was poorly resourced in terms of trained human capital at the local level and relies on extension support from a different government ministry and often with logistical and commitment challenges.

The National Irrigation Policy and Development Strategy (NIPDS, 2011) demands that irrigation development should be demand driven and service-oriented with the full participation of farmers and or commercial interests. As discussed earlier, since 2006, the government, through the World Bank-supported Irrigation, Rural Livelihoods and Agricultural Development Project (IRLADP) has embarked on rehabilitation of old irrigation schemes established in the 60s and 70s, and establishing new small and micro-schemes. Most importantly, the project has focused on strengthening capacity of the irrigation sector institutional framework, including staffing at national and district level, developing appropriate by-laws and facilitating irrigation management transfers as well as developing structures for supporting Water User Associations.

Malawi is undergoing a water management reform process in which Catchment Management Authorities (CMAs) are to be established, in line with international trends, to replace the current system in which the Ministry of Agriculture, Irrigation and Water Development, and the National Water Resources Board, which are the lead agencies in water management, are responsible for monitoring and formulation of water management policy and not its actual management. The new Water Policy will seek to redefine and devolve water management structures (GOM, 2002).These CMAs will be commercially-

oriented, government-owned institutions and are to establish their own operational modalities.

The agricultural sector consumes 49% of the country's water resources and with lack of knowledge on proper irrigation methods, and poor capacity to recycle water by small industries, water use capacity is low (Mulwafu et al. 2002). Malawi's National Water Policy of 2005 provides for several improvements in the management of water resources. In particular, there is a provision for promoting effective utilisation, conservation, and protection of water resources for sustainable agriculture and irrigation, fisheries, navigation, eco-tourism, forestry, hydropower and disaster management and environmental protection. Other provisions include the need to adopt Integrated Water Resources Management (IWRM) Principles, and promote private sector participation in water resource development and service delivery (GOM, 2005). Challenges in achieving these expectations relate to the fact that key aspects of water resource governance such as water demand management, are hardly practiced despite the requirement of the irrigation policy for water to be used efficiently (Mulwafu et al. 2002). Njoloma et al. (2009) recommend that 'planning of a comprehensive and sustainable water resource management and implementing it in an integrated manner with other sectors is the key to the success of the sector'.

2.8 Conclusion

Malawi faces immense pressure to grow its agricultural sector, both to meet the food demand for a growing population, and to provide opportunities for creating incomes-generating opportunities that will lift millions out of poverty. Chief among measures designed to deliver such growth has been the promotion of irrigation. Although the history of irrigation spans over five decades, it appears that specific actions to improve irrigation effectiveness have failed to learn from past experiences- rendering irrigation as a fix that is likely to fail. Several interventions implemented by the Government have either been too small to make sufficient impact in sector development, or have failed to address the underlying challenges facing farmers, such as unlevelled plots, lack of financial capital and management capability. Without addressing these basic issues, management transfers of irrigation schemes may only provide false hopes and set farmers up for failure. While it has been argued that ensuring farmers' rights over land and water is a vital ingredient for an effective strategy for growing agriculture, most of the existing land, water and irrigation laws and policies have centred on increasing the level of formalisation. Institutions across scales of governance will also need to focus attention on how these scarce resources are governed, particularly in light of climate change. These issues are the focus of this research. Having provided an overview of the national context, we now turn to discussion of the field sites in which detailed ethnographic fieldwork was carried out.

3 THE FIELD SITES

3.1 Nsanje District

3.1.1 Geographical location

Figure 3: Location of Nsanje in Malawi

Nsanje district lies on latitudes 16°45'S and 35°10'E and is the southern-most district of Malawi. The district is surrounded by Mozambique on all but its northern border, which is shared with the upland districts of Thyolo and Mulanje. Nsanje is located within the Lower Shire Valley and lies at an altitude ranging from as low as 60 metres above sea level to 180 metres above sea level. The Shire River is the main physical feature of this livelihood zone, shaping both vulnerability, through its impact on flooding, and resilience in the case of households that are profitably engaged in irrigation based agriculture. The Shire River passes through Nsanje on its journey from its source in Lake Malawi to meet the Zambezi River which eventually pours into the Indian Ocean. Significantly, there are other rivers such as the Ruo that originate from the mountains in Mulanje, and are notorious, along with the Shire, for causing flooding in the district. In January 2012, the area of TA Mlolo in Nsanje District was hit by two floods caused by the swelling of Ruo and Shire Rivers due to heavy rains. The major brunt of the disaster (71per cent) was felt by individuals and communities. The floods affected 2,887 households translating to 10,376 people, which is 4 per cent of the population of Nsanje District. Out of these affected people 6,159 were displaced because their houses were damaged. In 2015 severe floods caused by tropical cyclone Chedza resulted in loss of about 200 lives, displacement of 170,000 people and food production shortfall of 500,000 metric tonnes which will result in millions, especially in the southern region, seeking humanitarian assistance following loss of crops and volatile food prices (Christian Aid, 2015; FEWSNET, 2015).

Agriculturally, the flat terrain and close proximity to the Shire and other rivers that characterises the Lower Shire Valley positions the region as ideal for plantation-type farming. The flat terrain is complemented by deep dark soils that are agriculturally rich. To the east of the river, up to the Thyolo escarpment are medium and course alluvial and colluvial soils while to the west is a broad plain comprised of vertisols and grey-brown earths (GOM, 2009). Soils are predominantly dark loams although clayey loams can also be found within the study area. The district has a very high population density averaging 123 people/km^2 (NSO, 2008) and Makhanga Extension Planning Area (EPA), in which fieldwork was carried out, is one of the densely populated areas. Land use intensity is very high and with a combination of high land scarcity and low external input use, particularly in terms of inorganic fertilisers, many soils in the EPA have been over-mined in terms of the key elements, Nitrogen, Phosphorus and Potassium. As we will discuss later, lack of fertiliser and

not water, was cited by the largest proportion of farmers as the most important contributor to low yields. Saline soils are also found within this region.

Climatically, Nsanje district is located in a rain shadow region and receives low rainfall averaging 872mm per annum and is prone to dry spells and droughts. The low altitude coupled with extensive deforestation and stream bank cultivation in the upland districts of Thyolo have over time intensified the siltation levels on the rivers thereby magnifying the risk of flooding. The average summer and winter temperatures are both relatively high at 32.3°C and 20.7°C, respectively (MMS, 2008). These typically warm temperatures accelerate evapotranspiration and consequently exacerbate water demand thereby leading to higher water abstractions particularly in the non-winter months. The combination of high temperatures and abundant water resources, including stagnant water in irrigation canals as a consequence of challenges in the maintenance, increases the proliferation of mosquitoes resulting in high malaria incidence in and around the irrigation scheme. Records at Makhanga Health Centre, for example, indicate a morbidity of 4 per cent due to malaria within the EPA.

In addition to the district's climatic volatility, the combination of factors including low soil fertility, land degradation due to high population pressure (123people/km^2) and limited access to agricultural land (72 per cent of households have less than 1 hectare of land) has led to Nsanje suffering more frequent food production shortfalls which increase the risk of food insecurity. Flooding in Nsanje is due to the geographical location of Nsanje proximal to the mouth of the major rivers in the Lower Shire valley, notably the Shire, Mwanza and Ruo which are all heavily silted (GOM, 2009). These rivers are also very important sources of water for supporting commercial (mainly sugar cane production), formal and informal irrigation activities in the district.

3.1.2 Social and Economic Issues

Nsanje district is both ethnically and culturally diverse. The society is a mixture of the patriarchal Sena who originate from Mozambique, and the Chewa, Yao and Man'ganja groups which are all matrilineal and with a longer history in Malawi. These two systems of marriage and inheritance (patrilineal and matrilineal) are said to have some level of influence on agricultural production through determining the transfer of land across generations and influencing the nature and extent of commitment and investment in the land, level of effort and type of activity undertaken on the land by both men and women, and income and assets accrued by the household. The Sena are locally known to be fisher-folk and any other assets they may own, such as land and livestock, are normally transferred through male children. In integrating into matrilineal systems, Sena men may use marriage with local women of a matrilineal group to access land and other resources. The matrilineal groups in this district do not have clearly defined livelihoods- they depend on a combination often involving crop cultivation and livestock farming. The social diversity at the local level is very useful for examining the systems of entitlement and access to resources that shape livelihoods and agricultural outcomes. The general consensus is that there has been

substantial mixing of cultures over time and practices, including intergenerational wealth transfer, does not strictly follow either one of the two social systems but is a hybrid of both.

Livelihoods are predominantly dependent on crop and livestock production. Rice and cotton are the main cash crops, while maize is often sold by most households to generate cash for meeting household financial obligations despite quantities often being inadequate to meet household food requirements. Livestock farming is the main income source for the wealthy households while poorer households rely on providing casual labour (*ganyu*) for cash or food. Other activities include fishing and petty businesses, including basket weaving and selling various wares in the market places. Proximity to Mozambique allows some households to earn an income from providing ganyu in that country. In years of food deficit in the district, Mozambique often provides a strategic coping base from which some households in Nsanje may purchase or work for grain.

The district has characteristically high levels of poverty, even eclipsing the national poverty picture. Nationally, 52per cent of the population was classified as poor in 2013. Nsanje district lies in the southern region which has an average poverty rate of 60 per cent and is home to 49.7 per cent of Malawi's poor despite constituting 40.4 per cent of the national population. 76 per cent of Nsanje was classified as poor in 2005 (NSO, 2005- Malawi Integrated Household Survey 1).

Markets in Nsanje are weakly linked to others within the country due to general isolation of this district. Farmers are subject to highly volatile commodity prices, especially for maize that tends to fluctuate depending on season quality. For example, in years of glut when farmers obtain bumper harvests for maize, the prices are often too depressed due to oversupply on the market, and insufficient to support the succeeding season or move farmers out of poverty. Rice and cotton buyers, and to some extent those involved in sugar production, are subject to global price trends, but also suffer substantial loss from delayed payments by middlemen. The livestock market is particularly weakly developed especially for small stocks.

3.1.3 Agriculture

Nsanje district has approximately 193,132 hectares of land spread across five agricultural Extension Planning Areas (EPAs) and nine traditional authorities (TAs). Of this total area, 93,514 hectares is arable land and the remainder 99,618 hectares is non-arable comprising of forest reserves, land allocated to wildlife and marshes. Within the total arable area, an estimated 43494 hectares is cultivated while 50,020 hectares is non-cultivable (GOM, 2014). Agriculture in the district is supported by a combination of rainfed farming conducted mainly in the uplands, and irrigated farming which takes place in the lowlands particularly in areas served by wetlands. As with the national picture, rainfed farming dominates

agriculture while irrigation is increasingly gaining prominence and support within the sector at district level.

A variety of crops are grown in both the main summer season that extends from November to March/April and in the winter season starting from May through to August, or even later depending on water availability. Winter production is predominantly under irrigation and mostly takes place in the wetlands (*dimba*). Cotton and rice are the main cash crops, while food crops grown by farmers in the district include maize (also a cash crop), millet, sorghum, beans and pigeon peas. Rice and maize are the main crops grown under irrigation, while leafy vegetables, tomatoes and onions are also present but in much lesser proportions and restricted to the 'informal irrigation areas'. The lowlands within the district are also attractive for and do support some significant livestock production. Cattle holdings are significant in the zone, but ownership rates per household are very low. People also keep goats, chicken and guinea fowls.

Nsanje district is ideal for studying the issues and dynamics within irrigation and agriculture in general. The district has been earmarked as being strategic for irrigation development given the flat and deep alluvium soils and proximity to the Shire River. Irrigation water is delivered through a combination of treadle pump and, to a lesser extent because of high running costs, motorised pumps, watering cans, gravity feeding in rice production, and drip irrigation through perforated pipes. Water sources are also diverse and include rivers and streams, small dams, shallow wells, and canals that divert water from rivers into irrigation schemes. Water rights have been formally granted to only four entities across the whole district.

3.1.4 Demographic

In 2008 Nsanje district had a population estimated at 238,103 people. The total number of farm families was 60,790 with each family having an average of 4.5 members. The population is growing at 2.1 per cent per annum, a rate slower than the national average of 2.8 per cent per annum (NSO, 2009). Fertility rates are relatively high with an average woman bearing at least six children although with preference for four children. One of the drivers of high fertility rates has been the low literacy levels. The district level adult literacy rate was measured at 52 per cent, with the average for women being slightly lower at 46 per cent than for adult men. Low literacy rates is one of the main factors that have kept fertility rates high, and are also blamed for the high HIV/AIDS prevalence measured at 20.5 per cent for the Southern Region (NSO, 2009).The district had a net migration of -13.2 per cent in 2008 with South Africa being the main destination for international migration. Mobility between Nsanje and Mozambique is substantial and mainly for economic and food security reasons.

3.1.5 Historical

Agricultural activities in Nsanje have been influenced by some historical interactions particularly with Mozambique. In the early sixties there was an influx of Mozambicans into Nsanje and other parts of Mozambique. The migrants were predominantly Sena and depended on fishing as a source of their livelihood. In 1986 large numbers of Mozambican refugees arrived in Malawi following the intensification of the Civil War that had started soon after independence in 1975. Nsanje is believed to have hosted more than 220,000 refugees, a population exceeding the district population of locals by 30,000 (Rule, 1988). In addition to the economic strain brought about by refugee presence in Malawi, it has been reported that local Malawians lost access to land as some of their land was taken up to accommodate the refugees. Massive deforestation or land use change from forests and agriculture to residential is believed to have accompanied refugee settlement in Nsanje. Locals had to be incorporated into the UNHCR and government food assistance programmes as they could no longer produce their food. Others have argued that this situation may be responsible for poor farming knowledge transfer across generations of farmers, as well as low capacity and knowledge to produce food. The presence of non-governmental organisations involved in relief and development work is believed to have alleviated the crisis but also created donor dependency (Zetter, 1996).

3.1.6 Development Interventions

Nsanje is informally known as the 'darling of Malawi's donors'. This narrative stems from the historic involvement of the United Nations High Commission for Refugees (UNHCR) in alleviating the plight of refugees and affected locals in Nsanje, and the subsequent programmes for relief and development that were implemented thereafter. The high frequency of droughts and floods in the district has created a somewhat protracted humanitarian and relief situation in Nsanje, although the nature of interventions has been changing over time towards more developmental programmes. Despite its vulnerability to a volatile climate, Nsanje is also emerging as a promising success story on the basis of the potential that irrigation development has on livelihoods. The district hosts the Green Belt Initiative, Smallholder irrigation and Value Addition Project, IRLADP, Agriculture Infrastructure Support Project, among others. Development activities are coordinated by the District Executive Council comprising of government departments and their non-governmental partners. Key non-governmental partners include Goal Malawi, WALA, Concern, ROLEC, Action Aid and CARD.

3.1 The Study Location

The previous section provided a justification for the selection of Nsanje as the location for this research project. On the basis of consultations and initial interviews with a range of key informants

at the national and district levels, two irrigation schemes were identified for the study; Muona Irrigation Scheme and Chitsukwa Irrigation Scheme, both located within Makhanga EPA in Traditional Authority (TA) Mlolo. Geographically, TA Mlolo is located to the north to north east of Nsanje. The map in Figure 2 shows the location of the two schemes relative to each other and within the district, as well as the villages within which they are located, and from which most of the farmers are resident. This section provides a brief context of the two irrigation schemes on which the findings presented in this report are based.

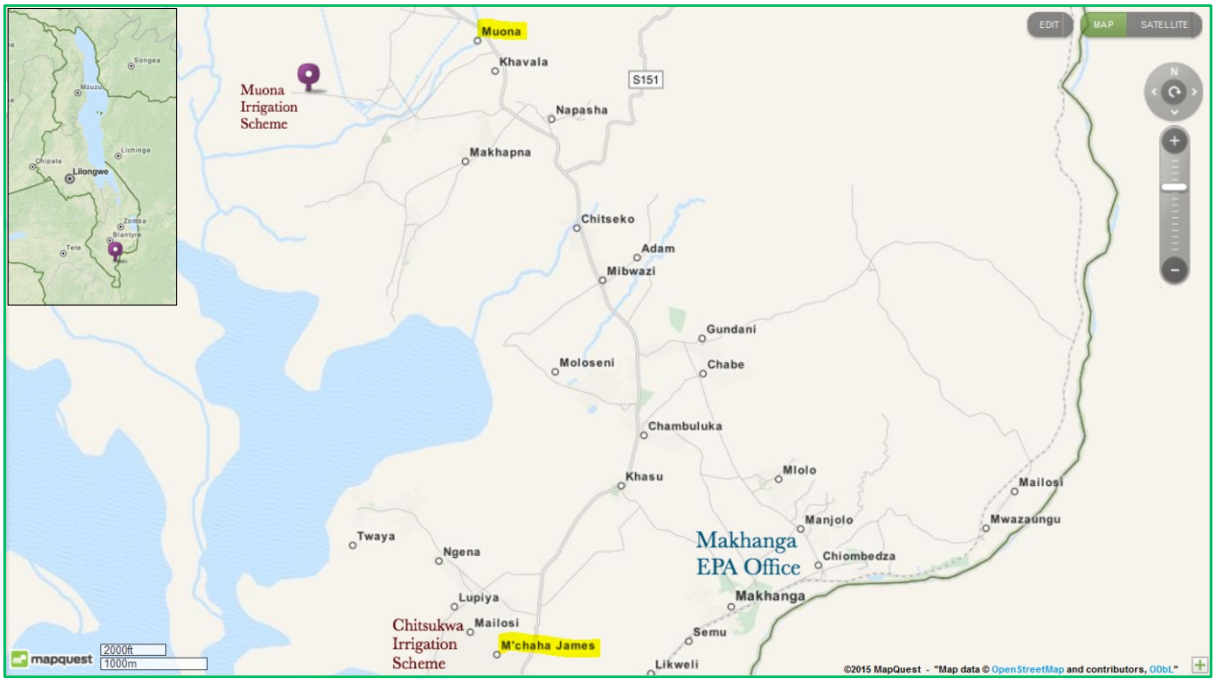


Figure 4: Map showing location of Chitsukwa and Muona Irrigation Schemes in Makhanga EPA in Nsanje

3.1.7 Muona Irrigation Scheme

3.1.7.1 Site Location and general description

Muona Irrigation Scheme is a gravity-fed irrigation scheme located in Makhanga EPA to the north of Nsanje District on map coordinates 16°25'S and 35°08'E. The scheme is located some 15km to the north of Makhanga EPA office, and some 58km from the Thabwa turnoff on the Thabwa-Fatima Road. The irrigation scheme has a gross area of 446 hectares of which a net 395 hectares organized into twelve blocks supplied with water by a network of main, secondary and tertiary canals is under production. Water for irrigation is derived from the Thangadzi River which originates from the uplands of Thyolo and Mulanje located to the north of Nsanje. The Thangadzi brings silt from the uplands, but also a rich alluvium which supports agricultural production. The scheme produces rice as the main crop, although maize is also a prominent crop especially for the blocks that are poorly served with water or in the winter season when available water is insufficient for rice production.

The irrigation scheme is located within TA Mlolo and is surrounded by villages most of which fall under Group Village Headman Chipondeni. The catchment of the irrigation scheme extends even beyond a 10 kilometre radius, with farmers from as far afield as Makhanga and Masenjere coming to rent land for the purpose of rice growing. Within TA Mlolo most of the farmers in the rice scheme come from the surrounding villages such as Chipondeni, Chinzeti, Cholomali, Biliati, Jokoniya, Malothi, Goke, Napasha, Chitseko, Mbwazi, Adam, Chambuluka, and Gundani among others. Outside Muona Irrigation Scheme, there are other much smaller irrigation schemes that support vegetable and crop production such as Goke, Nkhumba, Chinyanje and Makhapa. Goke and Nkhumba are treadle pump based and are both an initiative of local farmers. Chinyanje is located within a marsh and supports rice and maize production, while Makhapa will be a maize scheme once completed.

3.1.7.2 Production History

Small-scale irrigation in Muona has been in place since the mid-fifties when farmers diverted water from the Thangadzi River to support the cultivation of various cereals, including maize and rice, vegetables and tubers. In the early sixties a colonial officer or perhaps volunteer by the name Magreaver visited the area and observed farmers irrigating the area. Magreaver offered extension guidance to farmers and helped them improve food production, especially rice. This area where traditional irrigation was practiced became known after this colonial officer, and lies adjacent to the 446-hectare Muona Irrigation Scheme. Muona Irrigation Scheme was established by the government with technical assistance of the Chinese between 1969 and 1972 in response to a felt need by government to support farming activities because of the success of irrigation in Magreaver.

Muona Irrigation Scheme was established partly on *dimba* land that farmers had always been cultivating and by relocating Chinzeti village to a new location near Biliati Village within Group Village Head (GVH) Chipondeni. Unlike other schemes of its size and age, Muona has been until recently, been under customary land tenure arrangements. On completion of construction, people retained their fields but were encouraged to share their land with others, or rent it out. Those that had been displaced by the construction of the scheme were also allocated land, along with those that had no land to start with or were coming in to settle in Muona. While female-managed 'gardens' had dominated irrigation in Magreaver, men became more prominent in the production of rice, a cash crop at the point of establishment of Muona Irrigation Scheme in 1972.

Muona Irrigation Scheme was initially overseen by the local Member of Parliament, Gwanda Chakwamba, who is said by informants to have passed on the responsibility to the Traditional Authority because of excessive demands on his time. The TA subsequently yielded the management of the scheme to a Land Allocation Committee, which eventually

became a Management Committee. Up until 1975 when the management of the scheme was transferred to the farmers, the scheme was receiving technical assistance from the Chinese who introduced new and better yielding rice varieties. In addition, each block had an allocated extension officer, an irrigation officer was also stationed at the scheme, and discipline was enforced by the paramilitary wing of the ruling Malawi Congress Party, the Young Pioneers.

According to some key informants interviewed in the area, when Banda's authoritarian rule ended in 1994, the Young Pioneers were disbanded and the traditional leaders lost the influence over land they had enjoyed under Banda. This political change is seen as having influenced outcomes at the scheme. As explained by one informant

> *"In the euphoria of the end of Banda's rule, farmers disregarded cropping calendars and others even dumped waste from their fields onto the canals choking them. No one seemed to listen to the management committees anymore, they said they had democracy and democracy meant that everyone was free to do as they pleased".*

It was reiterated in several discussions that the newfound freedom was a far cry from the heavy state control that had allowed the scheme to thrive, at least in productivity terms, under the guidance of the extension officers and the enforcement of 'rule of law' by the Young Pioneers. Further upstream in Thyolo and Mulanje Districts, the deforestation rate was reportedly exacerbated by this loss of a system of central control, leading to high siltation of rivers such as the Thangadzi that supported irrigation in downstream Muona. This combination of stressors led to the deterioration of Muona to an extent that during the 1990s, less than half the scheme was operational. Also, in the post-Banda era the government implemented structural adjustment measures and to cut its expenditure reduced the number of extension officers from 13 to four. In the mid-2000s the government further phased out its support to irrigation schemes by introducing the Water User Associations (WUA), which replaced the Management Committee in Muona. All issues to do with management of land and water were thereafter handled by an elected WUA.

3.1.7.3 Rehabilitation of the scheme

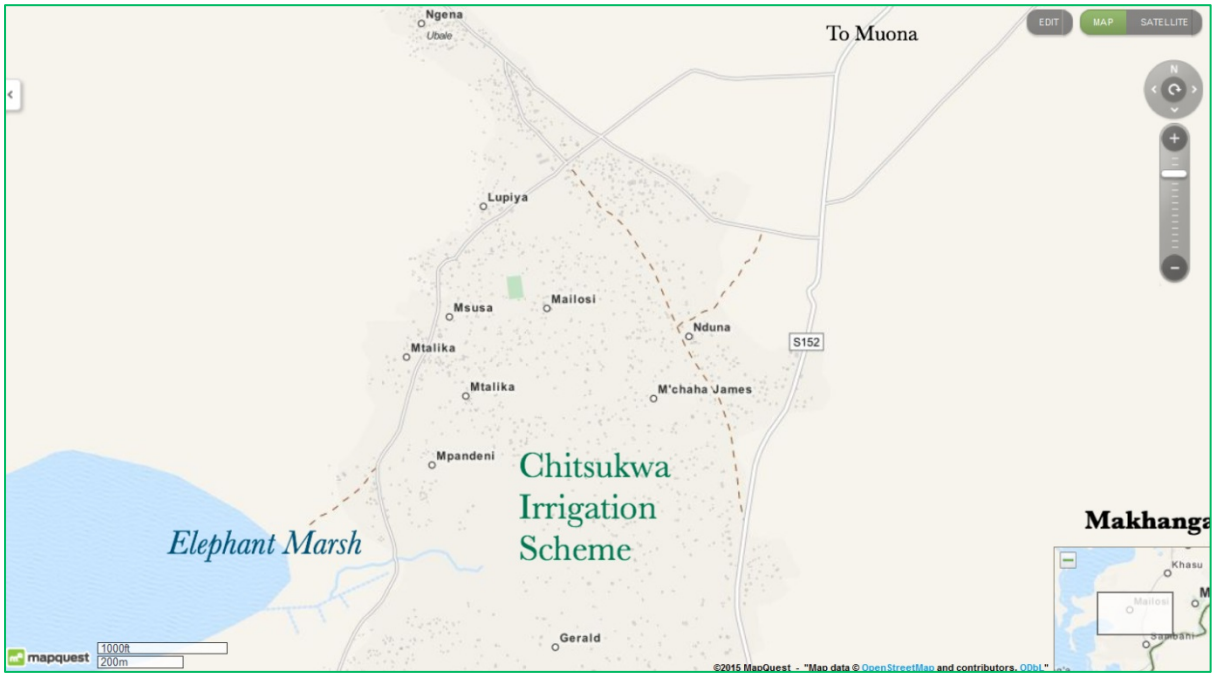
Under the management of the WUA the scheme showed signs of decline and eventually near collapse. Siltation of the main rivers reduced the water yield in the scheme thereby confining some sections of the scheme to rainfed farming, and in parts that were strategically located near functional canals, reduced the yield that farmers were obtaining. By the late 2000s the scheme had virtually collapsed and operated at less than half its capacity as a consequence of the high silt load in the Thangadzi River and the inability to divert water free of sand which led to the complete silting up of the headworks system. The perspective of the management of the scheme is that the costs of maintenance, particularly those associated with desilting, and challenges in managing water users and ensuring

discipline in the scheme, all contributed to the decline and eventual collapse of the scheme. Insufficient supply of water is believed to have exacerbated conflicts over both land and water in the scheme.

In line with the government's agricultural development strategy, rehabilitation works started in 2009 under World Bank funding through the Irrigation and Rural Livelihoods and Agricultural Development Project (IRLADP). The rehabilitation prioritised shifting the headworks system to a new site further up the Thangadzi River to avoid the heavily silted sections on the much lower course of the river. The rehabilitation involve construction of a new intake higher upstream where silt load could be managed, desilting and lining the main canals, and constructing a night storage reservoir. With the limit of funding, some priorities identified by farmers, such as levelling the scheme to ensure equitable water distribution, could not be achieved. In fact there were delays in the implementation of the project such that by the time works started around 2011 the context with regards to the level of siltation had intensified, and required much more funding than initially anticipated. The initial contractor was also found to be incompetent and a replacement had to be sought, further delaying the rehabilitation process (fieldnotes, 2013). Along with the hard technology, the rehabilitation also prioritised the building of capacity and strengthening of institutions for managing the scheme. A Cooperative has been established as a marketing arm for the scheme; various training sessions and knowledge exchange visits on production techniques, including seed multiplication and an agronomic practice known as the system for rice intensification (SRI) have been provided to the scheme users, principally those in the WUA. Some feeder roads were also constructed to support the production and marketing of crops including those produced in the scheme. Following completion of the rehabilitation works, the scheme was 'handed back' to the WUA in September 2014.

3.1.8 Chitsukwa Irrigation Scheme

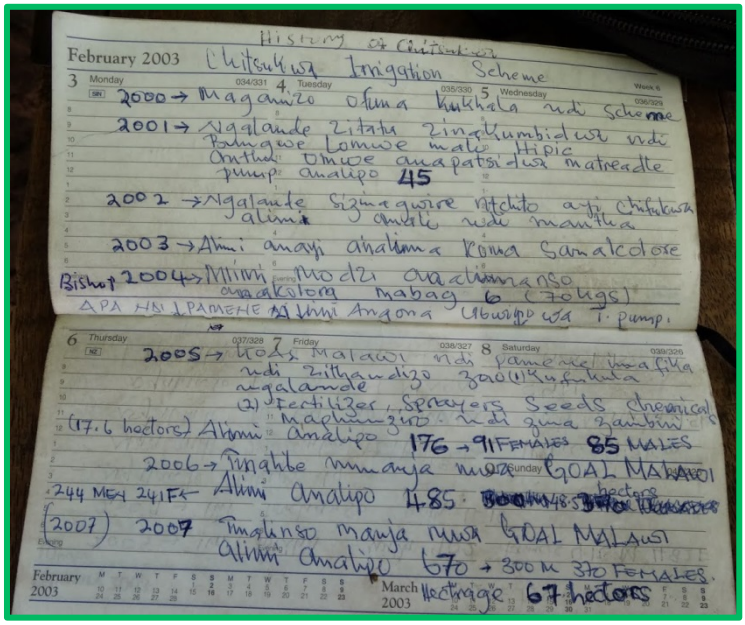
3.1.8.1 Geographical Location



Chitsukwa Irrigation Scheme is located some 15km away from Muona and also falls under the catchment of Makhanga EPA office. The scheme is located within Group Village Headman (GVH) Mchacha James and supports farmers from over fifteen villages, including those located as far afield as Goke and Chapinga, some 10 to 15km from the irrigation scheme. The majority of farmers use water brought in by canals from the Elephant Marsh, a large wetland measuring between 380 and 1200 square kilometres, depending on the flow of the Shire and Ruo rivers. The treadle pump is the main device used for water abstractions from either canals or shallow wells.

3.1.8.2 History

The initiative to establish a maize irrigation scheme was first discussed in 2001 between a small group of farmers and the local extension officer. In the following year three canals were constructed with funding sourced from a program for Highly Indebted Poor Countries (HIPC) by the district. According to scheme records (**Figure 4**) and interviews a total of 45 farmers signed up to be part of the scheme and were each issued with treadle pumps on loan from the government. Each unit was priced at K19500 in 2001 prices (US$320), a figure which most farmers found to be too expensive. In 2002 none of the 45 farmers managed to farm in the scheme because they could not get to successfully operate the treadle pump given its high labour intensity and difficulty in pumping water. Most returned the treadle pump to the government office in Makhanga and complained that the treadle pump had strained their backs to no benefit. In 2003 some farmers attempted to farm using the treadle pump and although they had established a promising crop they failed to harvest because the crops were grazed by livestock.



In 2004 only one of the four farmers that had planted in 2003 decided to plant maize in the irrigation scheme. He managed to harvest six bags of 70kg each (420kg in total) and this was by any standard a very impressive yield as farmers in the dry land normally harvested that much from four times as much land than that used by this particular irrigating farmer. This yield inspired more farmers into irrigation, with higher grain yield as the main motivator.

Figure 5: An extract from Chitsukwa Irrigation Scheme Records

In 2005, Goal Malawi came in to assist farmers in Chitsukwa through construction of additional canals, fertilizers, sprayers and seeds. Farmers were also trained on good farming practices and crop production under irrigation. A total of 176 farmers comprising of 91 females and 85 males were using the scheme which by then was covering 17.6 hectares. In the following year, the continuing success of farmers further led to an increase in the number of farmers using the scheme. In 2006 Chitsukwa had 485 farmers in total, and the scheme had grown to 48.5 hectares. In 2007 the numbers grew even further to 670 farmers on 67 hectares. Part of the growth was due to the fact that the irrigators had figured a way to reduce the workload on the treadle pump by removing some rubbers from the cylinders. The number of farmers continued to increase reaching 902 (416 male and 482 female) in 2008 and 1018 in 2009. Additional canals totaling 5 km were constructed under the Malawi Social Action Fund (MASAF), adding on to the initial 1.2km under HIPC and 1.5km constructed by Goal Malawi. At this point, Goal Malawi had also appointed a committee to run the affairs of the scheme as part of its (Goal Malawi) exit strategy. The committee collected K158 000 from farmers from the sale of portions of grain contributed by farmers who had received seed and fertilizer assistance from Goal Malawi. The funds were meant to meet the running costs of the scheme, but unfortunately it appears that these funds were misappropriated and could not be accounted for. In 2013, the scheme was supporting 2645 farmers and covered 280 hectares. The expansion of the scheme has been through conversion of dimba and dry land into irrigated land. Of the fifteen canals established in the scheme, four were outright clogged and non-functional while the remainder were operational with varying degrees of use (field notes, 2013).

The irrigation scheme is managed by an elected committee consisting of ten members two of whom are women. Each committee serves a three-year term. The first committee to manage the affairs of the scheme was chosen by Goal Malawi in 2005, and served for eight years after which an elected committee took over. The scheme committee works with a network of block committees, each block representing each one of the fifteen canals in the scheme. While the scheme management committee overseas the running of the scheme,

the block committee's focus is on managing canals and ensuring that all farmers participate in scheduled activities. Poor water management, low soil fertility and unfavourable markets for crop produce are some of the main concerns in this scheme, as will be discussed later.

4 RESEARCH METHODOLOGY

4.1 Data collection and Analysis

Field data collection was conducted over a period of nine months commencing June 2013. At inception and at both national and district levels, a scoping exercise was conducted with key informants drawn from various institutions, including government ministries, non-governmental organisations, local government, traditional leaders, farmers and irrigation scheme management offices. The purpose of the scoping exercise was to ensure that the research focused on policy and frontline implementation-relevant problems, as opposed to relying entirely on review of literature; to map relevant institutions and individuals to be consulted; and to establish a mechanism for communicating the findings and implications of the research in order to enhance the project's impact.

The duration of fieldwork coincided with both the winter cropping season (June to September) and the summer season (November to April) thus enabling a real-time examination of the various issues under study. An ethnographic approach which focused on recording and understanding irrigating farmers' everyday lived experiences was adopted. The field researcher attended community meetings, visited respondents in the fields and at home, and was resident in the same locale. A questionnaire survey involving 151 purposively selected households (on the basis of location, household economic status, and land access) was conducted across three villages serving the two irrigation schemes (Chipondeni, Chinzeti and Mchacha James). The household survey was complemented by focus group discussions, in-depth interviews with farmers and various actors in the irrigation schemes, key informant interviews and review of secondary data drawn from various actors in agriculture and irrigation development. Participant observation included attendance to meetings of the Water User Associations, field days, and community meetings. Photographs and video clips depicting various situations and issues in the study area were collected in the course of transect and guided walks and used in photo-elicitation interviews and as visual aids in focus group meetings and key informant interviews.

The interviews with farmers and different key informants were recorded, transcribed, and analyzed thematically through iterative reading of the interview material, categorization of the material by themes, and quantification of statements (Miles and Huberman 1994; Kvale 1996). A total of 12 focus group discussions and over 65 in-depth interviews and 40 key informant interviews, in addition to field notes, were analysed. The documented observations from field visits were used for method triangulation (Kvale 1996), enabling a critical perspective of descriptions given by farmers and key informants. Quantitative data from household interviews was analysed using Statistical Package for Social Scientists (SPSS).

Preliminary findings from the research were shared with farmers in the sampled irrigation schemes, local agricultural extension office, government, non-governmental and donor agencies at the district and national levels. Feedback from these sessions, including presentation in various conferences and working group meetings, has been incorporated into the analysis and finalisation of the report.

5 LIVELIHOODS, WELLBEING AND 'RESILIENCE'

5.1 Contribution of irrigation to food and incomes

This research project examined the extent to which the introduction of irrigation-based farming had resulted in improvements in both household food security and agricultural incomes. Farmers in Chitsukwa Irrigation Scheme were predominantly producing maize while Muona had a mixture of rice (main crop) and maize in sections that had constraints with accessing irrigating water. Maize in both schemes was grown as a food crop, while rice was being produced entirely for the market with some small portion consumed in some households. In both cases farmers were operating on relatively very small plots of land averaging between 0.1 and 0.2ha. In both schemes there were substantial inequalities in land use per household; access or affordability of labour and cash with which to rent land were the key differentiating factors in land access.

The low level of mechanisation and high dependence on manual labour, which is often paid for in cash, appears to have the effect of raising the cost of producing crops in both Chitsukwa and Muona, thereby undermining the profitability of the farming systems at household level. However, farmers and indeed the extension services that support them, do not often cost labour in their calculation of the productivity of small scale irrigation. Rather they assume that the farmer will supply labour; this study showed that for plots of more than 0.1ha a household would normally have to hire additional labour unless that household had more than two adults. Labour was, in fact, such a limiting factor that some households even failed to prepare 0.1ha of land, often resulting in food insecurity and worsening their poverty status.

Rice contributes to food security when sold or exchanged for maize and this is usually at a rate of 1:1. Most people produce rice for the market; they refer to rice as a 'white man's food' and only consume it in very limited amounts. A bag of rice may cost as much as between K7000 (US$14) for the Typhoon variety and K9000 (US$18) for the Super Fire variety during the peak of the lean season, but is normally sold at between K5000 (US$10) and K7000 (US$14), respectively, soon after harvesting. Maize prices range, on the contrary, was very volatile with process oscillating between from K3000 (US$6) and K12000 (US$24) within a twelve month season. Rice produced in the scheme is sold to buy maize through these exchanges, with farmers controlling larger tracts of land in Muona being able to produce entirely to earn cash income. Farmer preference appeared to be towards exchange of rice for maize rather than selling the rice and using the income to buy maize. A respondent in one of the focus groups explained the rationale:

> *"Once you touch the money from rice, you are faced by so many problems that require cash and chances are very high that you will end up using all that money to pay for those things at the expense of maize security".*

According to a FGD in Muona, an average household comprising of 2 adults and five children would consume a bag of rice per week (about 35kg after milling) or 50kg of maize per month. They argued that a larger volume of rice is required to obtain the same 'filling' as that provided by maize. Most households in both areas normally have adequate food to last them a period of six months. Beyond this period, a food stressed household would then resort to reducing the frequency and sizes of meals consumed in order to 'increase' the duration with food availability. In Chitsukwa, farmers reported selling an average of 6 to 8 bags of every 10 harvested in order to generate money with which to buy food and non-food items, including paying for transport and rent for land. The remaining bags of grain were most frequently inadequate to meet household food requirements beyond three to four months.

5.2 Livelihoods in Chitsukwa and Muona

Livelihoods around Chitsukwa are predominantly influenced by the Elephant Marsh. Over 90% of households in Mchacha James are engaged in dimba or irrigation production of food based on water derived from the marsh and brought into the scheme through canals. Irrespective of food self-sufficiency of total harvest, most households sell a portion of their grain for cash. The marsh also supports a vibrant fishing activity, although incomes appear to be very depressed because of poor market linkages and inability of locals to purchase the fish at prices sufficient enough to support viable livelihoods. Prior to irrigation, fishing was the most important livelihood activity in terms of number of households and income contribution. Occasionally some fishermen are engaged as tour guides for tourists, mainly medical expatriate students and personnel based at Trinity Hospital some 10km away, who intend to engage in bird watching in the Elephant Marsh. About 10% of households own at least one head of cattle, with substantial inequalities in ownership; the range in cattle ownership stretches from one to well over fifty for the wealthy households. The success of irrigation is influencing a shift from entirely livestock farming to a more mixed system and one with more inclination towards cropping. In fact, livestock farmers are finding it cheaper to produce their own grain rather than sell livestock annually in exchange for grain. The expansion of irrigation into areas previously allocated to livestock feeding is fueling conflicts over land use in this area.

While the scheme is a dominant feature within TA Mlolo, residents are also actively engaged in rain fed farming in the drylands. This type of farming is seen as less profitable and the crops are more susceptible to drought. Farmers produce maize, pearl millet, sorghum and beans under rainfed farming, and cattle ownership is relatively higher than in Mchacha James, the GVH surrounding Chitsukwa Irrigation Scheme. The proportion of well-built houses (burnt bricks and iron sheets) is much higher in the area around Muona than in

Chitsukwa and locals attribute this to the higher incomes earned with rice rather than maize. Others argue that low asset base does not necessarily imply lower economic status as it could be influenced by low willingness to invest in property given high risk of damage by floods.

> *"You cannot invest in property if you live in Mchacha James, the floods will come and wipe away everything. In Muona it's a bit different- they are on slightly higher ground and are not affected by floods as much as we are. I cannot imagine buying a sofa set here, the floods would damage it in its first year".* Male respondent, Mchacha James

Livelihood activities outside irrigation include fishing, dominated by Sena tribe, petty trade and brick making. The treadle pump has found utility in brickmaking.

5.3 Household Socio-Economic Status

Households in the study area use a wide range of proxies for ranking socioeconomic status. Some of the main proxies used include livestock ownership, type of housing structure, food variety and quality, and quality of clothing, among others. Respondents ranked households owning livestock as the strongest indicator for wealth, and despite depending predominantly on cropping; livestock farming was identified as the most preferred livelihood activity especially considering the risk of dry spells and low value of crop commodities. Those with livestock are seen as being more likely to be food secure since they can liquidate some of their stock to purchase food, or use the money to pay for renting land and casual labour (*ganyu*). The ability of livestock owners to acquire cash through sale of livestock often enabled them to plant earlier and therefore to harvest more grain. In Muona, respondents in FGDs mentioned quality of clothing and range of food consumed as equally important determinants of wealth status. The type of brick (burnt) and roofing (iron sheets), as well as ownership of assets such as solar panels and bicycles, were other indicators used at a local level. In Chitsukwa livestock ownership was the strongest indicator of wealth status.

The level of livestock ownership in the study areas, as is the case for Malawi in general, was very low with less than one in ten households owning at least one livestock unit. FGD respondents in Chitsukwa and Muona were asked how many people in every ten owned cattle, and the response was a resounding zero in both locations. The respondents pointed out that typically two or three people in the whole village would own livestock, thus indicating relatively high levels of poverty on the basis of livestock ownership. In most cases, however, those who owned livestock would own very large herds of sometimes up to fifty, as noted above. Some respondents attributed the low cattle ownership rates to reasons

such as the decreasing importance of cattle in payment for bride price (with more preference being for cash); livestock diseases in the early 90s (1993-94) that wiped out large herds of cattle; and the failure by most households to bounce back from the losses suffered. Some households pointed to the lack of security that followed the disbanding of the Young Pioneers, which was resident at village level up to the mid-90s. There were suspicions that most of the rustled cattle were being sold off in Mozambique. In addition to the threat of stock theft, it appears that there is limited control of livestock movement across the borders with Mozambique, and that undermines livestock disease control.

More households owned goats than they did cattle. Depending on location, there were between 2 and 5 people of every 10 who owned at least one goat. Pigs were very uncommon, while chickens and ducks were the most common with one in every two households rearing a chicken or a duck. In fact some households also kept guinea fowls which were seen as more hardened and less prone to fowl diseases. In Chitsukwa ducks were less preferred to chickens because in the event of flooding they tended to 'get carried away with the water and swim away'. While the largest share of respondents preferred producing their grain for food security purposes, a substantially high proportion of them equally aspired to own livestock and operate a mixed farming system comprising of both crops and livestock. In Chitsukwa it was seen as difficult for a farmer to produce enough grain that could be sold to buy a cow, while in Muona respondents reported of some farmers who had managed to buy livestock after selling their rice. The difference in the capability of raising the livelihood asset base through livestock purchase was linked to the higher income per unit mass for rice as compared to maize, and the lower tendency to value associated with rice , and low propensity to consume rice, as compared to maize and that there was a preference for consuming maize ahead of rice.

> *"We know of many farmers who have bought livestock using money from growing crops in the scheme".* Respondent in FGD in Muona

The difference in the capability of raising the livelihood asset base through livestock purchase was linked to the higher income per unit mass for rice as compared to maize, and the lower tendency to value associated with rice , and low propensity to consume rice, as compared to maize and that there was a preference for consuming maize ahead of rice. Respondent preference for livelihoods was for a mixed farming system comprising of both crops and livestock farming. Livestock (only) farmers eventually became poor by selling livestock each time they want to buy some grain as encapsulated in this statement:

> *"I would prefer to grow crops since I can sell crops and buy livestock. If one is a livestock farmer then they have to sell livestock in order to buy maize or rice; this reduces the livestock number and net worth".* Male respondent in FGD in Chitsukwa

Under conditions of water scarcity livestock were seen as offering a better cushioning to farmers. One livestock farmer remarked that "unlike crops, you can move livestock to

water". The major barrier to entry in livestock farming was the start-up cost; a cow costs around K120 000 (US$240), which is an amount equivalent to twenty 50 kilogram bags of rice.

5.4 Productivity assessment of Irrigated Farming

Gross margins for maize and rice were produced along with farmers and extension officers in the study areas with the results coming as a surprise to most participants. The tables below reflect the gross margin for a typical 0.1ha of maize and rice, respectively. For both the rice and the maize enterprise, field data suggests that maize farmers were operating at a loss at the scale of 0.1ha, while rice growers were only marginally profitable at the same scale. Household labour was costed at the average labour rate for the particular activity.

Table 1: Gross margin budget for treadle pump irrigated maize in Chitsukwa Irrigation Scheme

	Price per Unit	Units	Total in Kwacha
OUTPUT	5,000	10	**50,000**
Bags of rice			
INPUT			
Renting land	3,600	1	3,600
Land preparation (tilling)	3,600	1	3,600
Land preparation (fine tilth)	3,600	1	3,600
Weeding	800	1	800
Seed (2kg) mostly retained	0	1	0
Basal fertiliser (10kg)	3,400	1	3,400
Basal fertiliser application	600	1	600
Top dressing fertiliser	3,400	1	3,400
Top dressing fertiliser application	600	1	600
Labour for transplanting	3,600	1	10,800
Labour for weeding	3,600	3	3,600
Clearing band ridge	800	3	2,400
Winnowing	3,600	1	3,600
Harvesting	3,600	1	3,600
Transport (ox-cart) per bag	150	10	1,500
Total Input costs			**45,100**
NET INCOME			**4,900**

Source (field data, 2014)

The gross margins varied slightly within Chitsukwa; those fields located on dimba land required slightly less irrigation than those farmers in the drier parts of the scheme who had to irrigate at least once weekly throughout the season. The maize price of K4500 (US$9) was

the average for the season given that the prices oscillated from between as low as K3000 (US$6) to as high as K8000 (US$16).

In maize production it was costing farmers 13 bags of maize to produce 10 bags of maize. Despite this obvious low profitability in monetary terms most farmers showed an inclination to continue producing maize because there was security in food availability rather than in hoping to buy from the market, because they had no other economic activity that was generating cash. This calculation was based on costing household labour at the prevailing market rates.

Table 2: Gross margin budget for 0.1ha of irrigated rice in Muona Irrigation Scheme

	Price per Unit	Units	Total in Kwacha
OUTPUT			
50kg bags of rice per 0.1ha	4,500	10	**45,000**
INPUT COSTS			
Renting land	3,500	1	3,500
Land preparation (tilling)	5,000	1	5,000
Land preparation (ridging)	4,000	1	4,000
Seed (2kg)	700	2	1400
Basal fertiliser (25kg)	7,000	1	7,000
Top dressing fertiliser	7,000	1	7,000
Labour planting	2,500	1	2,500
Labour weeding	5,500	1	5,500
Treadling (food costs)	350	10	3,500
Treadling (labour charge)	1,500	10	15,000
Harvesting	3,500	1	3,500
Transport (ox-cart)	1,500	1	1,500
Total Input Costs			**59,400**
NET INCOME			**-14,400**

Source: Field data (2014)

For a farmer producing rice on a 0.1ha plot of land the profit they were realising was averaging K4900, which is equal to a single bag of rice. Thus farmers in rice production were using an equivalent of 9 bags of rice to produce 10 bags. Those farmers with financial resources and land access that allows for then to produce two crops of maize or rice per season were more likely to have larger stocks of the grain and were better placed to sell some of the crop for cash income. One key informant argued that maize and rice were only profitable over larger scales of production and not for small family plots. If farmers had the capability of producing two crops a year under irrigation then this would much greatly improve their food security situation.

Rice is produced for the market and has the advantage of much more stable prices as compared to maize. The price per bag of rice only varied with the type of rice and was

generally stable throughout the year at an average of K6000. On the contrary maize prices reached a low of K3000 per bag at harvesting time and rising up to way over K12000per bag in the lean season which stretches from October to March. Thus, with maize farming in a year that the rains are good and yields are higher farmers effectively earn less as prices are pushed down by excess supply on the market.

Other respondents argued that maize was only profitable if inputs were subsidised by the government. A 50kg bag of fertiliser costs K14000 on the market, but when subsidised can be bought for as little as K500. Thus, subsidised farmers can afford to sell their maize at a price of K3000 and break even or make some little surplus. Some farmers felt that it was the subsidies in maize production that were keeping them poor, since subsidised farmers could accept low grain prices and still remain profitable thereby maintaining maize prices at unfavourably low rates. The maize price was so low that traders from as far afield as Mozambique and Zambia were entering Malawi to buy maize thus giving an impression that the government's maize subsidy programme could actually be subsidising consumers in those countries. The low maize price is partly because the cost of labour is often not factored into the pricing model on the assumption that households supply the labour. However, this study found that the majority of households operating more than 0.1ha will require additional labour to be paid for.

5.5 Marketing problems

Farmers in both irrigation schemes faced about the same problems in terms of marketing. In Muona farmers sell their rice to traders from big cities such as Blantyre and Lilongwe, and the rice is normally sold per bag rather than per measure. Farmers complained that the traders 'force' them to fill up the bags to bulging point and thereafter tell the farmer the price they are willing to offer for the grain.

To reduce farmers' vulnerability to 'unscrupulous' traders, a Cooperative was established in Muona scheme with the mandate of purchasing grain from farmers at favourable prices and then marketing the grain in bulk to various markets. However, although the Cooperative buys rice on a per kilogram basis, most farmers shun the cooperative because despite the high prices it normally offers, the payments are often delayed. For the 2014 crop, for example, some farmers had gone for over five months without receiving their payment.

The other marketing issue was related to transport networks and availability of mode of transport. Both schemes are within two hours of Blantyre but the bad state of roads, including collapsed bridges, and high cost of transportation makes marketing expensive for farmers.

5.6 Gendered access to, and control over farming proceeds

As discussed in earlier sections, irrigation prior to the establishment of Muona Irrigation Scheme was dominated by women producing some vegetables and staple grains on small plots through diverting water off the Thangadzi River. Introduction of the irrigation scheme was followed with new land registration and this process seemed to be in favour of household heads most of which were men. Men also felt that the labour demand for irrigation was now much higher with the commercialisation of the irrigated crop plus the different type of crop. Extension messages were targeted at whole communities, but men had more favourable access due to their ability to attend meetings.

For households involved in farming in both the dry land and irrigation scheme, the gender distribution of household labour is such that the men are more involved in the irrigation scheme based on the common narrative that there is a higher labour demand and women are better off dealing with the dry land crop. The households are, according to such accounts, making decisions to allocate the 'most productive' labour on an enterprise from which expectation of income are higher. In the process, however, women within a marriage are left to worry about dry land crops which are typically low value or have limited market potential. These crops include the small grains (sorghum and millet) and other legumes like beans, as well as crops such as maize. Because of high risk of drought these crops do not usually perform very well.

Women felt that extension services were biased in favour of their male counterparts. The selection of the lead farmer often involved selecting the owner of the exemplary field rather than the person from whom such an output was produced. Those in charge of selecting argued that they selected the men because the men had the flexibility to move around than women who had household chores to contend with. Men targeted with extension services; given control over land by the new ownership arrangement in the scheme when the scheme was opened. Land allocation committees are also said to have been male dominated and they issued parcels of land to their peers.

5.7 Women and men's agricultural income

Besides the sale of crops, selling one's labour through *ganyu* appears to be the main source of income for men and women. The rate of ganyu was generally constant and was pegged on an equivalent of 5kg grain (dish) per band in rice farming in Muona. This innovative pricing system meant that labourers maintained a stable income irrespective of grain price fluctuations. The rate per band was K500, and was uniform irrespective of gender or age. However, despite this similarity in rate per unit of labour, respondents suggested that

households with men doing ganyu were likely to be better off than those without male labourers, because in the latter case, the women's contribution to income was decimated by involvement in several other household chores, such as fetching water and firewood, cooking, taking care of children, etc.

> *"If a woman does ganyu she may be forced to leave earlier to do chores at home; maybe she may be awaited by her husband at home"*. Female respondent in FGD in Muona

Despite ganyu being one of the major sources of income, households often allocated only one of the two adults to *ganyu* so that the other adult can engage in food production. Under cases of extreme poverty both adults would engage in *ganyu* with food shortage being the likely outcome. One female respondent in Muona noted:

> *"You may see others harvesting their maize and eating, yet you have nothing to give to your family, because you were busy with ganyu while others were planting. That is the problem with ganyu".*

Dependence on *ganyu* is said to have increased in the recent few years as a consequence of increased proneness to food insecurity.

> *"Some years back we used to harvest enough food to last until the next season, now we are harvesting less and have to depend on ganyu".*

Decision making power with regards to both choice of crops and use of farm income appeared to vary from one household to the next. Men were generally privileged in terms of access to agricultural information and controlled the crop produced under irrigation from which highest returns for the household were derived. Two views dominated discussions about household income use in a mixed gender FGD:

> *"Everything depends on the nature of the relationship between two married or cohabiting people; in most cases we believe that couples discuss how they spend their income from farming".* Male respondent interviewed in Muona

> *"Yes, there are cases where the man may dominate decision making and have total control over income, which he may spend on other women or cigarettes; and yet some women are equally irresponsible, they may go to the hair saloon with the little money they get from selling their crops".* Female respondent in FGD in Muona

The nature of entitlement to land, whether the land had been inherited from the man or the woman's side did not matter when it came to control over decisions on how to use the land and income from farming. As mentioned earlier, men were seen to have more exposure and training in agriculture and automatically assumed the role of decision maker in the field. However, decisions were made jointly in some instances although this depended on the nature and maturity of a relationship between couples. In a single gender FGD, views

expressed by women were different. Some women pointed out the problem of men dominating decision making and confining the women to certain mundane tasks such as food preparation and taking care of the household.

> *"You do not tell me what to do, your job here is to cook and eat".*

The women's FGD in Muona made some characterisation of women farmers in the scheme. They asserted that in households where women controlled the fields it was very likely that they would not use fertiliser or hire labour to assist them. Any crop harvested would be sold to contribute to household wellbeing, unlike in male headed households that produced more food and realised more money but had more leakages because of wastefulness in use of farm income. The women argued that in fact women headed households were among some of the most food secure in the village in spite of their general characterisation as being vulnerable to food insecurity. In contrast to women managed fields under irrigation, men's fields were seen as more likely to receive fertiliser, and planted on time since men could better afford money to pay labourers for *ganyu*.

> "*After the harvest the man can sell the crops and no one dares ask him where the money has gone to; in fact it is the woman who may have to do some extra work to earn money with which to feed the family*". Woman in women's FGD in Muona.

5.8 Wellbeing, food crops, income

Respondents in Chitsukwa regarded Muona as a relatively more affluent area and argued that the quality of houses, level of food security throughout the year and ownership of assets such as livestock and cattle was relatively higher in the latter. Some contradictory views, however, indicate that the poorer quality of houses for farmers around Chitsukwa was owing to low willingness to invest in expensive houses, or purchasing expensive furniture which would need to be replaced following the heavy almost annual floods. Muona, on the contrary is located on relatively higher ground and therefore less prone to flooding. Some respondents in Chitsukwa felt that their poverty situation was also a result of concentration on crops that had low value when sold for cash, and the fact that they were growing and selling a staple crop for cash. Rice was seen as strategic "because it is not part of our diet and therefore you can afford to sell all of it for a good price, and but maize and remain with a favourable balance". The combination of near annual (often biennial) floods which destroyed houses and led to loss of productive assets, including livestock and food, often meant that farmers in the flood prone Mchacha James area of Chitsukwa would have to concentrate on recovering from the last disaster, and not being progressive year on year. In a relatively dry year, however, respondents reported that the scheme would perform relatively better and people would be food secure for a longer duration compared

to those that grown rice and have to trade it for maize. Further, the price of maize was more open to fluctuation than that of rice. A good maize season often meant farmers got poorer as higher volumes on the market led to depressed price per bag, while rice was far much less volatile, although still said to be poorly priced.

Respondents argued that household level demographic structure had an influence on household poverty and food security status. Households without male adult members were more likely to be among the poorest and most food insecure primarily on the basis of inadequate labour for participation in ganyu casual labour and subsequent involvement in farming and other non-farm income generating opportunities. Plot for plot, women earned less money than their male counterparts for two main reasons. Firstly, men were perceived as being more fit and capable of covering more ground and therefore earn more on the basis of larger area covered. Secondly, a woman's involvement in farming was likely to coincide with competing demands for her time at home (e.g. child care and general household and community chores). In some cases, across the two schemes, more women head of households than men were operating on rented land than on land for which they had customary or other entitlement. Payment of rent would often result in loss of potential income for a household renting land.

5.9 Poverty cycles

Targeting development interventions at poorest households was seen as counterproductive by some respondents, on the basis that they felt that even those perceived as having assets required the same safety net to cope with environmental and socio-economic stresses, and not providing them would only result in them getting poorer. Ultimately, the whole village would become poorer since interventions were not protecting the assets in the village. Owning a house made of bricks, or a cow, did not translate to food security since the house could have been built at an earlier time when the household was prosperous, or the livestock could not be immediately sold to allow a farmer to purchase maize or other household needs.

Droughts and floods had the effect of eroding households' assets, especially with respect to sale of household assets including livestock and farming implements, and damage to houses necessitating reallocation of assets towards replacement rather than investment or transformative development of the household. Floods also had the effect of locking villagers away from markets or transport links, thereby increasing the costs of food.

Shortage of food during the main farming season, particularly during the land preparation stage for the dry land, from November to March, was associated with high likelihood of food shortage in the forthcoming season. Households that lacked food during the farming season tended to engage more in providing casual labour from which food and inputs were

procured. The provision of *ganyu* reduced time availability for managing their own fields resulting in shortage of food on their fields.

Poor households often lack food during the land preparation period. They report on providing *ganyu* in order to earn food, and as a result delay operations in their own fields. Delayed planting by poor farmers reduces their food production levels, and because they lack labour they do not usually have time to adopt any technologies that require extra effort. This means that they miss out on the opportunity of increasing their yields. Low yields mean that they have to work for food in the following season, and are therefore trapped in a vicious cycle of poverty and vulnerability to food insecurity.

5.10 The effect of the scheme on non-scheme farmers

While a majority of people in the villages surrounding the scheme have access to land in the scheme, either through customary entitlement or rented, there is a minority that operates on the fringes of the scheme and use water derived from the same source as the scheme, which is the Thangadzi River. Muona scheme was established in an area of land adjacent to Magreaver, an informally irrigated area where farmers relied on river diversions and overflow of the Thangadzi to grow rice, maize, bananas and other food crops. The introduction of the water user association to manage the affairs of the scheme and the introduction of the issue of water rights strengthened the position of farmers in the scheme as the owners of the water and a priority in terms of consumption. Farmers in Magreaver who had previously relied on the same river were now classified as informal, which meant disorganised and illegal and therefore not worthy of government support. The canalised flow of water passes through some fields in Magreaver and it is expected that these farmers should not tap into the water, but rather let it continue to its intended destination, the canals in the scheme. Irrespective of this attitude by farmers in the scheme, some of the farmers in the Magreaver area do divert some water 'illegally' to support rice or maize farming. They argue that the water flowing along the Thangadzi belongs to all citizens and that by diverting the water towards the scheme the scheme did in fact 'steal' other peoples' entitlement to water. While this is not a hotly debated issue, with water scarcity it may emerge as a potentially volatile situation in the future. The water user association was issued rights to water on the basis that the water users would pay a user fee. However, it appears that the fees are not being paid and there is no formal arrangement that actually entitles the scheme to absolute control of the Thangadzi.

The rehabilitation of Muona scheme, with the major works done between 2012 and 2014, further reinforced allocation of the Thangadzi water in favour of the scheme. The rehabilitation prioritised shifting in the water intake further up on the Thangadzi River in such a way that the lower level sections of the Thangadzi course just before Thangadzi reaches the scheme that had silted over time were avoided. The new intake was to operate on the basis that water would be directed into the main canal at the intake point, and when sufficient water to the scheme had been moved then the intake would be shut and water allowed to flow along the river. This arrangement thus prioritised scheme users at the expense of other farmers that depended on tapping water from the river for facilitating irrigation, among them farmers on the Magreaver area adjacent to Muona. Furthermore, as part of the rehabilitation of Muona a flood protection bund was constructed to protect the scheme from flooding of the Thangadzi River. The idea was to protect the investments made in rehabilitating the scheme, but this decision ignored the plight of villages located on the other bank of the river where no similar structure had been constructed. Villages in GVH Makhapa challenged those charged with rehabilitating the scheme to construct a bund on their side as well, but were told to "talk to your donor".

When the floods came they broke the banks of the Thangadzi and as predicted flooded the villages of Makhapa resulting in massive damage to houses, loss of livestock and spoilage of stored food. Roads were destroyed and the communities lost access to food markets in Fatima and beyond resulting in an upward spiral of food prices within Makhapa. For example, a bag of maize in Makhapa was going for K8000 while the same unit cost of K6000 barely five kilometres away. Impacts of the protection bund were also felt by farmers in Magreaver, who lost access to flood water from the Thangadzi which supported their rice production.

Key Messages

- *Irrigation increased crop yields but is yet to deliver on improved food security and poverty reduction.*
- *Farmers operate very small enterprises and these are characterised by high labour intensity and low profitability.*
- *Casual labour is an important coping strategy, but also part of the problem for poor households.*
- *Farmers lack access to markets for inputs and products.*
- *Pro-poor strategies may fail to address local development challenges if they are implemented without regard to the local politics and nature of resource entitlement, accessibility and meaning of community.*
- *Irrigation presents substantial gender considerations which should be managed well through policy and projects.*

5.11 Conclusion

The introduction of irrigation resulted in an increase in both a livelihood shift in favour of crop production, and at household level, an increase in crop production levels. However, the growth experienced in crop production has not been sufficient to either ensure household food security or lift the majority of farmers out of poverty. In fact, most farmers do not produce enough crops to meet the production costs they incur. Transitioning to livestock farming, the preferred livelihood option given the high status accorded to livestock farmers and better survival of livestock under droughts is nearly impossible for most of the farming households. Droughts and floods have been persistent and these climatic stressors have led to erosion of assets at household and community level, undermining future coping capacity. Poverty and poor coping capacity were both reinforced by high dependence on ganyu by poor households; the study found that engaging in ganyu meant that poor households delayed or were unable to complete operations on their own fields with short term impacts on the yields they received. Among both the poor and rich households, however, gender biases in allocation of labour, production decision, control over farm income and farming knowledge appear to be highly variable from household to household but with a general inclination in favour of men. Those charged with improving the schemes have not also recognized or acted on this dimension, nor have they taken into perspective the impact (both positive and negative) of the scheme on non-scheme users.

6 ACCESS TO LAND FOR IRRIGATION

This chapter presents findings from the field survey with regards to resource entitlement, access and management. The focus is on providing an insight into the institutions governing these key resources necessary for irrigation, exploring how relations of power manifest within the irrigation context, and the value systems and norms that determine who is entitled or can gain access to these resources. The first section will focus on land, and the subsequent one looks at water resources in agriculture.

6.1 The history of land access for irrigation

Access to land for irrigation in the two irrigation sites has been controversial since the inception of the schemes. In Muona the idea to establish an irrigation scheme was based on the observation of success of informal irrigation along the Thangadzi River which was being conducted mostly by women growing vegetables and some grains for supporting household food security. Their initial success through use of residual moisture following flooding of the area along the river was succeeded with direct diversion of water from the river using logs. At this point, the proportion of men working in this informal irrigation area started to rise following promising yields of rice and maize under irrigation. These farmer-driven efforts, however, lacked the support of government until the early sixties when, as discussed earlier, a colonial extension officer called Magreaver started providing farmers with technical knowhow and seed for producing rice at relatively larger scales. This cultivated area later became known by the name of this officer, Magreaver, and grew in importance as more farmers took up farming under irrigation.

On the basis of this success, the government through lobbying by the then Minister for the Southern Region, Gwanda Chakwamba, contracted Chinese experts to establish an irrigation scheme commencing in 1969 and completing works in 1972. The new scheme was constructed in an area adjacent to Magreaver and was capable of accommodating more farmers. The prospects of a new commercial crop lured more people, a higher proportion of them being male, into irrigation and away from local livelihoods such as fishing and livestock keeping. Women's focus groups argued that the increase in proportion of men in the scheme was at a cost to women, most of whom either lost they had operated on as new claims of ownership came up, while in some households the male partners took over the irrigation in the new scheme. In addition to this, land in the scheme was reorganised into plots with each plot being allotted to a former or new 'landowner', most of whom were male as illustrated in this response:

> *"Those tasked with registering the new farmers in the new scheme often recorded the names of the male household head as the owner of the land irrespective of the fact that the scheme was being established within a largely matrilineal society".*

The registration process thus changed land control in Muona, and its remnants still persist to this day. The gender division of labour which tended to prioritised male domination of irrigation and allocation of women's labour to the climatically more exposed dry land farming system; gender differences in access to information and contribution to farm decision making, have all been addressed in the previous chapter.

Various other strategies have been used to access land for irrigation. Historically, and to some extent even today, Sena men with roots in Mozambique gain access to farmland through marrying local Man'ganja women who, on the basis of matrilineal entitlement, had control over land. With the changes that took place when the scheme opened and land was reallocated to people, the role of marriage became more prominent in the dry land fields. Women interviewed in this study argued that the path through which land had been accessed did not really matter; a man could control household farming even if he was or was not the 'heir' of the land in question. Some women mentioned that they preferred having men to manage farming irrespective of whom the land belonged, because the men often had more farming knowledge that they did. This view was propped by the fact that men would have had a higher chance of accessing formal education, including in agriculture, and gained farming skills from parents since they were more involved as youths than their sisters who often had to do chores within the household. Important to note also is that like other institutions, success was based on there being a leader within the system; in male headed households decisions on farming were therefore made by the male with varying degrees of involvement of other household members.

In Chitsukwa, the construction of the scheme was on land that had a history of livestock grazing intertwined with cropping. This history appeared to be unclearly understood or agreed upon perhaps on purpose to safeguard specific interests; there was disagreement over what the land was originally used for and this disagreement was largely fuelled by the expansion of irrigation farming. One group comprising mostly of households with livestock claimed that the land had always been a grazing area and was then being converted into cropland. In contrast, the irrigators maintained the view that the land had always been for crop production but had been abandoned following successive seasons of flooding and during those episodes had been left for livestock grazing, and was now being converted back to cropping. The introduction of the treadle pump was seen as having prompted the reclamation of this farmland from grazing. The challenge with resolving this conflict locally was being complicated by the fact that the Group Village Headman was relatively new and less knowledgeable of the politics of land access having only recently assumed the position following the death of his uncle, the former GVH Mchacha James. In the matrilineal system the GVH is the nephew of the incumbent, and in the case of this study site, had to move from Masenjere, some 25km away.

6.2 Land and Water Rights

Muona Irrigation Scheme has 2266 plot holders, of which 1527 are male and 739 are female. These plots are held under customary tenure although a process is underway to change the system to one in which the WUA leases the land from the government and subleases it to plot holders. In the current set up land is mainly sourced through inheritance. While traditional leaders have no role to play in the scheme, they are responsible for managing land in the area surrounding the scheme, including Magreaver. Differences in intergenerational transfer of land are observed along social systems, mainly the matrilineal Man'ganja who are the original inhabitants of GVH Chipondeni, and the patrilineal Sena who dominate Chinzeti village and have roots in Mozambique. Households have an average access to 0.2ha in the scheme, with access ranging from 0.1ha to 2ha. There is evidence of local level land transactions in the scheme, although this is against the scheme regulations on sale of land. Conflicts over land access are very common among farmers. While the majority of the scheme enjoys deep alluvial soil, some sections are sodic with some evidence of salinization.

6.1.1 Payment for Land Access

Prior to the construction of Muona, and even extending to the early years of the scheme, the predominant payment for access to land was in-kind. A landowner facing a weed pressure problem could lease out their land for a couple of seasons and then reclaim it after the tenant had helped clear the weeds. Payment was, however, not mandatory; one respondent:

> *"If someone had offered you their land to use, it was expected that you would feel compelled to give something to show your gratitude. Most people gave a tenth of their harvest to the landowner, and that kept relationships positive".*

Land scarcity was also reportedly not the big issue that it now is. Consequently, even poorer people could afford to access land from their neighbours. Presently, land is available to rent at a rate of K4000 (US$8) per 0.1ha and the price may be as high as K6000 in the prime areas of the scheme. In Chitsukwa, rentals were in the form of cash and payable in advance. Rentals ranged from K500 (US$1) to K4500 (US$9) per 0.1ha with location, soil quality, water availability and accessibility being some of the attributes of a well-sited rented plot. In Chitsukwa it is understood that bidding over a highly desirable plot is not uncommon, pushing prices sometimes to over K5000. It was also only in Chitsukwa that we encountered some farmers who said that they were charging very low rentals as a basis for ensuring land access for their poorer neighbours as they feared that failure to provide land would mean they had to feed the neighbours at the end of the season. According to one female landowner in Chitsukwa:

"I know that if I do not give them land to farm they will be coming to me for food. We charge K500 or so per plot, not because we hope to make a profit but just to make sure that land is available for our neighbours".

6.1.2 The determinants of Land access

Access to land was quantitatively examined using the household questionnaire. According to local informants, there are only two categories of land access: owned and rented. 'Owned' land refers to land that a household is entitled to through customary tenure. This land was quite often accessed through inheritance from parents, but increasingly through purchases from the market. Therefore this category somewhat blurs the distinction commonly made between 'customary' and 'private' land. On the basis of 151 respondents interviewed through the household survey, we found that there were no statistically significant differences by gender of household head in proportions of households relying on owned or rented land. Indeed it should be noted that gender of household head is neither adequate to tell us much about the gendered access and control within households, nor does it work as a good proxy for gender analysis as it takes for granted that the default household head is male. As shown on **Table 4**, about a third of all households used owned land while the larger proportion (66.3%) relied on land rented from neighbours.

Table 3: Access to irrigated land by gender of household head

Household Type	Owned	Rented	Total
Male headed	35	72	107
	32.7%	67.3%	100%
Female headed	16	28	44
	36.4%	63.6%	100%
Total	51	100	151
	33.7%	66.3%	100%

Source: Field data, 2013

The amount of land that an individual could access also tended to vary with the type of land, of which three types were distinguishable. Households could have access (through renting or ownership) to one or a combination of *dimba* (wetland), dry land or irrigated field. Plots accessible were larger in the dry land (0.4ha), and much smaller in irrigation (0.27ha) and *dimba* (0.16ha). Across the three villages covered in Nsanje, farmers in Chitsukwa were more likely to have larger fields (0.32ha) followed by those in Muona (Chinzeti 0.29ha; and Chipondeni 0.20ha).

Table 4: Mean land size under dimba, dry land and irrigation for Mchacha James, Chinzeti and Chipondeni

Village	Number	Dimba	Dry land	Irrigated
Mchacha James (Chitsukwa)	51	0.27	0.62	0.32
Chinzeti (Muona)	48	0.10	0.36	0.30
Chipondeni (Muona)	52	0.10	0.22	0.20
TOTAL	151	0.15	0.40	0.27

Source: Fieldwork, 2013

The means of land access were compared by gender of household head for the three field types. In all cases but irrigation, male-headed households had control over more land. Under dry land, for example, women headed households had access to half as much land (0.27ha) as their male counterparts (0.45ha). There was, however, no difference in land access between male and female-headed households under irrigation. Women had access to 0.28ha while men headed household accessed an average of 0.27ha **(Table 6**).

Table 5: Access to land under dimba, dry land and irrigation for men and women headed households

Gender of HH	Number	Dimba	Dry land	Irrigated
Male	107	0.18	0.45	0.27
Female	44	0.11	0.27	0.28
TOTAL	151	0.15	0.36	0.28

Source: Fieldwork, 2013

Table 7 shows that land entitlement was only marginally stronger between those who had always lived or were born in the study villages, compared to those who had migrated into any one of the three villages. Those that had moved in had access to around 0.23ha of irrigated land compared to 0.28ha for those with more permanent settlement.

Table 6: Origin of respondent and access to irrigated land

Origin of respondent	Number	Land (ha)
Migrated in	15	0.23
Born in village	136	0.28
Total	151	0.26

Source: Field data, 2013

The link between education of household head and access to land was investigated. For irrigated fields, the higher the level of education attained by household head, the larger the field accessed. Household heads with no education accessed 0.24ha under irrigation, while their counterparts with primary and secondary education had access to 0.26ha and 0.39ha, respectively. The relationship was the opposite for dry land fields. Those with no education owned the largest fields (0.46ha), while those with primary and secondary education accessed 0.37ha and 0.32ha, respectively (**Table 8**).

Table 7: Household land access for household heads of different education levels

Education of HH	Size of irrigated field (ha)	Size of dry land field (ha)
None (n=52)	0.24	0.46
Primary (n=73)	0.26	0.37
Secondary (n=23)	0.39	0.32
TOTAL (N=148)	0.27	0.39

A correlation analysis was conducted to test the relationship between size of irrigated field and total number of people in the household. A relatively weak (r=0.194) but positive and

statistically significant association (0.017) was shown. This result indicates that the larger the size of the household the more likely it was that it would have a large sized plot of land on which to irrigate crops (**Table 9**). Larger households generally could command more land under irrigation based on family labour.

Table 8: Correlation between irrigated field size and household size

	Size of irrigated field	Number of people in HH
Size of irrigated field	1	0.194*
Total number of people in HH	0.194*	1

*. Correlation is significant at the 0.05 level (2-tailed).N=151

The study examined whether there was any association (correlation) between the age of household head and the size of land that they had access to. The result showed that there was no significant correlation (r=0.073; 0.073 and 0.067). As shown in **Table 10**, the study found that there was a strong association between access to land in *dimba* and access to land under irrigation. It may be that the people who had fields in the irrigation schemes may have controlled land in the *dimba* as well, and most likely as a result of inheritance of that land. The correlation between land access in the *dimba* and in irrigation was at 0.491** (p=0.000, 2- tailed).

Table 9: Correlation between age of household head and land access

	Age of HH	Dimba size	Dry land size	Irrigated size
Age of HH	1	0.073	0.075	0.067
Dimba size	0.073	1	0.055	0.491**
Dry land size	0.075	0.055	1	0.159
Irrigated size	0.067	0.491**	0.159	1

**. Correlation is significant at the 0.01 level (2-tailed). N=151

6.1.3 New technology that 'promoted' sharing of land

Introduction of mechanised farming technology is often associated with aggregation of land and reduced accessibility of land within farming communities in general. In the two irrigation schemes, however, irrigation development through introduction of the treadle pump and introduction of a canalised gravity fed system in Chitsukwa and Muona, respectively, were in both cases followed on by an increase in the number of farmers involved.

In the case of Chitsukwa the high labour intensity associated with treadle pump adoption led to fragmentation of land owned into smaller plots and its subsequent leasing, thereby improving general access particularly to poor households. Having introduced the treadle pump in 2001 and achieved virtually no uptake until 2006, in 2009 the government stepped in with further support of treadle pumps and built on the earlier intervention by Goal Malawi in Chitsukwa Irrigation Scheme. This technology for water abstraction not only made

irrigation possible, but also influenced inequalities in land access. Those households that owned land around the *dimba* and surrounding lands that were to be brought under irrigation lacked sufficient labour to utilise all the land under their control. Both the government and NGOs operating in this scheme encouraged landowners to share their land through rentals with their fellow village members, which they eventually did on realisation that irrigation was so labour-demanding so much that they were incapable of fully utilising their land entitlement. In the early days of the treadle pump, at least four person days were required to water a plot measuring 0.1ha (presently, two adult people can irrigate 0.1ha within a day's work). By making the treadle pump lighter through removing rubbers in the cylinders, the level of effort required to operate the treadle pump was more than halved. The treadle pump group sharing arrangement also placed pressure for early completion of tasks, increasing the labour scarcity and driving up the land market. Field interviews in Mchacha James suggest that the inadequacy of labour even for the households controlling land inadvertently forced farmers to fragment their land entitlement and rent out the land at fees payable in cash at season onset.

Importantly, respondents also noted that the NGO that was influential in supporting irrigation efforts in the scheme also discouraged farmers from using motorised systems. NGOs are said to have argued in favour of low mechanisation on the basis that growing maize would not be profitable to a farmer if they had to purchase and operate a motorised pump for use in their very small plots. At the time of the fieldwork there were several conflicts between motorised pump owners and their treadle pump using neighbours over water abstraction quantities. The salient concern, as it emerged through interviews, was that if "landlords" could gain access to motorised pumps that would offset the need for human labour, and then they would be capable of using more of their land. Under this scenario more landowners would retain their land, thus reinforcing inequalities in land access and, subsequently, agricultural income and food security.

Some farmers however argued that the NGOs and government had been wrong to dictate (or recommend very strongly) that farmers in a scheme such as Chitsukwa the motorised pump was not a suitable option. Their argument was that by so-doing they made motorised irrigation 'illegal' in the scheme and that the option of whether a motorised or treadle pump was to be used should have been made on the basis of viability by a farmer. One middle-aged male respondent argued that:

> *"This NGO restricted us from using the motorised pump. This is unfair because as a farmer one is always inspired to reach the next level. They (NGO) want us to be babies for fifty years".*

6.1.4 Intergenerational transfer of land

Inheritance of land was the main pathway through which land could be accessed for most households across the two irrigation schemes. Assuming two households owning the same amount of land, children from a smaller-sized household would have higher chances of accessing larger sized plots at the death of their parents, compared with a larger family. While in the past the land would be passed through specific lineal systems, e.g. matrilineal or patrilineal, evidence from both Muona and Chitsukwa showed that public discussions of ideas of gender equality had somewhat altered peoples' perceptions of the functioning of inheritance so that all children could essentially receive a share whatever land their parents left. While it was difficult to establish whether a household was patrilineal or matrilineal on the basis of marriages across social systems, it prevailed that male children were often less likely to migrate out of the village at marriage, than their female counterparts. In the 'patrilineal' system, the young woman would not expect to receive any land from the parents as she was likely to leave the village anyway; while in the matrilineal system female children inherited the land and leased it to their brothers, and had the power to retrieve it if they so desired. Irrespective of the marriage system, if two partners decided to separate it appears that the land was likely to be retained by the partner from whose parents the land was directly inherited.

The sharing of land often followed the death of both parents; in cases where one parent was surviving then the sharing of land was influenced by how much land was available and the capability of utilising the land by the surviving spouse. In other households, the death of the male partner was an automatic trigger for sharing of the deceased's land often among his brothers and children. Some respondents argued that with increased awareness of gender equality, parents in patrilineal, matrilineal or mixed marriage systems were increasingly transferring their land and other assets to children irrespective of the gender of the child. One respondent from within the matrilineal Man'ganja group in Muona remarked the following, in reference to land distribution:

"We have gender now; even boys can receive land in the Man'ganja set-up".

For large households with small land ownership the sharing of land often translated in very small holdings per beneficiary; in fact in some cases the land was not shared at all but maintained by the surviving parent while children sought land to rent elsewhere.

Marriage was another key pathway through which land was transferred across generations. Marriage was associated with changes to resource availability relating to both land entitlement and labour. Parents felt pressure to share their children's inheritance as soon as some of them reached an age at which they were responsible in their singular capacity. This means that land owned at household level was subdivided among the children, sometimes into very tiny plots of less than 0.05ha, as they sought to ensure that the new family would have a means by which they could produce food for consumption and the market. It was

noted through interviews that sharing land before one's death often meant that the remaining land would be inadequate to meet the food demand for the remaining family. The other dimension was that the household would be losing an effective and often efficient unit of labour, making production expensive in the future seasons. Thus marriage not only reduced the household's effective land accessibility, it led to a loss in labour. As described earlier, however, some households were able to access land through marriage across social systems.

6.1.5 Fragmentation of irrigated land and transaction costs

Land in the two irrigation schemes appears to be highly fragmented as a consequence of various individuals and groups seeking to ascertain their entitlement, either temporarily or permanently. Families break-up small plots to ensure that children have land on which to farm, and landowners organise their land in 0.1ha sections as a standard against which to charge rents. For tenants seeking to utilise more than 0.1ha of land it may is likely that they will have multiple landowners with whom to negotiate and pay. For example, a farmer using 0.5ha may need to have five landlords to deal with and the pieces of land may be located in five different blocks dotted right across the scheme. Such an arrangement increases the transaction costs of farming in the scheme. For example, the tenant has five canals to contribute towards clearing; has five block committee meetings to attend; has to be present on each one of the five plots on the day that they are irrigated to ensure that each plot receives water and complain if that does not happen. They also need to deal with different management issues, e.g. waterlogging may be a problem in one plot, an uncooperative neighbour on another, and so on. All these factors increase the demand on a farmer's time thereby restricting them to being in the scheme almost on a daily basis, at the expense of other livelihood activities. One respondent operating five plots, on which the above statements are based, argued that there were some benefits with spreading interests across the scheme:

> *"It is true that if plots are located in different parts of the scheme then the workload is increased. However, the risk of crop failure is lower for a farmer. They may get a place with poor water supply, but then some areas may be well watered and therefore compensate for that loss".*

As farmers seek to expand they rent even more plots further increasing their workload, and reducing them to 'managers' who rely on hired labour. This works better for the richer than poorer households. One male respondent noted that growth in small-scale irrigation meant increasing the number of plots managed which would lead to more produce being realised. The dimension of the costs of expansion, particularly in terms of extra labour they would need and the demands on their time, versus the economic benefits thereof, was quite often easily hidden or ignored by most farmers.

6.1.6 Restrictions on selling land in the scheme

In Muona farmers expressed an improved sense of security over their land following the introduction of a payment of the sub-lease to the WUA. They cited the government as a big threat to their land, and also felt that their land could not be grabbed by either private companies or government because they 'had a small piece of paper saying the land was theirs'. The scheme is now under a process of being leased to the WUA, and farmers only receive a receipt as proof of payment for the lease, charged at K1600 per year per 0,1ha. Respondents had varying accounts of the length of the lease, ranging from six years to 99 years. According to IRLADP, the institution that is overseeing the implementation of the rehabilitation of Muona an facilitating the handover of the scheme to farmers, the existing lease is covers a period of 25 years. The differences in the understanding of the length of the lease was influenced by the widespread rumour-mongering that followed the pronouncement of the introduction of the lease, coupled with the mixed messages sent by various institutions such as the WUA, the government extension officers and the government project for rehabilitating the scheme.

The regulations of Muona Irrigation Scheme specify that farmers are not allowed to sell the land that they 'own' or are entitled to in the scheme. The main argument used by the WUA leadership in favour of not allowing land sales in the scheme was that if farmers were allowed to sell their land then most would probably lose the only asset on which they could secure their livelihoods. The other concern was to prevent individuals from amassing land and creating small estates within the scheme.

However, the regulations allow for plot holders to exchange the land they hold in the scheme for land in the dry land or a residential plot. This loophole is reportedly being exploited by plot holders intending to sell land without going against the scheme regulations, and is in fact allowing the richer farmers to purchase plots at extremely undervalued rates. There are some cases where some landowners have exchanged a plot of 0.1ha of land for a couple of bags of rice as payment. Once an agreement has been made between the landowner and the buyer, scheme records are updated to give entitlement to the land to its new owner. The new landowner may then pay a sublease to the WUA to safeguard his or her right to use the land. In Muona, a plot measuring 0.1ha had an asking price of K30 000 (US$60), equivalent to six bags of rice (which is half the yield potential of 0.1ha per season). One farmer interviewed about land sales in the scheme noted that:

> Frank inherited 0.2ha of land from his parents. In addition, he bought 0.1ha from another farmer in the scheme for K30000. He is confident that even if he died his extended family would not be able to lay any claims on that purchased piece of land: the land is in his name in the scheme register and is therefore secure. It is common practice in the study area that at the death of the male landowner the land is shared among his brothers and sons. Frank has only one son aged two and three daughters with ages ranging from four to thirteen. According to Frank, it is his wish that all his plots will be taken over by his son.

"If two people agree on selling land they have to go to WUA and settle that. They never talk about money; they say that they are exchanging land-farmland for a residential plot. Behind all this there is money".

The restrictions on selling land could be seen as reasonable on the basis of protecting livelihoods from exploitation under extreme hardship, but then assets should enable people to escape and deal with stressors.

If land cannot be sold then households with land cannot use the only asset they have to pay for a change in livelihood e.g. moving into livestock farming, petty trade and other similar activities.

In the case of Chitsukwa Irrigation Scheme the seller and the buyer, along with their witnesses, would approach the village head or GVH to witness and record the transaction for future reference. A trip to the field in question is often done by all parties and demarcations noted but often not recorded.

6.1.7 Challenges associated with leasing land

Tenants' rights and obligations of landowners are unclear in both irrigation schemes. In some cases, both parties appear to work under the assumption that the other party 'knows' the expected behaviour in the scheme and therefore there should be no need to state the expectations. From the perspective of the scheme management in Muona, the annual general meeting and other meetings that are called in the scheme are opportunities within which farmers are reminded of the rules and regulations of using the scheme. Unfortunately, attendance has remained disappointingly low. According to the secretary of Muona Irrigation Scheme, in the last such meeting attendance was 32 of 4600 users in the scheme (tenants and landowners combined). The people who turn up to these meetings are the same people who are in charge of managing the scheme through their involvement in various scheme committees.

Unclear land rights create fears and concerns over security of land, influencing landowners to opt for the less risky short tenancies. In both irrigation schemes, the length of tenancies was up to three seasons on average. It appears that those entitled to customary land within these schemes were not sufficiently convinced of the security of their land, with fears of capture by tenants or other agents, including government. In this regard short-term tenancies were seen as an alternative arrangement that limited opportunities for a tenant gaining any form of absolute control over the land. It was mentioned that if a tenant was given the same piece of land over multiple seasons, he or she would establish familiarity with that piece, increasing on chances of being backed as the owner of the land should they decide to 'grab' that piece of land. Furthermore, given uncertainties relating to death, it was claimed that if a landowner died and one of their fields was under a sitting tenant there were often complications relating to retrieving the rented piece of land. Some tenants in the past have gone on to claim that they had paid for the land or made a certain arrangement with the principal landowner prior to their death. Constraints relating to short tenancies included the following:

6.1.7.1 Insufficient capacity to build soil fertility

It is difficult for a farmer to manage soil fertility if they are likely to move on an annual basis. According to interviews with agricultural extension officers and lead farmers in the study sites, compound fertilisers are slow to mineralise in the soil and a large portion of the fertiliser applied to the crops is only taken up by the following season's crop. This means that if a farmer applied such a fertiliser on rented land and shifted to another plot the next season, then they would not be able to benefit directly from their investment in fertiliser unless the other rented plots were equally being fertilised with the same nutrients. It appears to imply that if a farmer had security of tenure or at least through longer term leases then they would be in a much better position to manage soil fertility which would, in the long run, effectively bring down the demand for fertiliser and along with that, the costs. Associated with this regular circulation of tenants within schemes is the cost of land preparation particularly in the maize scheme in Chitsukwa. Preparation of ridges in Chitsukwa amounts to K4000 per 0.1ha. Most farmers operating more than 0.1ha of land will normally pay for labour for the second and other plots. If a farmer owned the piece of land they were using consistently year after year then they would not necessarily need to remake the ridges every season, unless there has been heavy animal movement across the field. This would have an income saving benefit and improve on the financial viability of the enterprise. In addition to the inconsistency in fertiliser application due to high mobility, there were some cases in which tenants reported not being allowed to use any form of inorganic fertiliser by the landowner. These cases were reported in both Muona and Chitsukwa. The argument was that inorganic fertilisers were not good for the soil in the long term, causing the salt to become too salty and 'tired'. Such an impoverished soil would not make for good transfer to the next generation:

> *"As a landowner my concern is ensuring that my children can inherit something worthwhile. If I let people use fertiliser on my soil, my fields will get tired over time and I will pass on rubbish to my children".*

Tenants on the other hand argued that the benefits of fertiliser application had long been demonstrated and since they were investing money, they needed to use fertiliser in order to generate sufficient harvests to offset the costs of renting land and hiring labour. One female tenant pointed out that:

> *"Land owners can afford not to apply fertiliser on their land; even if their yields are low it doesn't matter to them because they do not subtract the rent for the land like we do".*

A tenant's investment in land preparation and soil fertiliser application was often ignored in decisions to continue with the tenancy. It appears that under the current set-up there are no incentives to promote investment in improving soil fertility. There was also an accusation that landowners sometimes take advantage of tenants' investments in rice farming.

"At times the landowners can decide to watch you and see how you are in managing their plot of land. If you are applying manure and fertiliser, some will chase you in the following season and use the remnants of the fertiliser you used".

6.1.7.2 Inability to take up agricultural innovations

Evidence from discussions in Chitsukwa showed that the short duration of tenancies created a temporality that was not conducive for investment in such technologies as those promoted by the extension department. Techniques such as conservation, based on the use of crop residues such as mulch and maintaining water harvesting planting stations, along with precision fertiliser application, were seen to be valuable only in the long run. Over a season or two, a farmer could reduce some evaporation loss, but such benefits as improvements in soil quality, e.g. aeration and crumb structure, were only achievable over time. Mobility within the scheme would require biomass transfer from one plot to another, an otherwise tedious process that most farmers would avoid. Some landowners argued that they had longer knowledge of the land and had more to benefit from keeping it in a good state than other actors. They argued that they understood that introducing mulch, for example, would create termite problems that would negate gains achieved elsewhere, e.g. from higher moisture due to cooler soil and reduced evaporation loss.

Under a short-term tenancy, there were restrictions as to the nature of crops and farming system that farmers could operate within. For example, short season varieties of maize in Chitsukwa allowed for an easy fit within the short farming season, enabling farmers to cope with a likelihood of loss as a result of dry spells or droughts. However, short season varieties did not offer the best crop yields (quantitatively) as compared to medium and long season varieties. Furthermore, by operating within uncertainty over land access, the majority of farmers would not consider planting any crops or trees that would not fit within the period of the lease. In Muona, only rice was cultivated, while just across in Magreaver farmers were producing maize, rice, beans, and bananas on the same piece of land. Other leafy vegetables such as okra and *Amaranthus* could also be found. In Chitsukwa, farmers were producing maize with about 40% of farmers growing maize and beans.

6.1.7.3 Frequent changes to block committee composition

The block committee in Chitsukwa is constantly changing as a result of mobility of tenants who quite often make up to half the number of block level committee members. This regular change is seen as contributing to the circulation of good practices across the scheme, but disrupts consistency in the management process. In some cases a block may have the misfortune of getting non-cooperative tenants leading to severe challenges with managing the clearing of canals. There is therefore a preference for local tenants (from within the same GVH) in some blocks as such tenants are said to have a moral obligation to

cooperate with their neighbours, as compared to less well known tenants from further afield. Some of the tenants who had come from a bit further from the scheme, however, argued that they were the best tenants on the basis that they would behave amicably to ensure that they were given access to land in the future; they had more to lose by misbehaving since they had weaker social networks within the scheme.

6.1.7.4 The poor landlords

Evidence from field interviews suggests that land was being utilised strategically to enable households to cope with diverse household shocks, including shortage of cash or food. Advantage was taken of the high demand for land in the irrigation schemes to set up advance leases ahead of the farming seasons, sometimes with up to four tenants for the same piece of land, often resulting in conflicts among the tenants and between the tenants and the landowner when the season started. The common resolution, in the case of Muona, for example, was that such contested land would be taken and placed under the administration of the WUA until such a time that all the tenants have managed to get their share of using the land, which in some cases meant that the land could be held by the WUA over three to four years, unless the landlord repaid the tenants their money. While placing the land under administration created an impression of being a punitive action on the part of the WUA with several farmers considering that loss of control over one's land as a loss to the farmer, it was often not a sufficient deterrent to prevent reoffending. Some landlords had multiple plots, some as many as 25 plots of 0.1ha, and could repeat the same swindle on other unsuspecting tenants. The punishment meted by the WUA was, in a sense, aimed at easing tensions among tenants and landowners, but failed to address the economic losses associated with loss of access to land for a tenant. The cases were sometimes heard too close to the onset of the season when all the good farming land had been taken leaving victims of the rogue landlords to fail to secure their livelihoods and food security through irrigation.

Tenants in both Muona and Chitsukwa schemes appeared to rely on local intelligence in order to ascertain whether a landlord could be trusted. However, quite often the 'victim' tenant would be someone from another location who had failed to acquire the necessary background information prior to paying for land access. Transactions were based on a very loose understanding of trust, based on the perceived view that it is ethical to help a fellow villager with land, and rent is only a token of appreciation. There was no system or register in which bad tenants or landlords could be reported so that they could be avoided. Instead, the WUA mentioned that they had a system aimed at protecting farmers but farmers (tenants) were often not interested in using this system. According to the WUA, a willing landlord and willing tenant should both approach the WUA and indicate their intention to rent out and lease the land, respectively, at an agreed price. The WUA would then make a

record of this intention and bear witness by way of signature. Should there be a problem of non-compliance by either party then the WUA can step in and act appropriately to address the issue.

There are reasons why the WUA has been avoided despite the obvious benefit this would have in addressing rogue tenancy arrangements. Firstly, not all farmers would comply and if that is the case then there is a problem of their exclusion from the land market:

> *"No landlord has time to go with you to the WUA. They will accept the next offer for their land than make time to go all the way to meet the WUA".* Male tenant in Muona

Other tenants were of the impression that there was a cost involved if one used the option of involving the WUA in a tenancy arrangement. They were not clear as to who would have to pay for that cost. According to the WUA there is no charge for this service. The perspective of a district government official in agriculture on the issue of payment of rent and challenges of rogue landlords was that Muona and Chitsukwa were both atypical irrigation schemes in that somehow the farmers had retained customary hold to the land. The 'normal' procedure with most government assisted irrigation schemes was that prior to the construction of the scheme an agreement had to be made with the owners of the land to either give up their land and be compensated either in the new scheme or elsewhere within the village, or cede their land to the management of the WUA or WUG so that all the rent was collected by the WUA or WUG and then passed on to the landowners. The direct contact between the tenants and landowners was seen as a source of conflicts within most schemes that had taken an approach similar to Muona and Chitsukwa.

A particularly striking feature about the landowners, particularly in the maize scheme (Chitsukwa), was that most of the landowners were typically very poor in contrast with the common use of land ownership as a wealth indicator. In fact there appeared to be consensus among both tenants and landlords that landlords were poor, although the reasons for this varied. Based on the focus groups with either group, tenants argued that the landlords were often basking in the glory of their social power as landowners without investing time to working on the land. This meant that they did not generate any money except from the rent they collected, which was often not much anyway. One participant in a tenants' focus group said the following of landowners:

> *"There are some very bad apples in the scheme. Some landowners may rent out the same plot of land to five people! Yes, we know that most of the landowners are poor people, but this is very wrong. It robs people of their annual food supply and income".*

A recurring comment in discussions about the landowners' poverty was about their laziness to farm, rather than their incapability to access enough labour. Plot for plot, tenants argued that they were producing more than the landowners. The argument put forward by the tenants was that they were motivated by the capital investments they were making,

including paying rent for land, buying seed and fertiliser and preparing the land and other related activities. Tenants argued that most landowners, as a result of their 'laziness', would get jealous with a very well performing tenant. This would normally culminate in a landowner discontinuing access to the same land for that tenant. High performance by tenants in that context could be seen as a disincentive for accessing land.

The landowners argued that their motivation to lease out land was out of good moral responsibility, and that the rent charged was kept reasonable so that the poor could also access land and feed their children. They argued that the rent was often too low to allow them to meet their food and cash needs, and because they lacked labour like everyone else could not use their land to 'farm themselves out of poverty'. Land in Muona was being rented out at about K4500 per 0.1ha, an amount equivalent to the price of a bag of rice. In Chitsukwa the land rentals ranged from K500 to K2000 per 0.1 hectares per season depending on field quality and availability of reliable water. The higher rentals in Muona compared to Chitsukwa were understood to be a result of the higher income potential with rice farming than maize farming in Chitsukwa, as well as the higher demand for land in the former. Chitsukwa was established as a self-help scheme rather than a commercially-oriented enterprise with the sole aim of improving household food security rather than boosting farm incomes, as is the case with Muona. For that reason as well, the lower rentals in Chitsukwa are meant to enable even the poor to access agricultural land. One female landowner in Muona said of her income from rentals:

> *"If a landowner with six 0.1 plots decided to rent out all their fields they would make about K20 000. That amount of money cannot be used throughout the year for buying maize and other such things, it's way too little".*

Discussions with some senior members of the scheme suggested that issues of rogue landowners had been very rare in the past as a result of the stringent enforcement of law under the Banda era. Any landowner who cheated someone of access to land they would have paid for would automatically lose their land and that land would subsequently be allocated to another farmer in the waiting list for land. Some of the senior members of the Water Jury lamented:

> *"The coming of the WUA led to a relaxation of most of the rules in the scheme and the farmers noticed that and are taking advantage. People used to lose land over things like leasing land to more than the appropriate number of tenants for a particular piece, or theft. Nowadays we have all these things about rights and democracy, and that is what has driven our scheme to collapse. They dislike some of us because they think we made tough judgements as we are from another time (Banda's time), and so they may appeal against our judgement with the WUA executive. Sometimes they win when they go the WUA executive".*

6.3 Land Use Change and Implications for Livelihoods

6.1.8 Competition between livestock grazing and cropping

A prominent feature in discussions about irrigation in Chitsukwa was the conflict over land use due to competition between livestock farming and cropping systems under irrigation. As noted, there has been a drive in favour of irrigation development, and support to farmers by NGOs and government has been substantial. This support, , has apparently been at the expense of other livelihoods, particularly livestock farming and fisheries, which have both been on the decline according to respondent interviews. Since the re-energising of irrigation by Goal Malawi in 2006, following a rather weak initial uptake of the treadle pump by the government in 2001, the rate of increase both in terms of number of farmers and area under production has been phenomenal, as discussed earlier. Since 2008 the proportion of farmers using more than 0.1ha increased partly owing to the innovations that reduced the workload on the treadle pump and also owing to the drive to increase food and income security following an inspiring productivity gain experienced. The increase in land area was as a result of irrigators encroaching, clandestinely or through allocation of land by village headmen, into areas previously used for livestock. Enabling factors for this were the high level of support that irrigation was receiving from government, as well as the fact that the irrigators were well-organised through block and scheme level committees.

The issues at play in this conflict over land use were primarily grazing land and drinking water for livestock. The continued expansion of the scheme, in addition to the reduced availability of crop residues with some farmers retaining their maize stalks for soil cover (mulch) in support of irrigation and conservation farming, was reducing the graze available to animals. Livestock were also taking advantage of the canal water to drink, but in the process were creating a lot of siltation in the canals. Irrigators had responded to this harshly by maiming any animals spotted in the scheme during the cropping season, and there were several cases of animal poisoning and injury afflicted using *pangas*. Several plots were observed where irrigators had actually preferred burning the crop residues than let livestock feed. The argument made by the irrigators was that grazing livestock would damage their investment in ridge making.

Complicating the conflicts was the fact that on one hand the new GVH had no knowledge of the history of the land, having been recently brought into the area from a village some 25km away to assume the GVH title at the death of his uncle. The GVH had issued land to establish new villages and part of the land was inside the pastures. Irrespective of this demarcated land, irrigators had moved to take over unmarked land. On the other hand there were accusations that the GVH was biased in favour of the ‘wealthy’ livestock owners when asked to handle cases of conflicts between the irrigators and livestock farmers. The argument was that the richer livestock owners would rule in favour of livestock farmers as they were most likely to give him ‘an incentive’ for tilting justice in their favour.

The implications of this strained relationship were felt more by the irrigators than the livestock keepers. In some discussions, it emerged that the livestock keepers were refusing access to manure to irrigating households, forcing the latter to rely on inorganic fertiliser which was not only expensive but also not available in the market. It also appears that the norms of reciprocity, through which both groups complement each other to ensure survival, were compromised substantially as a consequence of irrigation expansion. One disgruntled livestock owner complained that as a result of the expansion of the scheme their animals were travelling longer to get food and as a result productivity was falling. It was also pointed out that tensions between irrigators and livestock farmers were undermining other livelihood activities:

> *"These people (*reference to irrigators*) are difficult to understand. Why can't they just allow animals to graze and leave manure? Their problem is that they have been trained to believe that manure comes from rotting maize residues".*

The livestock farmers also believed that despite not receiving comparable support from the government, there was strong resentment and jealousy of livestock farmers by irrigators. This jealousy was emanating from the fact that despite being successful as an irrigator, owning livestock is the 'ultimate achievement', most of the irrigators were still unable to raise enough capital to purchase livestock, even as small as a calf which cost an equivalent of fifteen bags of maize. The livestock keepers assumed that the injury meted on their livestock was the culmination of all this frustration at being 'stagnant' as a farmer. In the view of the livestock farmers, some of whom were also members of the irrigation scheme, there was too much leeway given to irrigators. One herdboy remarked that:

> *"It is very dismaying to see people farming right in the middle of the dambo. There is nothing or no one stopping them, no one".*

Furthermore, it appears that there has not been sufficient dialogue on the issue of land use change, which appears to be in favour of irrigators at the expense to those that own and depend on livestock farming. Grazing areas have not been clearly demarcated and irrigators are able to move in and start farming as they wish. It is often difficult to enforce non-use of this public land as leaders feel that by allowing people to farm in those areas they are in fact enabling their capability to produce food. The GVH and his fellow village headmen are some of the poorest people in the villages and because they do not own cattle they are often appear not too keen to help with resolving the issue of pastures.

Unlike other schemes that are managed by WUAs and Water User Groups (WUGs), Chitsukwa irrigation scheme is under the GVH and the scheme management committee does not have full power to make certain decisions, especially those relating to demarcating the scheme. The land is under customary tenure which means the GVH has the right to let anyone use the land as he sees fit.

6.1.9 Changes in cropping systems

While in Muona farmers have managed to maintain both rainfed and the irrigated plots side by side and benefit from a cash crop (rice) in addition to other food crops (including maize, beans, sorghum, sweet potatoes, millet), the situation has been different in Chitsukwa. The challenge of flooding in the main summer season restricts cropping to irrigation using residual moisture or water abstracted from canals and shallow wells at the end of the summer season. Nonetheless, despite the ever-present threat of flooding, some minority of households will still plant in the rainfed plots with the hope of less severe floods, while a substantial majority prays for floods and hopes to use residual moisture to ensure a larger harvest. Under irrigation, however, the number of crops grown has fallen to only one on average, with only a few farmers planting some beans as an intercrop. The reasons for a reduction in the number of crops relate partly to the fact that more households had entitlement to land in the dry land and had the freedom to grow any choice of crops, and the shift to irrigation has limited choices to what a landowner can allow; there is also a strong sense to achieve uniformity with everyone else in order to match with the group identity that Chitsukwa is a maize irrigation scheme. The design of ridges and introduction of conservation farming, as well as input assistance programmes for irrigation, has all been tailored around maize. After harvesting maize the farmers do not seem to be planting an additional crop. In a focus group held in Chitsukwa respondents noted lack of skills to grow any other crop, and insufficient markets for the vegetables that they could produce. One respondent noted that:

> *"If someone can come and show us what else we can grow, perhaps we could plant something in the 'off-season' and make some money out of it".*

There are some challenges, however, with an off-season crop. Livestock grazing would be restricted and water abstraction would be very high given higher evapotranspiration losses.

6.1.10 Use of 'marginal' and ecologically fragile lands

The introduction of the treadle pump in Chitsukwa as well as in Muona outside the rice scheme meant that farmers could cultivate maize in places where it was previously challenging to do so as they lacked the means of delivering the water. However, most farmers lamented the challenges they faced of accessing a desired length of hosepipe and as a consequence they were moving closer to the river's course. These areas along rivers are ecologically marginal and very fragile if exploited. The farming along riverbanks, especially in areas outside the scheme such as the uplands of Thyolo and Mulanje, has led to an increase in the level of siltation of the rivers that bring water to the irrigation schemes. High siltation of the Thangadzi led to the 'collapse' of Muona irrigation scheme and flooding of areas near the scheme, as well as the excessive flooding around Mchacha James village in which Chitsukwa is located. The study also noted different levels of understanding of the environmental guidelines restricting use of land along river banks. Some extension officers professed ignorance of any regulations restricting use of these ecologically fragile zones. In one interview, one extension officer highlighted this issue:

"We used to think that we were increasing the area under production by allowing them to farm along rivers, but now we have actually realised that we actually reduced the area for production".

6.4 Conclusions

Access to land is negotiated through multiple routes and these are intertwined with migration history, marriage and local systems of entitlement, and social networks through which people derive information on land available for renting on the market. Enforcement of institutional restrictions to land transfer through sale of such land, with an aim of ensuring long term access to land for poor landowners, appears to be futile or at least play a diminished role, as landowners, prospective buyers or tenants have innovated around the mechanisms of transfer of land or renting. Rogue landowners, uncooperative tenants have the danger of worsening vulnerability of poor households, and while their honest colleagues take advantage of a large market in providing access to land, they do not realise enough to sustain themselves and most are trapped in poverty. The introduction of labour demanding irrigation systems, particularly in the context of treadle pump based farming, helped 'free' more land from landowners who had insufficient capacity to utilise their land, and the continued resistance to motorised equipment is being used to protect land access for poor farmers, and openly claimed to be a measure for ensuring equitable water access.An active land market exists, in which land value reflects the advantage of the plot of land in terms of gradient, soil features, water accessibility and demand for land in the scheme. Some farmers, however, are not profit motivated and charge less for rent as their contribution to society. Conflicts over access and use of land are rife, and intergenerational land transfers often result in both diminished land size through division of plots among surviving family members, and disagreement on how soil is managed between landowners, tenants or their children. With the majority of farmers depending on rented land, lack of security of land access appears

Key Messages

- *Low mechanisation of irrigation may lead to improved land access for the poor, but this has to be understood from a perspective that examines the holistic livelihood.*
- *Farmers have access to small portions of land on average, but huge inequalities in access exist. These are shaped by history of settlement, marriage, access to labour, and strength and quality of social networks.*
- *Land rights only matter is they translate to rights to water.*
- *Land rentals reflect scarcity of land, quality of land with regards to soil fertility and water, but some landowners may forgo profit if this means socially protecting their 'community' members.*

to undermine long term soil fertility management. New farming techniques may also ignore local relations with respect to resource access and undermine the livelihoods of the most poor and vulnerable. Such has been the case with conservation farming which appears to have upset the relationship between those with livestock and those with crop residues. The next chapter looks into farmers' access to water for irrigation.

7 MANAGING IRRIGATION: WATER ACCESS AND UTILISATION

This chapter discusses the findings of this present study on water management practices, access and utilisation at the scale of the irrigation scheme. In Muona water is managed by an elected committee representing the Water User Association (WUA). The Water User Association is basically a group of farmers organised formally and legally, and with rights to both land and water for irrigation purposes. The WUA general assembly consisting of plot holders and tenants elects the WUA executive committee and the board of trustees. The WUA executive committee has the responsibility of handling the operational and maintenance affairs of the scheme and is supported in this task by various committees such as the Seed Multiplication, System for Rice Intensification. In addition to these operational committees, the WUA has a board of trustees selected by the general assembly and tasked with holding the WUA executive to account in the interest of protecting the rights and interests of all water users in the scheme. A Water Jury also exists in Muona and has the responsibility of handling disciplinary issues mostly relating to conflicts over land and water among farmers, and most commonly on issues relating to rogue landowners not meeting their obligations of making land available to tenants. The role of the water jury and the WUA executive replaces that played by the traditional leaders prior to the formalisation of irrigation activities. In Muona, management of water across the scheme is through block committees headed by a chairperson and in charge of ensuring that all water users within their respective blocks can access adequate water for irrigation.

In Chitsukwa Irrigation Scheme water is managed by a management committee elected by a general assembly comprised of both landowners and tenants. The management committee is a ten member committee with an executive and committee members charged with managing the affairs of the scheme. Key duties of the committee include ensuring that canals are well maintained to allow for distribution of irrigation water to all scheme users, managing some minor disputes among farmers, coordinating with external institutions such as local government and NGOs with regards to soliciting various forms of assistance, e.g. treadle pumps, funds for rehabilitating the scheme, seed and fertiliser, among other inputs. Any issues of discipline or conflict that the committee feels unable to manage are referred to the local group village headman. As is the case in Muona, the management of canals and water distribution is through block committees comprising of ten members selected from within a group of farmers sharing the same canal. These block committees are made up of both landlords and tenants, and because tenants are not permanent their composition is constantly changing thereby upsetting the management of these blocks. According to interviews with block committees in Chitsukwa, the seasonal changes in both the members of the committees and farmers (tenants) in the block means that the committees have to deal with different characters and using different approaches. Some committee members have introduced better ways of managing work and getting people to work together in clearing canals, but others have been controversial and disruptive thereby causing disturbance to the running of the block.

7.1 Sources of Water and Mechanisms for Distribution

7.1.1 Muona Irrigation Scheme

Muona Irrigation Scheme is a gravity-fed irrigation scheme. Gravity-based irrigation works efficiently where the terrain follows a gentle gradient thereby allowing water to reach all plots on schedule. In the case of Muona, however, the gradient of the scheme is neither uniform nor does it follow consistent direction of slope. This being the case, some sections of the scheme are difficult to irrigate by gravity, while others suffer from waterlogging and salinization as a consequence. The water for irrigation is derived from diversion of water along the Thangadzi River, which passes to the northeast of the scheme before it merges with the Shire River, at a point along its course but just before it reaches the scheme. With its source in the upland region of Thyolo and Mulanje, Thangadzi carries with it numerous sediments including logs that have in the past destroyed some scheme infrastructure, and silt which has had the detrimental effect of raising the river bed and increasing risk of flooding, as well as clogging the canals and reducing the soil quality in the irrigation scheme. The effective running of the scheme depends on farmers managing the canals well, through seasonal removal of silt and other debris, and sharing of water based on an established rotation system. Farmers' cooperation is difficult to establish because farmers themselves tend to pursue self ahead of group interests. These issues are discussed in detail throughout this section.

7.1.2 Chitsukwa Irrigation Scheme

Chitsukwa Irrigation Scheme suffers from poor water availability for irrigation despite being located within a hundred metres from a very large water body, the Elephant Marsh. Canals were dug from the marsh into the scheme to supply water but most of these appear to be either too shallow to carry water in sufficient quantities to meet water requirement in the scheme, or are also too meandering to have sufficient energy to reach all the plots of land covered by the scheme. The resulting poor delivery of water through canals coupled with a poor maintenance regime has resulted in conflicts across the scheme. The scheme regulations dictate that farmers proximal to canals should derive their water from these canals, with shallow wells being permitted only where the canals are too far and inaccessible through available hosepipe length. This regulation was put in place to ensure that farmers can cooperate around canal maintenance as allowing 'private' shallow wells would have meant that too few people are available to manage canals, thereby acting as a disincentive for cooperation. Observations in Chitsukwa, however, showed that even farmers with plots located right next to canals were in fact flouting this regulation and digging shallow wells. The scheme management committee reported that it faced substantial challenges in enforcing the regulations on shallow well digging because the

landowners claimed that they had entitlement to land under customary tenure, and since they 'owned' the land they could do whatever they pleased with their land, including digging shallow wells. One block chairperson argued that:

> *"The scheme committee is elected and that's a problem; they fail to enforce the regulations because they fear that they will not be voted next time if they are seen as being too strict".*

Beyond ensuring farmer participation in scheme maintenance, the block committees and scheme management committee reported facing struggles with dealing with the 'excessive freedom' that landowners enjoyed under customary tenure. The argument raised by some of the landowners was that the land was 'theirs' and they had every right to act as they chose to without any interference from the committees. These landowners were going against the scheme regulations that dictate that any farmer located near a canal should not be allowed to dig a shallow well (meant to enforce cooperation in canal maintenance). To improve the rental value of their plots, some landowners were digging shallow wells in these non-designated locations. The argument by the landowners was that both the scheme and the block committees were failing to get people to clear canals, and therefore they were only making the best decision to safeguard their farming and livelihood interests. As a consequence of this action, shallow wells were being constructed all over the scheme haphazardly and with possible detrimental consequences to the management of underground water resources. According to an irrigation officer interviewed in this study, the shallow wells should have followed a certain predetermined line; failure to observe this could result in overexploitation of the water.

As more plots established their private shallow wells, the burden of clearing canals became higher for those farmers abstracting water from canals. In fact, even tenants on plots using canals as sources of water were demanding that the canals be cleared by the landowners. As paying tenants, they were only concerned with accessing plots that were supported by a source of reliable water. The majority of tenants, nonetheless, were involved in the canal maintenance realising that the landowners were a minority and without water they would suffer from crop failure. It was noted by this study that there were no clear regulations in the scheme with regards to cooperation around water management. Quite often it was assumed that farmers would know, and this proved very difficult especially with those farmers who were coming from further away from the scheme, most of whom could not be bothered by souring of relationships arising from non-participation in scheme activities. Being a treadle pump operated scheme, farmers also face the burden of both high labour intensity in operating the treadle pump in addition to the costs of hiring additional labour units, and these costs are seen as undermining time availability to participate in group-based canal maintenance.

7.2 Scheme Design and Implications for Water Management

In both irrigation schemes there were reports and observations of conflict over access to water, and in both cases these were traceable to the design of the respective irrigation

scheme. Some of the design issues that had implications for equitable distribution and access included the following:

7.2.1 Uneven distance from plot to canal

When Chitsukwa Irrigation Scheme was constructed from the early 2000s there was considerable resistance from some landowners who felt that the canals that were being constructed over their land would effectively reduce the size of their land. This problem arose from the fact that farmers retained their customary right to land, which in most other schemes is given up so that the scheme is constructed on public land. So, in order to avoid those areas where a canal path could not be negotiated, the canals were built in a meandering way. Meandering canals are less effective in delivering water downstream as relatively more energy is lost on a meandering than straight channel. Thus today the canals are not exactly parallel to each other and some plots are located too far from the canal because the plot owner may have resisted having a canal over his or her plot. These plots suffer from chronic water problems and conflicts over water are more common among farmers.

Some farmers in the affected blocks in Chitsukwa also pointed to the fact that those who could access longer lengths of hosepipes, for instance members of past management committees who had looted donated hosepipes and shared amongst themselves, could rent that land at giveaway rates thereby making more profit for themselves. Other than that, any farmer attempting to use this land would most likely run into water problems and lose out after making their investment.

7.2.2 System for Water Distribution

While farmers cited 'selfishness' of neighbours as a constraint to water sharing in the scheme, field observations of water distribution in Muona indicated a much deeper problem with the design of the scheme. Water enters the scheme through a main canal and is subsequently diverted to the various blocks, depending on the rotation, via a network of secondary canals that rely on the opening and closing of gates located within these canals. Once at block level, water is directed into tertiary canals which, when they fill up or through some valves, release the water into the plots. The tertiary canals are, unlike the main and secondary canals that are cemented, earthen and therefore are prone to losing water. When farmers clear these tertiary canals they quite often contribute to upsetting their levelling. So, once water enters the field nearest to the tertiary canal that field should get saturated first before the field user opens valves to let water through to the conjoining plot, which may be controlled by a different farmer. This arrangement for moving water is problematic particularly in drier years whereby one farmer may refuse to release the water from his or her field, halting operations on the next field or causing the crop of his or her neighbour to suffer from moisture stress. Most of the conflicts over water in Muona were as a result of neighbours blocking the contiguous movement of water across the scheme. One farmer remarked that:

"When water is in short supply people get very selfish. Everyone wants to fill their field with water, they put themselves first. Some people may even block water from leaving their fields, which means that those in the interior cannot access water. This is very bad, because when those in the interior fail to get water they start getting agitated and forcefully demand that water be released. This is how fights flare up; people are willing to fight to the end just so they can get water". Male respondent, focus group discussion, Muona

Excess water from an irrigated block is drained out via a drainage canal on the opposite end of a sub-block. According to an engineer interviewed in Muona, the original design by the Chinese may have assumed that the plots between the tertiary canal and the drainage would be either owned by the same farmer.

"Farmers are not maintaining the tertiary canals in desirable state, and their approach of draining one field to irrigate the next is a disincentive for good maintenance of canals. Fields should be irrigated off the canal and not from adjacent fields".

"The design should have been such that each plot has a tertiary canal on one end and a drainage canal on the other, to take away excess water. But that is not the case; farmers siphon water from their neighbours' fields because there are very few tertiary canals. In fact most farmers have never seen the tertiary canals working; they believe water should be moving from one plot to the next". Interview with engineer in Muona

7.2.3 Depth of canals

In the above section, it has been shown that poor maintenance of the tertiary canals led to reliance on draining one field to feed the next. On the flip side, any attempts to clear the tertiary canal and rid it of silt and other waste material had the risk of further lowering the depth of the canal thereby upsetting the levelling. In attempts to maximise water yield from the tertiary canals, some farmers had lowered the height of their fields instead. Although this increased ease of moving water from the tertiary canal into the plot, it led to high risk of soil erosion. An irrigation engineer involved in the rehabilitation of Muona gave an example of one field belonging to a member of the scheme that had been lowered by a depth of 0.70m.

Canals in Chitsukwa were constructed using hand hoes and shovels under a public works programme implemented by government through a programme funded for Highly Indebted Poor Countries (HIPC), with subsequent assistance offered by Goal Malawi and then again government through the Malawi Social Action Fund (MASAF). The canals in Chitsukwa are very shallow in most parts, going down to as little as 15cm in certain areas. Respondents in Chitsukwa argued that the shallowness of the canals was as a result of use of human labour as opposed to machine digging as was the case with Mulewa Irrigation Scheme nearby. The almost annual flooding of the scheme also introduces silt that also contributes to a reduction in the effective depth of the canal.

Certain management practices in Chitsukwa contribute to the problem of siltation of the canals and their shallow depth. Firstly, canals are usually cleared as a public works intervention in which farmers are paid through cash or inputs proportional to their contribution to the canal clearance. This arrangement gives an impression that farmers should be paid for clearing their canals and without it turnout for seasonal canal rehabilitation is often low. The funding for excavation of silt from canals is often received very early in the year when the water table is still very high thereby impeding digging and resulting in shallow wells. Farmers clearing canals also have a tendency to place the excavated material as a bund right next to the canal. This material is subsequently washed back into the canal when the next rainy season starts around November. The resulting low water holding capacity in the canals leads to insufficient water flow around the scheme, and that exacerbates the likelihood and intensity of conflicts over access to water. In some canals, siltation has been due to livestock drinking while in others farmers have tried to address the problem by digging deeper but in the long run creating some shallow wells within canals. In Chitsukwa there is a regulation that states that farmers close to canals cannot dig shallow wells. This regulation was meant to ensure cooperation around canal maintenance by farmers. However, many farmers are resorting to digging private shallow wells instead of relying on canals, thereby increasing the workload for those remaining on the canal. Discussions with such farmers that have shifted to shallow wells emphasised both that the farmer 'owned' the land and should be free to dig if he or she wishes, and that they had given up on the communal canals.

7.2.4 Carrying capacity

Scheme records in Chitsukwa indicate that by 2009 the scheme was served by 14 canals measuring a total of 7.7km. The scheme was covering 164ha and supporting 1018 farmers. By 2013 the size of the scheme had increased to 254ha and over 2600 farmers. However, despite this large increase in size of the scheme there was no proportionate increase in the number of canals to deliver water to the additional cropping area. The major challenge for the management was that it was seen as morally challenging to refuse farmers from becoming part of the scheme if they wished to, and as a consequence the scheme's boundaries continued to extend so that the carrying capacity, even after discounting for the new shallow wells, was exceeded many times over. For the farmers incorporating themselves into the scheme, the aim has been to assume the identity of being part of the scheme so as to be entitled to any benefit earmarked for farmers in Chitsukwa, such as seed, fertiliser and equipment for use in irrigation. Further compounding the problem of canals being inadequate to meet the demand for water was their poor maintenance that reduces how much water can be handled.

In the case of Muona, farmers were of the view that the rice field had to be a permanent paddy field if a farmer was to achieve any reasonable harvest. According to a WUA member:

> *"Before they introduced this idea of SRI (system for rice intensification), we used to believe that a rice field had to be permanently under water. Thinking back, I think it's clear we were wasting too much water*".

This attitude meant that those with preferential access to water would have monopoly over it and deny their peers, so much so such that in the late season particularly, the carrying capacity would have been exceeded overall. In Chitsukwa, while a motorised pump was allowed for one farmer in early season, the same neighbours who had consented started initially forced him to stop its use for irrigating as they felt he was abstracting too much water since he was not putting any physical effort in the irrigating process. With a motorised pump in use the carrying capacity of the canals was severely undermined.

7.3 Proportionality in Water Access

Proportionality refers to equity or fairness in water access. Paul Trawick (2001) considers proportionality as existing where no one may use more water than the extent of their land entitles them, nor may they get it more often than others. Proportionality as a principle for ensuring equitability in the allocation of water proved problematic in both irrigation schemes. A dominant concern, particularly among farmers in underserved sections of the scheme, was that proportionality as a basis for decisions on water allocation seemed to work in favour of those located in sections that had better water accessibility. Individuals with positions of authority in the scheme, including WUA committee members, block chairpersons, and other affluent members of the community tended to have land allocations, entitled or leased, in blocks that had relatively better water availability or controlled the better sections within poorly served blocks. This group of powerful people, it was argued, would push for compliance to proportionality in water sharing knowing very well that this would work in their favour. One farmer operating 0.2ha of land in Muona's block F complained that the water supply in that block was so poor that farmers were resorting to growing maize instead of rice because of problems of water availability in this poorly levelled block. The responded commented that:

> *"The problem is that the block chairmen often cultivate plots in the better sections of blocks and never get to understand concerns of those in the drier parts. We should be selecting block leaders from the drier sections of the block… Even if you were to complain that the (allocated) forty-eight hours did not allow for adequate wetting of your field, they wouldn't agree to add a few more hours. They know they end up getting more water as a result. Such is life".*

7.3.1 Arrangements in place for ensuring proportionality in water sharing

In Chitsukwa Irrigation Scheme farmers reported that the application of proportionality in water sharing was by default of existing arrangements in sharing the treadle pump. Treadle pumps were being shared by groups of between five and eight farmers, with each farmer normally allocated a duration of two days to irrigate their plots before passing on the device. Observations in the field showed that most households were capable of irrigating at most a 0.1ha plot within a day, such that for the two days in which a farmer had access to a treadle pump most farmers would manage only 0.2ha. In addition to the constraints in availability of the treadle pump, labour was a common constraint among farmers, such that

even those farmers who were not sharing their treadle pumps were unable to consume more water through irrigation than their counterparts because water abstraction by treadle pump was seen to be too exhausting. In poorly maintained canals where water availability would be a problem, farmers would require much more time irrigating since they would take more frequent breaks while allowing for the canals to recharge.

Despite challenges with access to labour for treadling in Chitsukwa, farmers have vehemently resisted the introduction of the motorised pump. Extension officers argue that motorised pumps are unsuitable for maize irrigation as they would encroach too much into the income that a farmer could potentially realise through initial purchase costs plus the running costs of purchasing fuel. Farmers in the scheme were resisting the motorised pump on the basis that an owner would be able to abstract far more water than anyone else, and that would reduce availability for other water users. There is one case where a motorised pump farmer, who could finish a 0.1ha plot in two hours (treadle pump takes 8 hours) and fill the soil with water such that he would return after 2 weeks, while the crop in his treadle pump using neighbours' fields would start to show signs of stress in only one week from the last watering. While this farmer argued that he was only coming once in two weeks, as compared to weekly as most of his neighbours were, he was abstracting the same amount of water. It appears that there were other concerns that the farmers had. At the core of their concerns was the fear that if rich landowners were to buy motorised pumps then they would be capable of using more of the land they owned due to lower labour demand with a motorised pump, implying that land scarcity would be a more immediate effect.

In the case of Muona, proportionality in water access was enforced through an irrigation schedule in which each one of the scheme's thirteen blocks were allocated the same duration of 48 hours of watering as a standard by the WUA committee. On this basis all blocks get the same amount of water, at least in theory. In practice, however, respondents argued that despite proportionate allocation of water which could sound ethically correct, some blocks such as E, F and G which had not been levelled when the scheme was created, were receiving far less water as a result. For these blocks, the canals were set too low relative to the plot level such that more effort would be required to bring the water to the field. Compounding this, the fields were prone to developing anthills which not only reduced the surface area for farming, but upset the level of the field when disturbed. Destroying a single small anthill would cost a farmer about K8000 to K12000, or an equivalent of two bags of rice. After destroying the anthills, some farmers would spread the soil across the fields but this was only further exacerbating the levelling problem.

7.3.2 Challenges with using proportionality in water allocation

Most of the prominent individuals in the scheme, such as members of the WUA or Cooperative, were involved in rice production activities in blocks A, B and C, which were generally well-levelled and therefore relatively much easier to irrigate as a consequence. One key informant working in block E, one of the disadvantaged blocks, argued that it was in the interest of the WUA committee not to tolerate any requests for more water from underserved blocks, and instead run on the 'fair sharing through proportional amounts of water for all' card in order to safeguard their own private interests.

> *"Since our block is more difficult to irrigate, we have often argued for more time allocation but this request has been turned down by several times by the WUA committee. As farmers ourselves we know that they would never agree to that, they suspect that their crops would suffer if we were given more time".* Block chairman in poorly levelled block

A female farmer in the same block presented an argument that historically, water management committees were responsive to the plight of farmers in poorly levelled blocks. The water guards were salaried officers whose priority was fair allocation of water, and their job descriptions included ensuring that all farmers received adequate water. However, the new system under the WUA and block chairpersons, who are strongly interested parties in water allocation, only worked such that their own interests were fulfilled at the expense of fellow farmers. She pointed out that:

> *"In the past we used to tell the water guard that some plots had not been watered, and he would come and check and release more water. Nowadays we may tell the block chair and if his block is watered he won't care any less".*

Farmer recollections of the climate twenty to forty years ago suggest that the scheme is drier today than at any point in its past, other than in drought years. It is not clear, however, whether refusal for additional water was a response to water shortage or was being done to serve private interests. Another angle argued was that block chairpersons were likely to ignore the plight of their counterparts in the block if they were not directly affected by poor levelling. In block A, one female farmer was proposing that she would put herself forward for nomination for the position of block chairperson because the person in charge was totally unsupportive of the construction of a tertiary canal to serve the sections of block A on the Magreaver end of the scheme. She argued that the lack of interest by the block chairperson stemmed from the fact that he was from a better area of the block. Low lying plots in most blocks had an advantage of holding relatively higher soil moisture content than those on higher grounds or located further from the canal. In wetter than normal years, however, these plots may suffer from waterlogging.

The effect of this pursuance of proportionality in water sharing was felt on farmers' harvests. The average yield for rice in block F1 and F2, both of which are poorly levelled blocks, was 10 to 12 bags compared to 12 to 15 bags in the well levelled blocks such as blocks A, B and C, among others. It was also the case that farmers in the poorly levelled blocks were cultivating maize instead of rice in Muona, since the water received was often hardly enough to support a rice crop. In fact one respondent noted that:

> *"We always feel part of the scheme in years that we get to grow rice. That is not common though".*

7.4 Managing for Water Use Efficiency

7.4.1 Irrigation Scheduling

Water use efficiency did not appear to be the focus of water allocation and use in the two schemes studied. Water was being applied for the purpose of preventing wilting of plants and, particularly in rice production, maintaining almost permanent saturation of the soil throughout the season. In Chitsukwa the irrigation scheduling was based on the rotational access to a shared treadle pump, with farmers applying water just because it was their turn to do so, unless there was a rainfall event. For farmers outside the dimba, frequency was as high as once in seven days and with each watering lasting about 6-8 hours per 0.1ha depending on quality of labour available. In a season, a maize crop could be irrigated between 8 and 12 times. Those farmers using mulch were better able to protect the soil from direct exposure to the sun, and were irrigating at least once in 10 to 14 days thereby saving on household labour. One senior irrigation official noted that:

> *"Farmers are ready to tell you that they have irrigated for such a number of hours, they have no idea how much that translates to in terms of water used and what that means to overall water availability".*

As a result of both a lack of understanding of crop water requirements at different stages of development, and a lack of infrastructure for holding water for use later in the season, it appears that in both irrigation schemes there was evidence of water shortfall in the critical grain-filling stages of cereal development. From the mid to late season when rainfall activity would have ceased, the flow of the river receded and the total water availability fallen below levels adequate to cover the whole scheme, the WUA would then put up a rotation schedule set at either 24hours or 48hours of water flow into a block and applied in turns across the scheme. It is therefore the case that water was used with abandon up until a point where it fell below a certain critical minimum, below which fears of water being inadequate to meet season demand were seriously considered. At this point of worries over water adequacy, however, the challenge of enforcement of fair allocation to all users was significant. During the early season characterised by water abundance, a lot of farmers could open and close canal gates, thereby directing water into or away from their plots or blocks, without any regard to scheme rules. Even in late season some of these habits, such as self-managing water within a block, persisted - leading to some diversion of water away from allocated blocks, as well as theft of water at night. In some cases, scheme infrastructure such as canal gates were vandalised to render them useless when it came to directing water towards particular blocks.

7.5 Uniformity in Field Operations and Water Allocation

7.5.1.1 Effect of Non-Uniformity on Water Management

Discussions with management committees in both irrigation schemes suggest that the failure to ensure uniformity in field operations constrains efforts to efficiently allocate and use water. Both irrigation schemes operate on a seasonal calendar that gives an indication of what the farmer should be doing at a particular time period. In the case of Muona, the collapse of the Banda government and its heavy handed extension system which enforced planting dates and compliance with particular agronomic practices was replaced by a more chaotic arrangement in which farmers 'did as they pleased' and apparently refused to have dates dictated to them in the 'new democracy'. As one respondent put it:

> *"The problem started with democracy. We were told that democracy meant that we could do as we wished. No one listened to the authorities in the scheme anymore and everyone did as they pleased. There was chaos. People were throwing weeds into canals; others put soil and chocked the canals. No one could touch them".*

In Muona, the usual dates for establishing nurseries are between 15th January and 15th February with transplanting expected by the end of February. Observations in the scheme indicated that the level of compliance was very low in the 2014 season; about 40% of all plots had no established nurseries by the beginning of March. The nursery establishment dates are not enforced and farmers always seem to have clear reasons for delaying with nursery establishment. The most common challenge was lack of resources, particularly labour and money for inputs. Some respondents pointed out that the onset of the rice farming season often coincides with peak food shortage and they are forced to make difficult choices between working on the future crop and concentrating on survival in the short term. Some farmers were still transplanting rice seedlings as late as the end of April in 2014. Such delays in nursery establishment and transplanting were seen as very problematic particularly when it came to water distribution and its equitable distribution and consumption.

Differences in transplanting dates had the effect of creating uneven demand for water across blocks leading to wastage. For example, in cases where the farmer closest to the canal had not yet transplanted while his neighbours further away from the canal were already in season, water would have to pass through the delaying farmers' fields to reach its point of demand. While some makeshift canals could be constructed across these fields, some farmers relied on siphoning water off the conjoining field. Besides the wastage of water, non-uniform crop establishment also meant that throughout the growing season farmers operating next to each other would have different water demands over the season, thereby causing inconvenience to each other. The WUA committee reported that the scheme had strict cut-off dates and would terminate the irrigation schedule when the official date was reached, irrespective of whether some farmers still had a crop in the fields or not. This means that any water reaching the scheme would be directed away and into the

Shire. According to some farmers, such a move was not addressing the challenges in the scheme. They argued that it was callous for the WUA to cut out water for late planters because they (WUA executives) knew clearly of their constraints in securing labour and farm inputs.

Non-uniformity in field operations had a similar disruptive effect in Chitsukwa, hurting particularly the poorest and most vulnerable households. Farmers similarly adopted different planting dates as evidenced by some crops reaching full maturity whilst a neighbour's crop had just emerged. The early planters were able to take advantage of the residual moisture in the soil thereby reducing the frequency of irrigating, plus the canals had much higher water levels and a raised water table to facilitate a quick recharge. The early planters also had the advantage of recently cleared canals (through LDF public works programmes).

The other challenge associated with delayed planting was that the late planters were a minority such that they could not make up sufficient numbers to clear the canal in mid to late season. Early planters would refuse to cooperate as they had the least to benefit. This exacerbated the poor water availability in the scheme. However, those farmers that had shallow wells in their plots were less affected although they still had to face the burden of digging deeper to reach the water table.

The differences in crop harvesting dates also had negative consequences for livestock farming in Chitsukwa. The dried maize stalks were ideally available for livestock grazing, given also that some grazing area had already been converted into cropland by irrigators in recent years, but could not be utilised without fights breaking up given challenges in selective as opposed to open grazing.

7.5.1.2 Determinants of Delayed Planting

However, despite uniformity being a desirable attribute in the efficient operation of the schemes, interviews in both Chitsukwa and Muona demonstrate a more complex relationship between water management, food security and casual labour (*ganyu*). The high demand for labour in irrigation schemes, coupled with the fact that almost 100% of all households in the surveyed villages are involved in irrigation farming, means that those households lacking labour will have to resort to hiring labour, and the only source of labour is their fellow farmers. Unlike other parts of Malawi where labour is pooled to ensure that everyone plants in time, such an arrangement has never been in place in Nsanje. Food insecurity within the villages becomes the push factor driving some households to sacrifice their own plots in order to meet more immediate food requirements. Payment for casual labour is made per unit area of land worked, and is pegged at the prevailing price of 5kg of maize grain. As poorer households have to depend on providing *ganyu* to other households,

they tend to delay planting their own fields and end up doing so when water availability has fallen and insufficient for ensuring good yields. The study also noted that some of the richer households kept food reserves specifically for use for payment of *ganyu*. Delayed planting was also due to other reasons such as illnesses within the household and lack of farm inputs such as labour, seed or fertiliser. Other respondents, however, differed in opinion and argued that improved assurances of water availability under irrigation had in fact driven laziness and reluctance by farmers to adhere to scheme rules. This female respondent interviewed in Chitsukwa said:

> *"When we were farming in the dry land everyone knew and followed the planting times. Now that people know that water can actually come from below the ground they are difficult to convince, to manage. They can be doing their own thing while others are starting farming knowing that they can always plant using canal or shallow well water".*

Another respondent also argued that laziness was a factor:

> *"Some people behave like they are being forced to farm. They may choose to delay planting even when they have all the inputs. If you ask them why they are delaying they may ask you "what's the hurry?"*

When one of the members of the WUA executive was sent to India on an IRLAD sponsored learning visit in 2014, she was asked what she had found most impressive in India and what she thought would make the biggest difference in Muona she noted that:

> *"One thing I found most impressive with our colleagues in India is that they do everything at the same time. The crop is uniform throughout the whole scheme. When it's*

Farmers in Magreaver destroy protection bund.
Field notes, 16.01. 2014

Three men who are all landowners in Magreaver are being held in custody by the police in Fatima after being arrested on suspicion of causing damage to the flood protection bund put up under the ongoing rehabilitation of Muona Irrigation Scheme. According to witnesses interviewed, the men were spotted digging vents on the bund by a concerned villager who reported the issue to the local extension officer. The extension officer in turn reported the issue to the Site Technician employed by the consulting company that is managing the construction of the bund.

"The extension officer came to me and said, "Some people have damaged your bund", but I was a bit concerned that he had said it was my bund. Besides, I thought I was not the appropriate person to handle the matter. He responded that he was not the appropriate person either since the scheme had not been handed back to the government and farmers".

At that point, the matter was taken to the WUA executive and a visit to the scene was promptly arranged. The president of the WUA was out of wits in terms of the best approach to handle this problem. The Site Technician suggested that the President could use the case to send a strong message to farmers that such acts would not be tolerated. He suggested that the case be reported to the police. The president was hesitant and argued that such measures could "lead to people disliking us back in the village". Following deliberations, it was finally agreed that the matter be reported to the police. The three men were arrested and all pleaded not guilty. However, the three men were held in custody over the weekend. It appears there was not enough evidence linking the men to the crime, other than the fact that the water had been released into their fields. Their position was than any other farmer could have done, using the men's field as the transit route for the water.

The accusers realised that should the men be found not guilty in a court of law then other farmers would in the future take advantage of the police system and take cases to court where they could plead innocent, and argue on the basis of insufficient evidence. They requested that the men be released without trial, and made it look like a pardon (or warning) to any wannabes. The men were asked to fix the bund, which they did.

time for planting everyone plants at the same time, they respect deadline".

7.6 Water Rights and Access to Water in 'Informal Irrigation Schemes'

Tensions over who has right to and should access water appear to be intricately linked with the level of formality of the various contesting parties. Where land tenure is secured under a 'formalised' system, such as through the payment of a lease of the land from the government, farmers may assume that the rights to land come with the rights to water, and those under 'informal' customary land may not be allowed to access it unless the needs of the better good, the scheme, are satisfied. This subsection looks into water rights in Muona and subsequently, the implications of lack of security of tenure on water management.

Muona is an interesting case for examining the issue of water rights and its implications for farmers within and outside large irrigation schemes. In this study we observed some tensions over water 'ownership' between farmers in Magreaver, an informal irrigation area depending on the same source as the larger scheme Muona, and the water users association of Muona.

As we discussed in section xx above, water users in Muona Irrigation Scheme believe that the water of the Thangadzi River belongs to them, and should not be diverted to any other users unless the scheme has had enough to meet its requirement. The argument raised by the majority of farmers in Muona was that they are registered as a WUA and the Water Board is aware of their water abstraction. In addition to that, they claimed to be paying K100 per 0.1ha of land used per year although it also emerged that this figure was proposed and none of the farmers had made a single contribution to the water user fee.

The denial of water to farmers in Magreaver is despite a well-established fact that irrigation started off in Magreaver and was based on the diversion of water from the Thangadzi River. Farmers in Magreaver are portrayed as being informal and customary and without rights to water as they are not registered, against a formalised and well-known scheme that has established rights to water. Over the years, since the late fifties, farmers in Magreaver have relied on both diverting water from the Thangadzi and overspill from the flooding of the Thangadzi River to support production of rice in wet years and maize in the drier years. The formal scheme has, since 2013, constructed a flood protection bund as part of the rehabilitation, to prevent floods from reaching the scheme, but in the process blocked the fields in Magreaver from receiving any water from the flooding of the Thangadzi River. River diversion is also no longer viable, the river is now heavily silted in most parts and flows below the surface. Moreover, the construction of a new weir further upstream on the Thangadzi, to avoid the siltation on the lower profile, means that all the water is diverted into the main canal supplying the scheme and hardly any water is left to flow along the river.

Some farmers in Magreaver expressed displeasure at this monopoly over water by the scheme, but also conceded that the scheme had power over water and was too big to challenge. Their struggle is weakened by the fact that some of their members also operate plots in Muona Irrigation Scheme and are therefore not willing to engage in any action to challenge the scheme leadership. There have been some individual efforts. One set of farmers located near some of the scheme's canals did sometimes divert water through tampering with the canals or closing up gates and allowing water to overflow into their fields. Another group of farmers decided to dig vents on the flood protection bund, thus allowing water to flow from the Thangadzi into their fields. This second group was caught and arrested by police on charges of vandalism but there was not sufficient evidence that the crime had been committed by these men since the water had flowed over quite a number of plots that did not belong to any one of the three suspects. Further, the police had demanded to see the scheme regulations on use of water by non-scheme members and use them as a basis for assessing the accused men's case, but these documents are non-existent in the scheme.

7.7 Conclusion

The study found that while some of the ongoing efforts to develop irrigation, such as the rehabilitation of Muona Irrigation Scheme, were well intended, there was also a high risk that these could potentially reinforce some of the inequalities in resource access created by the establishment of the scheme in the seventies; ignoring the rights of Magreaver farmers' rights to . In the case of Magreaver in general and women farmers in particular which are the groups that initiated irrigation in Muona, exclusion from accessing water from the Thangadzi River water on the basis of these groups being classified as informal, is based on selective amnesia in which the weaknesses of past scheme designs. Water in these scheme is being managed by committees, but these face varying levels of capability in delivering water from

Key Messages

- *Water use efficiency does not appear to be a key consideration in water allocation.*
- *Carrying capacity of schemes is often exceeded.*
- *Attempts to share water equitably are difficult to achieve unless infrastructural dimensions such as levelling of fields, is done.*
- *Irrigation gives impressions of prolonged access to water. The poor delay planting due to ganyu, and therefore have diminished effective water accessibility.*
- *Farmers perform better-when they have secure water rights and operate within a fair and cooperative system.*

farmers. Challenges exist in ensuring farmer cooperation in canal maintenance, and lack of labour restricts this. Poor management of water in the downstream, and upstream activities that increase silt deposition into the irrigation chain, combine with plot level characteristics and farmer skills, gender and experience to produce access to water. Individuals in positions of power and privilege may be capable of controlling and accessing more water through preferential location and influencing decisions on water allocation. Schemes appear to have large farmer numbers and some are such that the carrying capacity is overstretched. In fact a common feature in most schemes was the absence of a water use efficiency plan. Having looked at both land and water access issues, we now turn attention to resources fir knowledge sharing, learning and farmer innovation.

8 KNOWLEDGE EXCHANGE, LEARNING AND FARMER INNOVATION

The study analysed the mechanisms through which farming information and knowledge were produced, shared and used by smallholder farmers. Of interest was to understand whether knowledge generated elsewhere could be applied in a different setting to enhance production levels and improve wellbeing. Additionally, we focused on farmers' capacities to innovate in response to everyday farming challenges, and the role played by relations of power in influencing knowledge exchange, learning and innovation.

8.1 Farmers' Access to Extension Services

Institutionally, the agricultural extension department within the Ministry of Agriculture and Food Security is the primary source of agricultural information and knowledge for farmers in Malawi. Regardless, very few farmers actually receive farming information and knowledge from the extension department, with most having to rely on village-based volunteers known as lead farmers, and NGO staff implementing development programs in the districts, for such information and knowledge. In the study area, for example, a team of ten extension officers is responsible for providing farming advice to over 14,000 farming households within Makhanga Extension Planning Area, implying a ratio of 1 extension officer for every 1400 farmers.

The extension department purports to be using a demand-driven approach, in which it is expected that a farmer requiring extension services should request for such services from the local EPA. This model, however, appears to disregard the fact that the majority of farmers are located some substantial distance from the EPA office and the extension department is poorly resourced to travel out to the farmers. While Muona had a resident irrigation officer, who was replaced by an agricultural extension officer in 2014, the scheme is located some 15km from the EPA office. Chitsukwa Irrigation Scheme is located some 6km from the EPA office. A majority of the farmers interviewed in this study appeared ignorant about the process of getting an extension officer to visit your field. A common narrative was that extension officers tended to visit fields of NGO-programme participating farmers only, because they were receiving 'something' from the NGOs running agricultural projects. One respondent interviewed in Muona noted the following:

> "*We never see extension officers here; they only go to those villages where an NGO is running a project because they know they get something. If you don't have an NGO operating in your area then (you should) forget that you can ever meet the extension officers*". Male farmer interviewed in Muona.

> "*They have sub-contracted their work to the lead farmers, who are simple farmers like us and need to work on their own farms. They should come down to the village*

and see what is happening, tell us where we are doing well and show us in areas where we are struggling". Community leader, Chitsukwa Irrigation Scheme

Thus, on the basis of the interpretation of these farmers, the NGO community has apparently dominated the demand on extension officers' time in favour of their target groups, with the rest of farmers having to make do with lead farmers wherever they exist.

As discussed earlier, interviews with officials at the district and national levels revealed the existence of some tensions between the Ministries of Agriculture and that responsible for Water and Irrigation development. At the level of the field sites, extension officers considered themselves to be only responsible for providing services to farmers in the drylands, and believe that the irrigation schemes should be managed by the Irrigation Department. However, the Ministry of Water and Irrigation Development in Nsanje only had two officers for the entire district. As a result, irrigation development was being managed by staff with both limited knowledge of the EPA-level politics and social systems, often leading to conflicts with farmers or poor design of projects, and limited presence on the ground. There are some reported instances where irrigation officers from the district office while attempting to mobilise communities around new irrigation schemes have instead been suspected of being land grabbers, and chased away by villagers. This silo approach to agricultural extension has even cascaded to the lead farmers, a network of village-based volunteers that have been trained to support farmers with farming information. Most lead farmers have been trained by the extension department and will not offer any advice or lead in new technology adoption under irrigation farming. This presents a lost opportunity in optimising on available human resources. It should be noted, also, that the curriculum through which most of the extension officers were trained did not encompass irrigation. Locally operating NGOs have been providing training to local extension officers in some EPAs in order to engage these for monitoring and providing support to farmers in their project areas.

8.2 The 'changing' nature of extension

Interviews in Nsanje revealed that despite the changes that have happened in the extension system, particularly the shift from a supply led to the demand-driven model adopted since 2000, very little change has been witnessed by farmers in terms of the nature of relationship between farmers and extension officers. During the Banda era respondents recalled receiving instructions directly from the President, who was also Minister of Agriculture, on the choice of crop and cropping calendar. Farmers were not permitted to plant certain crops that were seen to be of commercial nature as they had to concentrate on food crops. Even then, farmers resisted some of the technologies that were being promoted by the government. According to one respondent, farmers did not see much incentive in changing what they were doing because they still harvested very well regardless of whether they adopted or did not adopt the promoted farming technologies. One elderly respondent, a former extension officer himself, recalled that during his time group demonstrations were more common but uptake remained low because the rains were good and crop production was generally high. Farmers would learn from seeing their neighbours' gardens and emulating what they saw as working.

The government monopoly in extension changed with the increase of NGOs, which were moving into the district in response to challenges associated with Mozambican refugees, as well as climatic hazards such as droughts and floods. However, both the government and non-governmental extension systems appeared to agree that farmers' lack of education was impeding their ability to take up new methods and modernise their farming. They blamed farmers for being ignorant and too strongly rooted in 'traditional farming methods' which were not working. This attitude towards farmers is reiterated by extension officers at district and national levels who argued that:

> *"You cannot tell them anything, you cannot tell them what to do. These farmers are uneducated and that's the problem. They are too difficult to train".* Extension officer in Makhanga EPA

Extension officers in both government and non-governmental organisations appear to be deeply rooted in the thinking and attitude that 'farmers do not know' and that the so-called traditional farming is in need of modernising. Observations in the field confirmed that extension officers were more likely to network with younger farmers of their age range, and mostly those who appear to have gone to school but did not make it into agricultural training colleges, than with elderly farmers. These officers, however, have never sought to examine and understand why else, other than lack of education, farmers have not been taking up most of the extension messages they have been broadcasting.

8.3 Motivation for uptake of extension messages

Farmers in the two irrigation schemes were asked about the technologies they had taken up among those promoted by extension. Discussions with farmers on this subject revealed some challenges associated with the methods that were being promoted to farmers without regard to their resource availability, especially labour, and financial implications or profitability. For example, while there was consensus among farmers in Chitsukwa that mulching crops was a good practice for reducing water loss and improving soil quality, there was also recognition that communal livestock feeding was a higher priority and that mulch often introduced termite problems and led to thin stemmed plants that were prone to lodging (toppling over under their weight). From the perspective of both NGO and government frontline project staff, the challenge of inappropriate technologies stems from the 'scaling up of best practices' where technologies that have worked very well in one country or parts of the country are replicated even in areas where the context is not appropriate.

Conditions of drought and extreme dry spells are seen as major motivators of uptake of new technologies. One scheme committee member in Chitsukwa mentioned that following droughts, farmers are normally at their wits' ends and would 'accept anything that promises to prevent such a situation (i.e. food shortage) being repeated in the future'. Farmers are likely to take up new techniques, as was the case with the treadle pump following the 2005 drought that affected most of Malawi. In addition, local seed reserves especially of indigenous local seed are often depleted or totally wiped out in droughts and floods leading

farmers to be more open to hybrid or any seed that is available on the market, which they would in a normal season, refuse to take up.

Extension officers and farmers agreed that a system of maize planting called Sasakawa, where the planting intensity for maize is increased in order to maximise the number of plants per unit area while managing weed pressure, was seen as being one of the most successful in terms of adoption rates. The adoption has been so intense that any new technologies or farming methods have to fit in with the Sasakawa design, named after the Japanese NGO that trained farmers on this technology. Farmers have, without any extension involvement, come up with a smaller-bladed and shorter handled hoe to replace the traditional hoe that would otherwise be too large for the narrower inter-row space required with Sasakawa. The appeal of this farming method was that it was a small variation from the local practice of seeding maize in rows (before plant spacing was introduced by the government extension system) and therefore required minimal change even in labour demand. With this farming technology, the higher maize yield and flexibility to retain some practices such as mulching, use of tied ridges and other conservation agriculture techniques, makes Sasakawa popular with farmers. The main limitation, however, is that farmers find it difficult or have not modified the technology to allow for the cultivation of a second crop, such as a legume (groundnut, beans, groundnuts, etc.).

8.4 The lead farmer approach

Interviews with key government officials at national and district level attributed the shortage of extension officers has been attributed to a combination of loss of staff due to HIV/AIDS particularly in the 1990s and early 2000s, and absorption of some staff by NGOs, and general low numbers coming out of government agricultural training institutions. To make up for low staff numbers in the ministry, lead farmers have been recruited. Lead farmers are largely volunteers trained by extension officers and NGOs to provide a specific service of extending messages to farmers within their communities and demonstrating farming technologies that seek to improve productivity levels. They also provide local monitoring of projects and act largely as a local locus of change as they are also normally the first to take up new technologies. Lead farmers are not salaried but may sometimes receive some non-monetary 'incentives' such as t-shirts, farm inputs, and bicycles in rare cases. They attend regular workshops hosted by government and NGO projects and have the opportunity of learning new things ahead of their fellow village folk, thus giving them an advantage in access to information.

Lead farmers also receive allowances for attending training workshops. However, farmers in the communities in which the lead farmers live generally believe that they get paid for attending workshops. This belief creates animosity towards any information or new knowledge that the lead farmers may want to impart to their neighbours. A dominant narrative among respondents was:

"They attend all those workshops and get paid for that, and then come here and expect us to adopt whatever they bring for nothing (for no payment). That ship won't sail".

In response to such statements, the lead farmers argued that their attendance at workshops was at their cost and the allowance was hardly enough to offset the travel and accommodation costs:

"When I am out there attending workshops, everything in my fields stops. Can you imagine how much behind I will be after attending a one week workshop in Bangula right at the beginning of the season when my neighbours are already busy with land preparation or planting"? Male lead farmer in Muona

"*In irrigation farming every single day matters; every day that you delay planting puts you in danger of harvesting nothing*". Male lead farmer in Chitsukwa

"*It does take a lot of my time but I still do the work because we have been chosen to do the job, we have to abide by the needs of the extension officers*". Lead farmer in Muona

Lead farmers expressed concern over the timing of the training workshops, which was quite often at the onset of the farming season, or at times at the peak of the season when they had to dedicate all their labour to their fields. It appears that despite no financial benefit (as all the money received was expended in transport, food and lodging costs) lead farmers attended the workshops anyway in anticipation of potential benefits in the future and to retain and reclaim their positions as lead farmers. Their mere absence from the village to attend a workshop gave them a sense of importance among their peers although this sometimes meant diverting part of their households' finances to pay labourers to work on their fields in their absence. In cases where the lead farmers received some substantial stipend, some lead farmers reported having diverted part of the training stipend towards farm labour costs. Some lead farmers questioned why training workshops were not held closer to their home base, rather than in distant locations when all those present, except for the trainer, were from about the same location. A senior government official at district level argued that holding training as close to farmers as possible would allow the trainees an opportunity to do practicals in their own fields "instead of simulations conducted in hotel gardens" in the city.

Despite some community members expressing jealousy over the stipends sometimes issued to lead farmers, and being sceptical about their contribution to farming overall, some community members still expressed awareness that the lead farmers were filling a gap in extension services that the government could not, but were concerned about the fact that they were not being included 'on the government payroll'. Even if government was not able to put them on its payroll it had to, at least, sure recognition by making some small monthly token of appreciation for work done. Some lead farmers said they were spending three to

four days per week responding to request for assistance from farmers. When this issue was raised with extension, the response from one extension officer was,

> "*The problem with these lead farmers is that sometimes they get overzealous; they operate as though they were employed and then complain that they are being overworked. They should only be demonstrating the new methods on their fields and not doing the rounds in the villages. They want to feel important, to be seen to be having a job when they know they will not be paid. They (lead farmers) are examples from which other farmers should be learning*".

In one case of 'overzealousness' a female lead farmer was chased with sticks by the family of a male farmer she was trying to encourage on use of mulch. According to this lead farmer based in Chitsukwa, the man had argued that he would not use mulching because it would introduce termites into his field. The male farmer argued that she was too inexperienced in farming to offer advice that could be acted upon:

> "*Babies like you cannot advise us on anything. We have been farming even before you were born*".

The lead farmer who was in her mid-twenties felt it being her duty to convince the man to change to mulch-based land management because she wanted all the farmers in her block in the scheme 'farming the right way'. According to this lead farmer,

> "*I will not rest until all these farmers have changed their ways. That is my duty as a lead farmer*".

According to her, whenever a farmer gets the plant spacing 'wrong' she is supposed to tell them to uproot the plants. She says,

> "*Yes it is easy, I simply tell the farmer to uproot any wrongly placed plant. Standard planting is 25 by 25 centimetres for maize*".

Situating these incident in the wider arguments about the nature of extension and knowledge exchange in agriculture, the lead farmer demonstrated a lack of respect of the farmer's perspective and was working on the commonly held perception that farmers do not know and that their ways should be changed if there is 'anything new out there'. Perhaps the other dimension in this situation could be that of gender relations within the community, where women's agricultural knowledge is assumed to be inferior to that of men on the basis of 'traditional' roles within the agricultural sector.

Lead farmers appear to take up information imparted to them rather uncritically and practice as per instruction irrespective of whether these new methods are appropriate at field level. The problem with use of mulch is one such example. A male lead farmer argued that if termites were a problem then one needed to 'feed them with more maize residues' so that they would stay off the crop. However, in both Muona and Chitsukwa there appears

to be a shortage of grazing for livestock and use of mulch has reduced feed availability for livestock. Under communal grazing arrangements, maintaining crop residues until the following season is very labour intensive as the residues may have to be moved to the homestead and then back to the field at the beginning of the cropping season. By transferring the biomass (crop residues) the benefit to the soil was somewhat lost, and community relations between those owning and those without livestock soured in the case of Chitsukwa. In the case of this particular lead farmer, the maize in his field was being attacked by termites and several cobs were rotting on the ground, causing a pre-harvest loss. Other farmers who were not using mulch reported that keeping the soil consistently wet under mulching was not good for root development, plants under mulch often grew to be thin and tall as opposed to thick and sturdy, traits seen as desirable and more closely associated with larger cobs.

A Lead Farmer in Muona

John has been a lead farmer for three years now. He is educated up to secondary school and is frustrated that there are no jobs in the district; the only thing that was available for him was to become a lead farmer. He says the lack of rural employment is very frustrating because it means that there is no motivation for young people to stay in school.

> '*All the people I know who have been in school like myself are unemployed, and those that never went to school are prospering as business people. I wish the government and NGOs would offer certificates of attendance which I could count on to find a job elsewhere, but they (government) seem to want to retain us as lead farmers.*

According to John, there are some advantages of being a lead farmer. He gets exposed to many farming techniques way ahead of his peers in the village and as a result he is always ahead in terms of production levels. He has demonstrated some of these techniques to his neighbours and some of them have adopted them. John's dry land plot is located along a popular footpath and this makes whatever new technology or farming method he is using very visible. For example, two years ago when he started using a technique called minimum tillage, where one only tills where they intend to place the seed, he left his field untilled while everyone else around him had completed land preparation. Several people asked him why he was not tilling his plot and he explained. Several doubted that this would work, especially due to weed pressure, but were astounded when his crop came out well with large stems and very big cobs. His initially sceptical neighbour has been 'converted' and now practices the same, saving immensely on labour (which they divert to the irrigation scheme plots instead).

John complains that he inherited only a small piece of land and overall does not get to cultivate much land unless he rents some additional plots in the irrigation scheme. Sometimes he receives some bit of cash for attending workshops. It is meant for food and accommodation but he and his fellow lead farmers may survive of the bare minimum in order to make some savings.

At the moment, he is part of a group of farmers that has been trained in seed multiplication and if all goes well will soon be growing seed for the local seed rice market. John appears to be a very busy person; he has positions in four committees all operating within the GVH Chipondeni. From Monday through to Thursday he has something to attend to, and sometimes he meets up with fellow lead farmers to write progress reports for submission to the extension department at the EPA office. He feels as though sometimes he is dedicating too much time away from his farming to assist other people, some of which may never change their ways. John complains that in most government programmes one is lucky to get a soft drink, but with NGOs they sometimes receive allowances of as much as MK3000 per day. NGO opportunities are few. He feels that he is doing the same work as an extension officer, but the difference is that the extension officer gets something at the end of the month.

> *"Some farmers do listen, others don't. They think that because I am local, there is nothing I can tell them. They say, "You were born here, you cannot tell us anything"".*

John recently bought a solar panel for MK35, 000 and one of his cows gave birth to a calf. In total his household now owns four head of cattle. He is proud that he bought these cattle as fruits of his labour, and not through inheritance. Last year he bought a 0.1ha plot in the scheme. There is a new rice farming technique called SRI or the System for Rice Intensification, which is meant to boost productivity levels while reducing the input and water demand. John says he has no intention of trying SRI; he is a lead farmer in the dry land and is only concerned about making an impact in the dry land farming system. Perhaps if the technology proves itself to be beneficial he may be persuaded to take it up, but not until then.

It appears that despite their potential value in facilitating agricultural information sharing the lead farmers have only been weakly integrated into the irrigation schemes, particularly in Muona where they are nearly invisible. This has been partly a result of the extension department having a bias against irrigation activities on the one hand, and on the other, the need to retain power and authority at the block level by block chairpersons. In Muona, for example, it is the block chairpersons that have been charged with demonstrating the SRI farming technique to fellow block members on the basis that they are the leaders and others will learn from them. While this may work, the anticipated level of benefit for farmers will most likely be less than achieved by block chairpersons who are in most cases owners of land in strategic parts (near canals) and can access farm inputs on the basis of their social networks including scheme leadership and extension staff.

There are other challenges with the lead farmer approach. Principal among these is the lack of harmonisation of approaches in engaging lead farmers in agricultural and development projects in general which creates implementation bottlenecks on the ground.

While at district level development partners are coordinated through the District Executive Council (DEC), which allocates organisations to specific locations within the district on the basis of need, and in such a way that duplication is avoided, at local level the same partners appear to be poorly coordinated particularly with regards to engagement with lead farmers. There are some instances whereby NGOs and government projects operating within the same locale have targeted the same villages and engaged the same lead farmers. The difficulty arises where different organisations offer different incentives to ensure participation of lead farmers. For example, some NGOs were issuing bicycles to their lead farmers, while others only issued t-shirts or paid a small stipend for workshop attendance or for monitoring projects at the village level. Other NGOs however, operate under strict guidance not to 'pay' beneficiaries; the level of dedication of lead farmers on such projects is often very low and some of these projects have performed badly as a result. Even government extension staff were said to drag their feet when it came to non-per diem paying projects. These sentiments were echoed by government and extension officers particularly at the district level.

There was also some disharmony in the actual process of lead farmer selection. Some organizations tasked the village headmen to select candidates for this position, while others worked with nominations of suitable candidates by the community itself. Particularly in the former case, lead farmers were volunteered into those positions by their village headmen. In one particular case, such nomination had resulted in some tension in the village as a result of some villagers assuming that the position was 'a form of employment' which came with privileges. Other key government officials questioned the wisdom of NGOs taking the role of training government staff in agricultural issues, given that a substantial proportion of these NGOs have a limited history in agricultural development. A senior government official at the district level commented that:

"*Some of these NGOs have been doing water and sanitation or HIV/AIDS programmes; and the next thing one hears that they are running agricultural projects and they are training extension officers. Do they have the necessary capacity*"?

8.5 Knowledge Exchange

The study also examined the processes through which farmers were exchanging farming information and knowledge, and the effectiveness of these methods. In Muona, a new project seeking to promote a method of farming rice that requires fewer inputs, the System for Rice Intensification, is being piloted with block chairpersons taking the lead. According to the WUA executive, the block chairpersons are the 'fathers' within the blocks, from whom other farmers can learn and emulate new and improved ways of farming. The block chairpersons in Muona have been trained in the technology, including through visits to other irrigation schemes in Malawi, and will serve as technology demonstrators. The approach is that leaders should try the technology and everyone else can then subsequently learn from them through a cascading effect. A farmer in Muona observed that:

"*The block chairman should be convinced that the technology will work. Otherwise how will he convince farmers on his block?"*

There were mixed views on the effectiveness of this approach to training: one group of respondents argued that information or knowhow never really cascades and that those that receive training actually monopolise the knowhow and get ahead on their own. Those who have had the opportunity to provide *ganyu* to this elite club of highly placed people in the scheme were the ones that had the opportunity to gain new knowledge. Another group of farmers felt that it was sometimes difficult to emulate a technology that was tried with the richer people in the scheme, who also happened to have power over movement of water, had 'appropriately located fields' and cash to pay for the extra labour that came with such technologies as SRI. Proponents of the use of block chairpersons pointed out that targeting the technologies to people who had better resource access was an advantage to the rest of the farmers as they could avoid suffering damage should the promoted technology fail to work. In the 2013 to 2014 farming season, a selected group of the 'better' farmers were engaged in a seed multiplication project that, despite producing a lot of seed, failed dismally with tonnes of seed left unsold after the project failed to effectively link farmers to the markets, let alone understand the size of the market. Of the 80 tonnes of seed rice produced, only 250kg of seed were sold. In fact, SRI had the 'disadvantage' of reducing seed demand since it was being promoted as an input saving technology.

Farmers in the study area also pointed to *ganyu* as one of the main sources of agricultural knowledge and information. Of the 151 individuals surveyed with a household questionnaire 133 (88%) reported providing their labour as *ganyu*. Of those that provided *ganyu*, 62% reported that they had gained a new skill or new knowledge as a result of this.

The 'normal' practice is that the plot holder requiring *ganyu* services orients the labourers on how to prepare land and seed, on the basis of whatever training they would have learned, and these instructions are acted upon by the *ganyu* labourers.

8.5.1 Role of trust in knowledge exchange

While farmers have taken up a number of new farming methods, sometimes under pressure to benefit from free inputs that come with participating in some agricultural projects, it is clear that there have been some challenges with regards to the nature of the relationship between those that are seen to be sources of knowledge, predominantly the extension services, and the recipients, the farmers. Farmers noted that chief among their concerns is the apparent lack of interest in farmers that are not covered by NGO projects (where extension officers supposedly get some allowances for monitoring and assisting farmers). While extension officers lamented lack of motorcycles and fuel, and a large number of farmers per officer to contend with, farmers on the other hand held a view that the extension officers preferred to stay in their offices and send lead farmers via phone calls to do the work they were being paid for. Another dimension to mistrust was as a result of the frequent change in extension staff. One respondent mentioned that whenever the extension officer decides to visit, it is normally about introducing someone new and as soon as they believe they have built a relationship with that officer, they are moved to another district. Staff turnover was particularly high with the Irrigation department at the district level. Along with the issue of high staff turnover was a huge loss in institutional memory given relatively less rigorous data management systems.

From the perspective of the extension officers, mistrust of the extension officers was a result of the conflicting messages that they were sending to farmers. The issue raised in discussions with extension officers at both the EPA and district levels was that there was no single message from the government; the government was accommodating many donors who each had a different perspective on how to improve agriculture and the extension department was being tasked to pass on a mixed bag of messages. In one example, the extension officers had discredited the use of inorganic fertiliser which they blamed for damaging the soil in the long term (e.g. through salinization), but had to return to the same villages a few weeks later distributing inorganic fertiliser under the government's input support project, FISP. Similarly, some projects advocated for use of minimal tillage and concurrently the government was donating tractors for land preparation.

> "*We end up looking like liars because we always have to retract our statements. Now we may have to tell them that all these messages are coming from the top".* Interview with government extension officer

In the particular case of Chitsukwa Irrigation Scheme, farmers in the scheme raised the issue of 'resources going missing at the EPA' in reference to inputs destined for the scheme that they felt were arriving short of expectations. It emerged that there were adjustments to projects that were not communicated effectively with beneficiaries. This often led to suspicion of misappropriation by officers. In the case of Muona, farmers' representative through the WUA, held site meetings with the donor (in this case the IRLADP), the contractor, consultant and a government representative from the irrigation department to discuss works at the scheme. Any changes to the plan or adjustments were thus effectively communicated and such rumours of theft were uncommon.

8.5.2 Attitudes to farmers' knowledge

The extension department's attitude to farmers was predominantly one in which farmers were viewed as ignorant, stubborn and uneducated. Extension officers expect farmers to take up tried and tested methods from donors and research centres, and get very disappointed when this fails. However, farmers in both Muona and Chitsukwa suggested that some possibly useful technologies had not been taken up by farmers mainly because they required too much labour which most households could not afford.

At the same time the institutional make-up of the extension services appears to only acknowledge knowledge or information from sources other than farmers themselves. Farmers pointed out how they had modified soil fertility by adding inorganic fertiliser to manure and leaving this mixture to mineralise over a week before applying on soil. They refer to this mixture as *bokashu*, and argue that this mixture leads to earlier impact of fertiliser application than one would get with manure only where benefits of application are felt in the second and third years. The extension department has maintained that it cannot promote this technique without the approval, following scientific research, from the subject matter specialists within the government.

> *"We have told them to stop using that mixture; it has not been approved by our subject matter specialists. That's the problem with these farmers, you tell them what to do and they do their own thing*". Interview with government agriculture official

Extension officers' complaint about farmers' low usage of external inputs appeared ignorant of the issue of tenure arrangements, where some land owners refused that tenants apply fertiliser on their fields for the reasons discussed earlier. Other innovations that farmers had produced included modifications to the treadle pump to make it lighter to use through removal of some rubbers in the cylinder. This innovation dramatically increased the uptake of irrigation, far much more than any extension message would have achieved. The extension department has apparently failed to communicate the impact of the farmers'

modification in order to promote new designs that are more user-friendly. Farmers' innovation on the treadle pump led to a situation where the task of pumping could be done by one person while the other helped with managing the hosepipes. This saved substantial amounts of labour.

8.6 Gender Issues in Knowledge Exchange

There is a long history of gender-based exclusion in access to agricultural information and know-how in Malawi. A historical narrative from one respondent in Muona suggests that the colonial government, coming from a paternalistic society in Britain, had difficulties understanding the local culture of the Chewa and other matrilineal groups, in which women owned and controlled land. Irrespective of this, the colonial system trained predominantly male extension officers who tended to meet with and pass on farming knowledge to male farmers, who were in most cases not the owners of the land. Thus, male household members had preferential access to agricultural information and on that basis eventually developed power over farming decisions, thus weakening the women's hold to land. Over the years, more men have taken control of fields and more of them have cumulatively raised their power over the land that their wives owned.

Scheme registers or dry land field owner registers were often based on the name of the head of household, assumed to be the senior male member. Such recording of the names was often done without asking questions on to whom the land was entitled, or the nature of the partnership. When training workshops or meetings were called, it was also the same people on the record that got invited. Knowledge was thus imparted mainly to male members and they have enjoyed the privilege of being more knowledgeable, paving a way to monopoly in decision making.

The selection of lead farmers or general participants in agriculture-related activities often mirrored the land ownership registry. Village headmen and extension officers selected the lead farmers on the basis of the field quality of the candidate. In one particular incident in the scheme, a husband who had never set foot in the field had been selected to be the lead farmer despite the fact that his wife had done all the work to bring the family plot to that exemplary state. One woman in Chitsukwa lamented about this gender bias in selection of lead farmers, especially with regards to the use of the 'default landowner' in decision making regarding lead farmer selection, rather than on the basis of the main contributor to the field:

> *"I do all the work in our fields. My husband doesn't even come to this field because he is very busy with his fishing business. The village head saw this field and appointed my husband lead farmer, but he did not have an idea that I am the one who does all the work. Men are used to basking in their wives' hard work, they get to attend all the*

training workshops and meetings even though they come back and never do anything that they may have received training on. The extension people are only interested in dealing with the owner of the field, and most times that is not the woman".

The senior male member in the household was the individual most frequently invited to attend meetings. The justification for this was that culturally this was the appropriate way of doing things. One scheme leader in Muona explained that:

"*It is taboo to invite a woman to your meeting when the husband is there. It comes across as if you have some hidden intentions with her*".

Even on occasions where women were also invited their turnout was often very low particularly as a consequence of competition for their time with household chores. In this study, however, more than 50% of all women invited to focus groups turned up, although the figure was much less for the WUA meetings attended in Muona. Indeed the turnout was very low for WUA meetings, sometimes with less than 40 out of a possible 3000 farmers in attendance. In such meetings, the per centage of women would be in the region of 20%, with those present being senior members of the WUA and women with husbands employed in South Africa or deceased. Those charged with organising these meetings attributed the low attendance of women to lack of interest plus lack of time to attend meeting; women were said to prefer attending women only meetings, such as church or savings groups, or had too much work at home to spare time to attend WUA meetings. For some women there was no point in attending meetings if their spouses were also attending as this would take up time they would have otherwise devoted to other household or agricultural chores. One view raised by a women's focus group in Muona was:

"*There are too many meetings, there is always something happening almost every day. Women have too many tasks to attend to and most would rather not attend the meetings*".

A men's focus group viewed women's low attendance at scheme meetings as resulting from their low education levels, which made women less capable of holding positions within various committees where writing is a desirable skill, and therefore not have an incentive for attending. They also argued that low education levels meant that women found it difficult to understand what they were being trained on. One male respondent put it this way:

"*If you have not been to school then attending a training workshop would feel like torture because it's like being at school. Most of our women here did not go to school, and find learning difficult*".

Interviews with the women who frequently do attend scheme meetings indicated some frustrations faced in both training workshops and planning meetings. At the centre of their argument was the expectation of them to be 'women' rather than committee members in

these knowledge exchange or planning events. For example, these women argued that they often had to prepare food for guests or trainers in such events, leading to loss of actual time in training. The WUA committee in Muona professed lack of conscious awareness of these issues, and promised to improve in that area in the future. In fact, the WUA argues that it has been making a number of changes to improve the contribution of women in the running of the scheme. Where women felt that their opinions were not being considered seriously, the WUA has suggested that minutes of all points raised be recorded without attaching the name of the speaker, and then deliberated on to ensure that all voices are heard.

Female respondents in both irrigation schemes could access extension services as much as other community members, but the quality of interaction between the extension officer or lead farmer with female farmers was slightly diminished as women found it uncomfortable to be seen talking to a man. One woman respondent pointed out that she would try by all means to keep the conversation as brief as possible. This view of lead farmers and extension officers has been perpetuated by previous rumours of infidelity involving agricultural extension staff. In fact the high HIV/AIDS mortality among extension officers was suggested as proof of this problematic interaction between village women and officers (some of whom had families living elsewhere). Women whose husbands were fishermen were said to be more concerned about interactions with lead farmers and extension officers. None of the ten extension officers based in Makhanga EPA were female.

Working as *ganyu* labourers appears to have offered opportunities for learning. The farmer hiring *ganyu* labourers typically issues instructions on how he wants his or her land tilled and prepared and how the seeds or seedlings should be planted. In the process of executing such tasks, those providing labour also learn of new ways of farming thereby enhancing the transmission of information and knowledge among farmers.

> *"We do learn a lot from the fields in which we practice ganyu; I used to plant sweet potatoes on the flat until I observed that one farmer to whom I provided labour was using ridges and was harvesting more. I tried ridges on my field and have been using them ever since".* Female participant in FGD in Muona

8.7 Institutional Learning

In an effort to promote improved productivity in Muona, the IRLAD project has been building capacity among farmers in both production and scheme management aspects. Chief among these efforts has been to take farmers on learning visits to other irrigation schemes. A select group of farmers comprising mainly of WUA committee members and block chairpersons has visited other farmers to learn about seed multiplication and use of SRI in rice production. One observation made on their return from one of those trips was that they were highly motivated and anxious to copy some of what they had learned there.

Their new awareness of the layout of other schemes such as at Likangala raised these committee members' capability to critique the changes that were being implemented in their own scheme, as they now had a basis for comparison. For example, some farmers in Muona pointed out that relative to Limphasa, the outlet in the newly rehabilitated scheme was too small to supply the scheme, and the canals too shallow to ensure effective water distribution across the scheme. Following these field visits, feedback meetings appeared to involve those within the circles of the WUA committees, and there was no feedback passed on to the general members of the scheme. There appears to be no mechanism for mass-sharing of information across the scheme, and there is no documentation of these experiences. It was suggested that perhaps use of photographs and video could bridge the knowledge gap as information recipients often had to depend on descriptions given by those who would have travelled. In fact, there was hardly any information sharing between those who had and those who had not been selected to travel. A lady member of the WUA was selected to travel to India with farmers and extension officers from other districts in Malawi. The purpose of the trip was to learn about SRI and irrigation management in general. A key observation made by this WUA member was that there was a high level of uniformity in processes in the schemes in India, that farmers followed a strict calendar. However, although the lesson is very useful in principle, achieving uniformity in practices within Muona would be difficult given the high level of disparity in access to labour, land and water within the scheme.

8.8 Conclusion

Farmers face formidable challenges in accessing extension services, and mostly in terms of coverage. Inconsistent and conflicting government policy in agriculture leads to both confusion of farmers and mistrust of extension messages. This further worsens existing suspicions between these parties, in which the extension system has limited regard of local knowledge. The extension system has in some cases failed to appreciate local knowledge which appears to be rooted in local reality. Lead farmers are an important auxillary to the extension system, but there is lack of consistency in engagement, approach, and incentives

Key Messages

- *Technologies that do not result in additional labour requirement beyond present techniques are more likely to be taken up.*
- *There is mutual mistrust of both information and knowledge among farmers and extension officers.*
- *The cost of extension on locally based lead farmers need to be evaluated and appropriate and consistent incentive structures put in place.*
- *Mobility of farmers within the scheme and ganyu are unexpected avenues for knowledge exchange in the scheme.*
- *Women and men access agricultural information and knowledge differently.*
- *A crisis such as drought can be a necessary evil to trigger knowledge uptake.*

structure; in some cases over-engagement in these roles has created new forms of vulnerability.

9 CONCLUSIONS

9.1 The contribution of irrigation to livelihoods and incomes remains precarious

Irrigation has apparently contributed to improving the productivity of crops for smallholder farmers. Irrespective of this achievement, evidence presented in this study indicates that the livelihoods and incomes of farmers remain precarious. The gross margins for both maize and rice under irrigation do not indicate substantial financial profitability particularly for households that have to pay for labour access. Regardless, growing own food particularly under irrigation is preferable as it hedges against food price volatility and guarantees access to food. There is a notable absence of high value agricultural or horticultural crops, and much of this is due to poor linkages with markets and lack of knowledge on the existence of markets or production methods. Income generating potential of irrigation potentially requires inclusion of new crops or improvements in pricing systems for products and inputs.

9.2 Promotion of irrigation development is apparently at a cost to alternative livelihoods

The success of irrigation in improving productivity has been well-received by government and donor agencies, stimulating even higher volumes in funding resources in favour of irrigation development. While this appears to be in the interest of irrigation development, the irrigation centred approach appears to be weakly integrated within a broader framework for the development of the agriculture sector in general. Livestock development, for example, has been neglected at national and local levels resulting in conversion of grazing areas to irrigation and a serious undermining of livestock-based livelihoods. The result of land use change in support of irrigation at the expense of grazing has been conflicts over land use and, if not addressed by subsequent funding rounds, could exacerbate resource use conflicts and upset social networks through which people survive. Addressing challenges such as agricultural commodity pricing, extension support to farmers, markets and transport, among others, could benefit not only irrigation but other areas within and beyond irrigation. Land use change and implications for agriculture and other sectors needs to be known and tracked over time, and factored into planning for growth in agricultural and food demand. Policy stability and consistency within agriculture are both very low and are a threat to long term planning and investment in agriculture. Inconsistency in government position creates extension challenges.

9.3 Access and rights over land and water

Investments in physical infrastructure for irrigation have not been accompanied by equivalent efforts to improve clarity of water and land rights. Rights and responsibility of land and water are often unclear, resulting in conflicts. Attempts to resolve these conflicts may be affected by the overlapping of institutions and jurisdictions. Formalisation of institutions for governing land and water apparently result in some exclusion of some other farmers, particularly those not targeted by interventions. Lack of long term stability of tenure to land is a problem for soil fertility management and long term sector development. In terms of water, there appears to be very minimal attention paid to water use efficiency as a basis for sharing and using water. On the contrary, the focus on equitable distribution undermines success of irrigation in some sections of schemes, particularly those that have some geographical disadvantage such as uneven terrain. Despite irrigation being seen as an adaptation to climate change, there appears to be very minimal incorporation of climate change concerns in the design and management of irrigation at both national policy and scheme management levels. Furthermore, climate change will exacerbate water scarcity and affect irrigation development unless if sufficiently accounted for in planning.

9.4 Managing irrigation schemes

When schemes have been only partially rehabilitated, these efforts have raised expectations and resulted in disappointment. Support for irrigation development is increasingly provided through irrigation schemes managed by committees. While management has been devolved to the local level, various challenges such as high operational and maintenance costs, and the sheer scale versus management capability, mean that viability of these schemes is undermined unless external resources are supplied. Managing irrigation is affected by both the lack of uniformity in the scheme, particularly as a consequence of difference in ease of accessing labour, and challenges associated with discipline, e.g. farmers disregarding orders on the argument that the land is theirs and they can do as they please. The need to review the idea of delivering irrigation development through schemes perhaps needs to be reconsidered.

9.5 Development interventions

Irrigation development interventions are targeted at specific geographical locations. However, irrigation schemes where considered in isolation of the spatial, temporal and social dimensions are likely to fail because they remain connected to other places through, for example, the mobility of water. The study demonstrated that planning of irrigation development along political (e.g. district) boundaries could be less helpful than at catchment level where issues of siltation of rivers and subsequent effect on irrigation schemes can be considered and arrested timeously. There also appears to be challenges

with facilitating communication between upstream and downstream users, and lack of interventions and economic activity in the upstream undermines the success of livelihoods in the downstream. At the district level, donors and NGOs tend to focus on 'their scheme' and implement activities without paying much regard in some cases to the implications of those activities on non-beneficiaries of their interventions. Stronger accountability mechanisms at district level not mere box-ticking is required to ensure that interventions build on each other and support district priorities in a harmonised and coordinate manner with minimal transaction costs on government resources.

9.6 Adapting irrigation to climate change

In the face of rainfall uncertainties consistent with increased climate variability and climate change, irrigation has emerged as a viable option for enabling smallholder farming and one most preferred by both policy makers and frontline implementers. Evidence presented in this study has shown that despite irrigation being one of the most appropriate responses, there has been scant effort to ensure that irrigation based farming is adapted to climate change. In the irrigation schemes studied, and indeed in other large scale interventions for irrigation development implemented by the government, the impacts of climate change on water resource availability has not featured prominently, and local level evidence seems to suggest that no deliberate efforts have been put in place to both plan for and operationalise measures that will ensure viability of irrigation despite climate uncertainty. This could involve firstly, recognising that irrigation is only part of the solution and that it has to be adapted to climate conditions, and secondly, promoting a suite of measures aimed at managing water more efficiently. The latter could also involve setting up or strengthening the technical and social infrastructure needed to support adaptation to climate change.

9.7 Training and capacity development

Opportunities exist for equipping agricultural extension officers with irrigation knowhow so that they can more effectively contribute to agricultural development, rather than view irrigation development as a responsibility of the irrigation department. Intra- and inter-ministerial conflicts including relating to decisions about externally funded interventions, appear to get in the way of the development often leading to sabotage and economic loss. It is hoped that the merging of the ministries of irrigation, water and agriculture will foster closer collaboration rather than operation within silos. At the field level, lead farmers should likewise see themselves as agents of development overall and not align only with specific farming systems or partner organisations as this creates confusion locally.

Those seeking to build capacity appear to assume that farmers are not-knowledgeable and that their knowledge does not matter. Approaches such as those that depend on the trickle-down effect may allocate scarce resources to a few individuals and if assessment of transferability of information is not done or promoted then capacity building overall may be

a much slower process than envisaged. Targeting elite groups with information was shown to generate resistance to external knowledge, although this was at a very small scale.

9.8 Innovations for supporting irrigation development

Farmers in irrigation schemes are innovative both in terms of the hard (physical) and soft (institutional, social) dimensions and such innovations are driven by the need to reduce labour demand, attend to the challenge of lack of availability of support services and ensure continued and reliable access to land and water for irrigation. Innovative market systems such as payment for labour based on the price a bucket of maize on the day work is done, for example, has allowed labourers to hedge against food price inflation given the very volatile maize price situation. Some innovations that are seen to threaten equitable access to land and water, such use of motorised pumps, have been resisted by farmers. Farmers appear to lack a supportive agricultural extension service that values farmers' local knowledge and innovativeness, and a research and technical support services that can assist farmers in tackling issues faced in uptake of new innovations. Introduction of new farming techniques could consider following a less formal approach that would allow farmers to modify the techniques and identify one that works in specific farmer conditions.

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