Trends and Outlook: Agricultural Water Management in Southern Africa

COUNTRY REPORT MALAWI

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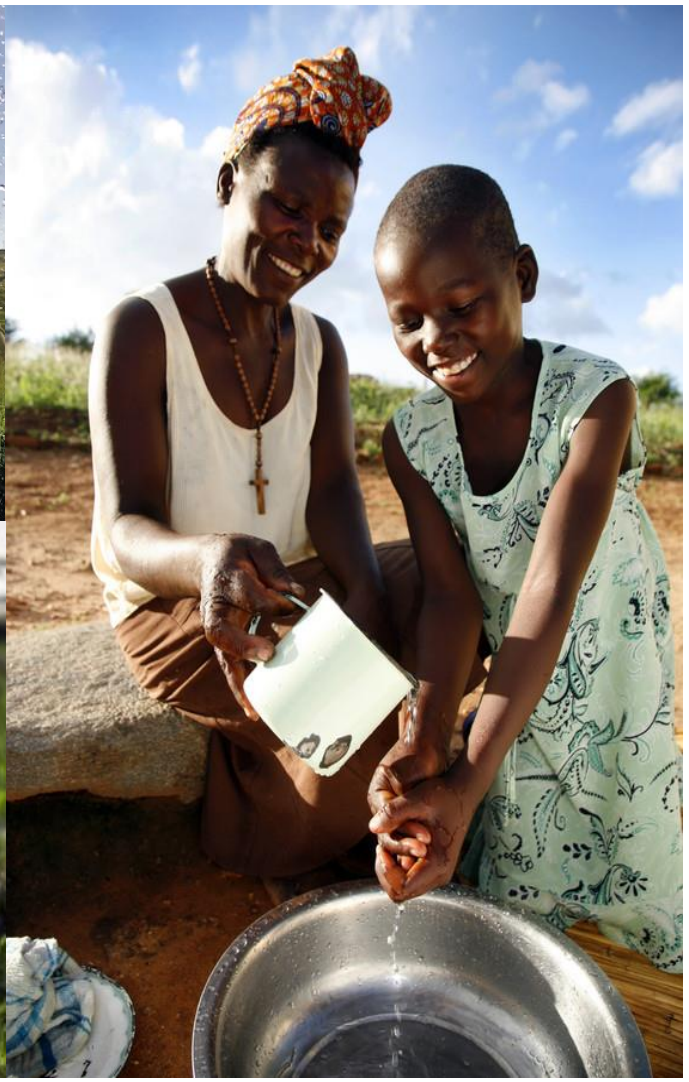
2015



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Acronyms

AU	African Union
AfDB	African Development Bank
ALSP	Agricultural Infrastructure Support Programme
BADEA	Arab Bank for Economic Development
CAADP	Comprehensive African Agricultural Development Program
COSPE	Cooperation for the Development of Emerging Countries
DANIDA	Danish International Development Agency
EU	European Union
FANR	Food, Agriculture and Natural Resources [Division}
FAO	Food and Agricultural Organization of the United Nations
FISP	Farm Input Subsidy Program
GDP	Gross Domestic Product
ha	hectare
HDI	Human Development Index
HORTCUM	Horticulture Cooperative Union of Malawi
IFAD	International Fund for Agricultural Development
IMT	irrigation management transfer
IRLADP	Irrigation Rural Livelihoods and Agricultural Development Programme
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
KCG	Kasinthula Cane Growers Limited
MAFS	Ministry of Agriculture and Food Security
MAI	Ministry of Agriculture and Irrigation
MAIWD	Ministry of Agriculture, Irrigation and Water Development
MFDP	Ministry of Finance and Development Planning
MGDS	Malawi Growth and Development Strategy
MIDSUP	Malawi Irrigation Development Support Programme
MIWD	Ministry of Irrigation and Water Development
MK	Malawi Kwatcha [currency]
MLHPPS	Ministry of Lands, Housing, Physical Planning and Surveys
MoDPC	Ministry of Development Planning and Cooperation
MYP	Malawi Youth Pioneers
NEPAD	New Partnership for Africa's Development
NGO	non-governmental organization
NIPDS	National Irrigation Policy and Development Strategy
O&M	operation and maintenance
PPP	Public Private Sector Partnership
RAP	Regional Agricultural Policy
ReSAKSS – SA	Southern Africa Regional Strategic Analysis, Knowledge and Support Systems
RSAP IV	Regional Strategic Action Plan IV
SADC	Southern African Development Community
SCMP	Smallholder Crop Production and Market Project
SFIP	Small Farms Irrigation Project
SUCOMA	Sugar Corporation of Malawi
USAID	United States Agency for International Development
WR	water resource

Acknowledgements

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1 Introduction

1.1 Agricultural water management for poverty alleviation and sustainable growth

About 70 percent of citizens of the Southern African Development Community (SADC) depend on rainfed agriculture for their livelihoods (SADC 2003). Moreover, enhanced and sustainable development of this sector is the engine of improved economic growth, socio-human development, food and nutrition security and alleviation of poverty (SADC 2014a). Broad-based agricultural growth with agriculture-based industrialization can replace the extractive, capital-intensive and often 'jobless growth' path as currently persists in SADC's dual economies. Inclusive agricultural growth not only contributes to national food security at affordable prices, export and foreign currency; it also creates employment for the rapidly growing new generations, narrows the wealth gaps, and stabilizes SADC's young democracies.

However, rain fed agriculture is directly exposed to the hazards of climate. SADC's rainfall patterns are characterised by high and unpredictable variability over the seasons, years, and decades. Moreover, Southern Africa is predicted to warm up faster than the rest of the world (IPCC, 2014). It is one of the few regions in the world that will experience significantly drier conditions, more extreme and unpredictable dry spells, droughts, and floods, while sea levels will rise faster here than elsewhere. These increased temperatures and less predictable, more variable extreme events hold SADC's farmers and economy 'hostage to hydrology'. This is also true where average rainfall is abundant. These predictions of long-term climate-induced changes render the need for 'no regret' measures today even more urgent.

A key 'no regret' measure that turns these climate hazards into opportunities is improved agricultural water management, or 'agwater management'. Agwater management encompasses a broad menu of techniques ranging from improved on-field water harvesting and soil moisture retention to year-round water storage for year-round fully controlled irrigation of crops, trees and livestock feed; improved water supplies for livestock; and the development of fisheries and aquaculture. Agricultural water management was a vital component in Asia's Green Revolution to boost the 'trickle-up' growth path through poverty alleviation (Jazairy, 1992).

The CAADP of the African Union's (AU's) New Partnership for Africa's Development (NEPAD) recognized this unlocked potential throughout Africa by prioritizing the first of its four pillars, that of 'Sustainable Land and Water Management'. In pillar one, African states committed to the doubling of irrigated area from the 3.5 percent at the time to 7 percent by 2015 (CAADP 2009).

SADC's Regional Indicative Strategic Development Plan (2003, revised in 2007 and 2015) re-affirms CAADP goals, including pillar one. SADC operationalizes this through both its Water Division and the Food, Agriculture and Natural Resources (FANR) Division. The SADC Regional Agricultural Policy (RAP) (SADC 2014a) envisages the improvement of the management of water resources for agriculture (SADC 2014a, section 10.5). In the results framework, outcome 1.4 foresees that water infrastructure for agriculture is expanded and upgraded. The RAP commits to assess the effective utilisation of existing irrigation infrastructure and to promote new infrastructure development (SADC 2014a, section 16.1 (75)). In terms of monitoring, the RAP results framework signals the need to provide baseline data on the number of dams, irrigated area and irrigation management practiced in the SADC region (SADC 2014b).

The Regional Strategic Action Plan IV (RSAP IV) (SADC 2015), which is based on the SADC Water Policy (2006) and Strategy (2007) aims at 'An equitable and sustainable utilization of water for social and environmental justice, regional integration and economic benefit for present and future generations'. Noting that there is about 50 million hectares (ha) of irrigable land available within the SADC Region of which only 3.4 million ha (7 percent) is currently irrigated, the RSAP IV emphasizes the importance of infrastructure development and water resource management for food security in the water-food nexus, and the stronger urgency to take action in the view of climate variability and change. RSAP IV also highlights the benefits of multipurpose dams for both energy and irrigation. At local level, SADC Water commits to conduct action-research to develop and sustainably implement resilient water-related infrastructure; and to innovate affordable and appropriate technologies and innovative approaches and practices. Priority interventions are the demonstration and upscaling of community-based water for livelihoods projects (SADC 2015).

1.2 Trends in irrigated area

In spite of the major unlocked potentials and strong policy commitments, the average percentage of arable land in SADC has only slightly increased from 7.6 percent in 1990 to 8.4 percent in 2012 according to the Food and Agricultural Organization of the United Nations (FAO's) AQUASTAT (see Figure 1). A peak was reached a decade earlier. Moreover, the high average percentage of irrigated land is largely the result of irrigation by large-scale agribusiness in only four countries (Madagascar, Mauritius, South Africa and Swaziland). Moreover, both smallholder irrigation in South Africa and irrigated land area in Madagascar declined.

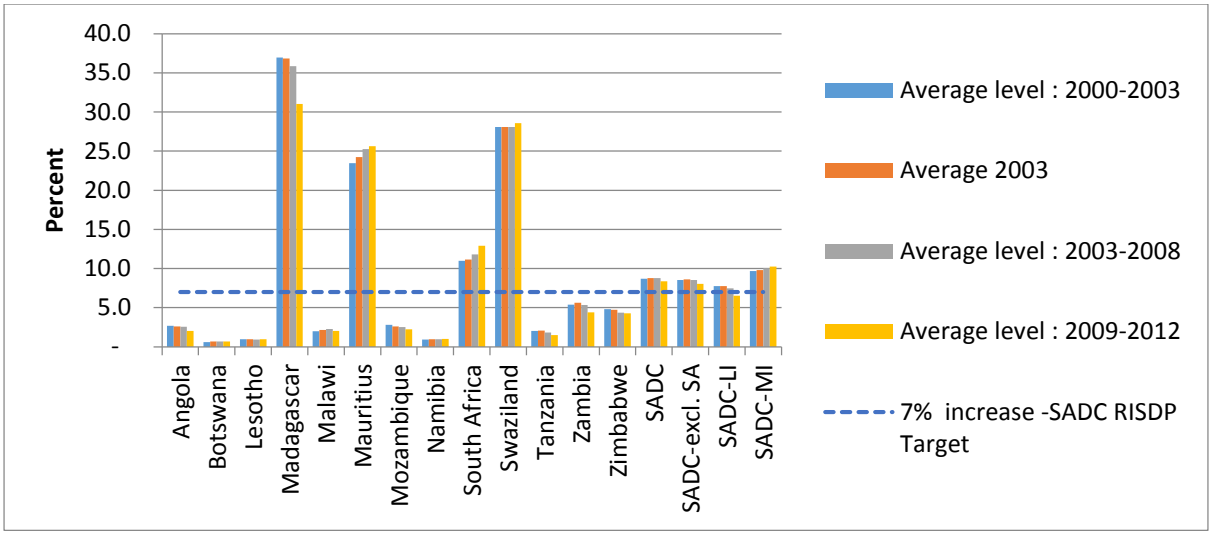


Figure 1: Irrigated area as proportion of arable area
Source: FAO AQUASTAT

This raises a pertinent question: why is irrigation expansion stagnating, and how can this be turned around? Unfortunately, there is no systematic regional body of knowledge to analyze these trends and provide answers. As the Regional Agricultural Policy observes, there is not even a base line on irrigation management practiced in the region, neither for the upgrading of existing infrastructure nor for new investments.

Moreover, in spite of the clearly related common goals of the Water and FANR divisions in SADC and in national states, forums to bring these sectors and other relevant stakeholders together are rare. Potential synergies between sectors that would allow each sector to better achieve its goals remain untapped.

The present study on 'Trends and Outlook: Agricultural Water Management in Southern Africa' seeks to fill these gaps. The project is part of the ReSAKSS – SA project, implemented by the Southern Africa Regional Program of the IWMI. It is supported by USAID's Feed the Future Program through USAID's Southern Africa Regional Program. At the interface of both water and agriculture, the IWMI is well placed to enable such dialogue and provide a robust knowledge base on inclusive agricultural growth in general, and agwater management in particular.

1.3 Study aim and method

In order to explain the current stagnation and find ways to overcome this, the following questions will be answered:

- What are the precise hydrological hazards of climate variability and change, and what is the meaning of 'water scarcity' for agriculture in SADC?

- What lessons can be learnt from past and current investments in agwater management in SADC, in particular from their strengths and weaknesses in sustainably contributing to poverty alleviation, food security and agricultural and economic growth?
- How can SADC and national government, non-governmental organizations (NGOs) and donors build on these strengths and overcome weaknesses?
- What are the untapped synergies between the public sector agencies with mandates in agriculture and those with mandates in water management, so that both sectors can achieve their goals more effectively?

The method to answer these generic questions consisted of both an extensive literature review and analysis of past performance (Mutiro and Lautze 2015), as well as interviews with key stakeholders at SADC and national levels. Further national studies with illustrative in-depth case studies were conducted in four selected countries: Malawi, South Africa, Zambia and Zimbabwe. This report is the Country Report for Malawi.

The Synthesis Report and the four country reports of the Trends and Outlook: Agricultural Water Management in Southern Africa Project are available at www.iwmi.org - Southern Africa Regional Program.

1.4 Definitions and research approach

Agwater management encompasses a wide range of interrelated hard- and software measures to ensure that the right quantities of water of the right quality reaches the right sites of agricultural (and other) uses at the right time. Improved water control enables crop diversification, stabilizes and increases crop yields, and enables more cropping seasons, including the slack and hunger seasons. Storage in dams or in 'green infrastructure' (such as recharged aquifers or managed wetlands) attenuates floods. Hardware typically includes (combinations of) infrastructure to harvest and store precipitation and run-off water by recharging aquifers, to convey and apply water, and to drain excess water. This study focuses primarily on water supply to crops through infrastructure that extends beyond in-field soil and water conservation alone.

There are various classification systems of agwater management – and even more blends: by source (well, surface storage, stream, wetland, groundwater); by technology (which often determines the scale as well); by ownership and/or management either by individuals or communal groups; by plot size and/or scheme size; by goal of investment and type of beneficiaries (household food security; marketing); by formal or informal in terms of formalized, written and state-backed rules; whether privately invested in capital costs and/or operation and maintenance (O&M), and rehabilitation, or by government, NGOs or otherwise; etc.

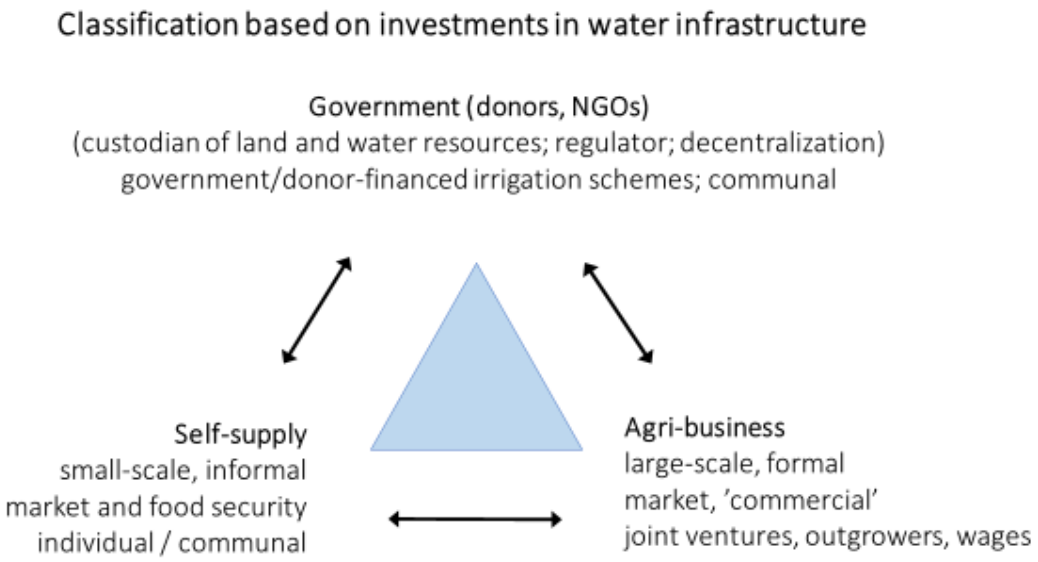


Figure 2: Classification of types of investments in irrigation based on types of investors

For the present purpose of learning lessons for investments, we build on the latter; so the main criterion to distinguish the different types of irrigation is: who is the main investor in the construction and installation of infrastructure? Capital costs are usually the most expensive part of irrigation. Moreover, claims to the water stored and conveyed tend to go together with investments in the infrastructure and subsequent maintenance ('hydraulic property rights creation') (Coward 1986). As we will see, although their performance varies widely, each type is quite specific in terms of the historical and political-economic context in which it emerged and continues to exist, and its strengths and weaknesses in contributing to poverty alleviation and socio-economic growth.

The first type of irrigation investments are by governments, both before and after independence. International donors and financers typically work through governments, while most NGOs also work in close collaboration. Government- or NGO-financed schemes are typically collective schemes. They may be accompanied by resettlement at local or wider scales. The involvement of government can range from very strong (in government-run schemes) to a role that is limited to design and financing of the infrastructure construction and sometimes rehabilitation, leaving all other tasks to communities. In addition to investing in infrastructure, governments also play unique roles as regulator and custodian of the nation's land and water resources in SADC's evolving resource tenure systems. Governments influence the next two types of irrigation in both capacities.

The second type of irrigation investments are by citizens – also known as self-supply – where citizens are the key investors in infrastructure for their own benefits. That is done by

individuals or groups, and often is seen as informal. Adaptation to climate variability through these investments has been at the heart of agrarian societies' survival since time immemorial. One strategy for people is move to and from water through their settlement patterns. Both farmers and pastoralists look for the better-watered areas with better rainfall and fertile soils throughout the seasons, also using receding floods and water that accumulates in valley bottoms or entire floodplains for dry season cropping and grazing. People's other age-old strategy is to make water move to them, which requires investments in infrastructure. Household wells provide groundwater for domestic uses, livestock, and small-scale production at and around homesteads. Free gravity energy has long been tapped in mountainous areas in river-diversions, sometimes with night storage. These are typically for domestic uses, irrigation, brick making and other uses. The availability of new appropriate technologies boosts innovation. Multi-purpose infrastructure is the rule; single uses are the rare exception, because rural (and peri-urban) people have multiple water needs, and multi-purpose infrastructure is more cost-effective. People also use and re-use the changing multiple water sources for greater environmental resilience.

The public sector plays a role in supporting technology development and uptake, for example by stimulating market-led equipment supply chains. The Regional Agriculture Policy (SADC 2014a) promotes the removal of import tariffs on equipment for that reason. Effective forward and backward linkages as a result of broader agricultural support for inputs, marketing and skills development are a key 'pull' factor to convince farmers to invest in infrastructure. Further, government's land and water policies, laws and regulations also affect investments for self-supply.

The third type of investments in infrastructure are those by agri-business. Colonial settlement and state formation was largely shaped around this type of investment, and it forms the basis for SADC's dual economy of highly mechanized, often export-oriented large-scale farming; alongside largely manual smallholder agriculture, lack of electricity, poverty and unemployment. The financial crisis of 2008 fuelled further foreign or national investments in SADC's abundant land and related water and mineral resources, also dubbed as 'land and water grabs' (Mehta, 2012). Governments play key roles in these investments through their national investment policies, public-private partnerships and, especially, their post-colonial custodianship of both land and water resources.

The present report discusses the findings of the country assessment in Malawi. Section two describes the context of Malawi. Section three examines the nature of water resource availability and variability in Malawi, and the meaning of 'water scarcity', current water uses and the still untapped potentials for irrigation expansion. Section four traces the trends since pre-independence, in particular with regard to the dominant investor: government, later assisted by donors and NGOs. From an era of top-down authoritarian government-run schemes, Malawi opted for irrigation management transfer of existing schemes and 'self-

help' for new often sophisticated schemes, to participatory irrigation development with a strong focus on affordable small-scale technologies and, increasingly, the recognition of smallholders' own investments. Section five discusses water reforms. The case study in Section six: the self-help Ngolowindo scheme (17 ha) reflects these changes and the intrinsic risks. Section seven presents the case study of Tapempha Fam (10.5 ha) illustrating the growing trend of individual smallholders' investments in infrastructure for self-supply. Conclusions and recommendations are given in Section eight.

2 Context of Malawi

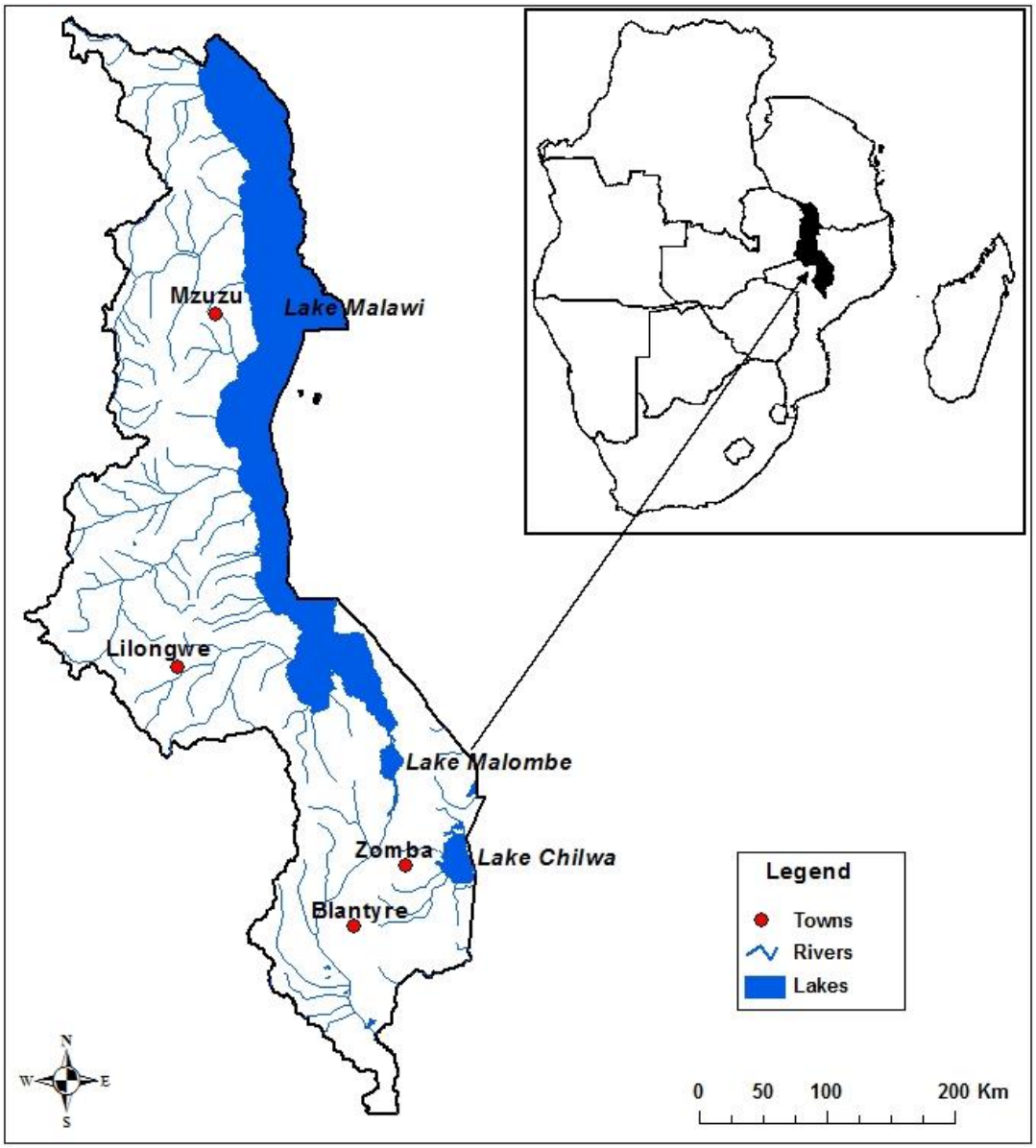


Figure 3: Map of Malawi and its location in Southern Africa

Malawi (see Figure 3) remains one of the poorest countries in the world. Its Human Development Index (HDI) of 0.414 ranked the country at position 174 out of 187 countries in 2014. Agriculture continues to be the backbone of Malawi's socioeconomic development, and it has remained the highest contributor to the Gross Domestic Product (GDP) since Malawi became independent. The Ministry of Development Planning and Cooperation (MoDPC) (2011) reported a contribution of 27.6 percent in 2011 (Figure 4). The agricultural sector also contributed 90 percent of foreign exchange earnings and 80 percent of the labor force, apart from accommodating 85 percent of the total population living in rural areas. Hence, the growth of this smallholder subsector is vital for the country's agricultural and socioeconomic growth.

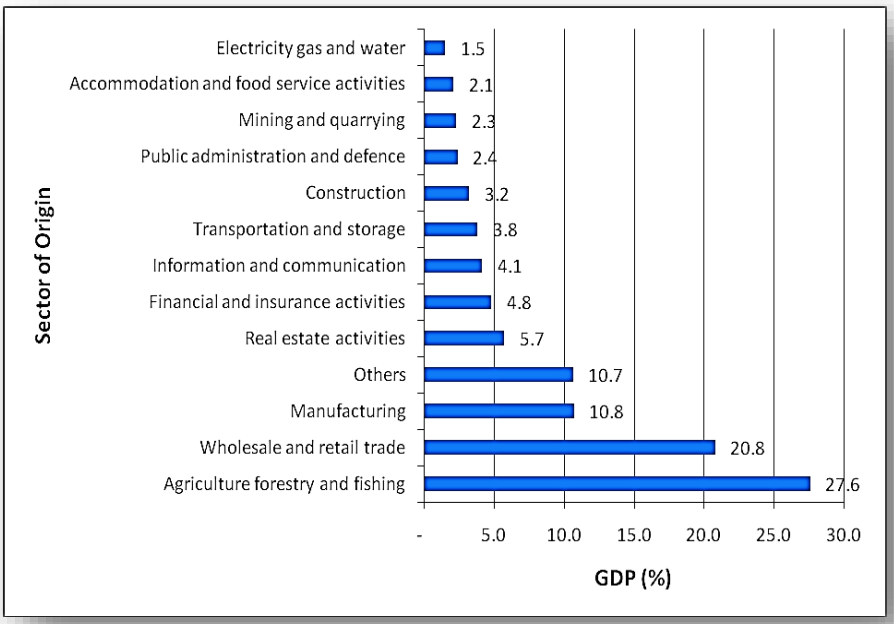


Figure 4: Real sector contribution to GDP in 2010
Source: MoDPC 2011

Land distribution is unequal. The country's 30 000 estates cultivate between 10 and 500 ha, with a total of 1.2 million ha, or 16 percent of cultivable land. Settlers developed these estates in the colonial era. At independence in 1964 ownership shifted to government and its officials. About 600 000 ha of estate land has remained underutilized and is, in principle, designated for redistribution according to the 2002 Land Policy (USAID undated). In contrast, 58 percent of smallholders cultivate less than one ha; 11 percent of them are landless or near-landless. With an annual population growth of 2.8 percent, from 4 million in 1966, population has grown to more than 16 million, a fourfold increase in 50 years, and smallholder farm sizes have became even smaller.

Agriculture is regarded as a number one priority in the Malawi Growth and Development Strategy II (MGDS II) to boost incomes and food security and alleviate poverty (MFDP 2011).

Government and donors are agreeing that by focusing and concentrating efforts on agricultural development, Malawi would significantly reduce poverty and enhance economic growth. This stand has been substantiated with the results of the Farm Input Subsidy Program (FISP) that the government has implemented since 2005. FISP, combined with good rains, has led to significant increases in maize production from 1.2 million metric tons in 2004/05 to 3.4 million metric tons in 2009/10. The renewed emphasis on agricultural sector has transformed Malawi from a net importer to a net exporter of maize, and allowed the majority of households to attain food security since 2005/06. It has also led to low and stable maize prices - very important in a country where the majority of households are net consumers, and food accounts for over 60 percent of household income (MAFS 2011). Since then, the country has managed to have a food surplus every year (Table 1).

Table 1: Food surplus/deficit 2006-2011

	Season				
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011*
Surplus (Metric Tons)	1.3	0.3	1.3	0.8	1.1

*Source: MAFS, 2011; * based on April 2011 Second Round Crop Estimates*

In order to increase the agricultural productivity, irrigation has been given policy priority number two. Most of agricultural sector's contribution to GDP has been heavily dependent on rain that exposes farmers to rainfall vagaries, droughts and floods. Climate change is predicted to increase temperature and exacerbate unpredictability, variability and extreme events. With increasing land pressure and climate change, a growing number of Malawian smallholders is increasingly turning to irrigated agriculture as a means to intensify production on smaller plots.

Currently, only a tiny fraction of arable land is irrigated. Arable land in Malawi is estimated at 4 million ha. Of the 4 million ha, 90 563 ha represents 2.3 percent (the estate and smallholder subsectors combined) of the total arable land irrigated in 2010. This comprised 48 382 ha under the estate subsector and 42 181 ha under the smallholder subsector. The irrigated estate subsector accounted for 1.2 percent of total arable land, while smallholders' irrigated land accounted for 1.1 percent of the total arable land. The next section examines whether water resource availability is sufficient for further expansion, and the implications of water resource variability (MAIWD 2012).

3 Water resource availability and variability under climate change and irrigation potentials

3.1 Average water resources availability

This section discusses overall water resources, which are abundant in Malawi, but also the strong variability and unpredictability of water resources over space and time, which will be exacerbated under climate change. This implies short seasonal cropping seasons and major risks to dry spells and floods. These risks discourage high-input agriculture as losses are insurmountable for short-term survival. This underscores both the strong potential and the strong need for agwater management solutions that lead to better control of water through storage, conveyance and drainage of water.

Annual rainfall and run-off averages show that overall water resources are abundant, ranging from 725 mm to 2 500 mm. The resulting mean annual runoff of Malawi, minus evaporation, is estimated at 588 m^3/s or 18 480 x 106 m^3. The mean annual runoff over the land area of the whole country is 196 mm (i.e. an equivalent of 588 m^3/s), and this constitutes 19 percent of the mean annual rainfall.

As shown in Table 2 the total renewable water resources are estimated at 17.28 km^3/year. External renewable resources are inflows into Lake Malawi from Tanzania and – to a lesser extent – from Mozambique. These inflows are slightly higher than Malawi's own inflows. Unused water on 94 percent of Malawi's land area and from Lake Malawi drains as environmental flows through the Shire River into the Mozambican part of the Zambezi river. The remaining 6 percent of Malawi's land drains into the small internal basin of Lake Chilwa.

Only 2.5 km^3/year of rainfall recharges aquifers and becomes groundwater. There are two main aquifers in Malawi: the extensive Precambrian weathered basement complex (which has yields only up to 2 l/s) and the quaternary alluvial aquifers of the lakeshore plains and the Lower Shire Valley (which are higher yielding, up to 20 l/s). Small-scale groundwater abstraction currently forms a significant part of the rural water supply system, both for domestic consumption and livestock. This is likely to continue across much of the country. However, due to its relative scarcity in comparison to surface water resources, combined with the low overall yield of aquifers as a whole and of boreholes individually, groundwater resources are unlikely to play a significant role in further agwater management investments.

Table 2: Total renewable water resources

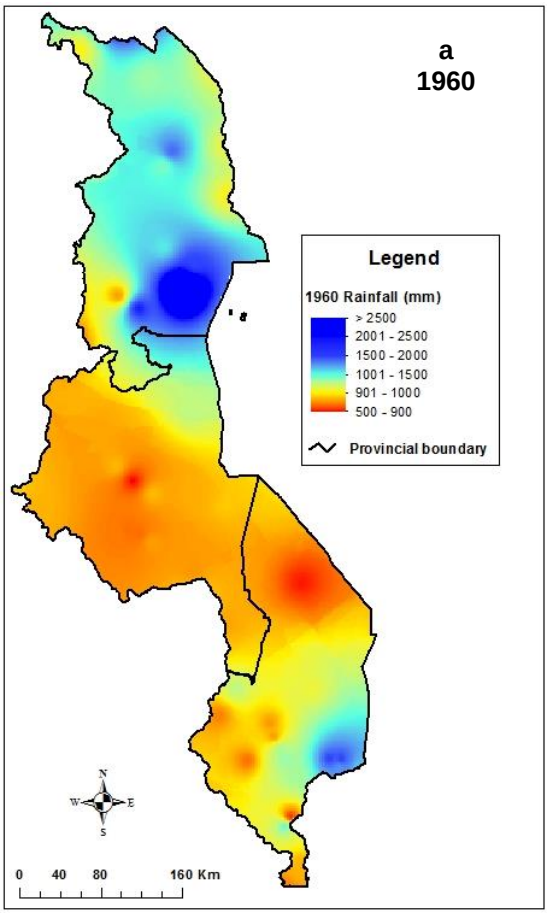
		Unit	Year	Source
Renewable water resources				
Long-term average annual precipitation (depth)	1 181	mm/year		
Long-term average annual precipitation (volume)	139.9	km^3/year		

		Unit	Year	Source
Internal renewable water resources	16.14	km³/year		
External* renewable water resources	1.14	km³/year		
Total renewable water resources	17.28	km³/year		
Renewable surface water resources produced internally	16.14	km³/year		
Renewable groundwater resources produced internally	2.50	km³/year		
Overlap between surface water and groundwater resources	2.50	km³/year		
Dependency ratio	6.597	%		
Total renewable water resources per capita	1 015	m³/year	2012	MoAIWD
Total dam capacity	0.0418	km^3	2010	MoAIWD
Water withdrawal				
Agricultural water withdrawal	1.166	km³	2012	MoAIWD
Municipal water withdrawal	0.148	km³	2012	MoAIWD
Industrial water withdrawal	0.0477	km³	2012	MoAIWD
Total water withdrawal	1.357	km³	2012	MoAIWD
Total water withdrawal per capita	99.86	m^3	2012	MoAIWD
Surface water withdrawal	1.005	Km³	2012	MoAIWD
Groundwater withdrawal	0.47	Km³	2012	MoAIWD
Total freshwater withdrawal	1.475	Km³	2012	MoAIWD
Total freshwater withdrawal as % of actual renewable WR	7.853	%	2012	MoAIWD
Agricultural water withdrawal as % of actual renewable WR	6.748	%	2012	MoAIWD

3.2 Climate-induced water resource variability

While annual averages indicate high water resource availability for further storage, conveyance and drainage, the rainfall pattern is erratic. This poses one of the biggest threats to agricultural production and economic growth. Malawi's sub-tropical climate is seasonal. The hot-wet season stretches from November to April, during which on average 95 percent of the annual precipitation takes place. The months stretching from December to March are characterised by hunger as food reserves from the previous season run out. In the dry winter season from May to August the mean temperatures vary between 17 and 27°C, with temperatures falling. Frost may occur in June and July.

In addition to uneven temporal distribution, spatial distribution is also highly uneven. Annual average rainfall varies from 725 mm to 2 500 mm with Lilongwe having an average of 900 mm, Blantyre 1 127 mm, Mzuzu 1 289 mm and Zomba 1 433 mm. Moreover, both variability and unpredictability of rainfall are very high. The variability and spatial distribution of annual rainfall is shown in Figure 5 for six different years (1960, 1970, 1980, 1990, 2000 and 2007) in maps a, b, c, d, e and f respectively.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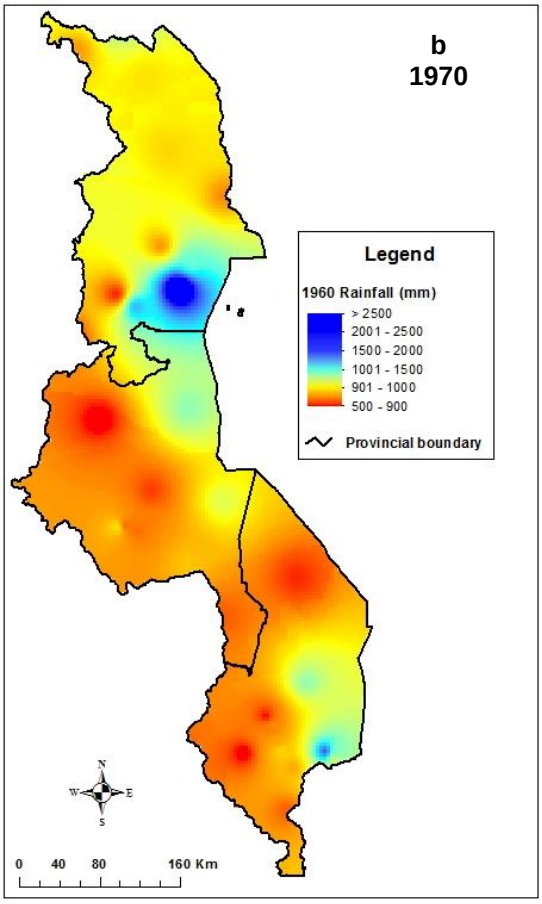
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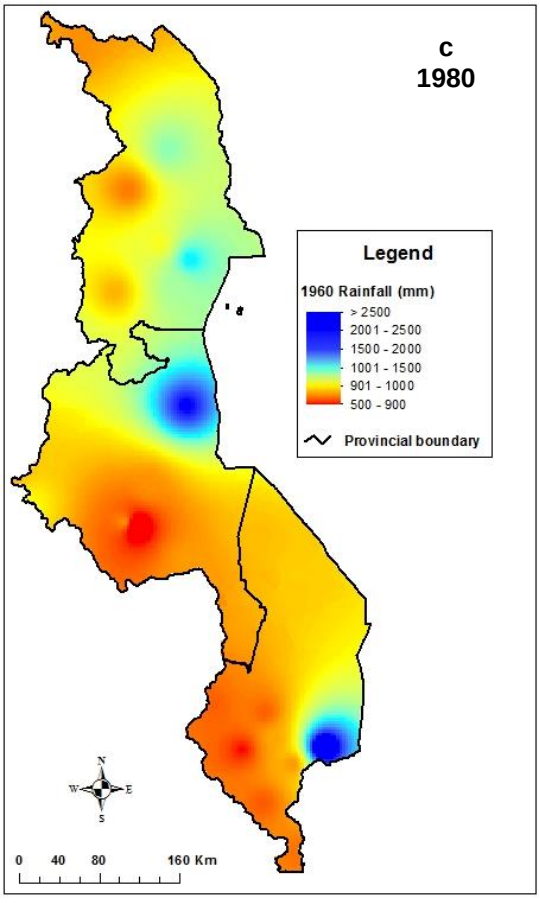
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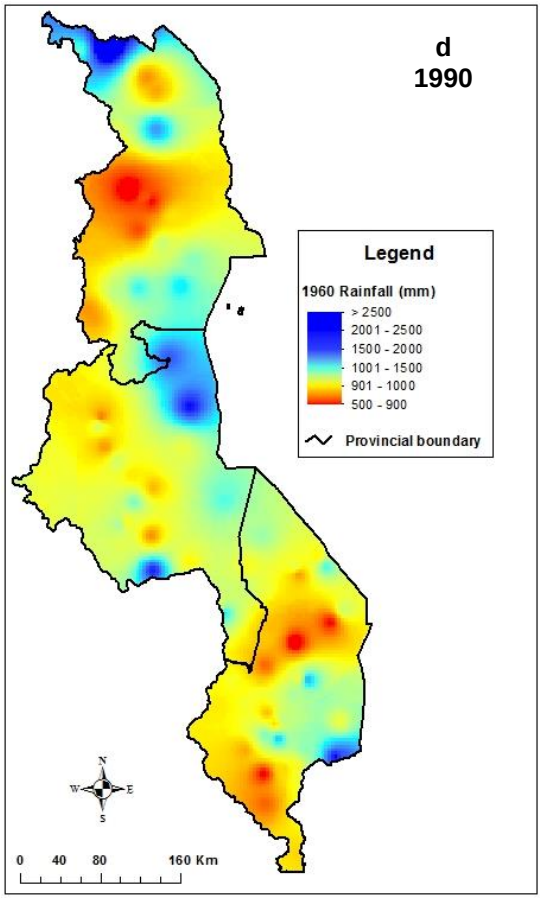
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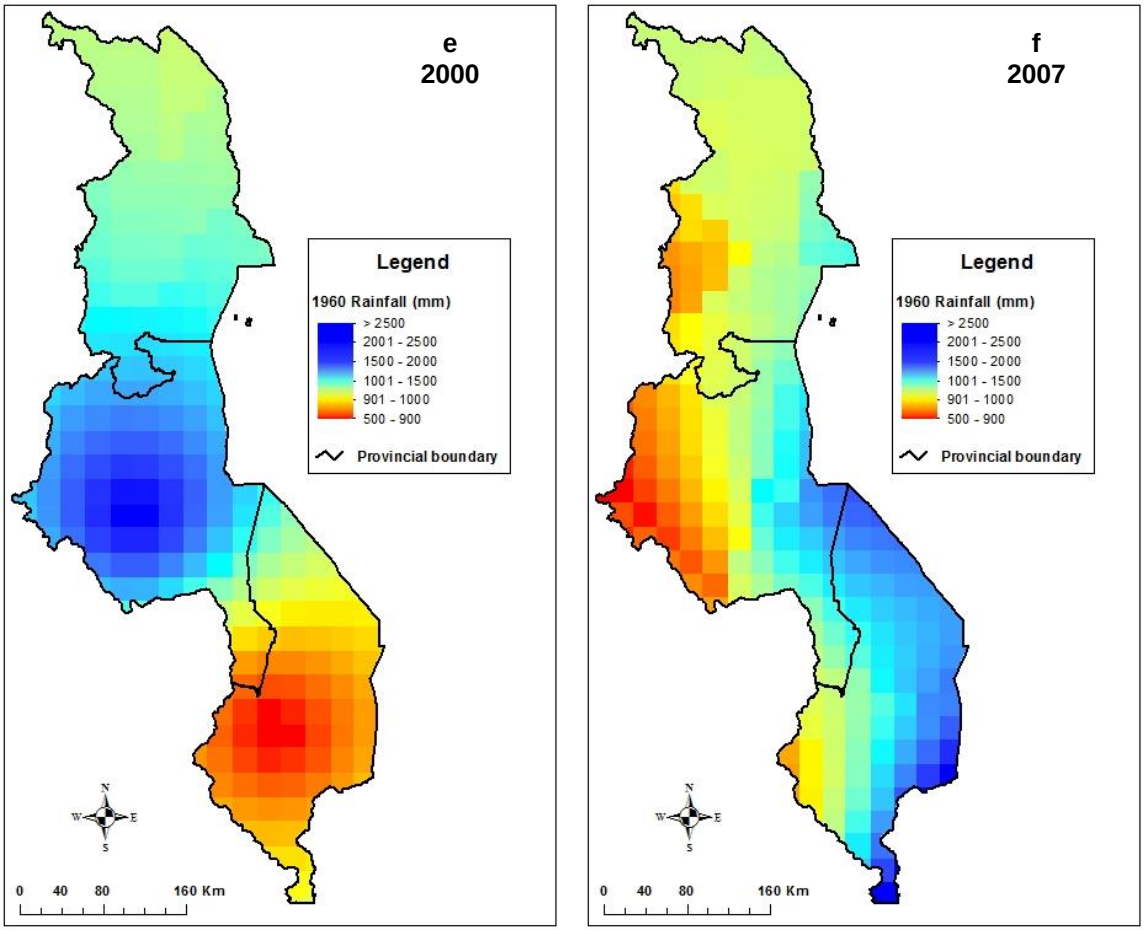

Figure 5 (a-f): Spatio-temporal rainfall distribution in Malawi between 1920 and 2007
Source: L Nhamo and FAO Climate Database 1950-2007MoDPC 2011

These weather conditions also imply extremes, both droughts (as in the 1991/1992 season) and floods (as in 1988/89 and 2014/15). During droughts upstream stretches of rivers may become ephemeral instead of year-round. Crops fail and ground- and surface water for livestock dries up.

Low-lying areas like the Lower Shire River Valley, one of Africa's largest flood plains, which is also affected by backwaters from the Zambezi River when the river swells, and some areas in Salima and Karonga are most vulnerable to floods (see Figure 6). The International Food and Policy Research Institute (IFPRI) (Pauw et al 2010) estimates that the southern region of Malawi bordering the Shire River experiences an average loss (calculated as an average annual loss from the range of floods taken from historic figures) of around 0.7 percent of GDP or USD 9 million per annum due to flooding. This figure rises to 1.7 percent of GDP in a one in five year flood, and 2.5 percent of GDP in a one in ten year flood. Floods not only ruin crops but the economy is also affected by price rises nationally due to shortages of staple food crops. Flooding tends to affect small and medium scale farmers disproportionally. Large estates can find flood a benefit where they have the ability to manage it. Homes and

infrastructure can be damaged by floods and pollution caused by flooding, and this can cause public health issues and environmental damage and, in extreme cases, people may be forced to evacuate their homes, or worst, lose their lives.

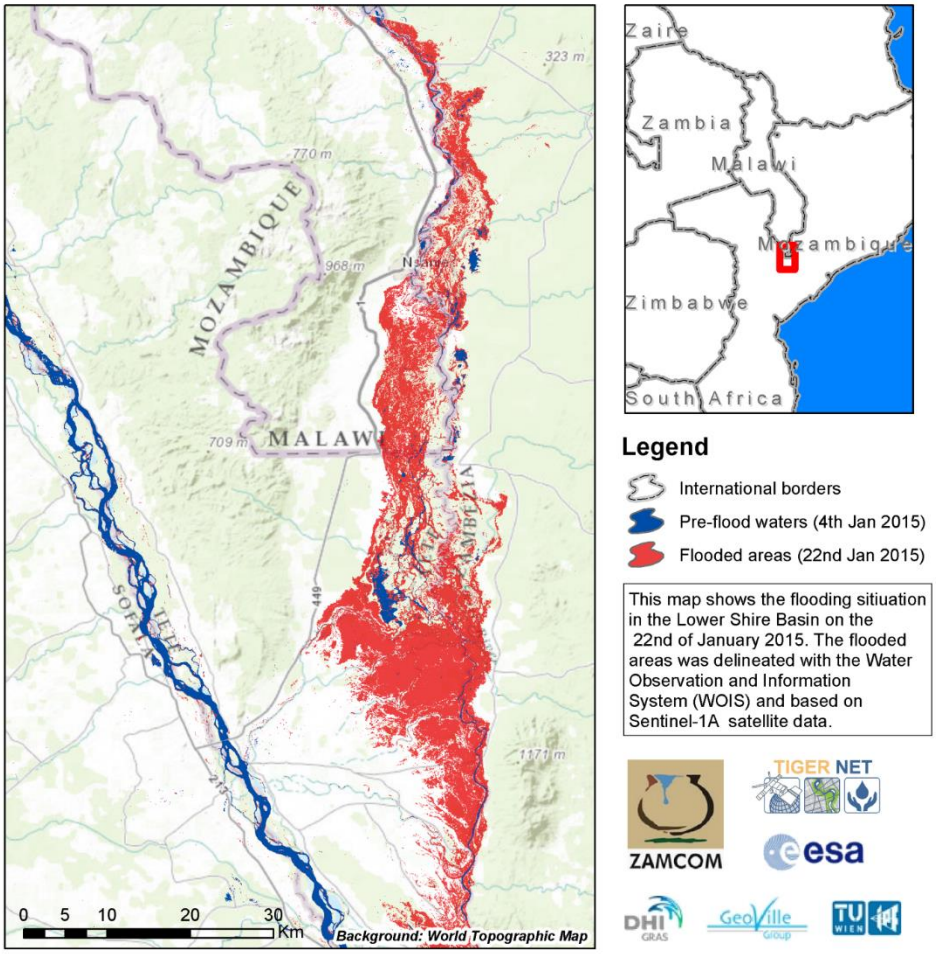

Figure 6: Floods in Lower Shire River Basin 22 January 2015Spatio-temporal rainfall distribution in Malawi between 1920 and 2007

As elsewhere in SADC, climate change is predicted to increase temperatures and droughts. Rainfall will become more variable and unpredictable. This exposes farmers and livestock even more to risks. It will lower yields and discourage high-input agriculture. This underscores the need for maintenance and improvement of current agwater management investments and future expansion.

3.3 Current water uses and untapped irrigation development potential

While water resources are abundant, withdrawals are still very low. There are nine major dams on several rivers that supply municipal water systems and are used for hydropower and flood control. The country has about 750 small and medium dams, most of which are in disrepair.

As also indicated in Table 2, the total freshwater water withdrawals from developed water sources is estimated at 1.48 km^3/year representing only 7.9 percent of total renewable water resources (see Figure 7). This relatively low level of water development indicates economic water scarcity, so lack of financial, institutional and technical means to invest in infrastructure. Of all water withdrawn, 1.166 km^3 /year, 79 percent, is for agriculture. The rest (21 percent) is for domestic and industrial uses.

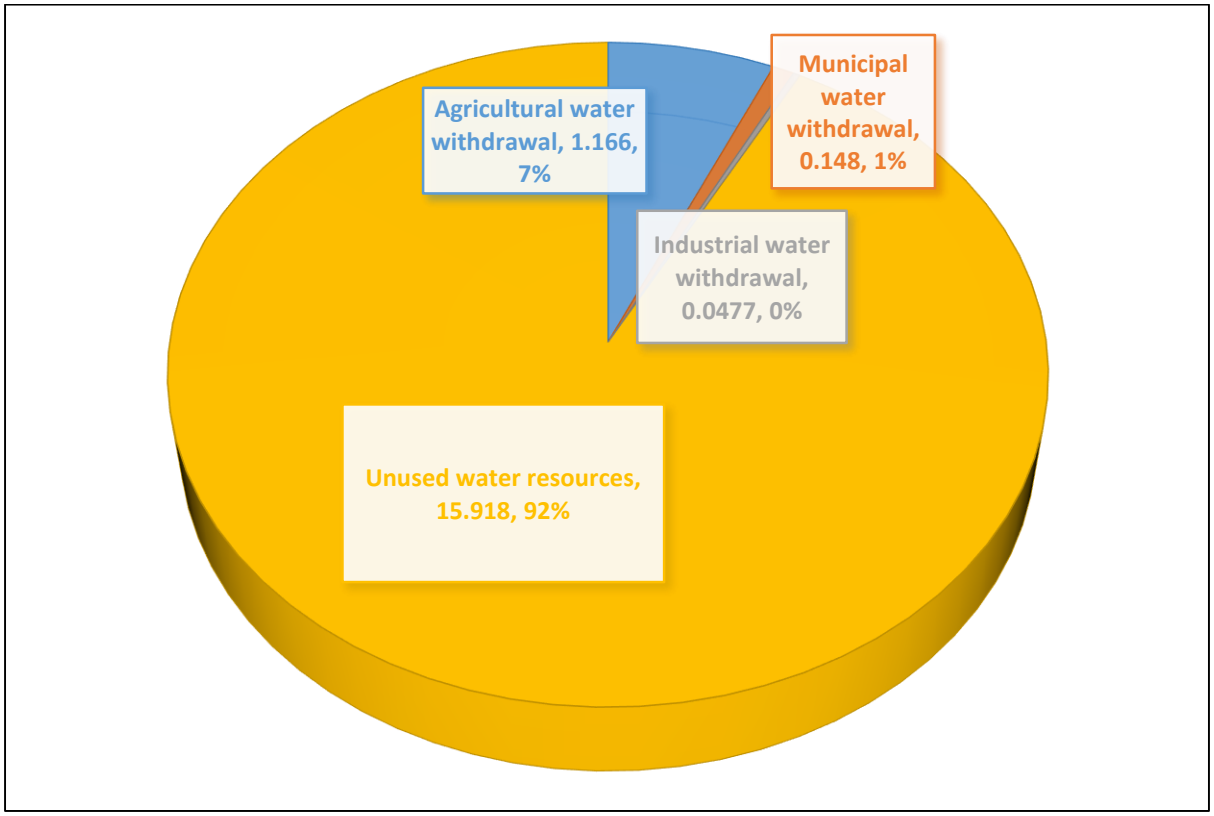

Figure 7: Volumes (in km^3/year) and percentage of water withdrawal by sector

Water resources are sufficient to irrigate all arable land in Malawi. However, suitable land availability and other factors also need to be taken into account. Considering these other factors, various estimates of potential have been made. The Office of the President and Cabinet's Green Belt Initiative 2011 identified a potential of 1 000 000 ha of irrigable land and pilot sites which have been earmarked for development. However, others' assessments were more modest, falling within the range of 400 000 ha to 1 000 000 ha (Wiyo and Mthethiwa 2008; MIWD 2010; Atkins and Wellfield Consulting Services 2011). Thus, it can be stated that, in 2010, the proportion of land put under irrigation varied from 9 percent to 22 percent of the total estimated potential of irrigable land. The smallholder irrigation subsector and estate irrigation accounted each for half of this, varying between 4.2 and 10.5 percent of the potential irrigable land. It is clear that the gap between existing and potential irrigated area is

significant. Figure 8 shows these proportions for the assumption that 23 percent of the (lowest estimated) potential is currently already irrigated.

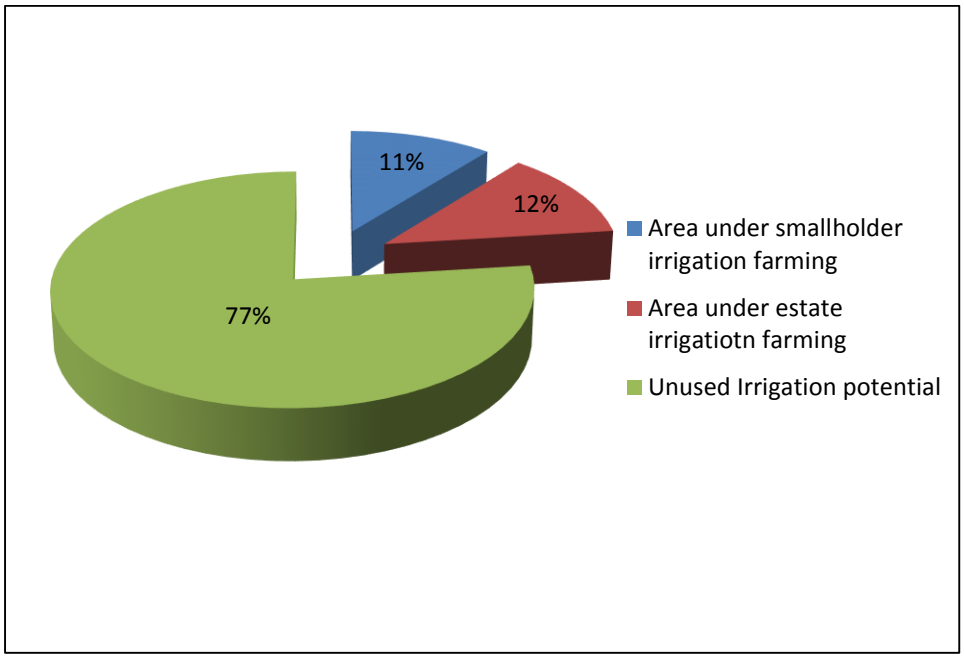

Figure 8: Proportion of area under irrigation against lowest estimated potential
Source: MAIWD 2012

3.4 Irrigation classification and eras

How can this irrigation potential be realized, in particular for smallholders? The remainder of this report will analyze past and ongoing agwater investments in Malawi with the aim to derive lessons for continued and improved agwater management and for future expansion. Some investments are successful while others are performing poorly. For sustainable food security, poverty alleviation and livelihoods enhancement in general, we will trace benefits of investments in agwater management and the factors that contribute to their success or failure.

There are various types of smallholder irrigation to consider. However, there is no uniform classification in Malawi. Classifications by scheme size differ and, in the case of communal schemes, they usually refer to the scheme size, irrespective of plot sizes. For example, the Irrigation Rural Livelihoods and Agricultural Development Project (IRLADP) and the International Fund for Agricultural Development (IFAD) classify irrigation schemes of ≤ 10 ha as mini irrigation schemes, 10-50 ha as small scale irrigation schemes, and ≥ 50 ha as large scale irrigation schemes. In the support to irrigation by Japan International Cooperation Agency (JICA), irrigation in Malawi is classified as follows: ≤ 50 ha as small scale irrigation schemes, 50-100 ha as medium scale and ≥ 100 ha as large scale.

The classification of Hanatani and Sato (2011) also distinguishes formal (government or NGO supported) and informal irrigation schemes (self-supply). Formal irrigation schemes are those where government planned, designed and constructed permanent structures according to professional irrigation standards. In government-run schemes, smallholders are often re-settled and their roles are limited to providing labor. In government- or NGO-*supported* (or so-called 'self-help') schemes, operation, maintenance and, in principle, rehabilitation is expected to be undertaken by the smallholders. Government-run and government- or NGO-supported schemes are typically communal. Small village dams also fall into this category. Their benefits include irrigation, but also livestock watering and domestic uses.

In informal irrigation schemes farmers themselves invest in infrastructure construction or installation for self-supply, although government may support them. Individuals or groups can make these private investments (Hanatani and Sato 2011). Technologies are low cost and sometimes temporal. Water can be taken from any source: streams, lakes, wells and soil moisture in wetlands. Informal horticulturists often use watering cans and treadle pumps to take water from the valley-bottoms (dimba) or small streams. Gravity-fed river-diverting irrigation using local materials (wooden poles, bamboos, rocks, grass, mud, etc.) has been widely adopted by groups of farmers throughout the country, owing partly to donors' assistance (Arai et al. 2005; Kanamori 2008).

The development of these different types of irrigation was embedded in the evolving socioeconomic and political context, as well as government and donor policies. Wiyo and Mthethiwa (2008) categorized irrigation development in Malawi into four distinct eras: (1) the government initiated and run scheme era; (2) the self-help era; (3) the scheme management transfer era; and (4) the 'irrigation for food security' era.

The present study focuses on three distinct eras over which irrigation development in Malawi has evolved (Ferguson and Mulwafu 2004; Wiyo and Mthethiwa 2008): (1) the pre-independence to 1980s era of government irrigation schemes; (2) from the 1980s onwards, irrigation management transfer in existing schemes and 'self-help' in new schemes emerged; and (3) after 2000, government, donors, and smallholders focused on individual and small-scale communal technologies to achieve food security.

4 Trends in irrigation development and lessons learnt

4.1 Overview of trends

Viewing the trends in irrigated areas, there has been a remarkable increase in smallholder irrigation after 2000. As shown in Figure 9, irrigated area expanded from 9 653 ha in 2000 to 42 181 ha in 2011 (MAIWD 2012). While the area under estate irrigation roughly remained the same, the increase was entirely in smallholder irrigation.

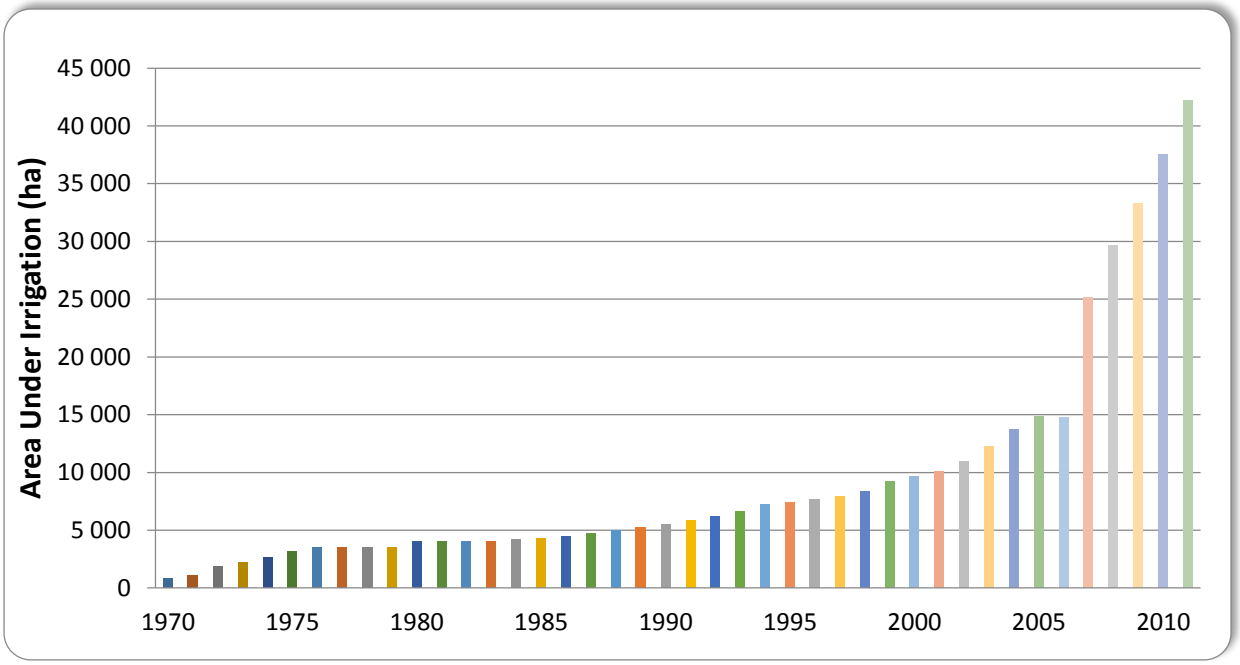

Figure 9: Trend of irrigated area
Source: MIWD Annual Report 2011

Although this area is still a small portion of the total cultivated area, this three-fold increase in smallholder irrigated area is well beyond the CAADP goals of doubling the irrigated area by 2015. As we will discuss next, the increase in smallholder irrigated areas was also influenced by a radical new irrigation investment approach by government, based on lessons learnt in the past eras.

Information about the impacts of these changes is scant. Benefits of smallholder irrigation are rarely quantified. An exception is the Department of Irrigation of the Ministry of Irrigation and Water Development (2011) which reported that smallholder irrigation subsector benefited 333 888 people in the 2010/2011 dry farming season, a period during which many workers stayed idle before irrigation.

There is little if any documentation on the contribution of irrigated agriculture to GDP in Malawi. PricewaterhouseCoopers (2008) under the African Development Bank (AfDB) funded a Horticulture and Food Crops Development Project, Malawi. The project reported that horticulture contributed 58 percent to agricultural GDP and 22 percent to the total GDP. Knowing that most horticultural production in Malawi takes place by smallholders during the dry season under irrigated conditions it can also be inferred that irrigation contributed at most 22 percent much to GDP.

It is noted that rainfed agriculture productivity also remarkably increased after 2005, while the rainfed area remained the same (see Figure 10). This is attributed to the Farm Input Subsidy Program, mainly for maize, and good rains.

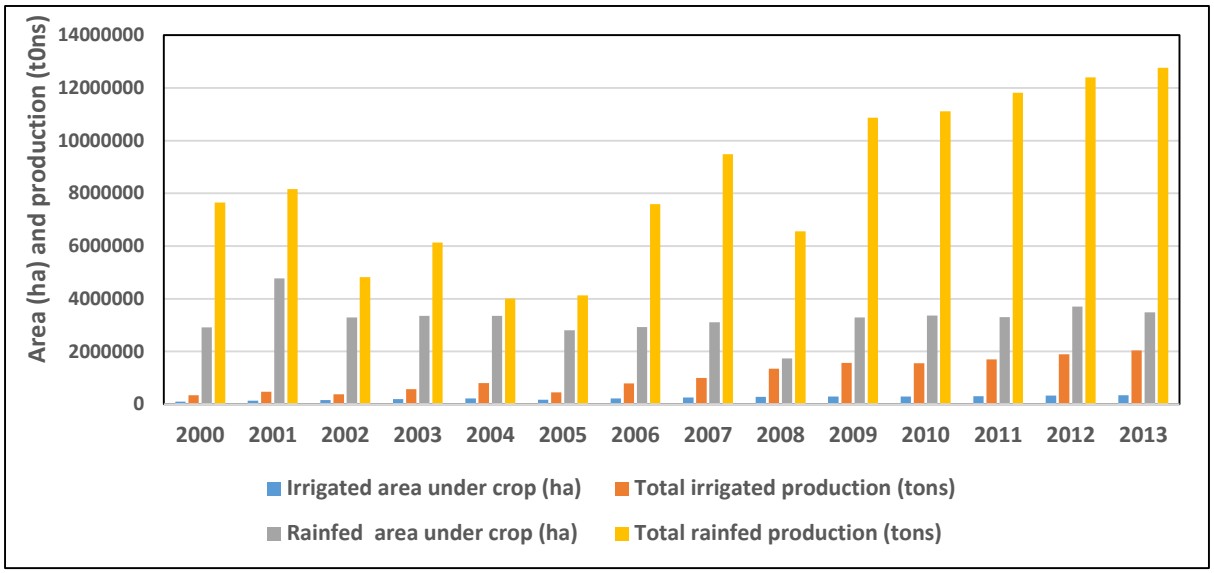

Figure 10: Trends in irrigated and rain fed areas and crop production
Source: MoAIWD, 2014

4.2 The pre- and post-independence era up to 1980s: the era of government-run schemes

Smallholder irrigation development started in Malawi in 1949 at Limphasa. In mid 1950s, two more schemes, namely, Domasi and Likangala smallholder Irrigation Schemes, were developed on the Chilwa/Phalombe plain, and an irrigated crop research station was established at Maganga.

Estate irrigation also started. The largest estate irrigation scheme was established in 1965 by the then Sugar Corporation of Malawi (SUCOMA) but now owned by the Illovo Sugar Company and covering 13 800 ha at Nchalo in Chikhwawa district. A further 6 000 ha at Dwangwa in Nkhotakota district was established in 1979 for sugar production for export and the domestic market. Irrigation was also introduced on estates growing other crops such as tea, coffee, tobacco and macadamia nuts.

Later, a total of 16 smallholder irrigation schemes including the first ones covering a total area of 3,200 ha was established with the primary purpose of rice production. During this era, the goal of irrigation development under the smallholder subsector was to grow a single crop of rice for domestic and export markets to address poverty, unemployment and household food security. The rationale for planting rice was because rainfall was adequate and reliable enough to grow other field crops like maize, beans, groundnuts, and tobacco. It was only rice

that needed more water than what the rainfall would supply. Government relocated resettled farmers from other parts of the country to the irrigation schemes.

The government designed, implemented and maintained the irrigation and there was little involvement of farmers in scheme management and O&M. During this era the government irrigation schemes were fairly well maintained and run in a top-down fashion by government (Krogh and Mkandawire 1990). This represented a heavy financial burden for government. However, after independence Malawi also received financial and technical support from donors, especially the Taiwanese Agricultural Technical Mission and Danish International Development Agency (DANIDA).

In the era of Malawi's first president, Hastings Kamuzu Banda (1964-1994), the Malawi Young Pioneers (MYP) were brought in as agricultural trainers and disciplinarians. This kind of approach alienated farmers from the scheme ownership, responsibility and management. Consequently, the scheme surroundings and infrastructure begun deteriorating as farmers totally depended upon government to operate and maintain the schemes. At the same time, the deepening economic and political crises of the 1980s and the withdrawal of Taiwanese support forced government to considerably reduce its role in scheme management and upkeep. In 1993 it accepted the Structural Adjustment Programs.

4.3 1980s to 2000s: the era of irrigation management transfer and self-help

By 1980 the developed irrigated area under the smallholder subsector had reached 4 040 ha. During the 1990s, in particular, physical infrastructure continued to deteriorate on the 16 government-run irrigation schemes. As Malawi made the transition from decades of authoritarian rule to a multi-party democracy in the mid-1990s, farmers often ignored cropping calendars and other rules established during the Banda presidency. Thus, since the early 1990s a decline has occurred in many of the formal authority structures governing the smallholder irrigation schemes. There is a general sense among the population that the old rules and regulations were *ipso facto* unfair (Ferguson and Mulwafu 2004) and, like the regime that imposed them, should be rejected. The financial burden on government became too big for it to continue bearing all the costs of running the schemes and of developing new ones.

To ease the financial burden and to assist farmers who lost crops due to drought, government unilaterally changed its approach to irrigation development by introducing two types of reforms. First, government changed its policies in the 16 government-run irrigation schemes. Their performance continued to decline. This forced farmers as well as the government to introduce the production of other crops apart from rice during the dry season. Kasinthula Agricultural Research Station was designated as an irrigation research

center to study the production of alternative crops to rice. Maize, beans, groundnuts, fruits and vegetables were introduced.

Moreover, towards the end of this era, government introduced the transfer of government-run irrigation schemes to farmers' associations, often referred to as irrigation management transfer (IMT). This has been widely promoted as a means to decentralize functions of the state, to reduce public expenditure, and to instill a sense of local ownership and responsibility in farmers. In Malawi, although some aspects of IMT were adopted in the mid-1990s, it was not until 2000 that more fundamental measures were taken towards implementation. By then, government embarked on programs to rehabilitate the government-run irrigation schemes for IMT. The IFAD funded Flood Plains and Development Programme 1998 – 2005 was one of such programs that aimed at the rehabilitation of the Domasi and Bua government irrigation schemes for purposes of IMT to the beneficiaries. However, there is little evidence of successes, partly because history and context were being ignored (Ferguson and Mulwafu 2004). None of four conditions for success identified elsewhere under which the transfer of government's management to farmers should take place were met. These conditions are: (1) IMT must significantly improve the life situations of a significant number of scheme members; (2) the irrigation system must be central to creating such improvement; (3) the economic and financial cost of self-management must be an acceptably small proportion of improved income; and (4) the proposed organizational design must have – and be seen to have – low transaction costs (Vermillion 1997; Vermillion and Sagardoy 1999; Shah et al. 2002). Lastly, in the new Land Policy of Malawi (MLHPPS 2001) many land tenure issues related to the irrigation schemes remained unaddressed.

The second reform was for new schemes. Here, government introduced the so-called self-help irrigation schemes where government provided funds and technical expertise for major works like intake works, main canals and other major conveyance structures. Communities contributed labor and local construction materials. With continuing government support farmers were to take responsibility for O&M of the irrigation schemes. Community ownership was emphasized. However, government was still in the driving seat as far as irrigation need identification, and decision making about the type of irrigation to be established were concerned. Examples of the schemes developed during this era are: Ngolowindo Irrigation Scheme (case study in Section 6) and Kambwiri-Sele Sprinkler Irrigation Scheme in Salima district; Mchenga Irrigation Scheme in Lilongwe District; and Chonanga Irrigation Scheme in Karonga District. It was also increasingly realized how informal irrigation activities in wetlands were a survival issue by farmers who suffered rainfall failure.

4.4 2000s to date: the era of participatory irrigation development and self-supply

4.4.1 National decentralization and multi-party democracy

Following the change from authoritarian rule to multiparty democracy in the 1990s, Malawi embarked on what must be considered a radical redefinition of governance structures and rights of ownership and access to vital land and water resources. At the same time, these new policies and laws were also informed by neoliberal development thinking with its emphasis on private sector initiatives, redefinition and reduction of the role of the state, and promotion of new decentralized, stakeholder-driven, and community-based management institutions. For the latter, almost all government ministries underwent rigorous policy reforms, including decentralization. Most administrative and political functions once concentrated in ministries at the national level were being transferred to the district and municipal levels under the control of District Commissioners and District Assemblies. Agriculture, irrigation and water sectors were among the ministries designated for the decentralization soon after the new political dispensation. Line ministries were to retain responsibility for policy formation, enforcement, standards, and training. To avoid the overlap and lack of coordination among ministries that previously existed at the national level, their representatives at the district level would be integrated into a single administrative entity and would serve as a secretariat to the District Assembly. Marking a significant change from the past, civil servants were to be accountable to the populations they served, not to their parent ministries in central government. The District Development Committee and Plan were the principal means by which integrated sectoral planning was to be achieved.

The overall goal remained to alleviate poverty through agriculture as priority number one. The Malawi Poverty Reduction Strategy Paper (GOM 2002) was described as the 'center of government's plans and priorities', informing all new policy and legal reforms. The four 'pillars' of the policy are pro-poor economic growth, human capital development, improving the quality of life for the most vulnerable, and good governance. Poverty reduction took on added urgency as a result of the food shortages the country experienced in 2002. Between 1 000 and 3 000 people were estimated to have died from hunger that year as a result of the interaction of policy, political, and weather-related failures (Devereux 1997). The major Farm Input Subsidy Program for fertilizers in 2005 reflects this priority.

4.4.2 Government and donor irrigation policy

As population growth, land pressure and droughts intensified, Malawi increasingly turned to irrigated agriculture as a means to increase production. Irrigated agriculture was and is still regarded as a means to boost incomes and food security, and is considered to be a way to reduce poverty by government and donors. Malawi's National Irrigation Policy (MAI 2000) and 2001 Irrigation Act reflect this stance. These policy reforms allowed and empowered smallholder farmers to initiate, plan, design, implement, operate and maintain their own

irrigation systems. All new irrigation schemes were to be beneficiary driven. Government would only facilitate and provide technical and financial support where the level of expertise and magnitude of the financial resources required were too large to be borne by the rural smallholder farmers. The 2002 National Irrigation Policy and Development Strategy (NIPDS) and its revision in 2011 cement this idea (MIWD 2011). The NIPDS stresses that irrigation development should be demand or beneficiary driven, and government should play only a facilitating role. The overall goal remains enhancing household incomes, food and nutrition security.

However, the National Irrigation Policy lacks clarity with regard to the title holder of the customary estates or irrigation plots. It is also silent with regard to women's status in patrilineal and matrilineal land tenure; the latter prevails in virtually the entire southern part and parts of central Malawi. This risks exacerbating gender inequities by dispossessing women's land and water assets, and transferring titles to men (Ngwira 2003).

In this era of irrigation development donors also appeared to be more interested in supporting small scale irrigation than large scale irrigation development. As emphatically reported by Hanatani and Sato (2011), the only irrigation investment that has been successful in Malawi is the informal small scale irrigation schemes compared to the formal irrigation schemes whose performance and sustainability has still been questionable despite efforts to rehabilitate and to transfer management of the government run irrigation schemes to farmers. Figure 11 shows the funding that government and donors have been allocating towards the development of small scale irrigation in the country. There has generally been an increasing trend, but the funding levels appear not to match with the priority number two placed on irrigation for it to make a significant impact on the country's economy.

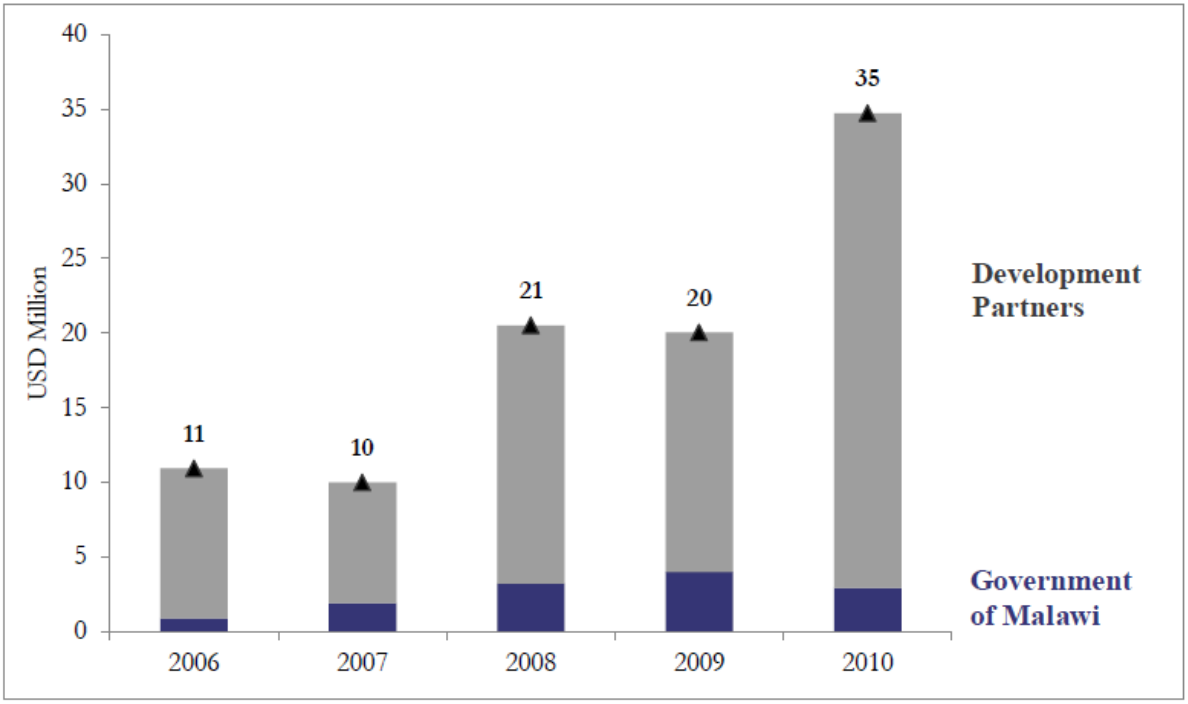

Figure 11: Government and development partners' investments in small-scale irrigation
Source: Castalia, based on analysis of data by Ministry of Finance (MAIWD 2012)

By 2011 Malawi was implementing the following donor funded projects: the Smallholder Crop Production and Market Project (SCMP) funded by the AfDB targeting 3 055 ha; the Small Farms Irrigation Project (SFIP) funded by the Arab Bank for Economic Development (BADEA) targeting 1 600 ha; the Malawi Irrigation Development Support Programme (MIDSUP) funded by Malawi Government; the Agricultural Infrastructure Support Programme (AISP) co-funded by World Bank and AfDB; the IRLADP co-financed by the World Bank and IFAD; and the Green Belt Initiative pilot phase financed by India (initially targeting 1 940 ha, with a long-term target of 1 000 000 ha).

4.4.3 Achievements

These government and donor investments in irrigation largely contributed to the above-mentioned tripling of smallholder irrigated area. By 2011 irrigated area under the smallholder subsector had reached 42 181 ha.

Data on expansion by technology (Figure 12) shows that gravity fed irrigation, which is usually communal, contributed most to the expansion of the irrigated area. Treadle pump adoption, which had been strongly promoted through subsidized dissemination of treadle pumps, halted after 2007. One of the reasons seemed to have been the withdrawal of government support after fierce public critique by environmentalists, invoking the colonial law that riparian borders should be left untouched over 20 meters.

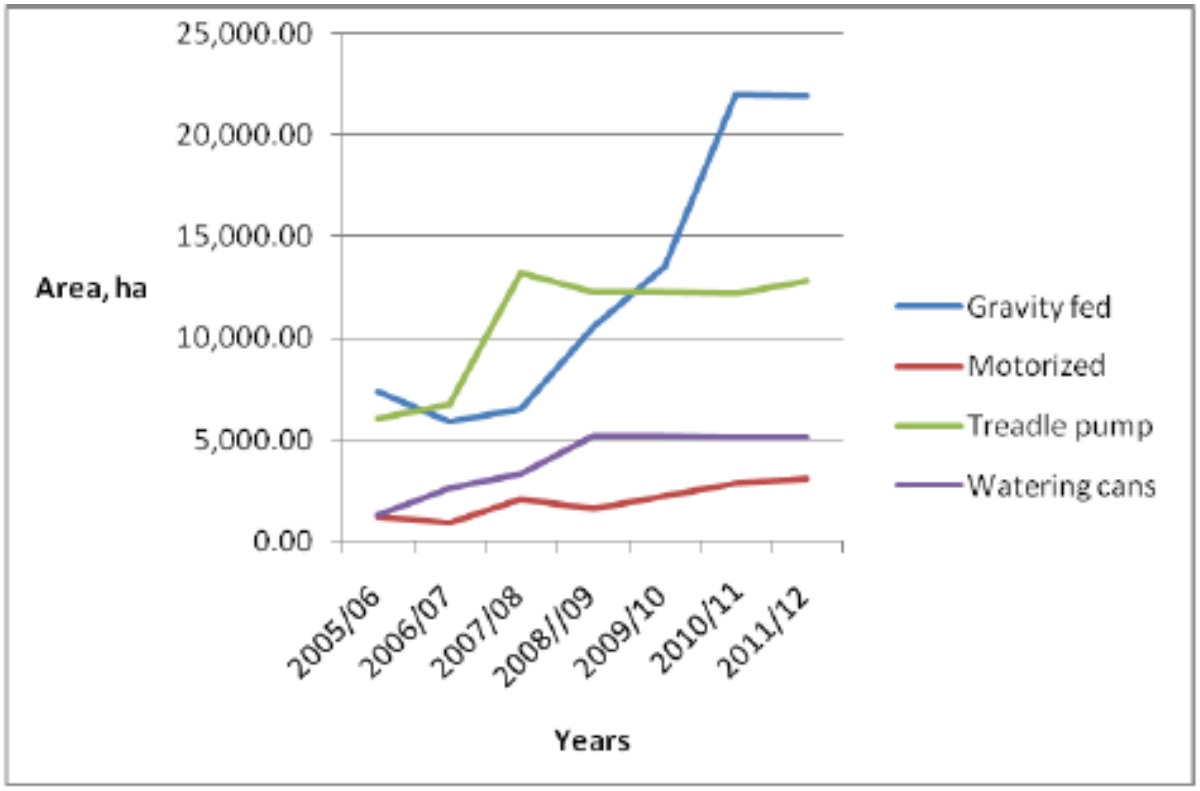

Figure 12: Expansion of smallholder irrigated area by technology

Source: MAIWD 2012

The NIPDS (2011) also advocates the expansion and intensified use of informal irrigation by small-scale farmers along stream banks, drainage lines, and in wetlands. This form of irrigation for self-supply had received little previous government attention (Peters 2004; Kambewa 2004). Thus, Malawi's new irrigation policy constitutes a significant departure from the past emphasis on costly government-supported smallholder irrigation schemes administered in an authoritarian, top-down fashion. The second case study (section seven) is about such a smallholder investing in her own infrastructure in the category between 10 and 50 ha, as defined by IRLADP.

4.5 Agribusiness

The estate subsector, particularly sugar estates of Dwangwa and Nchalo, are some of the large employers of all levels of the labour force including unskilled, skilled, technical and professional labour. In parallel to its efforts to improve smallholder irrigation performance, government also aimed at improving performance of estate irrigation schemes through the innovative approach of 'Public Private Sector Partnerships' (PPPs). The BRL engineering consultancy for the World Bank (BRL-World Bank 2011) defined PPP as a private and government business venture which is funded and operated through a partnership of government and one or more private companies. It involves a contract/agreement between a public sector authority and a private party, in which the private party undertakes a public service or entrepreneurial endeavour and assumes substantial financial, technical and

operational risks as per the revenues from the undertaking. PPP transaction models are diverse depending on: (1) the functions that the contracting authority wants the private operator to be in charge of, and which form the basis for negotiations and eventual agreement between the public authority and the private operator; (2) the application of risks between the public or contracting authority and the private operator which can be negotiated and agreed upon as conditions in performing the functions and the contract in general; and (3) the origin of the revenues that the private operator will7 receive for performing the functions in fulfilling the contract.

A successful example of such PPP is the Shire Valley Cane Growers Trust. This was mandated to establish a company called Kasinthula Cane Growers Limited (KCG), using the existing 756 ha Government Kasinthula Sugar Cane Growers Irrigation Scheme in partnership with Illovo Sugar Company, and benefiting 282 farmers. The trust holds 95 percent of the shares of KCG while Illovo holds the remainder. BRL-Worldbank (2011) reported that, due to its outstanding performance, the KCG sugar estate was being expanded by an additional 400 ha that would increase the number of farmer beneficiaries to 482. This success was partly attributed to KCG's access to the Illovo milling machine and the ready export market the KCG has under Fair Trade arrangements where demand exceeds 20 000 metric tonnes of raw sugar while KCG was only able to produce 8 000 metric tonnes.

As donors were more interested in supporting small scale irrigation than in large scale irrigation development, the long impending Shire Valley Irrigation Project, a mega public-private irrigation project of 40 000 ha, was further delayed. However, since the 2000s, feasibility studies of the Shire Valley Irrigation Project have been revived. Important hurdles identified are the smallholder inhabitants' earlier experience of losing land to the large-scale sugar cane estate of the Illovo Group, the already existing shortage of land and land pressure, and growing landlessness. The studies are silent about matrilineal land tenure in most of this area (BRL-Worldbank 2011).

5 Water policy and legal reform

The neo-liberal policies reduced and decentralized the role of the state. Stakeholder-driven and community-based management institutions received more attention in driving development. Opportunities for the private sector increased. For land, the change to multi-party democracy in 1994 also opened up new opportunities to overcome the colonial legacy and, instead, ensure all citizens' rights to land, including a redistribution of land, starting with land that estates had left unused.

In contrast, such efforts towards decentralization and equity were absent for water. Neo-liberal thinking, including pricing of water services and water resources, were reflected in the 2005 National Water Resources Policy (MIWD 2005) and the 2013 National Water Resources

Act (MAIWD 2013), which introduced basin-level water resource management. Focusing on integrated planning, the Act envisages a National Water Authority and Catchment Management Committees of flexible sizes to advise the Authority. At lower levels, the Catchment Management Committees will closely collaborate with the decentralized government and Traditional Authority structures. The option of demand-driven planning and investments through local government planning processes improves public participation and sustainability, unlike the earlier drafts of the water policy in which public participation was lacking (Ferguson and Mulwafu 2004).

In 2012, the Shire River Basin Management Program was launched, supported by the World Bank, to operationalize the policy and Act. This important basin is home to one third of the population. The basin's water resources generate 98 percent of national hydroelectric power and provide water for smallholders' and sugar agribusiness irrigation, municipal water supplies, nature reserves and tourism, fisheries, and navigation. Floods are frequent and can cause major damage and take human lives (see above).

However, the Water Sector Performance Review (MAIWD 2012) signals a field where the new Act risks contradicting the irrigation policies and the government and donors' efforts to promote small-scale irrigation for self-supply. This concerns the ways in which the 2013 National Water Resources Act prescribes abstraction permits for any productive water uses, including water abstraction by treadle pumps. The Sector Performance Review proposes to simplify their application process (MAIWD 2012). The new permit system risks contradicting the irrigation policies in various ways. Firstly, contrary to the trends towards decentralization, permits are issued from the top-down by central government. Even when basin organizations are established to take over this task, there will be a gap between basins and villages. Secondly, water resources information, upon which permits are to be based, is lacking. The majority of the rivers with highly variable water flows remain ungauged. This renders monitoring of flows and the prediction of floods difficult, if not impossible. Thirdly, the administrative capacity to handle tens, if not hundreds of thousands small-scale users is clearly lacking. Between 2009 and April 2012 only 319 permits were newly issued or renewed. The question is even whether issuing of permits is a priority for an under-sourced state that also, for example, has to monitor 34 000 existing boreholes (but could only monitor 34 of those) (MAIWD 2012). Fourth, permits favor the administration-proficient large-scale users who can easily be reached by the state. Women, even where matrilineal land tenure prevails, are especially threatened, because administrative measures such as permits tend to be written in the name of the household head, supposedly a man, and only in their absence, a woman.

Last but not least, by only accepting permits as the single legal system to enable lawful water use, the Act erodes customary and other local water rights regimes to solve water disputes. Yet, communities have developed rules and institutions to deal with water sharing during the

dry season and droughts since time immemorial. Unlike land, for which legal pluralism and customary tenure are the norm, legal pluralism in water tenure, with its precious institutional capital around the notion of water as the commons, is not only ignored but also legally rejected. The same smallholders who are supported by government, donors and NGOs to take up irrigation and, as much as possible, invest in self-supply, are seen as wasteful, ignorant, and, according to the letter, even criminal takers of water.

Their claims that water is "given by God" implies a contestation against the state declaring itself the owner of water resources, and charging fees on that basis. These ownership claims can be traced back to the colonial era. The handful of settlers declared all water resources as being vested in the overseas rulers, dispossessing Africans from their entitlement to water with a stroke of the pen. This claim to ownership underpins the settlers' self-declared authority to issue permits as the only way to be seen as a lawful water user. When the state became the custodian of the nation's water resources at independence, it consolidated this dispossession of customary water rights regimes by imposing the norm of permits on all Malawians. This operationalization of state powers as owner of water represents a new hurdle for both smallholders and an already overburdened state. These can be removed with a similar stroke of the pen, for example by targeting permits only to the few high-impact users, who are generally the main polluters and over-users. For conflict resolution within or between communities, the first point of resort would be the local water sharing regimes and the new decentralized local and district governments (Van Koppen et al 2014).

The matter is further complicated because this legal system is being transformed into a taxation system by tying fees to permits. The revenue generated is supposed to finance the yet-to-be established basin organizations. Even from the angle of revenue generation, it makes little sense to tax many small or micro users for the tiny volumes they use. The transaction costs for revenue collection are higher than the revenue generated. Moreover, organizing farmers into Water User Associations with the primary objective of easier tax collection for the state is bound to fail: people will not organize for that reason alone. More essential is that the logistic unfeasibility to reach many small-scale users, whether for permits or taxes, excludes the same majority from decision-making about water investments and allocation. Those who can pay most easily risk dominating decision-making.

6 Case study self-help era: Ngolowindo donor-supported collective irrigation scheme

6.1 Introduction

For the in-depth case study of an irrigation scheme in the self-help era, the 'success story' of the Ngolowindo irrigation scheme was selected. This scheme is in the typical rural area of the

Salima district. It covers 17 ha and has a membership of 140 smallholder farmers comprising 101 women and 39 men. It was initiated in 1985. Farmers grow crops like tomatoes, onions, cabbages, mustard, bananas and sugar cane for household food security and for sale locally and in supermarkets in cities. In line with the evolving irrigation policies, from 1985 to 1990 extensive support was provided by the government of Malawi and the government of Israel. After their withdrawal, the sustainablity of the scheme declined. The Italian NGO Cooperation for the Development of Emerging Countries (COSPE) came to support the scheme between 2000 and 2007. Farmers benefitted from good internal organization and collective water supply, input provision and marketing. Significant income was generated. Yet, by 2011, at the time of the case study, the scheme was again collapsing. The electric pumps were breaking down and money could not be mobilized for replacement. Farmers apportioned much of the blame to themselves. What had gone wrong?

6.2 1985-1990: full government support

6.2.1 Initiative

Ngolowindo Irrigation Scheme was established in 1985 over an area of 6 ha. In 1988 it was expanded to 14 ha, and to 17ha in 2003. The government of Malawi, through the then Ministry of Agriculture and Irrigation, identified food insecurity and extreme poverty as major factors inhibiting livelihoods of people in Ngolowindo village. To solve the problem the government decided to establish an irrigation scheme in 1985. The stakeholders involved in the establishment of Ngolowindo irrigation scheme were the Department of Irrigation, village headman of Ngolowindo village, Ngolowindo villagers, and the government of Israel (who provided technical and financial assistance). Rigorous discussions were carried out with the villagers as they thought government wanted to take away their land. In fact, government had come to Ngolowindo village after another nearby village refused the irrigation scheme. Ngolowido welcomed and accepted the idea as they were at the time in dire poverty.

Conforming to the government's approach at the time, appraisal, feasibility, planning and technical designs (surveys, drawings and technical data) were carried out by government staff. All the construction services and materials were provided by government. Scheme appraisal standards such as irrigation efficiency, the furrow irrigation system, ground water wells, pump capacity and the storage reservoir used at planning were acceptable. Financial analysis parameters such as cost/benefit ratio, internal rate of return, and net present worth were acceptable for funding by the government of Israel. The procedure for preparing feasibility reports according to the government of Israel's funding criteria was followed, and the project showed viability at planning stage.

Beneficiaries were asked to provide manual labour. A major assumption was made that this self-help approach whereby farmers were only asked to contribute manual labour during the

scheme design and construction phase was enough to gain ownership and managerial responsibility among the beneficiaries.

Ngolowindo irrigation scheme leased the land according to the communal land tenure system which tends to be under the village chief's control. This made it conducive for communal investment. Only micro land disputes still exist at the scheme level when the governing bodies allocate plots to individual members.

6.2.2 Infrastructure

Ngolowindo irrigation scheme has three major components of infrastructure, namely three ground water wells with three electric submersible pumps, a 925 000 litre storage reservoir, and a lined canal network. The wells are 70 m deep, and the pumps are suspended at 60 m. Two of the wells have a 150 mm diameter and the other has a 200 mm diameter. These wells were equipped with submersible pumps of capacities of 6.5 litres per second each of the first two pumps and 10.5 litres per second the third pump. Bigger pumps could not be used because the ground water well yields in the area do not exceed 15 litres per second. All the canals including the main and field canals are lined with cement mortar. The furrow irrigation method was used, and the furrows in each plot are 100 metres long.

This collective scheme helps reduce O&M costs per individual farmer. On the other hand, electricity costs are high, and frequent power failures impede the utilisation of the pumps. The lack of alternative water abstraction devices makes the scheme totally dependent on the electric submersible pumps. Further, these structures demand highly skilled and trained personnel in O&M which are very costly. Also, working capital is needed for replacement and O&M costs of the infrastructure. The lack of advance planning by the farmers to set up equipment replacement and maintenance costs, and the continued expectation that the government will replace them, appear to be the main reasons for the collapse. Other requirements for profitable farming seemed to be in place.

The infrastructure was designed to deliver irrigation water requirement for the growing of crops such as maize, tomato, cabbage, onion with an average crop water requirement of approximately 500 mm per growing season. For an average farming season of four months with 8 twelve-hour irrigation events per month, one would need about 6 pumps of discharge of 10 litres per second to irrigate all the 17 has in one season. The crops were to be marketed to the rising urban population in the city of Lilongwe and neighboring cities and towns of Blantyre, Zomba, Salima, Karonga and Kasungu.

In sum, the government provided everything including planning, design, drawings and construction, construction materials, farm inputs and frequent extension visits. Farmers provided only manual labour for minor works like bush clearing and for cultivation on their plots.

6.2.3 1990-2000: self-help in O&M

In 1990 the government introduced the new policy of farmer managed irrigation schemes, and the Ngolowindo farmers were expected to fully be responsible for meeting the O&M as well as cultivation costs on their own. During this period the scheme declined. This was exacerbated by marketing problems.

6.3 2000 – 2007: success again

6.3.1 Support

From 2000 to 2007 COSPE, with funding from the EU, brought in intensive support in the form of training in irrigation water management, horticultural production, marketing, group dynamics, cooperative formation and management. Collective marketing helped in bargaining, meeting volumes demanded on the market and reduction of market costs. The Departments of Crop Production, Irrigation, and Agricultural Extension also provided training to farmers in their respective fields, while the Department of Cooperatives of the Ministry of Industry and Trade provided training in cooperative formation and management.

Farm structures such as an office block, a produce handling house, storage shed and a mini agro processing building were constructed. Assets such as buildings and leased land were used as collateral to access credit. This attracted micro finance institutions who would otherwise shun small scale irrigation farmers owing to the high risks associated with agricultural produce.

An extension worker paid by COSPE was deployed to the site during the period COSPE was at Ngolowindo. His role was that of a farm manager who made sure a proper farming calendar was produced and all farming and irrigation activities were carried out on a daily basis. COSPE also established a revolving fund which it used to procure all the farm inputs for onward lending to individual scheme members. Collective input acquisition helped to buy inputs in bulk thereby reducing input costs per individual farmer. High input and equipment costs can become unaffordable to small scale irrigation farmers. The revolving fund was a success: all farmers were able to pay back their loans through the cooperative marketing arrangement.

6.3.2 Internal organization

COSPE helped the Ngolowindo scheme to develop a Constitution, including membership and a board of directors, and to register as a cooperative with a limited liability with the Malawi Government Registrar of Cooperative Societies in 2001. A look at the trend of the membership from 2000 to 2010 in Table 3 shows a constant women membership and a fluctuating male membership. It is also noted that the board leadership had an almost 50-50 (five women and four men) composition since 2005 before which it was the reverse. The high membership of women in the scheme was attributed to women being more concerned with

household food security and dedication to hard work. Men were more attracted to non-farming income generating activities like fishing, seeking employment in towns and outside Malawi. Some women were able to send their children to schools and universities.

Table 3: Membership by gender at Ngolowindo irrigation scheme

Year	Membership		Board Leadership	
	Women	**Men**	**Women**	**Men**
2011	101	44	5	4
2010	101	44	5	4
2009	81	15	5	4
2008	101	74	5	4
2007	101	74	5	4
2006	101	39	5	4
2005	101	39	5	4
2004	101	39	4	5
2003	101	39	4	5
2002	101	39	4	5
2001	101	39	4	5
2000	101	39	4	5

Source: Scheme records obtained during study interviews in October 2011

The scheme was sub divided into blocks of 100 m x 100 m. The cooperative plot allocation is shown in Table 4. It was learnt that each member was responsible for all irrigation and agronomic activities in his/her plot. The activities were carried out at the same time in each block for crop uniformity as per the agreed farming calendar. Members present during the visit expressed satisfaction with these plot sizes. The plots were not permanently allocated to a member as they would change from one season to another. All plot allocation regulations and rules of cultivation practices were properly spelt out in the by-laws of their Constitution.

Table 4: Plot size per farmer at the Ngolowindo irrigation scheme

Crop	Plot size per farmer	Ha planted in first cycle for all 140 members
Maize	5 ridges (0.75 m x 100 m)	5.2
Tomato	3 ridges (0.75 m x 100 m)	3.2
Onion	1 bed (1.0 m x 100 m)	1.4
Cabbage	2 ridges (.75 m x 100 m)	2.1
Rice	214 m^2 (3 ha shared among 140 members)	3.0
Total ha		14.9

Source: Scheme records obtained during study interviews in October 2011

The Constitution spelled out vision, mission, objectives, eligibility for membership, inheritance, leadership, roles and functions, meetings, disciplinary issues, penalties and expulsion. Strict compliance with the Constitution was practiced. Before becoming a member of the scheme a person was given a copy of the Constitution to study and, once satisfied,

he/she was given an agreement to sign indicating that he/she would comply with the provisions of the Constitution. Thus, all the 140 members of Ngolowindo Irrigation Scheme signed the agreement.

The cooperative has a board of directors. The board of directors operates through eight subcommittees with five members each. The subcommittees included:
(1) An Irrigation Committee responsible for irrigation water use and management. It was also responsible for planning and O&M of the irrigation system, including the pump house, wells, storage reservoir and main canals. Collectively, farmers were responsible for maintaining the irrigation canals that supply water to their block.
(2) A Marketing Committee responsible for executing the transactions of buying and selling of farm produce. This Committee was charged with the duty of looking for markets for the farm produce.
(3) A Credit Committee responsible for getting loans on behalf of the cooperative for onward lending to individual farmers and loan repayment.
(4) An Agro Processing Committee responsible for the agro processing annex that was introduce by COSPE in 2007 that produced fruit juices and jams of mango, baobab, tomato, and other indigenous fruits.
(5) An Asset Committee responsible for safe keeping of all scheme assets, including irrigation equipment, infrastructure and farm tools.
(6) A Disciplinary Committee responsible for settling any disputes among the scheme members. To this effect the members present during the visit cited an incident in which one of the scheme members stole a main switch for the power supply to the scheme. He was tried by a court of law and imprisoned in 2006. The cooperative society in its general meeting resolved to terminate membership of the member in line with their Constitution.
(7) An Education Committee responsible for training scheme members in production, irrigation, marketing, entrepreneurship and group dynamics.
(8) An Internal Audit Committee responsible for ensuring that financial transactions were carried out according to professional standards.

The Scheme employed paid personnel including an accountant, a cashier, a stores clerk, a sales clerk, three guards and a driver. The Cooperative Secretariat was responsible for paying electricity bills.

The monitoring system appeared to be effective. The Scheme maintained records of meetings and resolutions and other activities e.g. they had separate farm production, marketing and agro processing records. The Production Committee regularly inspected inputs (especially herbicides and pesticides) used by members. It also ensured that farmers selected horticultural crops to grow from a calendar of crops that was agreed on in the previous year.

Members expressed satisfaction with the performance of all the Committees despite the collapse of the irrigation scheme.

In this way, the 140 members derived significant benefits from being organized. Shared irrigation equipment and shared input provision reduced the costs for all. Financial resources could be mobilized and pooled. Collectively, better market prices could be negotiated. As a registered cooperative society, Ngolowindo could better bargain with outsiders for better services, to be heard in fora that matter, to sue and be sued, and to recruit competent personnel and fire incompetent ones.

6.3.3 Livelihood benefits

Members derived important new livelihood benefits from irrigation. They cultivated crops that could not have been grown without irrigation. However, yields lowered compared to the era in which government or COSPE provided inputs equally to all farmers on loan. The high input prices which each individual farmer had to bear on his/her own reduced fertilizer and chemical inputs. Also, the highest value crops such as broccoli, cauliflower and yellow and red peppers, which were in high demand in supermarkets, were not grown because they demanded high management and strict adherence to quality and supply deadlines. Table 5 shows the yields and income per ha. One ha is shared by 10 -12 members.

Table 5: Crop yields and income of selected crops grown at Ngolowindo Farm

	Ngolowindo (communal)	(MK)
Maize (cobs/ha) sold green	53 333	400 000
Tomato (kg)	30 000	1 200 000
Onion (kg)	22 000	1 500 000
Cabbage (kg)	35 000	800 000

Source: Scheme records obtained during study interviews in October 2011

An agro processing mini plant was introduced in 2007 by COSPE with funding from the European Union (EU). It processes baobab fruit juice throughout the year, and seasonal mango, guava, tomato and pawpaw juices. This unit remained operational. Table 6 shows income and expenses of the agro processing unit in 2010.

Table 6: Income and expenses from Ngolowindo Agro Processing Unit in 2010

Month	Income	Expenses	Difference
		(Malawi Kwacha)	
January	59 500	76 736.00	-17 236.00
February	94 655	80 803.00	13 852.00
March	142 535	98 182.00	44 353.00
April	48 460	44 117.00	4 343.00
May	44 655	47 254.50	-2 599.50
June	34 810	49 118.00	-14 308.00
July	87 590	67 538.85	20 051.15

August	87 770	117 730.00	-29 960.00
September	78 285	63 094.20	15 191.80
October	48 635	48 635.00	0.00
November	46 120	58 065.00	-11 945.00
December	52 975	62 450.00	46 120.00
Total	825 990	813 723.55	12 266.45

The scheme also allowed farmers to obtain assets. Table 7 shows the assets that farmers at Ngolowindo claimed they had acquired from the income from the irrigation scheme. Food security was also not an issue when the scheme was operational. Farmers claimed during the discussion that if it were not for the breakdown of the pumps leading to the complete stoppage of the irrigation scheme, some of them would have acquired television sets, ox-carts and even cars within the foreseeable future.

Table 7: Assets acquired using the benefits from the irrigation scheme at Ngolowindo

Asset	No of scheme members possessing the asset of 140
Brick walled house with iron sheet roof	20
Brick walled house with grass/plastic sheet thatch	126
Bicycle	130
Cellular phone	90
Radio	140
Paying school fees at good schools	10
Owning goats	126
Television	0
Ox-cart	0
Car	0

Source: Scheme records obtained during study interviews in October 2011

Lastly, the irrigation scheme offered not only employment to the 140 members and their families, and also employed the above-mentioned paid staff.

In summary, the Ngolowindo Horticulture Cooperative Society Limited served as a useful model and example of a community-based development initiative that has put in place democratic institutions to enable effective management, good governance, women empowerment, transparency and accountability. Farmers expressed satisfaction with the support services provided by Government and COSPE during their respective periods. The frequent presence of COSPE boosted the morale of the farmers. However, COSPE pulled out in 2007. Since then Ngolowindo farmers were left to run the scheme on their own.

6.4 Collapse and lessons learnt

Malawi Rural Finance Company, a micro finance institution in the agriculture sector, had provided loans to Ngolowindo Cooperative Society Limited. In 2009 individual farmers failed

to pay back the loans they obtained from the revolving fund. They attributed this to the failure of the cooperative to market the produce it bought from the scheme members. It was reported that MK 400 000 was outstanding. At the same time the pumps were not being serviced, and their degradation accelerated until all three broke down in 2010. They were uninstalled for safe keeping against vandalism.

Farmers were reluctant to carry out maintenance work on the infrastructure after the break down of the pumps. They were in a state of shock as irrigated farming in the scheme was their only occupation and employment for food security and household income, and the amount of money required to replace the pumps was so enormous that they were rendered powerless.

It was at this point that the farmers said they realised they had made a mistake by depending totally on the government and then COSPE. They claimed they were being spoon fed, and were not assisted to take over the running of the scheme as a business. They argued they should have created a separate fund for O&M of the pumps. However, in the self-help era, infrastructure was entirely the duty of government. Nobody had raised with the cooperative about need for a replacement strategy. The Committees were lay people, and the Secretariat was staffed with personnel of basic education. They had not had the foresight nor experience to plan for future eventualities.

Farmers were fully aware of the NIPDS' arrangement of introducing a matching grant as an exit strategy for O&M. To this effect they said they were already informed by government that the cost of one new submersible pump was MK 850 000, and they were required to contribute MK 425 000 to match the government grant of twice their contribution. However, the farmers said they were not able to raise the MK 425 000 and were not sure they would be able to do so in the foreseeable future. Nonetheless, they still said they would coerce members with outstanding loans to pay them back, and coerce every member to make a contribution towards raising the matching fund.

To conclude, it can be deduced that external assistance that does not have inbuilt comprehensive capacity building in all areas of farm business management, including infrastructure maintenance and replacement, and clearly defined modalities for takeover are a waste of resources in that they do not support long term sustainability. The assumption that once farmers participated in the project implementation they would be able to sustain the outputs of the project on their own without external assistance was incorrect – just as in government and other formal organisations and institutions – refresher courses must be conducted regularly to maintain good performance.

A tailor-made program must be developed to re-engage farmers into self-initiative, understanding, ownership of scheme benefits, losses, solutions to the losses, and any

consequences thereof. In such a program, the need to ensure there is no dependency on outside sources must be addressed.

It appears the that farmers at Ngolowindo still believe that the government will replace their broken down pumps. Government should engage with the farmers to motivate them to begin financial resource mobilisation from among themselves as their contribution towards the replacement of the broken pumps. There is need for government and other development partners to support the farmers to resuscitate it. Farmers should introduce an annual levy and set up a fund for O&M of the irrigation system components, particularly the submersible pumps; and there should be strict observance that the fund should not be abused by anybody. Right from the start, farmers should be assisted to set up a savings and credit fund to be used for procurement of farm inputs and to cushion them from various shocks.

In sum, government should put in place a capacity building programme in extension and training to run the scheme as a farm business.

7 Case study: privately owned Tapempha Farm scheme for self-supply

Tapempha Farm is a private small-scale irrigation scheme owned by an individual female farmer, Mrs Kathumba. It is located in Lilongwe district. It was established in 2008 covering 10.5 ha of irrigable land. The soil at Tapempha Farm is well drained sandy loam. This farm grows crops such as tomatoes, onions, cabbages, mustard, cauliflower, broccoli, red and yellow papers, lettuce, butternut and cucumber for sale at supermarkets in cities. The farm is run by the proprietor (managing director) who hires a farm manager and other workers.

The owner was a primary school teacher before she started farming. Realizing the high demand for green maize and vegetables in the growing city of Lilongwe she decided to start growing green maize for profit. She approached the headman in the village where her school was located to buy a wetland near the stream that was otherwise idle and deemed useless by villagers. Using her personal capital, she appraised, planned and designed the mini-scale irrigation scheme, using watering cans and treadle pumps. Each of the treadle pumps could irrigate up to 0.3 ha. In spite of being labour-intensive, Tapempha Farm excelled in growing green maize for sale in the city.

Her performance was so outstanding that the Ministry of Agriculture, Irrigation and Water Development rewarded her with a 10 horsepower diesel operated motorized centrifugal pump in 2008. This motivated her to venture into vegetable production to supply to the newly built supermarkets and large companies in the city. She bought 300 metres of 10 mm PVC pipes which she used for a delivery line from the pump to the field. The delivery pipe was

connected to a boom fitted with hose pipes to apply water direct to a planting station. She prepared beds for planting crops like tomato, yellow and red peppers, onion, cauliflower and broccoli. She imported the seeds for these vegetables from South Africa.

Diesel pumps are portable and easy to install and operate. For more complicated maintenance on the motorized pump, the proprietor hired locally available mechanics. She had no problems finding spare parts for the motor pump as they were readily available in the city of Lilongwe. However, diesel costs are high, which impeded the utilisation of the pumps. Moreover, the installation of diesel pumps in open spaces risked theft and vandalism. Reliance on one diesel pump is risky in times of failure, so Mrs Kathumba kept the treadle pumps and watering cans as back ups. Indeed, the only weakness in the technical design was that the PVC pipes were unburied, so exposed to UV light, which accelerated their deterioration.

In terms of water management, it is a risk that the scheme relies on pools of water from a stream which stops flowing during the dry season. Community activities around the stream are a threat to the stream's sustainability.

While decision making is faster as an individual than in a group, an individual irrigator lacks the advantages of belonging to an organisation. Especially individual marketing of produce makes it difficult to compete effectively on market prices, costs and lobbying for better services. Nevertheless, the proprietor managed to penetrate the elite markets (the newly built supermarkets and high class hotels in the city of Lilongwe) by walking door to door to advertise her products. At times she was requested to bring samples of her products, and it was then that agreements were made to engage her as a regular supplier of products. She worked tirelessly to make sure she met agreed upon supply deadlines and quality standards.

As shown in Table 8 the yields at Tapempha Farm were higher than at the Ngolowindo scheme. Tapempha Farm was also able to grow crops such as broccoli, cauliflower and yellow and red peppers which were in high demand in supermarkets. However, this demanded strict adherence to quality and supply deadlines. As a result, Tapempha Farm was able to make more money from the same crops than the Ngolowindo scheme.

Table 8: Yields and income realised from sale of crops grown at Tapempha irrigation schemes

	Irrigation Scheme			
Crop	Crop yields	Tapempha (Private)		
		Revenue	Variable Costs	Gross Margin
	(MK)	(MK)	(MK)	(MK)
Tomato (kg)	45 000	4 275 000	1 282 500	2 992 500
Onion (kg)	24 000	2 400 000	1 120 000	1 280 000
Cabbage (kg)	50 000	2 025 000	720 000	1 305 000

Source: Scheme records obtained during study interviews in October 2011

Tapempha Farm also creates employment for 27 people. The proprietor appointed two workers as foremen, who are responsible for planning irrigation events and O&M of the irrigation system. She also appointed one marketing officer (with tertiary education), one stores clerk, one sales clerk, one security guard, one machine operator and 20 general labourers.

Undoubtedly the starkest contrast with the Ngolowindo scheme is that Tapempha Farm achieved all this without any government support, other than the diesel pump and some assistance by the Department of Irrigation with the installation of the treadle and motor pumps. Apart from that, as she lamented, no support whatsoever was provided by the government custodians of knowledge and skills. Instead, she herself had to search for information which she managed to find at the Government Bvumbwe Agricultural Research Station located 350 km away from her farm.

This contradicts the NIPDS, which makes the statement that it will promote commercialisation of irrigated agriculture. However, it fails to elaborate how this will be achieved, what strategies will be put in place, which farmers will be targeted, and how government will allocate resources. The NIDPS also prefers providing support to farmers collectively rather than as individuals. This risks ignoring private initiatives like those of Tapempha Farm. Mrs Kathumba, without any agricultural or irrigation background, managed to set up the irrigation scheme, and to penetrate the market and win city supermarkets and large companies as buyers. However, for many other farmers in similar or less advantageous conditions, support by government would make the difference between success and failure. Government will definitely have high returns on any investment it might make at Tapempha Farm as evidenced by the motor pump it provided. However, government should come up with a program of identifying a larger cadre of farmers like the owner of Tapempha Farm, and start scaling up its support.

8 Conclusions and recommendations

Recapping the questions, the study found the following answers.

8.1 Hydrological hazards

What are the precise hydrological hazards of climate variability and change, and what is the meaning of 'water scarcity' for agriculture in Malawi?

With a stated irrigation potential of up to 1 million ha, mountainous streams, many wetlands, a lake shore, and regular flooding of large areas such as the Shire River Valley, Malawi has abundant water resources, in spite of its relatively high population density. The climate

hazards for the country's majority of smallholders are the high variability and total unpredictability of rainfall in space and time, while surface water storage and conveyance to buffer these vagaries are under-developed. The long-term potential of groundwater storage and recharge seems relatively limited. Unpredictability and variability will increase. This confirms the urgent need for 'no-regret' investments in agwater management, in particular storage.

8.2 Lessons from past and current investments

What lessons can be learnt from past and current investments in agwater management in Malawi, in particular from their strengths and weaknesses in sustainably contributing to poverty alleviation, food security and agricultural and economic growth?

How can the Malawian government, NGOs and donors build on these strengths and overcome the weaknesses?

8.2.1 Irrigation scheme investments by government, donors and NGOs

Investments in smallholder irrigation by the colonial government and the later independent government in partnership with donors and NGOs, have radically changed over the past four decades. The early pre-colonial 16 smallholder irrigation schemes were entirely government-run and served political goals of resettlement, food security and revenue generation. Smallholders were no more than labourers in their own fields. The same authoritarian top-down approach after independence did not work; the irrigation schemes became a financial burden for government. The structural adjustments and neo-liberalism further led to a form of irrigation management transfer by the 2000s that was essentially about shifting this burden to smallholders, without any success story.

In the new generation of investments of governments, donors and NGOs after the 1980s, the focus shifted to initial investments in infrastructure only, assuming that beneficiaries would self-help in O&M. Considerable resources were, and still are, spent on capacity building to ensure a strong and legally recognized organization, both to deal with internal organization, but also to strengthen bargaining power with outsiders. However, as the case of the Ngolowindo scheme shows, even success cases struggle to fill the gap that investors are inevitably leaving after their departure. Expensive and high-energy consuming mechanized infrastructure appears a major risk factor. Firstly, construction is the favoured contribution of support agencies and their contractors, without much consideration of later rehabilitation and replacement. Future irrigators are neither consulted during the design and technology choice phase, nor encouraged to set up a replacement fund later. Secondly, with rising energy and input prices, sophisticated irrigation is only profitable under very disciplined cultivation regimes of high-value crops with guaranteed, rewarding markets. Yet, smallholders still tend to cultivate crops and only look for markets later. This weakness in the

many self-help smallholder irrigation schemes requires agronomic, accountancy and marketing skills training and, for expensive irrigation technologies, engineering skills training is required. Credit facilities are also key. Organized interest groups need to be supported, such as the Horticulture Cooperative Union of Malawi (HORTCUM). This is a specialized umbrella body of primarily smallholder horticulture cooperatives. It is responsible for bulk marketing and bulk purchasing of inputs at national as well as regional levels.

Above all, the government (including politicians) and the myriad of donor agencies should align their promises, grants and loans, and avoid raising inconsistent expectations that confuse and demotivate smallholders to take action themselves.

As shown in the Farmer Input Subsidy Program, smart subsidies can play an important role in agriculture for broader economic growth, wellbeing and independence from food aid. The government's strong and unique support after 2000 to small-scale technology development, including small motorized pumps, in participatory irrigation development, was one such smart subsidy. It contributed to a significant increase in the irrigated area.

A question that requires more study regards the specific needs and potentials of smaller and larger irrigators, and the synergies or trade-offs between production of staples for own consumption and the production of other crops for sale. Also, the advantages and disadvantages of the government's tendency to only target organized farmers 'for more widespread' benefits, needs to be compared with the advantages and disadvantages of targeting individuals, both the independent entrepreneurs like Mrs Kathumba or college graduates engaging in irrigation for self-supply (as below), and the poorer farmers who may prefer smaller and more localized initiatives. Malawi's policies of 50-50 matching funds may be an effective targeting strategy for the wealthier farmers.

In order to ensure profitability of irrigation government, donors and NGOs should boost the forward and backward linkages, for example through agronomic, technical and marketing skills training, price information networks, level playing fields with traders, credit and saving facilities (and culture). This support should not only target the small-scale irrigators in government-funded schemes, but also those who invest in irrigation for self-supply, outside the ambit of the state.

8.2.2 Investments by individuals or groups for self-supply

The government's recognition of smallholders' self-initiated wetland cultivation, river diversions and flood recession was another break-through in the move from top-down government-run irrigation schemes to participatory approaches that start with what smallholders already do, and have done since time immemorial. A neo-liberal government emphasizing market forces and private investments would be expected to welcome the major strength of these investments: at no or low cost to the tax payer, income and food

security are increased, employment is created, food prices are reduced, and agricultural and broader economic growth is fostered, and all in a sustainable manner. Hence, a policy that promotes market driven irrigation development should be more specific on how it develops the marketing system so that forward and backward linkages will be a pull factor, triggering further investments in agwater management.

8.2.3 Investments by agri-business

With much of estate land lying idle, agribusiness before and after independence appeared considerably less productive than smallholder irrigated areas. There have been efforts to redistribute this land to Malawi's many land-poor citizens (USAID undated). Government's past experience in irrigation development linked to re-settlement may be useful to move back to.

For both these resettlements and for new investments, a clear strength of agri-business is that it can offer guaranteed markets and input supplies for outgrowers, as in the PPP arrangement of Kasinthula Cane Growers Limited with a market of 20 000 metric tonnes of raw sugar. Ensuring a market overcomes the persistent problem that investments in irrigation are often supply-driven. Outgrower arrangements avoid the sensitive land dispossession issues that the establishment of new estates have. On the other hand, major win-win potentials may justify such a project, for example, the large-scale Shire River Valley Irrigation Plan. The success depends, above all, on how land dispossession of women and men in both matrilineal and patrilineal societies is dealt with and compensated for. As custodian of both land and water resources, the state has an important role to play in levelling the playing field and negotiating contracts for broad participatory planning and design of these large-scale projects.

8.3 Cross-sectoral synergies

What are the untapped synergies between the public sector agencies with mandates in land and agriculture and those with mandates in water management, so that both sectors can achieve their goals more effectively?

The study identified a potential discrepancy between the land and agricultural sectors and the water sector. The fact that 70 percent of water withdrawals is for irrigation is seen by some as a risk imposed by irrigators who should be blamed and, if possible, regulated. However, for others, the same 70 percent is an achievement of mitigation against the hazards of climate which is vital for poverty alleviation and agricultural growth, *especially* if it is done at no cost to the tax payer. The issue at stake is the recognition of customary and local resource management regimes. For land, the change to multi-party democracy in 1994 initiated a reform to overcome the colonial legacy and ensure all citizens' rights to land, including a redistribution of land, and including land that estates had left unused. However,

for water, the core of the colonial legacy was taken forward unchallenged, and will now also be further implemented: the denial of local water law and the enforcement of permits (even for treadle pump users), which renders many local water users formally unlawful. The new Act makes no reference to customary water rights regimes or an equitable redistribution of water. Permits may even become the relatively easy way for foreign and national high-impact users to vest their first-class entitlements to water over the second-class entitlements of the large majority of small-scale users. Thus, water law risks contradicting the government's, donors' and agricultural ministries' policies for poverty alleviation and smallholders' private investments in water infrastructure. As a taxation measure, permits should align with decentralizing fiscal policies, ensuring that collection costs outweigh revenue. Last but not least, nation-wide permitting conveys the message that available water resources need to be shared at the current very low level of water development. Yet, more storage would be a win-win for all.

Water scarcity is an economic scarcity, and not only a physical water scarcity. Clarity on this issue will support the agricultural sector to accelerate investments in irrigation, and will also benefit smallholders implementing self-supply. The water sector can better target its taxation and water regulation, for example, to the few high-impact users who over-use and pollute, and often fail to develop the storage needed. The water sector can also build on communities' local conflict resolution arrangements. For dry-season scarcities that will exacerbate with growing demands but without adequate storage development, tailor-made solutions need to be found, where possible as a win-win for all.

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