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USAID STRATEGIC ECONOMIC RESEARCH AND ANALYSIS – ZIMBABWE (SERA) PROGRAM

ZIMBABWE'S IRRIGATION POTENTIAL:

MANAGEMENT MODELS FOR IRRIGATION SCHEMES AND A POLICY FRAMEWORK FOR EFFICIENT IRRIGATED AGRICULTURE

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Contents

LIST OF TABLES AND FIGURES v

ACRONYMS vi

EXECUTIVE SUMMARY viii

ACKNOWLEDGEMENTS xi

CHAPTER 1: INTRODUCTION 1

1.1 Background 1

1.2 Objectives of the research study 1

1.3 Materials and methods 2

1.4 Conceptualisation of irrigation 2

1.5 Study report organisation 3

CHAPTER 2: HISTORICAL ANALYSIS OF IRRIGATION DEVELOPMENT IN ZIMBABWE 4

2.1 Introduction 4

2.2 Three phase irrigation development in Zimbabwe 5

2.3 Lessons from history 16

CHAPTER 3: ZIMBABWE'S IRRIGATION POTENTIAL 19

3.1 Status of the Irrigation Sector in Zimbabwe 19

3.2 Current Financing of the irrigation sector 20

3.3 The Country's Irrigation Development Capacity 20

CHAPTER 4: PROPOSED SUSTAINABLE IRRIGATED AGRICULTURE MANAGEMENT MODELS 22

4.1 Introduction 22

4.2 Key success factors 22

4.3 Proposed management models 24

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS 29

5.1 Introduction 29

5.2 Toward sustainable irrigated agriculture 29

5.3 Proposals for policy and regulatory issues 32

ANNEXURE: CASE STUDY REPORTS 34

Case study 1: The Lilstock irrigation syndicate 34

Case study 2: Mutema Irrigation Scheme (the banana project) 39

Case study 3: Odzani River Irrigation Company (ORIC) 43

Case study 4: Chifundi and Elmly Park Irrigation Schemes: An A1 Fast Track Land Resettlement Programme (FTLRP) partnership model 45

REFERENCES **50**

LIST OF TABLES AND FIGURES

Table 1: Overview of Zimbabwe's irrigation sector (1999) 4
Table 2: Policy initiatives and practice in the years 1889 to 1930 of the colonial era 7
Table 3: Policy initiatives and practice in the years 1931 to 1942 of the colonial era 8
Table 4: Policy initiatives and practice in the years 1950 to 1970 of the colonial era 9
Table 5: Policy initiatives and practice in the years 1980 to 1983 of the pre-ESAP era 11
Table 6: Policy initiatives and practice in the years 1985 to 1987 of the pre-ESAP era 12
Table 7: Policy initiatives and practice under the ESAP era 13
Table 8: Summary of rehabilitation and development costs 19
Table 9: Current irrigation status by farming sector 20
Table 10: Irrigation sector financing 20
Table 11: Lilstock irrigation syndicate current membership 35
Table 12: Inventory of existing irrigation infrastructure 36

Figure 1: Proposed model of organizational structure for optimum utilization of existing/new A1 and Communal irrigation infrastructure 26
Figure 2: Proposed model of organizational structure for optimum utilization of new and existing A2 irrigation infrastructure 27
Figure 3: Proposed model of organizational structure for optimum utilization of informal irrigation 28
Figure 4: sketch map showing part of the farms in the proposed Lilstock irrigation syndicate 38

Box 1: Four major answers can be put forward 5
Box 2: Strategies used by CONEX and DNA in advising farmers 8
Box 3: A Snippet of the Tilcor Concept 10
Box 4: Modalities for accessing the NFIF funding 12

Picture 1: Impressive banana crop under micro-jet sprinkler systems at Mutema Irrigation Scheme in Chipinge district, Manicaland Province, 2016 41
Picture 2: On-farm banana grading, weighing and packaging at Chibuwe Irrigation Scheme in Chipinge district, Manicaland Province, 2016 42
Picture 3: The 60 km Odzani River Irrigation Company (ORIC) gravity-fed canal in Mutare district, Manicaland Province, 2016 44
Picture 4: Winter wheat under a recently installed center pivot irrigation system at Chipfundi A1 irrigation scheme in Makonde district, Mashonaland West Province, 2016 47

ACRONYMS

ADA	Agricultural Development Authority
AFC	Agricultural Finance Corporation
AIMS	Automated Irrigation Management System
ARDA	Agriculture and Rural Development Authority
AREX	Agricultural Research and Extension
CIC	Combined Irrigation Company
CMC	Cooperative Management Committee
CSOS/T	Community Share Ownership Scheme/ Trust
CSU	Central Service Unit
DC	District Commissioner
DDF	District Development Fund
DERUDE	Department of Rural Development
DOI	Department of Irrigation
EMA	Environmental Management Agency
ESAP	Economic Structural Adjustment Programme
FAO	Food and Agriculture Organisation
FTLRP	Fast Track Land Resettlement Programme
GMB	Grain Marketing Board
GNU	Government of National Unity
GOZ	Government of Zimbabwe
IDF	Irrigation Development Fund
IMC	Irrigation Management Committee
LICUM	Lilstock Irrigation Consortium Management Unit
LSCF	Large Scale Commercial Farmer
MAMID	Ministry of Agriculture, Mechanization and Irrigation Development
MTP	Medium Term Plan
NERP	National Economic Revival Programme
NFIF	National Farm Irrigation Fund
NRA	Native Reserve Area
ORIC	Odzani River Irrigation Company
PPP	Public Private Partnership
PSIP	Public Sector Investment Programme
RBZ	Reserve Bank of Zimbabwe
SERA	Strategic Economic Research and Analysis
SLA	Sabi Limpopo Authority
SNV	Netherlands Development Organisation
STAMP	Smallholder Technology and Access to Markets Programme
STERP	Short Term Economic Recovery Programme
USAID	United States Agency for International Development
WWIRP	Wheat Irrigation Rehabilitation Programme
ZIM AEID	Zimbabwe Agriculture Income and Employment Development Programme

ZIM ASSET	Zimbabwe Agenda for Sustainable Socio-Economic Transformation
ZIMCORD	Zimbabwe Donors' Conference on Reconstruction and Development
ZINWA	Zimbabwe National Water Authority

EXECUTIVE SUMMARY

This study was commissioned to provide technical assistance for the development of a management model for irrigation schemes appropriate for each irrigator sector in Zimbabwe. The purpose is to increase the sustainability and operational efficiency of irrigated agriculture in the country. It is intended that this will contribute toward the formulation of an appropriate policy and regulatory framework by the Government of Zimbabwe on the sustainable utilisation of new and existing irrigation infrastructure, its management, and its optimum expansion. Implementation of this policy and regulatory framework will put the country on a path towards the complete realisation of its irrigation potential, and re-establish the food basket status Zimbabwe enjoyed in the pre-land reform era. Irrigated agriculture has the potential to sustainably increase food production in Zimbabwe and help ease the food security challenges the country is currently grappling with. This report provides an analysis and evaluation of both existing and proposed irrigation schemes on farm lands, and recommends an organisational structure model appropriate for each farming sector. The organisational structure model will provide answers on what irrigation design, irrigation management (operation, maintenance repair and replacement of irrigation infrastructure components), and irrigation financing models need to be adopted for each particular farming sector.

Methods of data collection and analysis included drawing from concepts on irrigated agriculture in order to further understand what irrigation broadly entails. The case study approach was used where one (1) proposed and four (4) operational irrigation schemes were objectively selected for the research. Interviews were subsequently undertaken with key informants such as scheme management members, ordinary irrigators, officials of government agencies who provided services to the schemes, and private partners found on the irrigation schemes visited. A check list of questions was used. The approach of doing a literature review was also employed to understand past and current key policy, regulatory, and institutional arrangements that guided the utilisation and management of irrigation infrastructure. Other methods used included expert elicitation, where opinions of experts on irrigated agriculture were solicited, as well as field observations. Field observations helped to assess the repair and maintenance status of the irrigation infrastructure in place in the visited schemes, and also to assess the condition of the crop under cultivation.

This research study finds that irrigation schemes in Zimbabwe must have an organizational structure model appropriate for each irrigator sector in order to increase sustainability and operational efficiency. Organizational structure models recommended included the Cooperative Model for A1/Communal Irrigation, the Combined Irrigation Company for A2 irrigation, and the Canal/Pipeline for Informal Irrigation. Each organisational structure model was developed from sub-models such as the irrigation design, irrigation management, and the irrigation management financing sub-models. The purpose was to ensure the optimum use of both existing and new irrigation infrastructure, leading to the sustainability and operational efficiency of the irrigation scheme. In the Combined Irrigation Company organisational structure model for A2 irrigation, the irrigation design sub-model comprises of the conveyance network of canals/pipelines commonly owned, with the individual member A2 irrigators owning the in-field infrastructure on his/her plot. The irrigation management sub-model comprises of the establishment of a Combined Irrigation Company (CIC) Board which manages the irrigation water conveyance network to the field edge of the member A2 irrigator. A critical Central Service Unit (CSU) is employed to operate, maintain and repair the combined water conveyance network. This removes the member A2 irrigator from the direct management of water delivery up to the field edge. The A2 irrigator focuses on his/her

in-field irrigation infrastructure while paying a levy to the CIC board for field edge delivery of irrigation water. In all the organisational structure models, financing of infrastructure development is the duty of the government in the form of a facilitative role by sourcing lines of credit for irrigation infrastructure development, with the beneficiaries responsible for the loan repayment. Creation of an Irrigation Development Fund (IDF) is proposed where farmers can borrow funds for irrigation infrastructure development at low interest rates as was the case with the National Farm Irrigation Fund started in 1985.

Success was observed with the involvement of private partners to form a Public-Private-Partnership (PPP) with irrigators. For example, this is in the case of Mutema Irrigation Scheme in Chipinge district of Manicaland province. Matanuska, a banana processing, grading, packaging and marketing company, partnered the Mutema irrigation scheme. The PPP arrangements at Mutema successfully revitalised the irrigation scheme through linking the irrigators with not only credible but sustainable markets, linking the irrigators with credit facilities, upgrading the irrigation system technology by replacing the surface system to a more energy-efficient and water-saving micro-jet sprinkler irrigation system, and through the production of the high value banana crop. Additionally, the cases of Mutema, Chipfundi and Elmly Park A1 Irrigation Schemes, showed that smallholder irrigators can use a good credit history to access crop input financing from commercial banks and commercial micro-finance institutions in the absence of title deeds as collateral security.

In the Cooperative Model for A1/Communal Irrigation, the irrigation design is that of having a single irrigated block. Members of the irrigation scheme elects a Cooperative Management Committee (CMC), which runs the scheme through an employed Central Service Unit (CSU) in the same manner as the Combined Irrigation Company organisational structure model for A2 irrigation. However the composition, size and complexity of the CSU depend on the magnitude and demands of the irrigation scheme. Some of the advantages of the Cooperative Model include reduced pipe network lessening pumping energy requirements, easy adaption to the state-of-the-art irrigation technology such as the centre pivot, uniform management practices leading to uniform crop quality, and field crops such as maize, sugar beans and soyabean becomes more profitable on a large scale. This approach has led to the successful cases of the Chipfundi and Elmly Park A1 Irrigation Schemes in Makonde district of Mashonaland West province.

The Canal/Pipeline organisational structure model was recommended for Informal Irrigation. Informal irrigation, also known as micro-scale irrigation, started in the pre-colonial era when smallholder farmers, without government support, developed their own irrigation. This study proposes this model for the sustainable utilisation of informal irrigation in that it removes the users from stream bank and river channel cultivation. The model consists of a water supply institutional arrangement that is responsible for running and maintaining a canal that runs off a river, delivering water to the field edge of the user member, who in turn pays a levy for the service. At the moment, the composition of this water supply institution is not clearly understood. The member plots need to be moved to a recommended distance from the river bank. Motivation for this model was primarily premised on the environmental damage observed on the Save River caused by the informal irrigation practice of cultivation in the river channel.

This study recommends the Cooperative Model for A1/Communal Irrigation, the Combined Irrigation Company of A2 Irrigation, and the Canal/Pipeline for Informal Irrigation as the best organisational structure models. Embedded in each organisational structure model are sub-models for the irrigation design, irrigation management, and the irrigation management

financing sub-models, in order to ensure the optimum use of both existing and new irrigation infrastructure.

Several recommendations for policy and regulatory issues are also proposed to make irrigated agriculture the backbone of the national food security. These include:

- The management of irrigated agriculture must be guided by Statutory Instruments informed by Commissions of Enquiry addressing specific issues, as was similarly done in the past,
- The Government of Zimbabwe has a facilitation role in sourcing of lines of credit for irrigation infrastructure development, with the irrigator farmers/beneficiaries responsible for the loan repayment,
- PPPs and credit record history for bank loans are the main models for crop input financing,
- Irrigation, especially combined irrigation syndicates must be a vehicle for rural (Growth Points) development anchored on agro-processing,
- State-of-the-art irrigation technology should be used for all irrigating farmer categories.

Lastly it needs to be noted that this research study analysis has its limitations. These include:

- Time allocated to data collection was inadequate and hence only little time was spend at each filed site for interviews, group discussions, field observations and data collection.
- Other farmer categories such as credit-worthy A2 and large scale commercial farmers develop and manage their own irrigation infrastructure using direct loans from commercial lending institutions. The time limitation could not allow this category to be part of the case studies. Hence evidence from their success stories or failures is has not been considered.

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CHAPTER 1: INTRODUCTION

1.1 Background

Zimbabwe's rainy season is now characterised with late starts, early cut-offs, inadequate amounts, and poor rainfall distribution throughout the season. Supplementing rainfall through irrigation, can gap-fill these shortfalls and smoothen crop water requirements for successful production. Major drought occurs approximately once every three years. Approximately 80% of the country is classified as marginal or unsuitable for intensive crop production, yet these regions encompass large arable land masses (Ivy, 1978). Hence investments in irrigated agriculture are required to offset the rainfall problems.

However many of the investments in irrigation have proved to be commercially unsustainable especially so in the smallholder sector. This is mainly due to low productivity, poor market access, high transport costs, input shortages, lack of relevant training and the propensity to flood the market with a few common horticultural crops (e.g. green maize, tomatoes and onions). In this sector irrigation generally improves farm incomes, but often not enough to support the sustained operation and maintenance of irrigation infrastructure. And even if incomes are high enough, management institutions are not strong enough to extract a share of these resources for irrigation scheme maintenance. As a result, many schemes face a cycle of rehabilitation with external funding either by government and/or donor financing.

At the turn of the millennium, Zimbabwe undertook a fundamental land redistribution program which completely changed the large-scale commercial landscape resulting in 2 resettlement models: A1 and A2 resettlement. The area irrigated in the large scale commercial sector estimated at 82 % (or 98 400 ha) of total irrigated area in the country at the start of the land redistribution program (MAMID reports) shrunk along with the collapse of services of water management models, operation and maintenance models, and financing models for capital and commercial production. Faced with continued challenges of capital funding, input shortages, lack of relevant training, high cost of rehabilitation, and expensive irrigation equipment the total decline in irrigated area could be much higher now. Consequently, Zimbabwe is currently grappling with food security challenges since the turn of the millennium. Therefore, innovative approaches to making capital investments in irrigation more productive and sustainable are a must. A policy formulation initiative to guide capital investment in irrigation infrastructure development, its sustainable utilisation or management, and expansion is perhaps a worthwhile starting point toward the full realisation of Zimbabwe's irrigation potential.

1.2 Objectives of the research study

This research study carried out an in-depth analysis of past and current key regulatory, policy, and institutional arrangements that guided the utilisation and management of irrigation infrastructure. This analysis provided lessons highlighting what went wrong and what could be done right and also gave options to shape the full exploitation of the country's irrigation capacity. Access to affordable irrigation services by A1, A2 and communal farming sectors was a particular focus of the study. Solutions incentivising irrigators to utilise and manage irrigation infrastructure for sustainable agricultural production were proffered.

1.2.1 Main objective

The main objective of this study was to provide technical assistance toward the formulation of an appropriate policy and regulatory framework by the Government of Zimbabwe on the sustainable utilisation of the existing irrigation infrastructure, its management, and its optimum expansion. This policy and regulatory framework should put the country on a path to fully realise its irrigation potential, and re-establish the food basket status Zimbabwe enjoyed in the pre-land reform era.

1.2.2 Specific objectives

The specific objectives addressed include:

- Optimisation of the utilisation of existing irrigation infrastructure on farm lands,
- Recommending an irrigation design model, appropriate for each farming sector,
- Proposing an irrigation management, operation and maintenance model appropriate for each farming sector, and
- Proposing a cocktail of irrigation financing models.

1.3 Materials and methods

A combination of concepts and methods were used to explore the potential of irrigated agriculture to sustainably increase food production and help ease the country's food security challenges. The case study approach was used to understand the utilisation and management of existing irrigation infrastructure. Selected irrigation schemes were visited for data collection. These include the Proposed Lilstock Combined Irrigation Scheme located in the Upper Ruya Sub-catchment in Bindura District of Mashonaland Central Province; Chipfundi and Elmly Park Irrigation Schemes both located in the Lions' Den area of Mashonaland West Province; Mutema and Chibuwe Irrigation Schemes both in Chipinge district, Manicaland Province; and the Odzani River Irrigation Company (ORIC) in Mutare district of Manicaland Province.

Interviews were contacted with key informants such as scheme management members, ordinary irrigators, officials of government agencies who provided services to the schemes, and private partners found on the irrigation schemes visited. A check list of questions was used. These included the challenges the irrigation schemes faced, success stories, operation and maintenance models used, crops grown and yield (highest, least and average) levels attained. In addition, field observations were used to assess the repair and maintenance status of the irrigation infrastructure in place, and also to assess the condition of the crop under cultivation.

The approach of literature review was employed to understand past and current key policy, regulatory, and institutional arrangements that guided the utilisation and management of irrigation infrastructure. Expert elicitation was also used together with the other evidence gathered to propose irrigation design models, irrigation management, operation and maintenance models, and irrigation financing models appropriate for each farming sector.

1.4 Conceptualisation of irrigation

Irrigation can be conceptualised as a technology for:

- Rural development (Private Public Partnership models, Tilcor/Arda model): irrigation becomes the node for growth of rural service centres (Growth Points)

- Agricultural (cropping and livestock) intensification: irrigation enables the cultivation of more crops per year on the same piece of land, and
- Supplementing rainfall deficits leading to successful summer cropping.

We conceptualise irrigation as embracing all the three concepts cited above, that is, as a technology for rural development, for agricultural intensification, and for supplementing rainfall deficits, leading to the sustained food security of the nation. For sustained food security in Zimbabwe, irrigated agriculture is an inescapable imperative and should be based on:

- Rain-fed (summer) maize and soya bean production enhanced through supplementary irrigation,
- fully irrigated high value winter crops for local and export markets,
- Irrigation design and development models that optimise economies of scale and ensuring efficient use of water, energy, and inclusive growth,
- Irrigation management models that incentivise and enable small-holders farmers (i.e. A1 and communal farmers) to manage shared/combined irrigation schemes in a sustainable manner,
- Irrigation operation and maintenance models that harness the competences of both private and public sector knowledge and skills, and
- Irrigation financing models that ensure cost recovery.

1.5 Study report organisation

The rest of the research study report is organised as follows: Chapter 2, gives a historical analysis of irrigation development in Zimbabwe, while chapter 3 describes Zimbabwe's irrigation potential. Chapter 4 proposes three irrigated agriculture management models for: existing and new A1 and Communal area schemes, for A2 irrigation schemes, and for informal irrigation. Chapter 5 presents the conclusions and recommendations of the research study.

CHAPTER 2: HISTORICAL ANALYSIS OF IRRIGATION DEVELOPMENT IN ZIMBABWE

2.1 Introduction

The irrigation sector in Zimbabwe at the turn of the new millennium comprised several sub-sectors that varied tremendously in terms of technology used, management regime and contribution to the national economy (Zawe *et al.*, 2015). In a way the sector mirrored the dual nature of Zimbabwe's economy that came about as a consequence of the segregated agrarian development policies of the colonial era (Manzungu, 1999; Chidenga, 2003; Bolding, 2004; Zawe, 2006). The sector comprised of five main sectors i.e. (Large Scale Commercial, Agriculture and Rural Development Authority (ARDA) Estates, Communal and Resettlement Smallholder Irrigation schemes, Smallholder out growers, and Informal/Micro-Scale as indicated in table1).

The large scale commercial irrigation comprising about 73 % of the total area encompassed two private sugar estates, citrus estates, and a multitude of individually operated farm systems. The sector was characterised by high output production levels providing for the bulk of the agricultural exports of the country (tobacco, tea, sugar, citrus, and coffee), as well as the bulk of the seed maize and wheat. Technologies used were predominantly overhead irrigation systems (centre pivots, sprinklers) often making use of an elaborate network of interconnected dams and pumps. The sector had in the past enjoyed considerable government subsidy to develop this elaborate network of infrastructure. During the mid-1990s a new concept of infrastructure development was introduced: BOT build-own-operate-transfer with farmer syndicates. In terms of management, commercial farmers organised themselves in River Boards that would appoint water bailiffs to operate the elaborate network of interconnected dams and transfer canals, thus minimising water-related conflicts amongst different users (ZimConsult, 1996).

Table 1: **Overview of Zimbabwe's irrigation sector (1999)**

Category	Area (ha)	Area %	# schemes	# farmers
Large scale commercial	126,000	73	1,500	1,500
Parastatal (ARDA) Estates	13,500	8	26	N/A
Communal & resettlement	9,300	5	180	18,300
Small-scale out-growers	3,600	2	N/A	N/A
Informal/micro-scale	20,000	12	N/A	N/A
Total	**172,400**	**100**		

Source: GoZ (1999)

The Agricultural and Rural Development Authority (ARDA) is a parastatal that was established by government in 1983 through merging three pre-independence era organizations namely: Sabi Limpopo Authority (SLA), Tribal Trust Land Development Corporation (TILCOR) and the Agricultural Development Authority (ADA). The merger was necessitated by the need to create an institution that would guarantee food security in Zimbabwe. At the turn of the new millennium ARDA operated on 21 Estates, with a combined total potential arable land area of 98,232 ha, located in all the provinces of Zimbabwe. About 13,500 ha of this area were irrigated with systems ranging from flood to centre pivot irrigation technology.

The ARDA estates supported a total of 3,600 ha of smallholder irrigation schemes as out growers.

Informal and micro-scale irrigation was developed by the smallholder farmers without government support. In a number of situations government has suppressed and stifled such farmer initiated irrigation ventures on the ground that these were harmful to the environment. Different types of systems: wetland cultivation, riverbank cultivation, riverbed cultivation and collector well systems using sand abstraction wells in silted riverbeds (mufuku) are some examples. The size of such schemes varied from 10 m^2 to 50 ha. Organisational forms differed from individual use to women's groups or clan-based irrigator communities.

As for Smallholder irrigation, its sustainability and viability has been a subject of recurrent discussion throughout Zimbabwe's colonial and postcolonial history. This apparent high interest in smallholder irrigation, however, did not correspond with its current or past contribution to the national economy (Rukuni, 1993a: 2; Rukuni and Makadho, 1994: 137). By the turn of the new millennium smallholder irrigation covered only 5 % of the officially recognised total irrigated area in the country as shown in table 1 (GoZ, 1999). If one adds the estimated command area of informal irrigation practised by smallholders, their total share increases to some 17 % of a total of 172,400 hectares (see table 1). The gross output from smallholder irrigation in the 1984/85 agricultural season was only 0.4 % of the total agricultural produce (Harvey *et al.*, 1987 in Manzungu *et al.*, 1996; Peacock, 1995).

Box 1: Four major answers can be put forward

- Smallholder irrigation development has always had a clear political content as it embodied the two most contentious issues in the Zimbabwean history namely land and water. Colonial injustice was obvious and had remained unsolved 19 years after Independence. The distribution of both these resources required a rigorous redress (Manzungu *et al.*, 1996),
- Smallholder irrigation development was and still is viewed as capable of alleviating rural poverty, which is manifested by transitory and chronic hunger, malnutrition and unemployment (Makadho, 1994),
- Smallholder irrigation development offers a chance to modernise peasant agriculture. Modernisation may result in smallholder irrigation contributing to the growth of local industries as well as to foreign currency earnings. Intensifying agricultural production in communal lands through irrigation alleviates the increasing pressure on scarce land resources. Thus smallholder irrigation development has been described as a foundation for rural growth (Makadho, 1994),
- After the devastating 1992 drought, the smallholder irrigation gained political expediency, with the Minister responsible for Agriculture as well as the State President promising a dam and an irrigation scheme in each district (Bolding *et al.*, 2004; Zawe, 2000).

2.2 Three phase irrigation development in Zimbabwe

In Zimbabwe, both pre-independence (pre-1980) and post-independence governments have been the key drivers of irrigation development, at strategic, planning, financing, implementation and management levels. The extent of government involvement was dictated by government strategic objectives that differed, in particular before and after independence. Though none of the governments managed to produce a comprehensive irrigation policy document, strategic considerations that varied from time to time and from one government to the next had a profound impact on irrigation development, especially in terms of how projects

were initiated, financed, the technologies selected and implementation processes undertaken and the operation and maintenance of irrigation infrastructure. The motivations driving especially smallholder irrigation development placed smallholder farmers at the epicenter of the strategies, allowing farmers to participate to the extent that was consistent with the strategic development objectives of the government of the day. As a result, Zimbabwe has not had a comprehensive irrigation policy to guide both irrigation development and management.
However policy discourse is problematic in that it is not in black and white and is subject to varied interpretation by the different stakeholders of the irrigation subsector (Bolding *et al.*, 2004). This paper argues that this discourse needs to be translated into a comprehensive irrigation policy. This chapter brings to fore the evolution of the discourse by tracing the legal and policy initiatives made by successive governments in their quest to deal with access to land and water by their subjects as well as increasing the productivity of the country's agriculture sector.

2.2.1 Pre-colonial era

Pre-colonial era irrigation development was basically what is known today as informal and micro-scale irrigation systems developed by the peasant farmers as individuals or groups without any government support. These irrigation schemes still exist to date. Notable irrigation schemes of this era are Mutambara irrigation scheme in Chimanimani, Wetland cultivation in Rusape, Marondera and Murehwa and also off river diversions in Nyanga highlands. The Manyika people (people of Manicaland) are said to have practiced furrow, 'informal' irrigation or *dambo* cultivation before the coming of Europeans (see Manzungu and van der Zaag, 1996: 4).

2.2.2 Colonial era

Colonial era policies aimed at control and regulation of agricultural production in the country to ensure high productivity and also ensuring environmental protection. The colonial governments were not apologetic but emphatic and aggressive in their quest to create a country in which the colonizers would live in separate areas from the colonized. They were also very sure that the colonizers would not allow the actions of the colonized to have detrimental effects on their livelihoods. Tables 2 to 4 outline the colonial agricultural policies and actions and how these created the conditions of possibility or impossibility for the development of the country's irrigated agriculture. See also Rukuni, 1986; Mombeshora, 2003 and Zawe, 2006 for more insights.

Table 2: Policy initiatives and practice in the years 1889 to 1930 of the colonial era

Period	Policy Initiative & Practice	Objective and Impacts
1889	British South Africa Company (BSAC) obtains the Rhodesia Charter from Queen Victoria	-Start of the colonial era and colonial domination of the African Native People, -Safeguarding primary water rights to all people (Natives and White Settlers).
1913	Water Ordinance	Vested all public water in the State through the Water Court prescribing conditions for appropriation and use.
1920	Doctrine of prior appropriation introduced into the Water Ordinance	Imprinting the principle of 'first come, first served' during periods of water scarcity.
1923	Passing of the Constitution of Rhodesia	-Incorporation of White settler irrigation methods into Native agriculture, -White extensionist Alvord appointed to train African Agricultural Demonstrators to modernise Native farming, -Farmers encouraged to build irrigation furrows, -Wheat seed & sweet potato vines given to Natives.
1925	Morris Carter Land Commission	Allocated 33 % of land to Native Reserve Areas (NRAs), and 50 % of land to White Settlers.
1926	Herskowitz cattle study	-Produced the "cattle complex theory"[1], -This resulted in cattle destocking in NRAs.
1927	The Water Law (1927)	Control of access to irrigation water: -vested responsibility for the Natives' water rights in the Native Commissioner, -offered Individual White Settlers with title to land and individual water rights tied to their lands, -but no deliberate government policy on irrigation.
1930	Land Apportionment Act	Separate Native and White Farmer agricultural development methodologies: - Country divided into White and Black areas, -Two departments for Agricultural Extension were created: Department of Native Agriculture (DNA) in the Ministry of Internal Affairs for blacks and Conservation & Extension (CONEX) for whites (for further explanation see Box 2), - The Native Agriculture Department intervened in smallholder irrigation by providing technical advice to farmers constructing their own schemes, - State supervised Native Agricultural production.

[1]Postulated that the reluctance by natives to sell or kill cattle for market or home consumption stemmed from their culture, traditions, prestige and status. Tribal Chiefs were as a result rewarded with money, regalia or other tokens if they persuaded their subjects to destock resulting in conflicts with their subjects (Palmer, 1977).

Box 2: Strategies used by CONEX and DNA in advising farmers

The two extension service departments used different strategies in advising farmers. The DNA was based on research demonstrations and farmer discussions. CONEX on the other hand employed Agriculture specialists based at research stations who interpreted research results into technical papers that were passed on to the Conservation and Extension Officers based in intensive conservation areas (ICAs). The Extension officers conducted weekly discussions with farmers at specified country clubs around the country where all farmers were to attend. The discussions included new farming techniques emanating from the technical papers developed by specialists and farmer problems that would be communicated to research through subject matter specialists. The result was development of agricultural manuals like the Irrigation Handbook, Beef Manual, Horticulture Handbook, etc. that farmers could buy. On the contrary The Department of African Agriculture emphasized more on demonstrations, control and regulation of African Agriculture production. A rigorous analysis of practice and impact of these strategies go beyond the scope of this study making it an important subject for another study.

Table 3: Policy initiatives and practice in the years 1931 to 1942 of the colonial era

Period	Policy Initiative & Practice	Objective and Impacts
1931	The Maize Control Act Cattle Levy Act	-Ensured modernisation of native agriculture posed no competition to White settler agriculture for markets and labour, -The Cattle levy Act was meant to limit cattle in NRAs (Palmer, 1977; Phimister, 1988; Chitiyo, 2000), -Natives continued to develop small irrigation schemes and practice rain-fed farming, -They retained control of schemes and decision making in the schemes.
1942	The Natural Resources Act	-Aim was to control the "destructive" behaviour of native agriculture.
1944	The Godlonton Commission Notice Number 612 of 29/11/1944	-Blamed "the conservation catastrophe" in NRAs on lack of good husbandry and leadership in Native Agriculture, -Proposed appointment of a statutory board to enforce good agricultural husbandry by legislative and administrative means, -Increased regulation and control of Native Irrigators, see box 2;[2] -Increased state resources for Native irrigation development. -Prescribed livestock carrying capacities for NRAs to force de-stocking through cattle auctions, -A basic six-acre arable plot supported by a herd of six cattle per household was adopted to replace the traditional native system of shifting cultivation (slash and burn) farming (Chitiyo, 2000);[3]

[2]To the Natives, the NRA had telling impacts on irrigated agriculture by curbing the African furrow irrigation and the cultivation of wetlands (matoro) (see Bolding, 2004)

[3]These recommendations remained the cornerstone of land utilisation in NRAs even after independence (Chitiyo, 2000).

Table 4: Policy initiatives and practice in the years 1950 to 1970 of the colonial era

Period	Policy Initiative & Practice	Objective and Impacts
1950	Amended the Land Apportionment Act	-Removed Blacks from White areas, moving them to Native Reserves Areas, -Stimulated compensatory construction of dams for Native irrigation schemes to resettle the displaced.
1952	Conservation Law Passed	-Created the Intensive Conservation Areas (ICA) in White Farming Areas, -Outlawed cultivation within 30 metres of streams so as to minimise erosion; -Restricted access to and use of water by Natives already disadvantaged by the Water Law of 1927.
1961	The Southern Rhodesia Irrigation Policy Committee Report	-An Irrigation Policy Committee set up in 1960 explored the strategy of using irrigation as a means of settling displaced black people, -Farmers resisted participating in new schemes built by Government leading to under-utilisation of smallholder schemes, -Curtailed development of small-holder irrigation schemes citing low cost-effectiveness.
1965	UDI 1965	-Consolidated the policy of separate development for Blacks and Whites, -Need to ensure food self-sufficiency it the face of sanctions through increased agriculture production.
1968	Tribal Trust Lands Corporation (Tilcor) Act	-Establish a corporate body to design and develop sustainable irrigation based Growth Points in rural areas, -Strategy to modernise Tribal Trust Lands to reduce migration of Natives to White Areas (see box 3), -The Irrigation based Growth Point entailed the establishment of a highly mechanised irrigated Large Core Estate with elegant crop and livestock handling and processing facilities operated by Tilcor, -The Core Estate offered irrigation and crop management services to surrounding smallholder irrigator out growers, -The out growers adopted the cropping programme of the Core Estate that provided crop input, tillage, weed control, harvesting and marketing services, -See also (Zawe, 2000) for more insights.
1970	Land Tenure Control of Irrigable Areas Regulations (CIAR)	-Use of irrigable areas declared a privilege with the following consequences: -Occupants expected to fully utilise allocated land, -Native's conduct is controlled and regulated, -District Commissioners were empowered to control irrigable areas within their district, -Implementation of the regulations was through a resident White Irrigation Manager, -Regulations ensured order, efficient, co-ordinated and disciplined use of land and water, -Result was high production due to fear of eviction.

Box 3: A Snippet of the Tilcor Concept

- Tilcor's ultimate aim was that Growth Points, with all their facilities, would be controlled by the local Africans.
- In Rhodesia there are 18 million ha of land reserved for the African, within which a largely traditional way of life continued to exist. By contrast, in the areas dominated by Europeans, due to their more materialistic background and ability to attract and generate capital, development has been rapid and efficient.
- The country, therefore, faced an imbalance of development and standards of living due to the inability of the traditional African areas to organize the capital necessary for growth.
- To assist the transition from subsistence to cash economy was the essence of the mandate given to Tilcor by an Act of Parliament in 1968. In specific terms, the Act sought to plan, promote, assist and carry out development in the Tribal Trust Lands for the benefit of the Africans.
- There were, of course, within tribal areas, a network of Government facilities such as schools, health clinics, and agricultural and community advisory services. But these were barely able to cope with the Government's ever-increasing work and besides, Government is not entrepreneurial in spirit.
- Tilcor's task was to find suitable areas where capital development in an activity in which the rural African can play a full part would lead to a natural development of urban complexes closely related, economically and socially, to the surrounding area.
- To establish the magnitude of the task, a survey of all 167 tribal areas of Rhodesia was carried out. During the same period, two large-scale agricultural development projects at Katiyo and Chisumbanje were set in motion.

Source: Norris, 2012

2.2.3 Independence era

Independence era policies varied with the government thrusts at different times. This era can be divided into four periods: the pre- ESAP (Economic Structural Adjustment Programme) era, the ESAP era, the Fast Track Land Resettlement era and the Dollarized or Multi-currency era.

The pre-ESAP era

Tables 5 and 6 outlines the policy initiatives and practice used in the pre-ESAP era.

Table 5: Policy initiatives and practice in the years 1980 to 1983 of the pre-ESAP era

Period	Policy initiative &Practice	Objective and Impacts
1980	Communal Areas Act	-Established the Communal ownership of land in previous NRAs, -Land tenure in communal areas was vested in the District Councils, -Rural Councils were created in the White Farming Areas, -There was no change in management of irrigable areas.
1981	Growth with Equity Zimbabwe Donors' Conference on Reconstruction and Development (ZIMCORD) Willing Buyer Willing Seller Resettlement Programme	-Growth of the large commercial farming sector through credits, -Resulted in increased tax base, -Taxes financed smallholder agriculture subsidy. -Abundance of donor funds, -Irrigation rehabilitation of schemes damaged by the liberation war, -Continued use of the control of irrigable areas regulations, -Sudden growth in smallholder agriculture in the first five years, -New irrigation schemes in former white areas for smallholders, -However only marginal farms were offered.
1982	Merging of two Extension Departments: AGRITEX and DERUDE Department of Rural Development (DERUDE)	-The birth of AGRITEX responsible for agricultural extension with emphasis on smallholder farmers, -Provision of credit to smallholder farmers by the Agricultural Finance Corporation (AFC), now Agribank. -Responsible for smallholder irrigation construction and management.
1983	DERUDE Smallholder Irrigation Policy Initiative Merging of TILCOR, & Sabi-Limpopo Authority	-To reduce State role in smallholder irrigation Operation & Maintenance (O & M), -Borrowed content heavily from CIAR, -Change from control and regulation to persuasion, - Created Irrigation Management Committees (IMCs),[4] -Increased Smallholder participation in irrigation development, -Irrigation development and O&M by DERUDE, -The Irrigation Policy did not cover the Large Scale Commercial sector. -Creation of the Agriculture and Rural Development Authority (ARDA), -Smallholder out-grower schemes developed under TILCOR handed over to ARDA, -ARDA's focus not exactly the same as TILCOR.

[4] IMCs were created in smallholder irrigation with the responsibility for discipline of irrigators, assisting irrigation officers to select new farmers, acting as liaison between farmers and government officials and mobilizing farmers in self-help projects.

Table 6: Policy initiatives and practice in the years 1985 to 1987 of the pre-ESAP era

Period	Policy initiative &Practice	Objective and Impacts
1985	National Farm Irrigation Fund (NFIF)	-To ensure the involvement of all farmers in financing irrigation development, -All funds for LSCF were utilised while funds for smallholder farmers were not utilized due to availability of donor funds, -NFIF was a low interest rate loan; the fund was administered by the Agricultural Finance Corporation (AFC); for modalities of access see box 4, -Resulted in rapid expansion of the LSCF sector irrigation.
1987	Strengthening of the Irrigation Branch of AGRITEX Merging of the Irrigation Divisions of AGRITEX and DERUDE	-Developed capacity of the Branch to design and construct efficient and commercially viable smallholder irrigation schemes, -New irrigation specialists were recruited and trained in-house using the FAO technical experts on design of drag-hose sprinkler irrigation and preparation of irrigation feasibility reports, -Marked the serious introduction of sprinkler irrigation technology (in particular drag-hose technology) in the smallholder sector, -Small holder irrigation development & extension under one roof, -Conversion of post of Irrigation Manager to Senior Extension Supervisor, -Replacing Smallholder Irrigation Management with Extension.

Box 4: Modalities for accessing the NFIF funding

- Eighty five percent of fund reserved to large-scale farmers (LSCF),
- LSCF used fund to develop farm dams, headworks construction, pipelines and in-field irrigation infrastructure,
- Fifteen percent of the funds were reserved for groups of smallholder farmers,
- They used it for infield irrigation facilities only,
- Water conveyance from source to field edge was funded through the Public Sector Investment Programme (PSIP),
- Beneficiaries were expected to grow wheat during loan tenure.

The ESAP era

Table 7 outlines the policy initiatives and practice that characterized irrigation development and use in the ESAP era.

Table 7: Policy initiatives and practice under the ESAP era

Period	Policy initiative &Practice	Objective and Impacts
1990	Economic Structural Adjustment Programme (ESAP)	-Deregulation of the economy, and the introduction of the free market economy, -Cut back of Government expenditure by reducing subsidies, -Government abruptly withdrew most subsidies, but continued to bail out some smallholder schemes on an ad-hoc basis, -AGRITEX adopted Irrigation Management Turnover (IMT) by default, -Smallholder Irrigation farmers were given O & M responsibilities without preparation, -Collapse of irrigation schemes due inadequate O & M.
1994	Smallholder Irrigation Policy and Strategy	-Advocated for the growth of the area under irrigation, -Encouraged the establishment of a water pricing structure, -Promoted the use of efficient irrigation technologies in the smallholder irrigation sector, -Encouraged private sector participation in smallholder irrigation, -Policy never published nor circulated resulting in limited use.
1997	Environmental Management Act	-Classified irrigation development as a prescribed activity that can only proceed with authorization by the Environment Management Agency EMA, -An exemption or Environment Impact Assessment report by the implementing agency certified by EMA before irrigation development can commence.
1998	Water Act (1998)	-To rationalize water resources planning, development and management, -To vest water ownership in the state, -Removal of the issuance of priority date system of water rights and their replacement with renewable water permits, -To improve efficiency of water use through the implementation of the user pays principle, -Management of all water resource is by the Zimbabwe National water Authority (ZINWA) replacing River Boards, -Polluters of water pay, -Financing of management of water resources by ZINWA would be through cost recovery from users with targeted subsidies for vulnerable groups such as small-holder farmers.

The Fast Track Land Resettlement Programme (FTLRP) period (2000 to 2009)

The FTLRP that started in 2000 saw large chunks of land being redistributed from the large-scale white commercial farmers to the majority blacks based on the A1 and A2 resettlement models[5]. Along with this land redistribution, irrigated land was also redistributed. A1 farmers and A2 farmers acquired irrigated land replete with a cocktail of irrigation technologies, ranging from semi-portable systems to centre pivot and drip systems. Varying complications in organisation were encountered. Organisational variation ranged from single farm pumping units feeding straight into sprinkler laterals to complicated consortiums comprising networks that included lift pumps to canal systems, night storage dams and separate booster pump stations at individual farms. The systems had been constructed to minimise management costs

[5]A1 resettlement model was a model in which farmers were allocated communal grazing, an individually owned arable 6 hectare plot and a 0.5 hectare residential plot in a village setting like is the case in communal areas while A2 was a model in which farmers were allocated individual plots like in commercial farming areas however with no title deeds.

by sharing overheads created by dams, mainlines and canals, main pumping stations, security guarding costs and operation and maintenance costs. This transformed some otherwise impossible individual irrigation systems into some of the most efficient, profitable and enviable irrigation ventures in the country (see case studies below). The result of the fast track resettlement programme was that the once single user or consortium managed networks were invariably converted into multi-user systems overnight. Also important to note is that in most cases either the outgoing farmers or petty criminals and vandals (in search of a quick buck) removed movable irrigation equipment and vandalised immovable parts of the irrigation network. This scenario has since defined the new irrigation development agenda that the country has set for itself, aiming to revive the flamboyant agricultural sector that was once the marvel of the African continent.

The period was characterised by policy clashes between Zimbabwe and the international community regarding the implementation of FTLRP and national governance issues that resulted in the isolation of the country by the international community. The result was rapid decline in agricultural production, rapid decline in the economy and an increasingly hungry population. To avert the crisis, the government adopted fire-fighting strategies in rapid succession.

In 2002, government launched the National Economic Revival Program (NERP). With NERP, the government abandoned the free market principles, advocated earlier under ESAP, in favour of a managed economy. As part of NERP, the Reserve Bank of Zimbabwe (RBZ) assumed a more prominent role in the implementation of development programmes, through quasi-fiscal financing. In the irrigation sector, the government realising that most commercial farm irrigation systems were no longer functional, embarked on a massive irrigation rehabilitation programme dubbed the Winter Wheat Irrigation Rehabilitation Programme (WWIRP). This programme was extended annually up to 2009 funded by the Reserve Bank of Zimbabwe (RBZ).

The RBZ progressively became the main financier of irrigation rehabilitation. Initially the Government financed and implemented the programme through a number of departments. The Agriculture and Rural Development Authority (ARDA) was responsible for the disbursement of funds, while the Department of Agricultural Engineering, (AREX) and to some extent DDF were responsible for verifying the project funding requests in terms of land quality, water resources, adequacy of equipment applied for, and capability of the applicant. The WWIRP though concentrated on A1 and A2 irrigation schemes with very little support to smallholder irrigation development. The reduced government support coupled with runaway inflation and eventual introduction of the multicurrency system eventually crippled the smallholder irrigation sector.

In agriculture, the change from neo-liberal policies to a managed economy required a comprehensive overall policy strategy revision resulting in the promulgation of a number of measures that reflected this departure. Below are some of the key measures adopted:

Introduction of price controls on grain

From 2002 to date, the government controlled the producer prices of maize and wheat. These controls however posed a number of problems including failure of reviews of producer prices to keep up with hyperinflation. As a result, the value of agricultural commodities was severely eroded thereby reducing farmer incomes, and incapacitating smallholder and other irrigators

as far as operation and maintenance of irrigation schemes was concerned. This led to a general decline of agriculture production and productivity (GoZ, 2010).

The Government Input Scheme

In the year 2000, the government adopted and announced an agricultural production enhancement strategy based on the provision of subsidized inputs to the farming community. However, due to resource limitations government annually failed to get adequate funds for the program. Over the years the funding gap widened due to the absence of commercial lending from banks to A1 and A2 farmers citing lack of collateral security. The need to appropriate resources for agriculture, mechanization and irrigation development further compounded the problem. Due to shortage of cash under the fiscal financing, alternative funding through the RBZ was introduced. The effects were that:

- inputs became available on the parallel market where prices were much higher than the government controlled prices;
- there was gross abuse of government input subsidy programs like fertilizer, seed, chemicals and fuel;
- price distortions ensued due to speculative behaviour within the whole economy and
- non-availability of fuel at appropriate times and locations.

The result was a severely stressed agricultural sector, including the whole irrigation sector.

Operation Maguta

Operation Maguta program was the Government's contribution to national food security. In its simplest form, Operation Maguta was a form of Command Agriculture where the farmer was given not only guidance on what crops to grow but how to grow them. The program was coordinated by the national army of Zimbabwe (ZNA) as a military operation to ensure food security. It focused on the growing of maize and small grains especially in the smallholder sector and winter wheat in the commercial sector. The program though was quite handy for A1 and A2 farmers who had no access to credit due to lack of collateral. Although the lack of adequate resources and timeliness of delivery of inputs hampered the program, all sectors of irrigators: A2, A1 and smallholder irrigators benefited.

Dollarization era

Market deregulation

Following the unveiling of the monetary and fiscal policies for the year 2009 by the new Government of National Unity (GNU), government removed controls on the prices of all crops including the staples wheat and maize. This resulted in GMB becoming the buyer of last resort. Also the export and import of these commodities were deregulated. The intention was to ensure that as much grain as possible would be available on the market. The result was instant. All shortages of the staples were averted and other agricultural products quickly became available on the market.

The Short Term Emergency Recovery Program (STERP)

The program made proposals for economic recovery in the various sectors during the nine months of the year 2009 following the establishment of the inclusive government. For agriculture, the program proposed the provision of crop packs to support farmers to boost agricultural productivity and improve food security at the national and household level during the winter cropping of 2009 and the summer cropping of 2009/10. The programme was however hampered by shortage of resources.

The medium term plan (MTP (2011-2013)
The plan promoted enhanced agricultural productivity and recognized the important role irrigation plays in the economy. The MTP emphasized rehabilitation of smallholder irrigation schemes and with it government started investing sizable amounts of cash into the sector under PSIP. For example a total of US$ 11 and US $ 16.5 m 2011 and in 2012 respectively was made available for the rehabilitation of smallholder irrigation schemes (DoI, 2011; 2012).

The Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZimASSET)
ZimASSET is the current national economic blue print guiding the economic growth of the country. In the irrigation sector it is emphasising irrigation rehabilitation in all farming sectors. It is encouraging Public Private Partnerships for irrigation infrastructure development. With this thrust, government is now facilitating the availability of credit lines for the development of irrigation infrastructure. The government is also reengaging Bilateral and Multilateral donors for the support of irrigation development. Smallholder irrigation rehabilitation is prioritised under the country's International Monetary Fund (IMF) staff monitored programme thus ensuring assured budget disbursement. Important to note is that price controls for wheat and maize grain was reinstituted together with import controls of some commodities.

2.3 Lessons from history

The review of colonial policies and practices adopted for the agricultural sector demonstrated that irrigation development was closely related to the need to create peaceful co-existence between the colonial government and the Native African people. Soon after colonization, the Native irrigators enjoyed a measure of autonomy from government. However, as the colonial government invested more resources into the Native irrigation sector, its control over Native irrigation schemes increased. The control and regulation of the conduct of the Native farmers was in a bid to ensure high productivity at irrigation schemes. The policies and laws passed were informed by Commissions of Inquiry set-up by the government on specific issues. Recommendations of some past Commissions of Inquiry are still in use today as Law. In summary, the irrigation sector was guided by policies and laws that were simplified into regulatory frameworks that were implemented by assigned distinct government agencies. The following issues stick out:

1. The enactment of successive laws and regulations to control access to water progressively moved from riparian ownership of water to water rights that were attached to land. In the Native Reserve areas, the water right was allocated to the District Commissioner (DC) who was the land authority empowered to include or exclude irrigators from an irrigation scheme in event of failure by irrigators to meet obligations for use. In addition, the DC was also empowered to ensure that the Natives did not lose their water rights to their LSCF competitors.

2. The Maize Control Act, that ensured that the modernisation of Native agriculture posed no competition to White settler agriculture for markets and labour. This act ensured food security for the country in that the Natives were forced to practice a four-year crop rotation on their arable land (Maize with Manure, Maize without Manure, Millet and Groundnut). This rotation devoted about half of the Native farmer's arable land to maize cultivation every year. On the other hand, their large-scale commercial counterparts growing tobacco were forced to adopt a four-year rotation that included

maize (Tobacco, Maize, Grass) in a way to ensure availability of the staple maize crop for national food security.

3. The Cattle Levy Act that was enacted to limit cattle numbers in NRAs (Palmer, 1977; Phimister, 1988; Chitiyo, 2000). Although viewed by the Natives as repressive, the Act served to curtail the problem of over-grazing in the catchment and maintain adequate soil cover to protect the land from erosion and possible siltation of the water courses. The Natural Resources Act although viewed as aimed at controlling the "destructive" behaviour of Native agriculture, served a similar purpose with the Cattle Levy Act.

4. The Tribal Trust Lands Corporation (Tilcor) Act although it was meant to buttress separate development for Whites and Natives, it resulted in the creation of viable Growth Points like Sanyati in Kadoma district, and Checheche in Chisumbanje. This can be a good instrument of all-inclusive development. The Core Estate model used by Tilcor offered opportunities for irrigation and crop management services to surrounding smallholder irrigator out growers such as tillage, weed control, harvesting and marketing services. Agro-processing of produce was done at the local Growth Point.

5. Control of Irrigable Area Regulations demarcated Irrigable areas in communal areas as separate land tenure from the rest of the communal areas. It then created regulations for the establishment of irrigation management entities around the DC who had power and authority to exclude non-compliant irrigators.

Following independence, the new government initially adopted the same policies that were in force in the colonial era. However the policies were slowly neglected with diminishing government resource availability to implement them. Some of the key issues affecting irrigated agriculture after independence include:

1. *Financing of irrigated agriculture:* In 1981, the Zimbabwe Donors' Conference on Reconstruction and Development (ZIMCORD) was held leading to the availability of abundant donor funds for the rehabilitation of smallholder irrigation schemes destroyed during the liberation war. This resulted in a sudden growth in smallholder irrigated agriculture in the first five years of national independence. The National Farm Irrigation Fund (NFIF) was initiated in 1985. This was a low interest rate loan administered by the then Agricultural Finance Corporation (AFC) now Agribank. The NFIF resulted in rapid expansion of the LSCF sector irrigation. In 2002, the Reserve Bank of Zimbabwe (RBZ) through quasi-fiscal financing embarked on a massive irrigation rehabilitation programme under the Winter Wheat Irrigation Rehabilitation Programme (WWIRP). This programme was extended annually up to 2009. Beneficiaries included the smallholder (A1 and communal) and A2 irrigators.
2. *Irrigation schemes management:* In 1983, Irrigation Management Committees (IMCs) were established to increase smallholder irrigator participation in irrigation and simultaneously reduce state role in smallholder irrigation operation & maintenance (O & M). However, these institutions were not backed by any legislation compromising their legitimacy and effectiveness. In the ESAP era, government hastily transferred the management of smallholder irrigation schemes to the IMCs. The capacity of the IMCs eventually collapsed due to the worsening economic situation which ended with hyperinflation and the subsequent dollarization in 2009. In the former LSCFAs, that

are now A1 and A2 farming areas, no deliberate institutions have been established to operate and maintain the irrigation schemes. The former commercial farmers operated their irrigation systems as single users.

3. *Lack of Commissions of Inquiry:* The interventions by the independent Government of Zimbabwe on irrigated agriculture was never premised or informed by expert investigation. The government interventions such as the RBZ quasi-fiscal financing of irrigation infrastructure rehabilitation, Operation Maguta, the re-introduction of price controls on wheat and maize grain from 2002 were adhoc interventions yielding unintended outcomes. In the contrary, policies and laws passed in the colonial era were informed by Commissions of Inquiry set-up by the government on specific issues.

CHAPTER 3: ZIMBABWE'S IRRIGATION POTENTIAL

3.1 Status of the Irrigation Sector in Zimbabwe

This section briefly discusses the status of irrigated agriculture in Zimbabwe by first looking at the irrigation potential of the country. This is then followed by a discussion on the current area equipped, functional and the area needing rehabilitation. After this the current resource mobilisation efforts for irrigation development are discussed as well as the country's irrigation development capacity.

3.1.1 Irrigation Potential in Zimbabwe

Zimbabwe adopted different irrigation techniques such as supplementary irrigation, deficit irrigation, and protective irrigation. The later involves applying irrigation water at only specific critical growth stages of the crop. With these irrigation techniques and also taking into consideration investments into the construction of new dams that the government has embarked on, Zimbabwe has a total identified preliminary potential irrigable area of 2,500,000ha. An estimated amount of US10.5 billion dollars is required to develop this area. The area, spanning across communal, old resettlement, small-scale commercial, ARDA, A1 and A2 farming sectors, can be commanded using water from existing, under construction and planned dams, underground water and small, medium and large rivers. Table 8 presents a summary of potential irrigation by provinces and related costs. To realise this huge potential, the government has to lure private sector investment into the irrigation sector.

Table 8: Summary of rehabilitation and development costs

Province	Total area (ha)	Total amount (US$)
Manicaland	273,000	1,228,500,000
Mashonaland central	670,000	3,015,000,000
Mashonaland east	231,000	1,039,500,000
Mashonaland west	312,000	1,404,000,000
Masvingo	213,000	958,500,000
Matebeleland north	455,000	2,047,500,000
Matebeleland south	146,000	657,000,000
Midlands	200,000	900,000,000
National total	**2,500,000**	**10,593,000,000**

Source: Department of Irrigation (2015)

3.1.2. The current developed area

The total area equipped with irrigation facilities is 186,000 ha out of which 130,000 ha is currently functional (DoI, 2015). The area that needs rehabilitation across all the farming sectors is 56,000 ha (see table 9). Some of the functional irrigation schemes do need upgrading with new irrigation technologies to improve on irrigation efficiencies and uniformities as well as reducing labour and power costs.

Table 9: Current irrigation status by farming sector

Sub-sector	Equipped (ha)	Functional (ha)	Rehabilitation (ha)
Communal	15,000	10,000	5,000
A1 & old resettlement	30,000	23,000	7,000
A2	61,000	22,000	39,000
ARDA	17,000	12,000	5,000
Plantations	63,000	63,000	0
National total	**186,000**	**130,000**	**56,000**

Source: Department of Irrigation (2015)

3.2 Current Financing of the irrigation sector

The irrigation sector has four main sources of funding for development, and operation and maintenance. These funding sources include farmer's own saving, direct funding by commercial lending institutions (e.g. commercial banks), funding through contract farming (PPP), funding through state assisted lines of credit, funding through donor financing and public sector investment programme (PSIP) financing (see table 10).

Table 10: Irrigation sector financing

Source	Farming Sector	Current Amount (US$)
Own Savings	All sectors but mostly informal smallholder irrigators	Not Known
Direct Funding from Commercial Banks	All sectors but credit worthy A2 and commercial farmers	Not Known
Contract Faming (PPP)	All sector but mainly farmer growing cash crops like tobacco, sugar cane, and bananas. PPP is a major source of Irrigation funding	Not Known
State assisted lines of Credit	A1 and Communal Farmers (More Food Brazil-Zimbabwe Programme)	45,000,000
Donor Financing	Smallholder communal irrigation schemes	12,000,000
Public Sector Program	A1 and Communal Irrigation Schemes	6,000,000

Source: Department of Irrigation, 2016

3.3 The Country's Irrigation Development Capacity

Irrigation development is about infrastructure development. Infrastructure development is invariably by the State. The government and its mandated institutions/organisations/agencies are therefore expected to take centre stage in irrigation infrastructure development. In Zimbabwe the mandate to develop irrigation infrastructure is entrusted into four main institutions:

- ARDA responsible for developing large-scale irrigation schemes like Chisumbanje,
- DDF responsible small dams and group irrigation schemes below 20 ha,
- ZINWA responsible for developing Large Dams and Large conveyance canals and pumping stations,
- Department of Irrigation responsible for irrigation planning, feasibility studies, designing, construction and construction supervision.

The government departments however are expected to contract out the works to private sector irrigation companies for actual execution of works. Important to note is that in the case of commercial agriculture production including A1 and A2, apart from dams, and conveyance systems, infield irrigation infrastructure is the responsibility of the owner of the farm. In this case infrastructure development may be entirely by commercial irrigation companies.

The status of both the public and private sector irrigation service providers was affected by the economic slump. Most institutions lost experienced staff to the diaspora. Important to note is the collapse of the Irrigation Association of Zimbabwe that was important for self-regulation of the sector. Most irrigation companies require capacity building to enable the sector to meet the irrigation development requirements of the nation. However, the Department of Irrigation is in a much better shape of late (Director, Department of Irrigation Development, personal communication, 2016). The department has a compliment of 63 engineers, 96 technicians, and several artisans. Two thirds of the staff is deployed in the 8 rural provinces of the country. The department has never had this kind of staffing before. Its capacity is commendable as can be confirmed by the way the department implemented the More Food Brazil-Zimbabwe Programme. It is unprecedented that the department installed more than 50 Centre pivots in just ten (10) months (Director, Department of Irrigation Development, personal communication, 2016).

This paper argues that the mandate of the different institutions in the irrigation sector should be guided by a comprehensive policy and regulatory guidelines that are backed by well-informed statutes. This comprehensive policy guideline should be articulated in simplified forms as regulatory guidelines to the different institutions and all irrigator categories for implementation and compliance.

CHAPTER 4: PROPOSED SUSTAINABLE IRRIGATED AGRICULTURE MANAGEMENT MODELS

4.1 Introduction

The country's potential for irrigation development is preliminary estimated at an area of 2,500,000 ha underpinned by the available water resources which includes the Zambezi River, the nearly complete Tokwe-Mukosi Dam, and several other inland dams. Effective harnessing of this potential would ensure that Zimbabwe would be able to meet its human and industrial requirements for key field and horticultural crops. However, irrigated agriculture needs to be more productive and sustainable in order for the country to regain its regional food basket status. Several factors are frequently mentioned and discussed as possible determinants of success or failure. These are briefly summarised in the following paragraphs.

4.2 Key success factors

4.2.1 Markets

Irrigation schemes which are closer to major buyers of their produce are more likely to be successful (GoZ, 1999). For example, the city of Harare's Mbare Musika is the hub of fruit and vegetable trading in the country, being the largest fresh produce wholesale market (Knowledge Transfer Africa, 2013). Hence proximity to this market is an important factor for success. This proximity reduces transport and transaction costs and improves knowledge of the demand for irrigated commodities. However, there is still a risk of flooding the market with a common set of commodities (e.g. common horticultural crops such as tomatoes and onions).

4.2.2 Access to credit

A recent study suggested that credit for the provision for irrigation development and working capital to irrigators was important to the sustainability of irrigation schemes. "*The argument is that if irrigators are provided with credit finance to install irrigation infrastructure on their farms instead of grants, they will regard the infrastructure as theirs and not government infrastructure. This will increase their confidence to maintain the infrastructure and to borrow for working capital thus commercialising the production process and as well increasing productivity and sustainability of the scheme"* (GoZ, 2013) .

4.2.3 Contract farming

Contract farming as a form of PPP is often cited as an important enabler of sustainable irrigated agriculture (GoZ, 2013). Contractual supply links the irrigators to specific markets thereby assuring the purchase of agreed quantities and quality of specific crop produce at acceptable prices. Often these contracts may support growers with crop inputs and technical advice and in so doing assist the growers to increase crop yield and quality. This was observed in the case of the Matanuska banana company with Mutema irrigators. However some contractual arrangements may breakdown due to misunderstandings, side selling, or the late withdrawal of the contracting partner (GoZ, 2013).

4.2.4 The strength of the Irrigation Management Entity

According to observations made in this study, irrigation schemes with stronger water and irrigation infrastructure management institutions are more likely to reinvest in sustaining their infrastructure. However, water user associations have commonly been prone to elite capture, political interference, mis-management, or simply lack of interest among scheme participants. One option is to bring in an outside agency to manage the scheme and tax farmers for the irrigation services. However farmers sometimes reject the rules imposed by external managers (Huppert *et al.*, 1998).

4.2.5 Irrigation technology

Irrigation schemes with low-cost water supply systems (e.g. gravity-fed schemes) offer higher economic returns and are more sustainable than those with more expensive water supply technologies (e.g. high volume pumping). However, there may be trade-offs between the cost and reliability of water supply. The evaluation of irrigation options ought to consider the relative costs of technology operation and maintenance as well as the initial investment, or rehabilitation costs (Svubure and Zawe, 2014).

4.2.6 Crop choice

Irrigation schemes growing high value crops with good commercial market linkages are more likely to sustainably improve farm incomes (while covering water and maintenance costs) than schemes producing basic food crops (GoZ, 2013). By corollary, proposals to promote the expansion of irrigation as a means to improve national food security may call for some trade-offs. There may be scope for producing high value cereals such as rice, wheat and barley, if technical efficiency is high. But the expansion of maize production is likely better pursued through improvements in water use efficiency as supplementary irrigation in rain fed systems than through full irrigation. In general, in order to generate the cash to pay for inputs and maintain irrigation infrastructure, the primary aim should be to prioritise crops for the market, not for home consumption (GoZ, 2013).

4.2.7 Extension support

High levels of crop productivity are essential to assure incomes rise enough to pay for water, invest in maintaining irrigation infrastructure and raise household incomes. Generally this requires an entirely new cropping system compared with the rain fed systems farmers were accustomed to. Similarly, most extension workers are not trained to provide strong advice on high input production, irrigated water management and effective relay cropping. New types of extension support are needed either from the public or private sector. A new cadre of extension workers may need to be trained to take care of the increasing role of women and youths in agriculture in the face of extension having almost no women to provide the service (GoZ, 2013).

4.2.8 Infrastructure maintenance

Most irrigation schemes operate on the assumption that the public sector (government, development project or NGO) will pay for the periodic rehabilitation of their irrigation infrastructure. This strategy is backed by a historical record of public investment. Externally-funded rehabilitation undermines incentives to build management and savings systems necessary to maintain infrastructure (GoZ, 2013).

4.2.9 Storage

Good post-harvest and handling practices are essential to minimise crop losses at irrigation schemes. In addition, the provision of good storage facilities not only reduce post-harvest

losses but help the farmer to store produce when prices are not favourable and release it when prices firm (GoZ, 2013). This ensures that a fair price for the produce is realised. Reported in this study is the case of Matanuska at Mutema irrigation scheme. Matanuska, a banana trading company constructed a pack shed at Mutema irrigation scheme for on-farm grading, weighing and packing of bananas. While increasing transparency in the marketing of the produce with on-farm grading, the pack shed also provides a cool environment for banana grading, weighing and packaging and this lengthens the banana shelf life.

4.3 Proposed management models

Management models were proposed for the A1/Communal, A2, and informal irrigation sectors. The different management models aim to increase operational efficiency and sustainability of the current and proposed irrigation systems in the respective irrigator categories/sectors. Embedded in the management models are aspects of financing of irrigation scheme maintenance, repair and components replacement.

4.3.1 The Cooperative Model for Management of A1 and Communal Irrigation

The cooperative model merges the individual farmer plots creating a single irrigated block of land to be run as a cooperative. This organisational and management model borrows from the successful case of Chipfundi and Elmly Park Irrigation schemes in Makonde district of Mashonaland West province. For example in the case of Elmly Park, each A1 settler farmer surrendered 4 ha of their total 6 ha arable land allocation to establish an 80 ha of land irrigated as one block by a centre pivot system, and an additional 20 ha block irrigated by a semi-portable system. In the case of Mutema and Chibuwe Irrigation Schemes, the individual plot-holder retained the management of his/her banana crop. Nevertheless it was apparent that the entire banana plantation at both schemes was uneven, suggesting a variation in crop quality and of course yield per plot. This crop variation could be removed by adopting the single block manged crop proposed in this analysis. Besides, the Elmly Park farmers partnered a white commercial farmer to operate and maintain their irrigation system and to provide for tillage, harvesting and transport services. In return, the white commercial farmer gained a negotiated percentage of the crop produce and a political good image. This arrangement immediately restored the high productivity levels attained by the out-going white commercial farmers while placing the newly resettled A1 farmers on a learning curve of irrigated commercial agriculture.

Organisational structure

Fig. 1 shows the organisational framework of the cooperative model for the utilisation of existing and proposed A1 and communal irrigation schemes based on the case of the Elmly and Chipfundi Irrigation Schemes in annexure 1. In this cooperative model, the members of the irrigation scheme elect a Cooperative Management Committee (CMC) which runs the scheme through an employed Central Service Unit (CSU). The composition, size and complexity of the CSU depends on the magnitude and demands of the irrigation scheme. The CSU is responsible for the scheme operation, maintenance, repair and replacement of components. It supervises the work of service providers hired by the CMC for services it cannot offer. Generally the CSU is headed by the Scheme Manager who in turn supervises the Scheme Operator/Engineer. The Scheme Operator/Engineer supervises the Pump Minders/Operators, Security Guards and General Hands. Pumping units are the most frequently problematic and hence the most important component of the irrigation system. Recurrent pumping unit breakdowns will almost invariably lead to irrigation systems failure.

Pump minders are therefore a must at the irrigation scheme. Thefts are also a big issue. Prone to thefts are irrigation system components and the maturing crop. Consequently security guards are needed. A Workshop Supervisor runs the workshop and also supervises the Drivers. The Accounts Clerk is responsible for all bookkeeping and maintaining other scheme records. Various government agencies provide free technical and advisory services to the scheme. These government agencies also implement all relevant statutes important for the successful running of the scheme. The CMC administers the profit sharing after all costs and levies are deducted. The costs deducted include payment for services rendered by service providers (see Fig. 1) and CSU staff wages. The CMC operates a commercial bank account into which all crop sales revenue is deposited allowing it to first deduct the necessary payments before declaring dividends to the member irrigators. This is not the case with other smallholder irrigation schemes where the plot-holders administer their own sales and remit a levy to the IMC for payment of energy, infrastructure maintenance and repair costs. The later irrigation schemes are almost invariably saddled with crippling energy debts, and infrastructure in a bad state of repair.

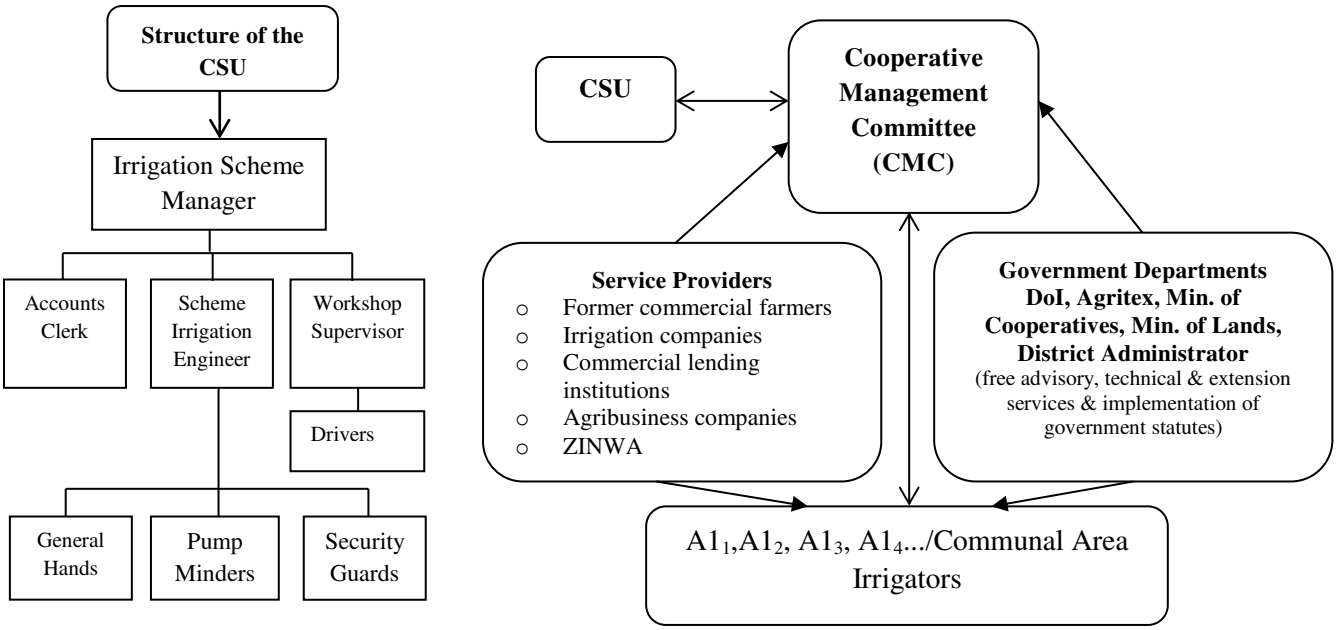
A dryland area if available can be allocated to each cooperative member for individual cropping and livestock activities outside the irrigated block.

Advantages of the single irrigated block cooperative model

The irrigated block becomes the centre for agricultural production. Some of the advantages include:

- reduced pipe network lessening pumping energy requirements,
- easy to adapt to the state-of-the-art irrigation technology such as the centre pivot,
- uniform management practices leading to uniform crop quality,
- field crops such as maize, sugar beans and soyabean becomes more profitable on a large scale,
- the yield gap between the best farmer plots and the poor farmer plots is closed leading to more food production from the merged plots,
- the government can easily craft any statutes for irrigated agriculture necessary for boosting productivity,
- scheme members have more time for dryland agricultural activities, and also
- more time for other social/community activities.

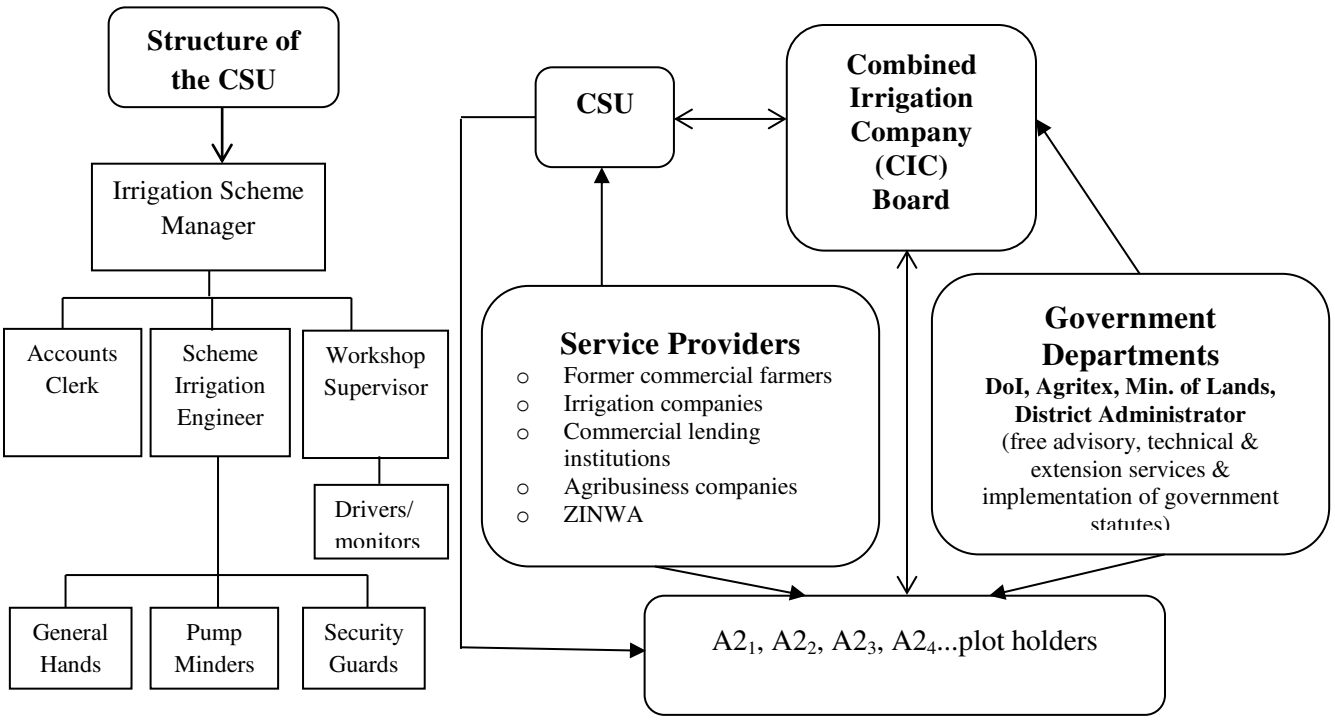
Figure 1: Proposed model of organizational structure for optimum utilization of existing/new A1 and Communal irrigation infrastructure



4.3.2 The Combined Irrigation Company for A2 Irrigation

The Combined Irrigation Company for A2 farmers resembles the organisational structure for A1 and Communal irrigation. The difference being that the A2 farmers form a Combined Irrigation Company (CIC) with a Board responsible for delivering irrigation water through a Central Service Unit (CSU) to the field edge of the member farmers (Fig. 2). The A2 member farmer in turn establishes own in-field irrigation works and own pumping to irrigate crops of their own choice. The A2 farmer pays a levy to the Board for water received and for the CSU employees' wages. The portion of the levy for water covers for the maintenance of the water conveyance infrastructure. This was the case of the Odzani River Irrigation Company (ORIC) in Manicaland province and the proposed Lilstock Irrigation Syndicate in Mashonaland Central province reported in this study. The CSU can hire Service providers in liaison with the Board for services needed in the maintenance, repair and replacement of any components of the pumping and conveyance of water to the member farmers. Relevant government agencies offer mainly free advisory, technical and extension services to both the member farmers and the Board. In addition the government agencies also administer any relevant regulatory services to both the Board and the member farmers to comply with applicable government statutes.

Figure 2: Proposed model of organizational structure for optimum utilization of new and existing A2 irrigation infrastructure

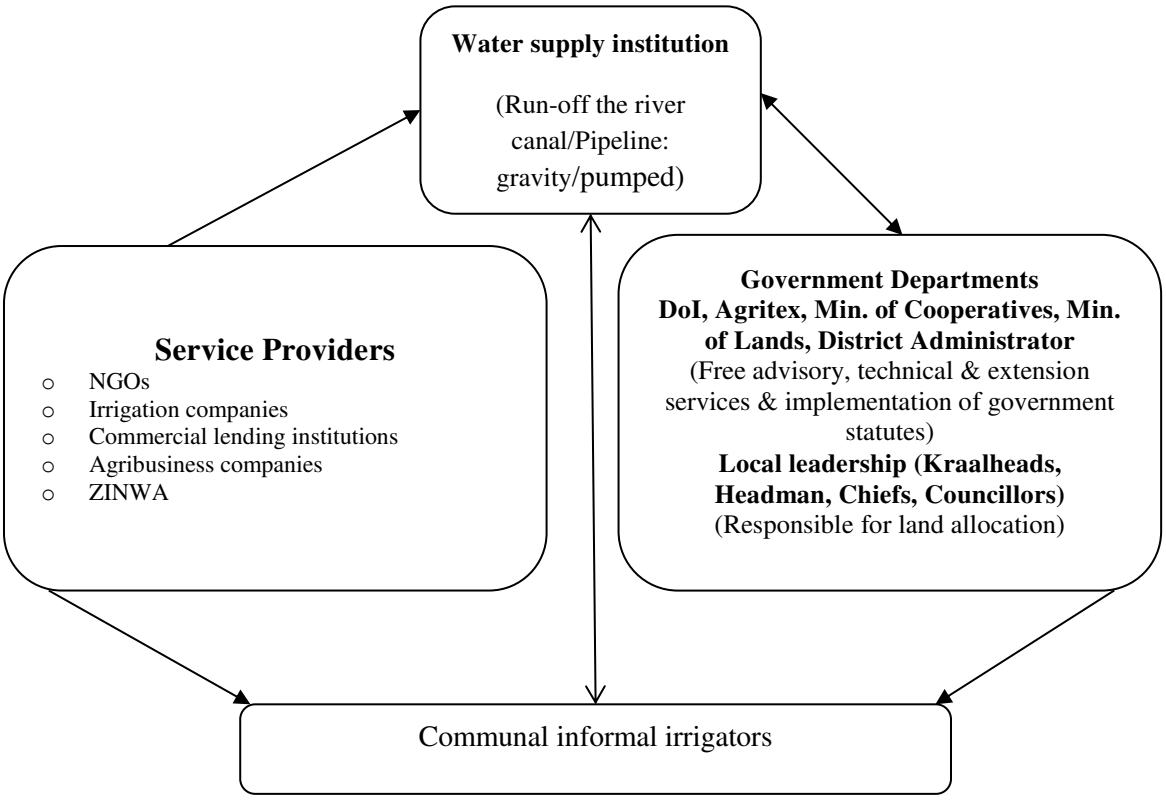


4.3.3 Canal/Pipeline for Informal Irrigation

Informal irrigation, also known as micro-scale irrigation started in the pre-colonial era when smallholder farmers, without government support, developed their own irrigation (see Chapter 2). Contributing about 12 % of the irrigated area in 1999, informal irrigation cannot be ignored. It must also be noted that a number of Donors and NGOs have supported micro-scale irrigation especially through nutrition and market gardens (USAID-STAMP, 2011; SNV, 2014). These NGOs have worked with smallholder farmers in fruit and vegetable production using micro-scale irrigation. Besides giving financial assistance to the farmers, the NGOs also ran capacity development training programmes for the farmers, to enable them to participate fully in the various horticultural value chains (USAID-STAMP, 2011; SNV, 2014). These NGOs include the Smallholder Technology and Access to Markets Programme (USAID-STAMP) and the Dutch SNV (Netherlands Development Organisation) (USAID-STAMP, 2011; SNV, 2014).

This research study therefore proposed a model for its optimum utilisation and that removes the users from stream bank and river channel cultivation (Fig. 3). This model consists of a water supply institutional arrangement that is responsible for running and maintaining a canal that runs off the river delivering water to the field edge of the user member who in turn pays a levy to government for the service. The member plots are moved to the recommended distance from the river bank. This research study observed the environmental damage to the Save River due to cultivation in the river channel. Government agencies offer free technical and extension services besides enforcing any relevant government statutes to both the water supply institutional arrangement and the user members. The local leadership is mainly responsible for land allocation. Service providers can render services for a fee to both the user members and the water supply institutional arrangement. The important role of NGOs has already been alluded to earlier on.

Figure 3: Proposed model of organizational structure for optimum utilization of informal irrigation



CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This research study views the irrigated agriculture sector as broad and comprising of elements such as irrigation infrastructure development financing; irrigation infrastructure use; management of irrigation infrastructure repair, maintenance, replacement/rehabilitation; irrigation systems technology type; crop choice and input financing; irrigation agronomy; and, produce markets. The study makes the following conclusions on the organizational structure models to increase sustainability and operational efficiency of the current and proposed irrigation schemes in the respective irrigator categories/sectors:

1. the Cooperative Model for Management of A1 and Communal Irrigation,
2. the Combined Irrigation Company of A2 Irrigation, and
3. the Canal/Pipeline for Informal Irrigation.

Embedded in these organizational structure models are critical aspects of optimum utilization of the irrigation infrastructure installed, the irrigation design, irrigation management, financing of cropping, infrastructure maintenance, repair and component replacement. This section presents a synthesis of how each organisational structure model suggested addresses these critical aspects that can shape the full exploitation of the country's irrigation capacity. Issues toward the formulation of a policy and regulatory framework for irrigated agriculture are also suggested.

5.2 Toward sustainable irrigated agriculture

5.2.1 Financing of irrigated agriculture

Government facilitative role

It remains the duty of responsible government the world over to develop basic public good infrastructure for its people such as the road, rail, water, and irrigation schemes. This could be in the form of a facilitative role in sourcing lines of credit for irrigation infrastructure development with beneficiaries responsible for the loan repayment. The More Food Brazil-Zimbabwe Programme currently under implementation is an excellent example. Chipfundi and Elmly Park A1 irrigation schemes reported in this study were established under a government programme termed the Winter Wheat Irrigation Rehabilitation Programme (WWIRP) with funding from an RBZ grant. The scheme has recently upgraded its irrigation system by replacing the semi-portable system with an 80 ha centre pivot using funding under the More Food Brazil-Zimbabwe Programme. The finance in this programme is administered by a local bank, Agribank. The farmers repay the loan at a rate of USD 100 per ha per crop of which 75 % is for loan repayment and 25 % for the equipment maintenance. In the Cooperative Model for Management of A1 and Communal Irrigation as discussed in section 4.3.1 of this report, the CMC operates a commercial bank account into which all crop sale revenue is deposited. This allows the CMC to remit the loan repayment and maintenance fee to Agribank and other costs before declaring dividends to the member irrigators. This is ensures compliance in the debt servicing obligations by the beneficiary irrigators.

PPPs
The Government of Zimbabwe has facilitated the entry of the private sector into the utilization of lines of credit as demonstrated in the More Food Brazil-Zimbabwe Programme in the Chipfundi A1 irrigation scheme case described in annexure 1 in this report. The Agribank, a commercial bank administers the loan under the More Food Brazil-Zimbabwe Programme, while Irrigazim, an irrigation contractor is installing the irrigation infrastructure. The government irrigation agency, DoI, thanks to its high capacity is also installing such irrigation equipment in other parts of the country.

Another case is the revitalization of the Mutema Irrigation Scheme under facilitation of a private partner, Matanuska, a banana processing, grading, packaging and marketing company. The partner repaired two boreholes and installed a micro-jet irrigation system at each of the farmer's 0.25 ha plots replacing the open canal flood irrigation system that was in place. As described in detail under case study 2 in annexure 1 of this report, the plot-holders repaid the loan advanced to them for the scheme rehabilitation and upgrading.

The role of a good credit record
The case of Mutema, Chipfundi and Elmly Park Irrigation Schemes, already discussed in annexure 1 of this report shows that smallholder irrigators can use a good credit history to access crop input financing from commercial banks and commercial micro-finance institutions in the absence of title deeds as collateral security. In Zimbabwe, the Financial Clearing Bureau (FCB), is a credit reference bureau that keeps a credit registry through collecting information from creditors and available public sources on a borrower's credit history. The FCB can be a useful institution for vetting A2 farmers' credit worthiness since there appears to be lack of progress for now on farm title deeds.

Proposals for an Irrigation Development Fund (IDF)
Motivated by findings reported in this study, creation of an IDF is hereby proposed where farmers can borrow funds for irrigation infrastructure development at low interest rates as was the case in the National Farm Irrigation Fund (NFIF) (see Chapter 2). This policy proposal also draws from the policy concept of Tilcor (Tribal Trust Land Development Corporation) of the late 1960s (Tilcor Act, 1968). The Tilcor concept/model involved exploiting the rural areas' natural resource base through setting-up commercially profitable development projects there and in the process turns the Growth Point/Rural Service Centre into an urban centre. The Tilcor model was anchored by an Act of Parliament and received funding from the government. Various sources of funding can be explored to capacitate the IDF. This includes a donor conference such as the Zimbabwe Donors' Conference on Reconstruction and Development (ZIMCORD) of 1981 to appeal for funds for this cause and help ease the food security challenges the country is facing. In 1981, ZIMCORD was held leading to the availability of abundant donor funds for the rehabilitation of smallholder irrigation schemes destroyed during the liberation war (see section 2.3 of this report). The traditional annual Presidential Input Scheme Programme and the Government Input Packs (see section 2.2.3 of this report) can be re-packaged to support irrigated cropping for successful production. Another likely source of funding for the IDF is the Community Share Ownership Schemes or Trusts (CSOS/T) that were established in several rural communities starting around 2011. The CSOS/T is a vehicle for participation in shareholding by rural communities in various businesses involved in the commercial exploitation of natural resources. Especially targeted is the extractive industry because of the non-renewable nature of minerals resources. Rather than take a regional or local area perspective, the CSOS/T can be set-up at national level and be a

commercial source of funding to develop infrastructure in the country and a quota for irrigation can be apportioned to the IDF.

5.2.2 Irrigation design model

Implanted in each organizational structure model proposed for each farmer irrigator category is an irrigation design model. For example in the Combined Irrigation Company organisational structure (described in detail in section 4.3.2 in this report) model for A2 irrigation, the conveyance network of canals/pipelines is commonly owned and is managed by the appointed Combined Irrigation Company (CIC) board with the assistance of hired employees in the Central Service Unit (CSU). This removes the member A2 irrigator in the direct management of water delivery to field edge. The A2 irrigator focusses on his/her in-field irrigation infrastructure while paying a levy to the CIC board for field edge delivery of irrigation water.

Another aspect embedded in the irrigation designs is the use of state-of-the-art irrigation systems for both smallholder (A1 and communal) and A2 farmers. State-of-the-art irrigation technology systems have multiple benefits to the user. Some technologies are easy to operate and maintain, while some are efficient in water use and energy conservation. For example, A1 farmers in the case of Elmly Park Irrigation Scheme (see annexure 1 of this report) have been using an 80 ha Centre pivot since 2003 to date, something which was least expected of smallholder irrigators. Another case is of the Mutema Irrigation Scheme described in annexure 1 of this report. The Mutema farmers upgraded their irrigation system technology by replacing the surface system to a more energy-efficient and water-saving micro-jet sprinkler irrigation system through the facilitation of a private partner. Again, Chipfundi A1 irrigation scheme already alluded to also recently upgraded its irrigation system to a centre pivot under the More Food Brazil-Zimbabwe Programme. Besides demonstrating that even smallholder farmers can operate and easily maintain state-of-the-art irrigation technology, these cases also show that smallholder farmers can fund its installation.

5.2.3 Irrigation management model

Irrigation management essentially entails the maintenance, repair and replacement of components of the irrigation infrastructure. Besides, it also covers the costs directly related with the irrigation water provision such as pumping energy costs and the cost of the water commodity itself. An irrigation management model has therefore been embedded in the organisational structure model recommended for each irrigator sector. In this regard, the Central Service Unit (CSU) is a fundamental component of each organisational structure model. Section 4.3 on “Proposed management models” describes the role of the CSU in each organisational structure model. The CSU is hired by the relevant entity (i.e. the Cooperative Management Committee (CMC) in the case of A1/Communal irrigation or the Combined Irrigation Company (CIC) Board in the case of A2 irrigation) to effectively run the irrigation scheme. The CSU is responsible for all the maintenance, repair and replacement of components of the irrigation infrastructure (see the relevant section under section 4.3). In addition it is responsible for water payments to the Zimbabwe National Water Authority (ZINWA) and the pumping energy costs. However closely related to the success of the CSU in executing its functions is crop choice by the member irrigators. The case of the Mutema Irrigation Scheme’s switch to the high value banana crop proved to be more profitable than the traditional wheat, tomato and maize crops on small plots. Hence the Mutema banana irrigators besides improving their livelihoods, were able to pay for all the scheme rehabilitation costs and other costs directly related to banana production. This observation also agrees with findings of a study by the Government of Zimbabwe in 2003, that irrigation

schemes growing high value crops with good commercial market linkages are more likely to sustainably improve farm incomes (while covering water and maintenance costs) than schemes producing basic food crops on small plots (GoZ, 2013).

5.2.4 Optimisation of existing (and new) irrigation infrastructure

The organisational structure models recommended for each irrigator sector were constructed from sub-models already alluded to such as the irrigation design, irrigation management, and the irrigation management financing model. These sub-models serve to ensure the optimum use of both existing and new irrigation infrastructure leading to the sustainability and operational efficiency of the irrigation scheme. The government agencies such DoI, Agritex, Min. of Cooperatives, Min. of Lands, and the District Administrator's office that are providing services to the irrigation scheme have an important role to back stop the organisational structure models recommended for each irrigator sector to ensure success and optimum utilisation of the existing (and new) irrigation infrastructure.

5.3 Proposals for policy and regulatory issues

This research study makes the following recommendations:

A. Organizational structure models for irrigation schemes

In order to increase the sustainability and operational efficiency of both existing and new irrigation schemes, the following organizational structure models are recommended in the respective irrigator categories/sectors:

- the Cooperative Model for Management of A1 and Communal Irrigation,
- the Combined Irrigation Company of A2 Irrigation, and
- the Canal/Pipeline for Informal Irrigation.

B. Management of irrigated agriculture must be guided by Statutory Instruments

The Government of Zimbabwe must craft clear legislation, well informed and in line with the Constitution of Zimbabwe, on the management of Irrigated Areas in similar way with the colonial government which used many statutory instruments in its endeavours to modernise irrigated agriculture. Commissions of Enquiry should be set up and address a specific issue as was similarly done in the past. Adhoc measures are rarely successful. Smallholder irrigation is a privilege and must be regulated by statutes on aspects such as payment of levies for R & M services, dispute resolution and crop selection. Currently government relies on the Land Acquisition Act which primarily addresses compulsory acquisition of agricultural land but is silent on land use issues.

C. Irrigation, especially combined irrigation syndicates must be a vehicle for rural (Growth Points) development anchored on agro-processing.

D. Mini-hydro power generation must be an integral part on major dam walls.

The mini-hydro power will provide pumping energy for the combined irrigation syndicates, while the excess power is fed into the national grid.

E. The traditional Presidential Input Scheme Programme and the Government Input Packs must support irrigated agriculture for successful production.

F. Government's facilitation role in sourcing of lines of credit for irrigation infrastructure development must continue.

G. Farmers/beneficiaries of a government-facilitated credit must pay for the irrigation infrastructure.

Full cost recovery must be applied on loans extended for irrigation infrastructure for all irrigating farmer categories. For example, A1 beneficiary farmers in the case of the Chipfundi Irrigation Scheme infrastructure upgrade to a Centre pivot under the More Food Brazil-Zimbabwe Programme have already started servicing their loan.

H. Government and private sector partnership in the use of government-facilitated lines of credit

The Government of Zimbabwe must facilitate the entry of the Private sector in the utilization of the lines of credit. The Agribank, a commercial bank administers the loan under the More Food Brazil-Zimbabwe Programme, while Irrigazim, an irrigation contractor is installing the irrigation infrastructure in certain parts of the country. The government irrigation agency, DoI thanks to an unprecedented capacity is also installing the irrigation equipment in other parts of the country.

I. State-of-the-art irrigation technology is mandatory for all irrigating farmer categories.

State-of-the-art irrigation technology systems have multiple benefits to the user. Some technologies are easy to operate and maintain, while some are efficient in water use and energy conservation. For example, A1 farmers in the case of Elmly Park Irrigation Scheme have been using an 80 ha Centre pivot since 2003 to date, something which was least expected of smallholder irrigators.

J. PPPs and credit record are the main models for crop input financing

Through PPPs and farmer credit history, smallholder irrigators have been able to access crop input financing from commercial banks and commercial micro-finance institutions in the absence of title deeds as collateral security. In Zimbabwe, the Financial Clearing Bureau (FCB) is a credit reference bureau that keeps a credit registry through collecting information from creditors and available public sources on a borrower's credit history. The FCB can be a useful institution for vetting A2 farmers' credit worthiness since there appears to be lack of progress for now on farm title deeds. However, the concept of credit reference bureau has not taken root in the Zimbabwe financial culture.

K. Irrigated agriculture is the backbone of the national food security

The climate-induced frequent drought Zimbabwe has been experiencing in the past two decades has heightened the need for more irrigation development to mitigate the effects of drought. There is need to deliberately target a minimum threshold area for summer growing of maize and soya bean with supplementary irrigation to ensure successful production and high yields. Maize and soya bean are food security crops for Zimbabwe.

ANNEXURE: CASE STUDY REPORTS

Case study 1: The Lilstock irrigation syndicate

The Lilstock irrigation syndicate was conceived in the mid-1990s when 22 commercial farmers formed the Matepatepa syndicate where they made a coordinated effort to establish a network of dams and pipelines to irrigate a combined 11,150 ha of sugarcane (MAMID, 2015). Located in the Upper Ruya Sub-catchment in Bindura District of Mashonaland Central Province, the proposed irrigation syndicate is about 150 km road distance from Harare on the Harare-Bindura-Matepatepa highway, it lies between longitudes of $31^0$13' and $31^0$18' East of Greenwich and latitudes 16^o52' and $17^0$03' south of the equator.

Basic infrastructure of the Lilstock irrigation syndicate was implemented (see Table 12) and part of the 22 commercial farmers were irrigating. Full implementation was interrupted by the land redistribution programme of 2000 when all the commercial white farmers lost their land to the new A1 and A2 settler farmers. The state of the project is to fully implement it with the new farmers plus communal farmers in neighbouring Chiweshe communal area.

Scheme organisational and management framework

Scheme membership

It is imperative that the same vision of an irrigation consortium by the 22 pre-land reform era commercial farmers, as described above, drives the beneficiaries of the land redistribution programme occupying the same 22 farms. These include 770 A1 farmers, 250 A2 farmers and an estimated 800 households in the contiguous Chiweshe communal area in what could be a perfect example of an all-inclusive growth partnership. Table 11 below shows the participating farms and their current irrigation status.

Table 11: Lilstock irrigation syndicate current membership

Farm	Irrigation potential (Ha)	Developed area* (Ha)	Farming sector	Beneficiary households	Area currently irrigated (Ha)
Lilstock	800	100	Al	55	0
Dorper	300	200	A2	9	50
Felton	750	0	Al	24	0
Dimitra	850	0	A1/A2	103	0
Banwel	300	100	Al	50	0
Cowley	800	0	A2	12	60
Walton	250	250	Al	17	0
Ashcott	600	150	A2/Al	66	50
Chihumbiri	400	150	Al	58	0
Ruya Falls	700	200	A1	70	0
Chipa	400	100	Al	90	0
Chiweshe	800	0	Communal	800	0
Bruton	600	150	Al	100	0
Azikara	300	0	A2/Al	142	20
Tara	200	0	Al	30	0
Munzi	200	150	A2	4	90
Crewkerne	450	250	Al	40	0
Chinhenga	350	100	A1/A2	30	0
Butcombe	750	100	A1/A2	30	0
Butleigh	650	150	A2	30	40
Frinton	500	100	A1/A2	30	0
Dunkery	200	150	Al	30	0
Total	**11,150**	**2,400**		**1,820**	**310**

Source: Department of Irrigation (MAMID, 2015); Note: * = needs rehabilitation for full operation

Scheme water resources

The main water source for the scheme is the Lilstock Dam located on the Ruya River between Bindura and Mazowe Districts (1:50 000 map series sheet number 1631C3 and C4). The estimated capacity of the dam is 20,000 ML and upon completion, the full capacity will rise to about 30,000 ML. Other dams available for irrigation purposes in the syndicate include Ruya, Bindura, Masembura, and Arcadia dams. The river network that includes Pote, Mazowe, Ruya and Munzi rivers will be used for natural conveyance of water to farm abstraction points.

Scheme design

The core of the proposed project is hinged on the 11.5 km mainline which delivers water from the main Lilstock Dam water source to all the blocks of land. On farm system designs will then take water from farm reservoirs to the irrigated fields. It is envisaged that water saving technologies such as drip, centre pivot, sprinkler and hose reel irrigation systems be used. Figure 1 shows a sketch map of part of the farms in the syndicate.

Existing irrigation infrastructure

Interviews with engineers from the Department of Irrigation (DoI) show that some irrigation equipment installed by the 22 commercial farmers prior to the land redistribution exercise is

still in place. Rehabilitation and replacement of some equipment is required since some of the equipment has not been in use for quite some time now. Also vandalism and theft of some of the equipment has been reported. Table 12 gives an inventory of existing infrastructure at the proposed Lilstock irrigation syndicate.

Table 12: Inventory of existing irrigation infrastructure

Description	Unit	Quantity
Pump house	each	4
100HP lift pumps complete (Q= 700m^3/h= 30m)	each	6
250HP Booster pumps complete (Q=700m^3/ h=60m)	each	6
900mm AC mainline	km	5.5
Night storage dams	each	2
150HP booster pumping units complete (Chihumbiri)	each	3
100HP booster pumping units complete (Dimitra)	each	3
Pipeline (Chihumbiri to Dimitra)	km	6.5

Source: Department of Irrigation (MAMID, 2015)

Expected impact of the proposed project

Agro-processing at Nzvimbo Growth Point

Crop selection will be done with a view to feed into agro-processing as value addition at Nzvimbo Growth Point in neighbouring Chiweshe communal lands. This will spur development of Nzvimbo Growth Point into an urban centre using the policy concept of Tilcor (Tribal Trust Land Development Corporation) of the late 1960s. In simplest terms, the Tilcor concept/model involved the setting-up of commercially profitable development projects in rural areas (away from existing main centres), whose natural resources can be expediently processed on site and then transported to markets. Such projects would in turn stimulate general development in the rural areas creating employment opportunities in the selected rural community. Then, Tilcor projects operated on commercial lines, hence the growth points were set on a sustainable growth trajectory. Large scale crops such as wheat, maize, sugar cane and citrus can be considered.

Employment creation

Besides the envisaged permanent employment creation from agro-processing at Nzvimbo Growth Point, the proposed project has potential to create scores of employment opportunities during the construction of the project. More people will be employed as farm workers. This will curb the migration of job seekers to major towns.

Mini-hydro power generation

There are prospects to generate electricity upon the completion of the dam wall to supply the energy requirements for the entire proposed project with excess fed into the National Grid. This will contribute to the sustainability of the proposed project and also help ease the energy crisis the country is currently grappling with.

Food Security and income

Zimbabwe has been experiencing frequent droughts in the past two decades. This has heightened the need for more irrigation development to mitigate the effects of drought. The

proposed project has the potential to contribute significantly in terms food security at both household and national level. It will also greatly improve the income of the community and improve their livelihood. Significant acreage can be deliberately set aside for summer growing of maize and soya bean with supplementary irrigation to ensure successful production and high yields. Maize and soya bean are food security crops for Zimbabwe.

Increased food production

The level of productivity has been below average mainly due to poor rainfall for the past decade. Maize farmers were getting yield levels below 1 t/ha maize. However with irrigated production, farmers are expected to get higher yields. In addition, irrigation will enable framers to plant all year round and increase the cropping intensity.

All-inclusive growth

Expected beneficiaries of the proposed project include A1, A2 and communal area farmers from the neighbouring Chiweshe Communal lands forming an all-inclusive growth partnership.

Women and youths

Most of the beneficiaries will be women and youths, hence the proposed project will help address the gender imbalances of the past by empowering both the women and youths.

Figure 4: sketch map showing part of the farms in the proposed Lilstock irrigation syndicate

Lessons from the organisational and management framework

- the former white commercial farmers had adopted the combined irrigation syndicate model/approach by establishing a network of dams and pipelines to convey irrigation water to the field edge of several farms as a development trajectory,

- the initiative by the beneficiaries of the land redistribution programme to adopt the vision of an irrigation consortium of the 22 pre-land reform era commercial farmers demonstrates that it is possible to have all farmer categories in an all-inclusive growth partnership,
- combined irrigation syndicates can be a vehicle for rural (Growth Points) development anchored on agro-processing,
- mini-hydro power generation must be an integral part on dam walls to provide pumping energy for the irrigation schemes for sustainability with excess power fed into the national grid.

Proposals for the new era management structure

The original vision of Lilstock irrigation consortium was the establishment of a network of dams, canals and the use of natural rivers/streams to convey irrigation water to the field edge of the 22 white commercial farmers. A management entity was established to manage, maintain, repair and replace the conveyance infrastructure through levying the 22 pre-land reform era commercial farmers. The levies also covered the wages of the management entity. Now the proposed Lilstock irrigation consortium has 770 A1 farmers, 250 A2 farmers and an estimated 800 households in the adjoining Chiweshe communal area. Our analysis suggests that this management entity must be retained with the same functions and sustained through levying the CSUs at each farm and in the irrigated blocks of lands in the neighbouring Chiweshe communal lands. This management entity can be called the Lilstock Irrigation Consortium Management Unit (LICUM). Chapter 4 of this report discusses proposed organizational models for A1, A2 and communal area irrigation management. The Combined Irrigation Company (CIC) for both proposed and existing A2 irrigation has a Board that hires a CSU. It is this CSU through the CIC Board that remits levies to LICUM in exactly the same manner the 22 white commercial farmers could have done. This is in return for the water delivered to the CSU at each farm with A2 plot holders. In the case of A1 and communal irrigation, the respective CSU works with the Cooperative Management Committee (CMC) to remit levies to LICUM in the same manner as farms with A2 plot holders (see Chapter 4).

Financing of the proposed Lilstock irrigation consortium infrastructure is expected to be centrally by the Government of Zimbabwe through State-assisted lines of credit with beneficiaries responsible for loan repayment. An example is the current More Food Brazil-Zimbabwe Programme (see section 3.2 of this report). Contract farming, a form of PPP is another major irrigation financing option as discussed in the case of Mutema Irrigation Scheme in this report.

Case study 2: Mutema Irrigation Scheme (the banana project)

Historical background

Mutema Irrigation Scheme is a 235 ha smallholder irrigation scheme with a total of 374 plot-holders. Plot sizes vary from 0.5 to 1.5 ha per plot-holder. In Zimbabwean terms, Mutema is regarded as a large irrigation scheme. The irrigation scheme is located in Chipinge District of Manicaland Province of Zimbabwe. The scheme lies in Zimbabwe's Agro-ecological Natural Region 5, a region that is characterised by high temperatures and very low and erratic rainfall (< 500 mm per annum) rendering dry-land crop production difficult. Mutema Irrigation Scheme was established in 1932 (Chidenga, 2004). For its water source then, the scheme depended on the Tanganda River augmented by underground water through four boreholes that were drilled in 1970. However Cyclone Eline in 2000 destroyed all the water off-take structures and pools were covered with alluvial deposits. This rendered Tanganda River an

unreliable water source for the scheme. As a result boreholes became the major source of water for the scheme. However by 2011 only one borehole was intermittently working at the scheme virtually rendering the scheme dysfunctional.

The revitalisation of Mutema irrigation scheme

Cropping in Mutema irrigation scheme was based on tomato, wheat, and maize for many years. The scheme hardly made profits due to unsustainably low yields resulting from poor agronomic practices such as low fertilizer use and crop water stress. To address these challenges and revitalize the scheme, the Zimbabwe Agriculture Income and Employment Development programme (Zim-AIED), a USAID funded programme engaged Matanuska, a commercial banana company to partner the farmers at Mutema irrigation scheme. Box 5 gives a brief background of the Matanuska banana company.

Box 5: The Matanuska Banana Company

Matanuska is one of Zimbabwe's big banana processing and marketing companies. During the land redistribution programme, Matanuska lost more than 200 ha of banana plantations to the Fast Track Land Reform Programme (FTLRP) resettled farmers. The incoming farmers stumped out the banana in preference to field crops like maize and soyabean. Without the 200 hectares of bananas, banana processing and marketing would not be possible. Thus Matanuska was more than willing to partner the Mutema irrigation scheme and continue its banana processing and marketing business.

A total of 60 ha of the 235 ha total scheme area were delineated for banana production. The programme worked with 240 of the 374 plot holders. Each plot holder ended up with a 0.25 ha banana plot. Through a loan facilitated by Zim-AIED, Matanuska provided the farmers with tissue-cultured banana seedlings imported from South Africa, repaired two boreholes and installed a micro-jet irrigation system at each of the farmer's 0.25 ha plots replacing the open canal flood irrigation system that was in place. Picture 1 shows an impressive banana crop under the newly installed micro-jet sprinkler systems. Matanuska also constructed a pack shed at Mutema irrigation scheme for on-farm grading, weighing and packing of bananas. In this way, the programme helped to increase transparency in the marketing of the produce unlike in many cases where grading of produce is at factory level away from the farmer. Matanuska also offered a tractor to transport produce from the plots to the pack shed and trucks to transport the produce to markets.

Unlike the case with most smallholder irrigation schemes, under the Mutema irrigation scheme rehabilitation and upgrading programme, each farmer was expected to pay back the loans extended to them in full. Each farmer ended up with a total loan of US$ 4,700 of which US$ 1,700 was for banana seedlings and other inputs, and US$ 3,000 for irrigation infrastructure upgrading. The loan was payable at harvesting through deductions by Matanuska from the farmer's banana sales. To ensure success with the banana venture, Zim-AIED agronomists and extension agents provided hands-on training from nursery management to postharvest. In 2014, Matanuska was paying bananas at US$ 0.28 per kg compared to local prices of US$ 0.15 per kg. Good agronomic practices included mulching, irrigation scheduling, twine propping, fertilizer application and de-suckering (Zim-AIED, 2014).

Picture 1: Impressive banana crop under micro-jet sprinkler systems at Mutema Irrigation Scheme in Chipinge district, Manicaland Province, 2016

Impact of the Zim-AIED-Matanuska-Mutema irrigation scheme partnership
The 240 Mutema farmers are producing high quality bananas at an average yield of 80 t/ha against a national average of 10 t/ha. Their average net income from 0.25 ha of bananas was US$2,825. The 0.25 ha banana plot has transformed the lives most farmers at Mutema irrigation scheme. The banana programme was extended to Chibuwe irrigation scheme again in Chipinge district where 60 ha of banana were developed. However the rehabilitation did not upgrade the irrigation infrastructure from the canal flood system. Matanuska created over one hundred (100) new jobs on the banana plantations of which half are women.

Sustainability of the Matanuska-Mutema irrigation scheme partnership
In a bid to ensure the sustainability of the banana programme after Zim-AIED, an arrangement was successfully developed with a local bank CABS which took over the financing of the project through granting of loans to farmers for all banana inputs and other farming requirements. Through the Zim-AIED programme, farmers built a credit record which was lacking from the beginning. CABS used this proven credit record as a guarantee for loan repayment. All the banana farmers opened up accounts with CABS and repayment of loans is through stop order payment by Matanuska against bananas delivered to Matanuska.

In conclusion, the PPP arrangements at Mutema successfully revitalised the irrigation scheme through:

- Linking the irrigators with not only credible but sustainable markets,

- Creating a transparent marketing system with on-farm grading, weighing and packing of bananas in the presence of the grower (see Picture 2),
- Linking the irrigators with credit facilities,

Picture 2: On-farm banana grading, weighing and packaging at Chibuwe Irrigation Scheme in Chipinge district, Manicaland Province, 2016

- Upgrading the irrigation system technology by replacing the surface system to a more efficient energy and water saving micro-jet sprinkler irrigation system, and through,
- Production of high value crops (banana).

Analysis of the Mutema organisational and management framework

The combination of a number of factors underlies the successful revitalisation of the Mutema irrigation scheme. First, it's the PPP arrangement which facilitated the upgrading of the irrigation technology from the water wasteful furrow surface system to the more efficient energy and water saving micro-jet sprinkler irrigation system. The irrigators own the infrastructure and they repaid the loan advanced to them for the system rehabilitation and upgrading. An Irrigation Management Committee (IMC) is in place and is responsible for the repair and maintenance of the infrastructure through levying the scheme members. Secondly, the banana crop proved to be more profitable than the traditional wheat, tomato and maize crops on small plots. Thirdly, the private partner provided not only credible but sustainable markets. The absence of markets is a key missing cog responsible for the demise of several communal area irrigation schemes. Fourth, based on good credit history, the availability of credit for crop financing enabled the Mutema farmers to consistently produce a generally high

yield and good quality banana. Lack of credit for crop financing is also another factor negatively impacting on many smallholder irrigation schemes.

The farmers demonstrated good knowledge on banana husbandry and this can be attributed to hands-on training, first by the Zim-AIED agronomists and later on by the Matanuska agronomists and AGRITEX extension officers. However, it was apparent that the entire banana plantation at both the Mutema and Chibuwe schemes was not uniform (though measurements were not taken) reflecting variations in crop quality. This variation can be attributed to differences in crop management by the individual plot-holders. Consequently, the report analysis is in favour of a single block managed crop to remove the unevenness in crop quality/appearance.

Case study 3: Odzani River Irrigation Company (ORIC)

Historical background

The Odzani River Irrigation Company (ORIC) was based on a shared unlined canal that delivered irrigation water through gravity to 78 pre-land reform era commercial farmlands who jointly owned it as a cooperative. A diversion structure feeds the canal off the Odzani river weir which is located downstream of Lake Alexander which is in turn downstream of the Small Bridge Dam. Canal construction started in 1915 by the Ministry of Water Development and the city of Old Mutare using prisoners labour for digging-up. The canal was later run by the commercial farmers on their own.

The canal network use and management in the pre-land reform era

The canal network runs a total length of 60 km (Picture 3) including subsidiaries feeding the individual farmers. Each farm had one off-take from the canal that supplied water into the farm storage for onward conveyance into the field. The average water allocation per farm was 417 ML sufficient to irrigate about 60 ha of winter wheat, and water allocation ranged from 28 to 1,113 ML (Chiamba, personal communication, 2016). A canal management unit headed by a manager was established to operate the canal.

Picture 3: The 60 km Odzani River Irrigation Company (ORIC) gravity-fed canal in Mutare district, Manicaland Province, 2016

Current status of the canal use

Presently a total of 450 farmers comprising A1, A2 and Small Scale Commercial, 2 educational institutions, and some few remaining Large Scale Commercial farmers have access to the ORIC canal water and can potentially irrigate. However, only a handful of farmers are currently irrigating (Chiamba, personal communication, 2016). These include 10 Large Scale Commercial farmers, 6 A2 farmers, 17 A1 farmers, Hatzell High School and the Africa University. A canal management board was established to run the canal. The Board employs a team of workers who comprise a manager and 12 general hands. The Board retained the same manager employed by ORIC in the pre-land reform era to safeguard continuity. The Board supervises the workers to ensure that the irrigating farmers have water. In addition the Board administers a maintenance levy paid by the users and receives grievances from the members for resolution.

Challenges faced in canal use include:

- poor maintenance of the canal by users,
- vandalism of canal water control gates,
- unauthorised use of canal water,
- use the low efficiency flood irrigation system by the majority of irrigators, and the
- lack of understanding of roles of the different institutions interfacing with the farmers on the ground such as ZINWA and the Odzi Sub-catchment Council.

Lessons from the organisational and management framework

- the former white commercial farmers had adopted the combined irrigation model/consortium/company in irrigation water conveyance to the field edge as a development trajectory,

- a Board supervises the running of the combined water conveyance system,
- a management unit runs the conveyance system under the supervision of the Board,
- energy saving water conveyance systems are preferred for sustainability (e.g. gravity-fed systems),
- the combined water conveyance system is an all-inclusive growth infrastructure as all user categories have a real opportunity to access water and practice irrigated agriculture,
- need for irrigators to move away from the water-wasting irrigation systems such as flood in favour of water-saving systems such as center pivots, and
- users pay a maintenance levy for sustainability of the water conveyance system.

The future of ORIC

It is important that ORIC functions with about the same 78 entities/farms it delivered irrigation water to, in order to lessen the management challenges associated with over 450 individual irrigators. The few remaining white commercial farmers, Hatzell High School and the Africa University consistently pay the levies to ORIC for canal maintenance and repair works as well as toward the wages of ORIC staff. The smallholder farmers (A1 and communal) can be clustered into few irrigated blocks run by individual Cooperative Management Committees (CMC) (see discussion on the proposed organisational and management model for A1 and communal irrigation in Chapter 4). The CMC through their respective CSU will be responsible for remitting levies to ORIC for canal maintenance and repair works as well as for ORIC staff wages. Similarly the A2 plot-holders on one farm form a Combined Irrigation Company (CIC) in the manner suggested in Chapter 4 on proposed organisational and management model for A2 irrigation. The CIC levy the individual member A2 plot-holders and remit the levy to ORIC through its CSU.

Challenges cited which includes vandalism of canal water control gates, unauthorised use of canal water, non-payment and remittance of levies to ORIC can be addressed through enacting necessary by-laws in ORIC by the entire membership. These by-laws should provide guidance on what course of action to take in the event of violation or non-compliance by the user members.

Another observation is that only a handful of farmers are currently irrigating while the majority are not. The main reason cited for not irrigating was a lack of financial resources for either rehabilitation or new development of in-field irrigation infrastructure by the new farmers.

Case study 4: Chifundi and Elmly Park Irrigation Schemes: An A1 Fast Track Land Resettlement Programme (FTLRP) partnership model

Historical background

The Chifundi and Elmly Park irrigation schemes represent a partnership model that arose out of events unfolding during the FTLRP that began at the turn of the millennium. This model evolved as a consequence of five opportunities that actors on the ground decided to exploit:

- firstly, the mixed groups of farm invaders at Chifundi and Elmly Park were confronted with highly sophisticated irrigation technologies, the borehole-based semi-portable

sprinkler and centre pivot irrigation systems, which were also alien to the government irrigation and extension agencies,

- secondly, the willingness and commitment of the former commercial farm owner to provide technical, material, and mentoring services allowed for the emergence of the partnership,
- thirdly, in the case of Chifundi, the land invaders made up of communal area farmers and war veterans decided to co-opt the resident commercial farm workers into their A1 farm, thus benefiting from the latter's knowledge and experience of the farm and its irrigation systems,
- fourthly, the local level government agencies, the Department of Agricultural Research and Extension (AREX) and the Department of Agricultural Engineering (DoAE), actively supported the partnership production model in order to avert a looming wheat shortage in the country, and
- Lastly, the wide spread vandalism of irrigation infrastructure on invaded commercial farms causing a nationwide wheat shortage necessitated an extensive irrigation rehabilitation programme (Zawe, 2006).

The two irrigation schemes were established under a government programme termed the Winter Wheat Irrigation Rehabilitation Programme (WWIRP). The WWIRP was started in 2002 in an attempt to avert a looming wheat shortage. Most of the irrigation infrastructure on the occupied farms had been vandalised. The "vandalism" was perpetrated by both the incoming settlers and the outgoing farmers with the latter moving out with movable irrigation equipment that they were lawfully allowed to take away with them at displacement (Zawe, 2006). The country was headed for serious food shortages. The outgoing commercial farmer, owner of both farms had removed all the movable irrigation equipment to warehouses in Harare for safe keeping. The preceding rain season had been erratic resulting in the summer rain-fed crops being a write-off in many areas. Shortages of inputs such as seed, fertiliser, crop chemicals, and tillage equipment due to the deteriorating socio-economic and political image of the country compounded the situation (Zawe, 2006).

At both Chifundi and Elmly Park, with advice from AREX extension officers and DoAE Irrigation Engineers, the settlers chose the outgoing commercial farmer as the contractor to rehabilitate their irrigation schemes. After valuation, the outgoing farmer was fully paid for the reinstallation of the irrigation equipment. The installation took much less time than what was the case with settlers who opted for new installations by private irrigation companies who at the time were struggling to supply. The farmer also offered to provide training, operation and maintenance services for a fee. For Chifundi the equipment bought was a semi-portable sprinkler system capable of irrigating 90 ha; while for Elmly Park, the equipment comprised a centre pivot capable of irrigating 80 ha and semi-portable equipment for irrigating 20 ha.

Chipfundi Irrigation Scheme: organisation and management framework

In the case of Chifundi irrigation scheme, the A1 settlers officially registered themselves as a cooperative association. The plot size per farmer is 3 ha which is much larger than the common allocation of 0.1 to 1.5 ha for smallholder irrigation schemes.

Production Unit

A Production Unit consisting of former commercial farm workers was created. These were ex-employees of the displaced white commercial farmer who used to run the farming operations at the farm. The former Farm Manager headed the Production Unit which also had 4 security guards and 8 general workers to work in the field (changing pipes). The Production

Unit runs the 90 ha semi-portable sprinkler irrigation system consisting four boreholes, a balancing tank, booster pumps, infield pipes and sprinklers whilst the Cooperative Association brokers deals with service providers, like former commercial farmers and banks. Thus the settlers made a decision to run the irrigation block as a commercial entity, employing its own workers and generating income for the members who had joined the irrigation scheme. The resultant user organisation was a cooperative company.

Irrigation infrastructure upgrade

The scheme has recently upgraded its irrigation system by replacing the semi-portable system with an 80 ha centre pivot (see Picture 4). The Department of Irrigation development (DoI) formally DoAE installed the pivot under a government initiated line of credit called the More Food Brazil-Zimbabwe Programme (Zawe, personal communication, 2016). The pivot is supplied by a Brazilian Company, Irrigabraz through a local company, Irrigazim acting as the agent. The finance is administered by a local bank, Agribank. The farmers repay the loan at a rate of USD 100 per ha per crop of which 75 % is for loan repayment and 25 % for the equipment maintenance (Zawe, personal communication, 2016).

Picture 4: Winter wheat under a recently installed center pivot irrigation system at Chipfundi A1 irrigation scheme in Makonde district, Mashonaland West Province, 2016

Crop financing

Farmers get crop input financing from Agribank with whom they have built a credit track record with over the years. The farmers have adopted a wheat-soya bean crop rotation under irrigation. Their average wheat yield is 6 t/ha and ranges from 4.5 to 7 t/ha, while their

average soya bean yield under supplemental irrigation is 3.2 t/ha and ranges from 2.2 to 3.5 t/ha.

Elmly Park Irrigation Scheme: organisation and management framework

In Elmly Park, the A1 settlers organised themselves into a group of irrigators led by an Irrigation Management Committee (IMC). The IMC appointed a production manager, who liaised on a daily basis with a commercial farmer. The commercial farmer they partnered with still had his farm some 30 km away from Elmly Park farm. This commercial farmer provided all the farm services that included tillage, planting, spraying and harvesting in exchange for a share of the crop harvested. The production manager operated the centre pivot irrigation system with mentorship from the commercial farmer. The plot size per farmer is 4 ha which is higher than the then prevailing plot size allocation 0.1 to 1.5 ha for smallholder irrigation schemes.

Evolution of organisational set-up

The organisational set-up that evolved at Elmly Park was informed by the irrigation technology in place just like in the Chifundi case. The centre pivot irrigation system at Elmly Park was an automated machine that minimised operational demands. The centre pivot was equipped with an automated irrigation management system (AIMS) panel. With this panel, the pivot can be started, stopped, reversed and speeds changed by a single operator unlike the irrigation system at Chifundi. Once mastered, any operator can easily run the pivot. The functions on the panel are clearly explained in the operation manual supplied at purchase. This manual also clearly specifies those faults that the farmer can attend to and those that the farmer has to refer to the manufacturer's agents in the country. Because the centre pivot irrigates a circle the settlers at Elmly Park found it difficult to divide the irrigated command into 22 equally sized plots of a shape that would be convenient for conventional tillage machinery. Thus the settlers would be confronted with irrigated pies. Growing more than one crop simultaneously under the pivot was also nearly impossible. The national economic environment in the country posed another problem, in the form of shortages of inputs, fuel, cash, hyper-inflation and delays in payment by GMB for crops delivered for sale. With the above in mind, the settlers soon devised means of coping with the demands posed by the centre pivot, the socio-economic and the political environment. They surrendered around 4 ha of their 6-ha plots each for communal ownership, to grow a single crop at a time in the irrigation scheme. They adopted a commercial attitude to crop production based on communally borrowed inputs and hired labour. The farmers partnered a white commercial farmer who was the proud owner of a 100 % centre pivot irrigated 220 ha farm. They contracted him to operate and maintain their irrigation system and to provide for tillage, harvesting and transport services. In return, the white commercial farmer gained a negotiated percentage of the crop produce and a political good image.

Crop financing

Like their counter parts at Chifundi irrigation scheme, the Elmly Park farmers get crop input financing from Agribank with whom they have similarly built a credit track record with over the years. The farmers have adopted a wheat-soya bean-maize crop rotation under irrigation. Their average wheat yield is 7 t/ha and ranges from 5 to 8 t/ha, while their average soya bean yield under supplemental irrigation is 3 t/ha and ranges from 2.5 to 3.5 t/ha. Their average maize yield is 8 t/ha and ranges from 5 to 9 t/ha.

Lessons from the organisational and management framework at the two schemes

The PPP models

The Chifundi and Elmly Park Irrigation schemes were not typical PPP models based on clearly defined and coded policy prescriptions. The organisational forms at the two irrigation schemes evolved from the process of crafting workable management arrangements for managing the irrigation technology. The processes were emergent and contingent on a number of critical factors:

- the irrigation systems technology which required outside expertise for the operation and management. Chipfundi farmers roped-in farm level experience/expertise, while Elmly Park employed the management expertise of the former commercial farmers,
- the size of the individual farmer plot size was much higher than the then norm at most smallholder irrigation schemes, and the
- fear of failure to produce which resulted in eviction from the resettlement scheme and replacement by capable A2 settlers according to the political discourse then (Zawe, 2006).

An irrigated block run as a unit

The concept of an irrigated block of land run as a single unit was adopted at the 2 schemes. The irrigated block would be run on fully commercial lines with hired labour and cash or borrowed capital. After deducting all the running costs of the irrigated block, settlers would share the net profits equally.

Mentoring by the outgoing commercial farmers and ex-farm workers

The farm level experience/expertise of ex-farm workers and the management expertise of the former commercial farmers was key to the success of both Chipfundi and Elmly Park irrigation schemes. The mentoring highlighted the maintenance of the irrigation system infrastructure especially the pumps as top priority. Successful maintenance depended on achieving high crop yields. Achieving high crop yields in turn depended on three key factors namely:

- having the right type and amounts for the crop inputs,
- executing all operations on time, and
- having the right decision makers.

High-tech irrigation systems for smallholder farmers

Smallholder farmers can successfully use and manage advanced irrigation technology which was once a preserve for Large Scale Commercial farmers. It is however important that they get the much needed mentoring from the partner in the PPP arrangements.

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