Exploring growth in the adaptive cycle of a collaborative irrigation scheme: A case study of the Kaleya Smallholders Company Limited (KASCOL) in Zambia

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A thesis submitted in partial fulfilment of the requirement for the degree of Master of Philosophy in Integrated Water Management at Monash University

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May 2017

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Abstract

In this thesis, I explore the growth phase of a collaborative irrigation scheme using the theory of the adaptive cycle as an analytical tool. The study uses the adaptive cycle as a heuristic model for exploring and interpreting change in a collaborative irrigation scheme called Kaleya Smallholders Company Limited (KASCOL). It employs the concept of social capital as a core dimension of change to explore how the scheme evolved over time. In the KASCOL collaborative irrigation scheme, change was described in terms of social capital as a dimension of change in the growth phase. Social capital was defined as a resource that is embedded in social relationships that influence collaboration and measured in terms of trust and commitment as key attributes. Collaboration was defined as actors working together in pursuit of a desired collective goal.

A qualitative field research data collection method was used in the study. In-depth interviews were conducted with the following key informants: KASCOL management, its farmers' association and smallholder farmers. All the interviews were recorded using an audio recorder, and a documentary analysis was conducted to complement the interviews. This involved the gathering of relevant published documents on KASCOL's collaborative scheme. To analyse the data from the transcribed interviews and documents, the content analysis approach was adopted. Two key themes (adaptive cycle and social capital) were used to guide the coding scheme of the content analysis.

The results of this study showed that the adaptive cycle is a useful heuristic framework for exploring and interpreting the dynamics of social capital underlying collaboration. The study revealed that social capital in the growth phase of KASCOL had the ability to either enhance or hinder collaboration. High levels of social capital as a consequence of increased levels of trust and

commitment were found to facilitate collaboration, leading to the growth phase of the scheme. It was found that the early stages of the KASCOL growth phase were characterised by low levels of social capital. There was lack of trust among the community members towards the proposed collaboration between members of the community and KASCOL management. The low levels of trust influenced the growth phase of the collaborative scheme.

The evolution of the growth phase of the scheme was initiated by the steady increase in social capital when KASCOL changed its strategy by recruiting its own employees instead of community members. Only eight among the hesitant KASCOL employees agreed to join the collaborative scheme. KASCOL management managed to gain the trust of the eight employees by promising to give them back their employment positions in the event that they did not like the outcome of the collaboration. Given that trust is influenced by an actor's experiences and expectations, when expectations are met (Cullen et al., 2000; Cousin, 2002), the experiences of the eight employees were able to motivate other actors to exhibit cooperative behaviour towards the collaborative scheme. The increase in trust among collaborating actors increased social capital in the KASCOL scheme, which in turn influenced the nature of collaboration in the growth phase of the collaborative scheme.

Based on the findings of this study, it is recommended that water policymakers should conceptualise the governance of water systems such as collaborative irrigation schemes as adaptive cycles. Viewing such systems as adaptive cycles can create room for stakeholders and policymakers alike to integrate social capital as one of the key determining variables of dynamic change capable of influencing the direction of the system. Conceptualising water systems as adaptive cycles can also help policymakers

and stakeholders in the management of these systems and the design of policies that are flexible to adapt to the dynamics of social capital that underlie collaborative schemes such as irrigation schemes.

Keywords: Adaptive cycle, growth phase, social capital and collaboration

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signature: 

Siingwa Victor Date: 09/05/2017.

Acknowledgements

Special and sincere gratitude firstly goes to the Almighty God, who has been my strength and guide throughout the course of the study. Secondly, I would like to thank the Lloyd's Register Foundation and the International Water Security Network for awarding me a scholarship. The scholarship has enabled me pursue my studies.

Special thanks are extended to my supervisor, Associate Professor Bimo A. Nkhata for guiding me throughout the course of my studies. Your input, tireless support, and advice throughout the course of the study has made this research possible. Special appreciations are extended to Hester Stols, Research Coordinator at Monash South Africa, Linda Downsborough, Lecturer at the School of Social Science, Monash South Africa/Water Node and the entire Water Node research team. To all my colleagues, you were part of this journey — many thanks, guys.

Lastly, I would like to thank Kaleya Smallholder Company Limited (KASCOL) management for according me an opportunity to undertake this research with their institution as a case study and their support during the time of field work. I would also like to thank all the participants to this study for participating in this study. This thesis could not have been achieved without the support these people; indeed I am truly grateful for their contributions towards this work. To Simone Wilcock, many thanks for your contribution to this work through your editing services.

Dedication.

This work is dedicated to the Siingwa Family for their support and encouragement from the beginning of when I choose to undertake this Master's Degree to the end of the study. You have always been a wonderful family.

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List of Acronyms

BB	**Barclays Bank**
CBNRM	**Community Based Natural Resource Management**
CDC	**Commonwealth Development Corporation**
DBZ	**Development Bank of Zambia**
GRZ	**Government of the Republic of Zambia**
KASCOL	**Kaleya Smallholders Company Limited**
KASFA	**Kaleya Smallholder Farmers Association**
MUHREC	**Monash University Human Research Ethics Committee**
NGO	**Non-Governmental Organisations**
SES	**Social-Ecological System**
ZSC	**Zambia Sugar Company**

CHAPTER ONE: INTRODUCTION

1.1 Overview

This thesis aims at using the adaptive cycle as a heuristic framework for exploring and describing growth in a collaborative irrigation scheme called the Kaleya Smallholders Company Limited (KASCOL). By using the adaptive cycle heuristic, the study is able to illustrate the dynamics of social capital that underlie such collaborative schemes. Tracing the dynamics of social capital and its influence on the growth of the KASCOL collaborative irrigation scheme, the study shows the importance of social capital in fostering growth. The study is based on the understanding that a collaborative irrigation scheme can be conceived as a social-ecological system (SES) that is often influenced by the dynamics of social capital (Anderies et al., 2004; Walker et al., 2004). Some scholars have shown that social capital influences growth in collaborative initiatives, and that the dynamics of social capital are significant in understanding systemic change (Fisher, 2013; Njunki et al., 2008; Coleman, 1990). Social capital and collaboration can facilitate adaptation in a SES to unpredictability and foster resilience (Nkhata et al., 2008; Walker et al., 2004; Anderies et al., 2004; Gunderson and Holling, 2002). The adaptive cycle as a heuristic, it has been used to explore and interpret a system's dynamics into four functional phases (growth, conservation, collapse and reorganisation). The findings of this study are discussed in terms of their implications for collaborative strategies and how they would potentially influence the security of water resources in order to foster the resilience of water based SESs.

After this overview, this chapter starts by providing a background to the study in which water resource systems and the dynamics in social systems of SESs are presented. Thereafter, a problem statement is given in the sections that follow and the objective of the study is outlined. This chapter ends by proving the outline of the entire thesis.

1.2 Background to the Study

1.2.1 Water security and coupled SESs

Water systems are arguably one of the most critical natural resource systems that functionally link human systems with the water ecological systems. Such linkages form a coupled system that is usually termed a Social-Ecological System (SES) (Anderies et al., 2004; Walker et al., 2004). The nodes created by water resources with the social systems can be described as a consequence of the multiple usages of water resources, which include: water for domestic use in municipalities and rural areas; industrial use such as in the energy sector – the production of hydro-electricity; use in manufacturing industries; and use in the agricultural sector (Bakker, 2013; Petersen-Perlman, 2012; Cook and Bakker, 2012). In the agricultural systems, water resources are critical for food security – it has been argued that water resources are a large component of food security (Biggs et al., 2010; Cook and Bakker, 2012). In irrigated agricultural systems, water resources are a key resource input critical to the survival of crops (Whaley and Weatherhead, 2015).

The sustainable development of water systems as well as social system is associated with the economic development of nations across the globe (Biggs et al., 2010; Grey and Sadoff, 2007). Nations that have harnessed their water systems potential by harnessing the country's hydrology have invested into water infrastructure and institutions, while those that have not or are yet to harness their hydrology are found to be mostly developing countries (Borgadi et al., 2011; Grey and Sadoff, 2007). Such a linkage between development and water resources, has led to water managers and scholars to consider water management approaches that will secure the resilience of these coupled SES (Grey and Sadoff, 2007). To achieve an envisioned state of water resources both for humans and the environment some scholars have used the concept of water security as a vehicle to drive to that water secure state in which the productive potential of water resources as well as it destructive impact are harnessed (Scott et al., 2013; Cook and Bakker, 2012; Grey and Sadoff, 2007). In addition, water security is widely seen as a complementary management approach to integrated water resources management (IWRM) (Cook and Bakker, 2012). IWRM is an approach to managing water resources

that emphasises the coordinated development of water resources through processes and mechanisms that aim at coordinating competing water resource use among stakeholders (Scott et al., 2013; Cook and Bakker, 2012; Biggs et al., 2010). Cook and Bakker (2012) argue that most of the themes that the two concepts emphasise when it comes to water systems are complimentary. For example, IWRM emphasises processes and mechanisms in water resources management which are arguably also captured in water security themes such as availability, quality concerns, and ecological and human needs (Biggs et al., 2010; Grey and Sadoff, 2007). These aims can possibly be achieved through governance processes as a coordinating approach to competing water uses among stakeholders (Cook and Bakker, 2012).

Water security has a diversity of definitions both at conceptual and operational levels. Water security, at least at conceptual level, is often defined to capture almost all water-related insecurities arising from risks and uncertainties for both humans and the environment. For example, on a conceptual level the UN-Water (2013) defines water security as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability". However, the difficulty comes in when operationalising such a broad definition. It is difficult to capture all the variables these broad definitions of water security entail (Cook and Bakker, 2012). For Grey and Sadoff (2007) they use a broad conceptual definition of water security that includes a number of aspects for the environment, humans, economies etc. – but when operationalising it, they limit it to the ability of a nation to be able to harness its hydrology at the national scale. Cook and Bakker (2012) argue that for the purpose of capturing all aspects of water-related insecurities, a broad definition of water security is necessary, and that for the purposes of operationalising the concept and for management purposes, narrow and specific definitions may be required. Given the above understanding, both operational and conceptual definitions of water security have one theme in common: the need to reduce the risks, threats and uncertainties that are associated with water resource

systems in terms of quality and quantity, protection against droughts and floods, and the resilience of the entire SES (Chaffin and Gunderson, 2016; Biggs et al., 2013; Grey and Sadoff, 2007).

Scholars in interested in the management of water systems posit that given the multiple aspects of water that water security emphasises, achieving the latter requires collaborative approaches that will bring diverse actors with competing interests in water resources within a SES together to address complex water security-related challenges (Hepworth and Orr, 2013; UN-Water, 2013; Lankford et al., 2013; Cook and Bakker, 2012; Biggs et al., 2010). In this study water security is conceptualised as a state in which actors collaborate towards water-related issues for ensuring the resilience of a SES (Hepworth and Orr, 2013; Cook and Bakker, 2012; Innes et al., 2007). Collaboration is one of the approaches used to bring actors sharing a problem to work together to address such a problem for the collective good (Imperial, 2005; Grey and Wood, 1991). Collaborative strategies have been found to have the ability to enhance the governance and management of natural resources (Imperial, 2005). Some of the advantages of collaborative strategies are that; actors are able to draw on the experiences and expertise of other actors and reduce the transactional costs which accrue in unilateral settings and which make management of an SES challenging (Nkhata et al., 2008; Innes et al., 2007; Imperial, 2005; Grey and Wood, 1991). Although a number of definitions of collaboration do exist, for the purposes of this study, collaboration is defined as: actors working together to achieve a desired collective goal where in unilateral settings it is difficult to achieve such goals (Anthony and Campbell, 2011; Nkhata et al., 2008). The ability for actors to come together in any collaborative scheme is usually influenced by a number of factors, such as the role of the convener of the collaboration (Grey and wood, 1991) and social capital (Anthony and Campbell, 2011; Nkhata et al., 2009; Ostrom, 1990). In addition, Kizos et al., (2014) argue that social capital influences other forms of capital such as natural, financial, human and institutional capital. Social capital is known to influence the way a collaboration will proceed, affecting the management of natural resources (such as a fishery) and governance of commons (such as the internet), as well as affecting most collaborative alliances (Fisher, 2013; Anthony and Campbell, 2011; Nkhata et al., 2008, 2009; Cousin, 2002). In a way,

social capital plays a significant role in directing the dynamics of collaborative schemes in SES management (Nkhata et al., 2008).

Social capital is also a concept that has definitional diversity. However, most definitions are anchored on the outcome that social relations can facilitate – for example Coleman (1988, 1990) and Putnam (1995) consider social capital as a resource that facilitates action that actors can call upon to advance mutual benefits. Nkhata et al., (2009) considered social capital as property rights that regulate the governance of a natural resource system. Following on these scholars, in this study social capital is defined as a social resource that is embedded in social relationships which can influence collaboration among actors in a collaborative scheme for mutual benefits (Anthony and Campbell, 2011 York and Schoon, 2011). In addition, social capital as a resource anchored in social relationships is characterised and measured in terms of the levels of trust and commitment as key attributes (Nkhata et al., 2008). Social capital is also considered to be a key attribute influencing the dynamics in SES, in that the social system has the ability to direct the dynamics of SES (Walker et al., 2004). SESs, such as those formed by water systems, are unpredictable and dynamic systems in that water resources are influenced by climatic variations affecting both the environment and the human system (Scott et al., 2011). There is an increasing interest in the usage of the adaptive cycle as a heuristic model to interpret and characterise dynamic adaptive change in various SESs (see for example Rawluck and Curtis, 2016; Kizos et al., 2014; Baral et al., 2010; Nkhata et al., 2009; and Abel et al., 2006). The adaptive cycle a metaphor of adaptive change has found its usefulness in characterising and interpreting dynamic adaptive changes that influence the dynamics and trajectory of a system. In the section below, the development and application of the adaptive cycle is presented.

1.2.3 Interpretation of dynamic change in social-ecological systems and the adaptive cycle

Dynamic change in an SES is viewed as adaptive and cyclic (Gunderson and Holling, 2002). Scholars studying ecological systems developed the adaptive cycle concept as a heuristic model to explore and interpret cyclic change in ecosystems (Gunderson and Holling, 2002; Holling, 2001). The adaptive

cycle, although originally used in ecological systems, it has over time been increasingly used as a framework for interpreting change in coupled systems SESs (Vang Rasmussen and Reenberge, 2012; Baral et al., 2010; Nkhata et al., 2009; Abel et al., 2006). The applicability of the adaptive cycle in social systems is largely based on the assumption that most social systems can be described in dynamic terms and can exist in multiple phases or states (Nkhata et al., 2009; Holling, 2001).

The adaptive cycle (Figure 1 below), is a conceptual model used to interpret and organise adaptive change into four functional phases, namely: the exploitation phase, conservation phase, collapse phase and reorganisation phase (Holling, 2001). The exploitation phase (r) or growth phase is a phase in which a system is considered to be rapidly accumulating capital and connectedness (Gunderson and Holling, 2002). Capital is defined as the systems potential that influences the trajectory and sets limits on the range of options of such an adaptive system. Connectedness is defined as the degree to which a system is internally connected among its internal controlling variables – connectedness determines the degree to which a system can control its own destiny (Gunderson and Holling, 2002). As capital and connectedness increase, these variables lead the system into another functional phase in which relative system stability defines the system. During this new emerging phase, the system exhibits some level of stability in the sense that the functioning of the system is certain during the conservation (K) phase (Holling, 2001).

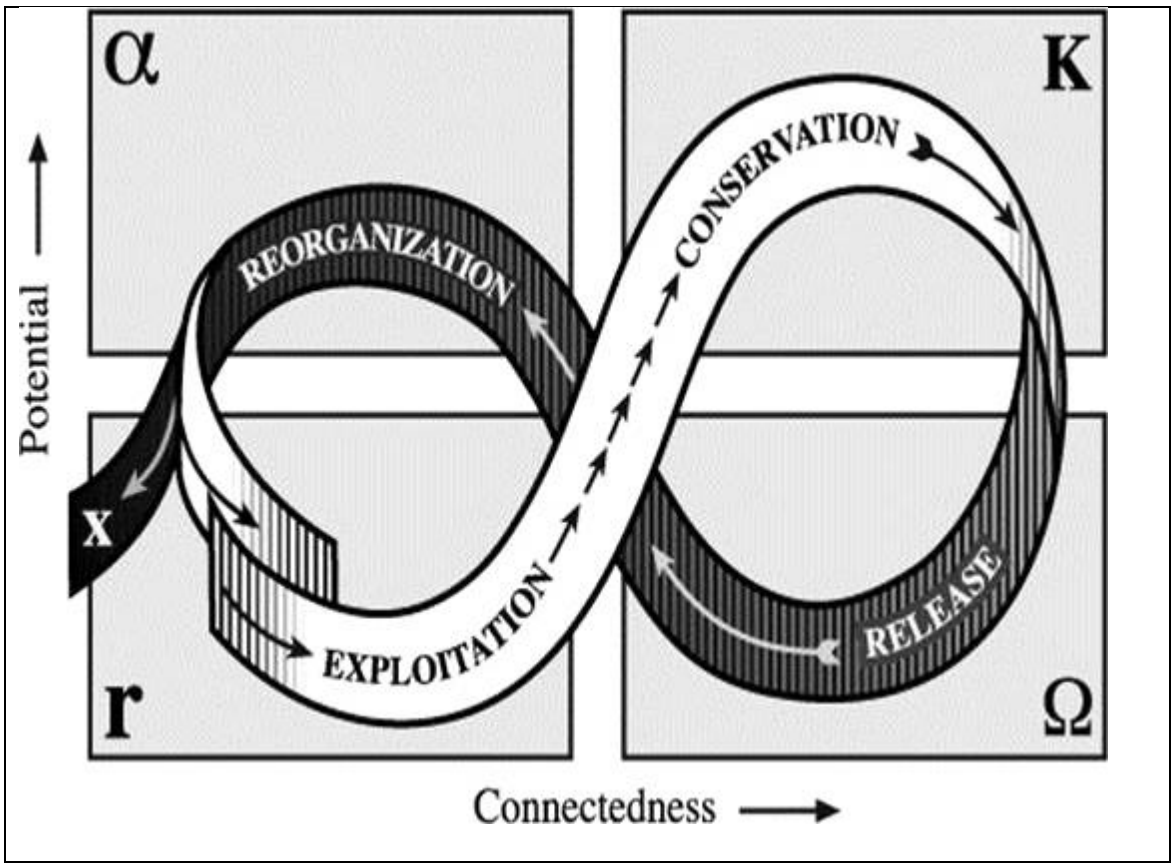


Figure 1: The adaptive cycle framework (adapted from Fath et al., 2015)

The adaptive cycle theory further proposes that a system may remain in the conservation (K) phase for a long time as it maximises productivity. This is until the system's controlling variables (capital and connectedness) become rigid and vulnerable to sudden internal and external shocks, which leads the system into a rapid collapse phase (Ω) in which the accumulated capital and system connectedness is lost (Gunderson and Holling, 2002; Holling, 2001). After the collapse of the system, a reorganisation (α) phase begins by accumulating the released capital and connectedness – either into a new system that begins its adaptive cycle (exit arrow X in Figure 1) or into reorganising towards the same old system – and going into the growth phase again (Gunderson and Holling, 2002; Holling, 2001). There is another variable in the adaptive cycle: resilience. Resilience is a variable that tests the system's vulnerability, in that during a shock, a system may avoid a collapse by resisting or absorbing that shock and continue functioning without changing the system's function and structure (Walker et al., 2004; Gunderson and Holling, 2002). Resilience emphasises a system changing its controlling variables without fundamentally changing structure and function (Walker et al., 2004). This variable is evident between the conservation phase and collapse phase of an adaptive system, although it

measures a system's resilience against external surprises. The resilience of a system can be tested at any phase in the system adaptive cycle (Walker et al., 2004; Gunderson and Holling, 2002).

1.3 Research Problem

The adaptive cycle has been used to interpret adaptive change in SESs. Examples include the study by Able et al., (2006), in which the collapse and reorganisation phases are explored in the Zimbabwean cattle and wildlife ranching land use system and the Aboriginal land use system in Australia. Other studies in which the adaptive cycle is used include the transformation of a fishery resource system from a common pool resource governance system to an open access governance system in Mozambique (Nkhata et al., 2009). Vang Rusmussen and Reenberge (2012) used the adaptive cycle to explore and interpret change in the Sahalian Agro-Pastoral SES: they examined changes in the household resource system in the community to ascertain changes in the SES. Baral et al., (2010) apply the adaptive cycle to understand the transformations in the governance of a SES involving wildlife conservation areas in Nepal. The adaptive cycle has been used to construct a conceptual framework for interpreting adaptive change in social relationships underlying collaborative schemes (Nkhata et al., 2008).

The adaptive cycle's application to SESs has shown a considerable variation in the way the variable of capital is characterised. To some, capital and connectedness can essentially represent similar things in SES such as all forms of capital: human, financial, social, institutional and physical (Abel et al., 2006). To others, capital in the adaptive cycle of a SES entails all the resources that strengthen the wealth of households in the community, such as financial, livestock and transhumance activities that are linked in a way to wealth creation (Vang Rasmussen and Reenberg, 2012).

Studies that consider the capital of a SES to be characterised as social capital and that consider it to be a core variable influencing the adaptive cycle of SESs are quite rare. However, two studies exist that characterise capital in terms of social capital. In Nkhata et al.'s 2009 study, the SES's capital is characterised as social capital, referring to the governance system regulating use of a fisheries system

through property rights assigned to individual resource users. This work explores the transformation of the Rovuma artisanal fisheries SES in Mozambique from a common pool resource governance system to an open access SES resource governance system. The other study (Nkhata et al., 2008) is a conceptual framework for interpreting social relationships underlying collaborative management of SES as long-term social relationships. In this work, relational capital and social capital in a sense mean one and the same thing in that they have the same root (social capital). Relational capital is characterised and measured in terms of the degree of trust and commitments in a social relationship. Social relationships are known to be to be dynamic and influence the collaboration that underlies collaborative schemes (Nkhata et al., 2009; Nkhata et al., 2008). However, there are scant empirical case studies that use the characterisation of social capital as trust and commitment as key attributes that drive the dynamics in the SES. This problem creates an opportunity for exploring how social capital measured as trust and commitment influences the dynamics in social capital that underlie collaboration.

1.4 Study Purpose

Given the above understanding of the problem, this study therefore aims in part to contribute to the number of empirical cases that illustrate how social capital influences dynamic change in collaborative SESs. Social capital in this study is conceptualised as a social resource that is characterised in terms of trust and commitment (Nkhata et al., 2008). In a sense, this study also contributes to the understanding of how dynamic changes in social capital influence the dynamics that underlie collaborative schemes such as irrigation schemes, conservation collaborative schemes and any other water-related collaborative SES arrangement. The study uses the Kaleya Smallholder Company Limited (KASCOL) as a case study for empirical testing of the influence of the dynamics of social capital on the adaptive cycle of a collaborative SESs. KASCOL is a collaborative sugar cane farming irrigation scheme that was first operated as a private sugar cane scheme in the year 1980, and three years later emerged as a collaborative scheme between the local communities and KASCOL management (Mungandi et al., 2012). The purpose of this study is therefore to explore the growth

phase of the KASCOL collaborative SES using the dimension of social capital. The adaptive cycle is used a conceptual model through which change in the SES is interpreted. Specifically the question I pursued in this study was; how did growth in social capital influence the growth phase and collaboration in the KASCOL SES?

1.5 Thesis Structure

In chapter two, a review of literature around water security, the adaptive cycle, collaboration and social capital are presented and a conceptual framework is outlined. The methodology is presented in chapter three. In that section, the research paradigms and the data collection process and analysis used in this study are highlighted. The contextual background and a detailed description of KASCOL as a collaborative scheme in the Kafue River Basin is presented in chapter four. The findings of this thesis are presented in chapter five. The findings of the study presented in chapter five are discussed in chapter six in relation to the literature; in this discussion chapter, the findings are linked to water security by discussing their potential implications for ensuring water security for resilient SES. Conclusions drawn from this study are presented in chapter seven. In that chapter, recommendations for future studies and policy implications are provided.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the concept of water security, collaboration, social capital and the adaptive cycle. The chapter begins by linking the concept of water security as a management framework for coupled water Social-Ecological Systems (SESs), and explores the role of social capital in influencing collaborative initiatives. In the second section, the role of collaboration in natural resource management is outlined with the emphasis on how collaborative activities may be useful in achieving water security-related management problems. The third section introduces the concept of social capital. Within this section there are three sub-sections that are dedicated to how the concept of social capital has been applied and measured, with reference to the forms of social capital, identified as: bonding, bridging and linking social capital. In the last three sections of this chapter, a description of how adaptive change in SESs has been examined and how the concept has been measured using the adaptive cycle heuristic is presented. The dimension of change, particularly social capital characterisation, in the adaptive cycle is also discussed, and lastly, a conceptual framework for social capital is presented.

2.2 Coupled Social-Ecological Systems (SESs) and Water Security

Water resources have been linked with the economic development of nations, particularly when the hydrology of a given country is harnessed to reduce the destructive potential of water in terms of floods and droughts and increase its production potential (Biggs et al., 2013; Grey and Sadoff, 2007). The integration of various environmental issues in the management of water resources and the framing of water security demonstrates the interdependence of water systems and the social systems as coupled systems (Cook and Bakker, 2012; Vorosmarty et al., 2010). Recognising the potential of governance mechanisms in coordinating various environmental and social needs for water resources is gaining support in scholarly work on water security (Biggs et al., 2013; Petersen-Perlman et al., 2012). Such scholarly work points to approaches that can be used to manage coupled social and ecological systems linked by water resources to achieve resilience of these SESs. A social-ecological

system (SES) is a system consisting of two subsystems: the social and ecological systems. They are defined by the interactions between the social system and the ecological system whereby each system is viewed as a sub-system of the main SES (Anderies et al., 2004). Examples of water-linked coupled SESs include irrigation systems and fisheries systems. Other coupled systems include those formed by landscape land use systems such as agro-pastoral SESs and wildlife conservation communities (Baral et al., 2010; Nkhata et al., 2009; Able et al., 2006). Water security is increasingly gaining support both as a management framework and as a paradigm (Biggs et al., 2013; Pahl-Wostl et al., 2011).

The conceptualisation of water security in water-related academic literature reveals a diversity of definitions. These various definitions can be broadly categorised into two categories, namely conceptual- and operational-level definitions (Cook and Bakker, 2012). Conceptual definitions are those that broadly capture all aspects of water resources that affect SESs, while operational definitions are those that are actually used in the analysis of a given case for water security. For example, Grey and Sadoff (2007) broadly define water security conceptually as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments, and economies", and their operational definitions are narrowed down to the ability of a nation to be able to manage the productive potential of water as well as its destructive potential (Cook and Bakker, 2012; Grey and Sadoff, 2007). Some of the common conceptual definitions for water security include those by the Global Water Partnership (GWP), the United Nations (UN) and Grey and Sadoff (2007). These are broad definitions that capture the broad aspects of the socio-economic and environmental productive potential of water resources, as well as the prevention of the destructive potential of water resources. For example, the UN-Water definition of water security is so broad as to capture political and peace-related concerns alongside the issues of water quality, water quantity, prevention of hazards and vulnerability from droughts and floods, environmental sustainability and other socio-economic human needs (UN-Water, 2013; Grey and Sadoff, 2007). Such broad definitions capture an envisioned state for water

resources: both the productive potential of water resources as well as the prevention of its destructive potential for humans and the environment – such as droughts, floods, etc. (Biggs et al., 2013). In a way, water security as a concept is framed around preventing water resource-related uncertainties and risks and ensuring the resilience of SESs (Biggs et al., 2013; Grey and Sadoff, 2007). Cook and Bakker (2012) argue that this diversity and broad way of defining water security is good as it allows for holistically capturing all the aspects of water security, while the narrowing of definitions is useful for operationalising the concept – especially for management. For the purposes of this study water security is conceptualised as the state in which actors in a water-linked SES collaborate to achieve a collective goal for the resilience of a SES (Hepworth and Orr, 2013; Grey and Sadoff, 2007). Water security, needed for the resilience of both society and the ecological system, can be achieved through collaborative strategies in which stakeholders with competing interests in water resources work together for mutual benefits (Innes et al., 2007). It is argued that collaboration is one of the ways that competing interest for natural resources and their management can be coordinated for the mutual benefit of all stakeholders (Innes et al., 2007; Imperial, 2005). In the section that follows, a definition of collaboration and its interpretation is presented.

2.3 Collaboration

Collaborative arrangements as a management strategy are known to contribute to the governance of natural resources problems and to addressing a wide array of problems affecting a group of actors (Imperial, 2005; Grey and Wood, 1991). The concept of collaboration, however, has multiple definitions. Scholars such as Grey and Wood (1991) reviewed a number of definitions that suggested and captured the meaning of the concept of collaboration before coming up with their own definition. These authors undertook such a study in the quest to develop a comprehensive theory of collaboration. Imperial's (2005) definition builds on Grey and Woods' (1991) definition of collaboration by borrowing some aspects such as the involvement of norms, rules and structures as key enablers of collaboration. However, most studies have tended to define and characterise collaboration in ways that best capture the purposes they aim to investigate. For example, Nkhata et al., (2008) use the

creation of more benefits, but in a unilateral state it can be difficult to create such benefits as a basis for actors collaborating. Other scholars such as Imperial (2005) analyse the types and forms of collaboration based on activities that each stakeholder does, emphasising the importance of collaboration in natural resource governance. Innes et al., (2007) examine how informality in collaborative programs is useful in solving complex river basin water management problems. In the case presented by Innes et al., (2007), these authors define collaboration generally as "co-labouring, working together". In the presence of social capital, collaborative arrangements are known to be very productive. For example, Nkhata et al., 2008 conceptualise relational capital as an enabler of collaboration. In this study, a similar line of thought in which social capital is a key driver of collaboration is advanced. Collaboration, for the purposes of this study, entails actors working together to achieve a collective good, where in a unilateral setting it is difficult to achieve such goals (Anthony and Campbell 2011; Nkhata et al., 2008). Given this understanding and in the context of the KASCOL scheme, collaboration denotes smallholder farmers working together with KASCOL Management to achieve the scheme's water management goals.

Social capital is considered in this case as the key driver underlying collaboration in collaborative schemes (Nkhata et al., 2008). Given the linkages between water security and collaboration, the following sections will focus on social capital as key variable influencing the collaboration.

2.4 Social capital and approaches to measuring the concept of social capital

The concept of social capital has generated multiple conceptualisations of what it entails. More often it is viewed as a resource that individuals or members of a group can draw on to facilitate mutual benefits such as livelihoods and cooperation towards a set goal (Fisher, 2013; Lansen et al., 2004; Putnam, 1995). It essentially encompasses the features of social organisation such as norms, social trust and networks of interactions that facilitate collaboration for mutual benefits (Putnam, 1995). In natural resource management literature, especially work focusing on the management of common pool resources (CPR), social capital also refers to the various institutional arrangements (rules and

norms) that guide interactions among members of a community and the resource system they depend upon (Ostrom, 1990; Anderies et al., 2004). More recent formulations and studies using the concept of social capital build on the principles of social trust, networks of interactions that are a feature of social organisation (Pretty, 2003; Lansen et al., 2004; Putnam, 1995). For example, Uphoff and Mijayaratna (2000) distinguish between structural and cognitive forms of social capital. These authors emphasise the idea that shared norms and trust at individual and household levels, and the horizontal and vertical social networks that emerge out of these interactions, constitute social capital. Structural social capital is defined as referring to networks, linkages and practices within and between communities and the forms of social organisation within which networks of relationships are located (Uphoff and Mijayaratna, 2000; Sanginga et al., 2007; Njuki et al., 2008). In contrast to structural social capital, cognitive social capital is defined as the attitudes, values, beliefs, social norms, and behaviours that exist within a community (Uphoff and Mijayaratna, 2000).

Further work on social capital has led to further development in the characterisation of cognitive and structural social capital introducing bonding, bridging and linking social capital (Pretty, 2003; Sanginga et al., 2007). Pretty (2003) describes bonding social capital as the social cohesion within groups or communities resulting from relationships between people of similar backgrounds such as ethnicity, social status and location. Bonding social capital is defined based on local ties, trust and shared moral values, reinforced by working together (Pretty, 2003). Bridging social capital entails social relations among different social groups, and linking social capital refers to relations among individuals and groups that occupy different positions in social hierarchies such as government structures (Fisher, 2013; Njuki et al., 2008; Larsen et al., 2004). These various conceptualisations of social capital based on the functionality of social capital (such as bonding) is contended to be useful, functional and productive for collaboration within a group of actors with similar characteristics (Sanginga et al., 2007). For example, these can be members of a community wildlife conservation group or local community fisheries group that are found within a community (Pretty, 2003; Njuki et al., 2008). Bridging social capital plays the function of coordinating various groups within the

community and forms networks in a horizontal direction when compared to linking social capital, which links individuals in a hierarchical order, mainly through vertical linkages (Fisher, 2013; Pretty, 2003).

2.5 Bonding social capital

Bonding social capital is defined as closed networks of close friends and relatives or horizontal relationships among equals within a localised community (Lansen et al., 2004). It is the trusting and cooperative relationships between members who are similar in a social demographic sense. It is reinforced by the existing trust and norms within a given community (Njuki et al., 2008; Pretty, 2003). Scholarly work shows that these forms of social capital influence social relationships in various ways. For instance, in the work that Lansen et al., (2004) conducted, they focused on the relationship between social capital and civic action that community members were engaging in. These scholars interrogated two types of social capital, namely bonding and bridging social capital. In this study, it was found that the formation of bonding social capital was influenced by social status (levels of education), longevity of the stay of an individual in the neighbourhood and ethnicity. Lansen et al.'s (2004) findings suggest that individuals who have lived longer in a community have a higher education level and those related to the ethnicity of the areas (non-Hispanics) were more likely to engage in creating ties and sharing trust within the neighbourhood. Social status, ethnicity and longevity of a person in a community are factors that can influence the formation of bonding social capital (Lansen et al., 2004).

In a different case, Sanginga et al., (2007) found that bonding social capital or the social cohesion that is formed within a group of homogenous members such as clans, clubs etc. had limitations in its ability to solve conflicts in natural resources management in the Southwestern Highlands communities in Uganda. Sanginga et al., (2007) argue that in terms of conflict resolution, bonding social capital was not able to resolve conflicts within the same community because the village clans which form bonding social capital among the local people failed to resolve conflicts due to a lack of

sanctioning power. As a result, community members opted for other forms of social capital such as linking and bridging to resolve their conflicts over natural resource management. Fisher (2013) found that bonding social capital influenced the sharing of information and the transformation of such information into useable knowledge among farmers' networks in England. Although the information did not relate directly to bovine tuberculosis, which was the focus of Fisher (2013)'s study, it was generally noted that farmers often shared their lived experiences with each other due to the degree of trust attached to their social relationships among each other. Few cases, however, in this study existed in which this lack of trust and the transformation of shared information into useable knowledge among the farmers was noted to negatively affect collaboration with others within the community (Fisher, 2013). This is something that suggests the existence of strong bonding social capital that forms exclusive networks of social interactions (Fisher, 2013). In a study by Njuki et al., (2008), in which the role of social capital in the adoption of soil enhancing technologies is studied, it was found that soil management technologies such as cover crops were linked to the existence of bonding social capital as mostly smallholder farmers obtained seedlings for the cover crops through internal connections within a village of clansmen. There are contextual factors, however, that affect the formation of social capital. In particular, Lansen et al., (2004) highlight that community or group stability in terms of affluence can have a significant influence on social capital formation. It was found that in poor communities formation of bonding social capital was challenging in that these people interacted less and the cohesion among them was low (Lansen et al., 2004). Bonding social capital in a way is less instrumental and operates through informal networks of interactions within the community of similar actors – i.e. belonging to the same social profile or group (Njuki et al., 2008; Pretty, 2003). Furthermore, in a study in which factor analysis methodology was used to isolate the various types of social capital bonding, social capital was associated with variables such as cooperation among people, formation of trust, participation in collective community activities and conflict resolution to a large extent (Njuki et al., 2008). This is in contrast with the findings of

Sanginga et al., (2007) in Uganda, where bonding social capital was insufficient to coordinate and resolve conflicts over natural resource management.

2.6 Bridging and linking social capital

The other forms of social capital that have been studied in literature are bridging and linking social capital. These two forms of social capital are distinguished from each other in terms of their main functions (Pretty, 2003). Bonding social capital is mainly horizontal relationships between and among different groups in the community, while linking social capital is associated with vertical or hierarchical relationships that link groups with other groups of different and higher, more influential social status (Fisher, 2013; Pretty, 2003). For example, Njuki et al., (2008) defined bridging social capital as relationships that cross social groupings such as those between people and organisations that are removed from each other and are in different communities. Sanginga et al., (2007) and Njuki et al., (2008) emphasise that bridging social capital links networks requiring collaborations and coordination with other external groups to achieve set goals. Lansen et al., (2004) adds that bridging social capital is the propensity of an individual to engage in civic actions on neighbourhood problems.

When creating bridging social capital, empirical evidence suggests that the presence of strong bonding social capital has a positive effect on forming bridging social capital (Njuki et al., 2008). In a case study presented by Lansen et al., (2004), it was found that community members with strong ties representing strong bonding social capital were more likely to engage others in collaborative activities to solve community or neighbourhood problems. In the same case study, contextual factors such as levels of education and ethnicity played a role in the formation of bridging social capital. For example, Lansen et al., (2004) found that those who were associated with the Hispanic community did not trust their neighbours, while individuals with a higher education presenting a higher social status were likely to engage with each other in the community once they perceived the community problem, and would start engaging others on behalf of the community. It is argued that social status may have significant influences on the transformation of bonding social capital into bridging social

capital (Lansen et al., 2004). In another case study, Njunki et al., (2008) found that in terms of adopting soil management technologies, bridging social capital was used in facilitating knowledge-intensive soil management technologies that required sharing of information on their use, training or visiting other farmers for practical demonstrations of such technologies. Farmers who used knowledge-intensive soil management technologies were found to have more external networks with other farmers and institutions, indicating the presence of both bridging and linking social capital. Although Lansen et al., (2004) did not include linking social capital in their study, the conceptualising of bridging social capital is generally understood to refer to external networks and trust among different groups working towards a collective goal by most scholars (Fisher 2013; Njuki et al., 2008; Sanginga et al., 2007; Pretty, 2003; Uphoff, and Mijayaratna. 2000).

Linking social capital is generally viewed as vertical linkages with actors with a higher hierarchical social profile such as training institutions and government departments (Fisher, 2013; Pretty, 2003). It is also known to be influenced by contextual factors within the loci of the groups in a given community. For example, the adoption of soil management technologies such as the use of organic fertilisers was influenced by factors such as land size and the access to capital of a smallholder, while the poor with small landholdings did not depend on the facilitation of linking social capital as they used technologies such as crop cover that could be accessed through internal connections within the village of clansmen and close ties of friends. In this case, the adoption of soil technologies requiring external support farmers made use of linking social capital (Njuki et al., 2008). Even though most of the conceptualisations of social capital include trust, the study conducted by Fisher (2013) employs trust as an important ingredient that leads to formation of productive social capital. In the absence of trust, linking social capital is difficult to develop, as noticed in the case of adopting information by farmers on how to control bovine tuberculosis in England. Farmers did not trust government officials, and as a result they did not make use of the information they provided; instead they used bridging social capital in which high levels of trust with private veterinary officials, who in some cases are farmers as well, were adopted (Fisher, 2013).

2.7 The adaptive cycle as heuristic for interpreting SES adaptive change

To explain change in ecological systems, scholars use the adaptive cycle as a heuristic model for organising and interpreting such change (Gunderson and Holling, 2002; Holling, 2001). The adaptive cycle consists of four functional phases which a system is thought to undergo before it can either restart the cycle or flip to start a new adaptive cycle different from the first one (Walker, 2004; Gunderson and Holling, 2002). Figure 2.1 below shows the adaptive cycle with two main dimensions of change, namely capital (potential) and connectedness. These four phases are the growth phase (r), the conservation phase (K), the release phase (Ω) and the reorganisation (α) phase. A system is viewed as going through a rapid growth period in which the system accumulates available capital for growth, and this capital increases, leading into the conservation phase of accumulated system potential. These two phases consist of what is called the fore-loop of the adaptive cycle (Gunderson and Holling, 2002).

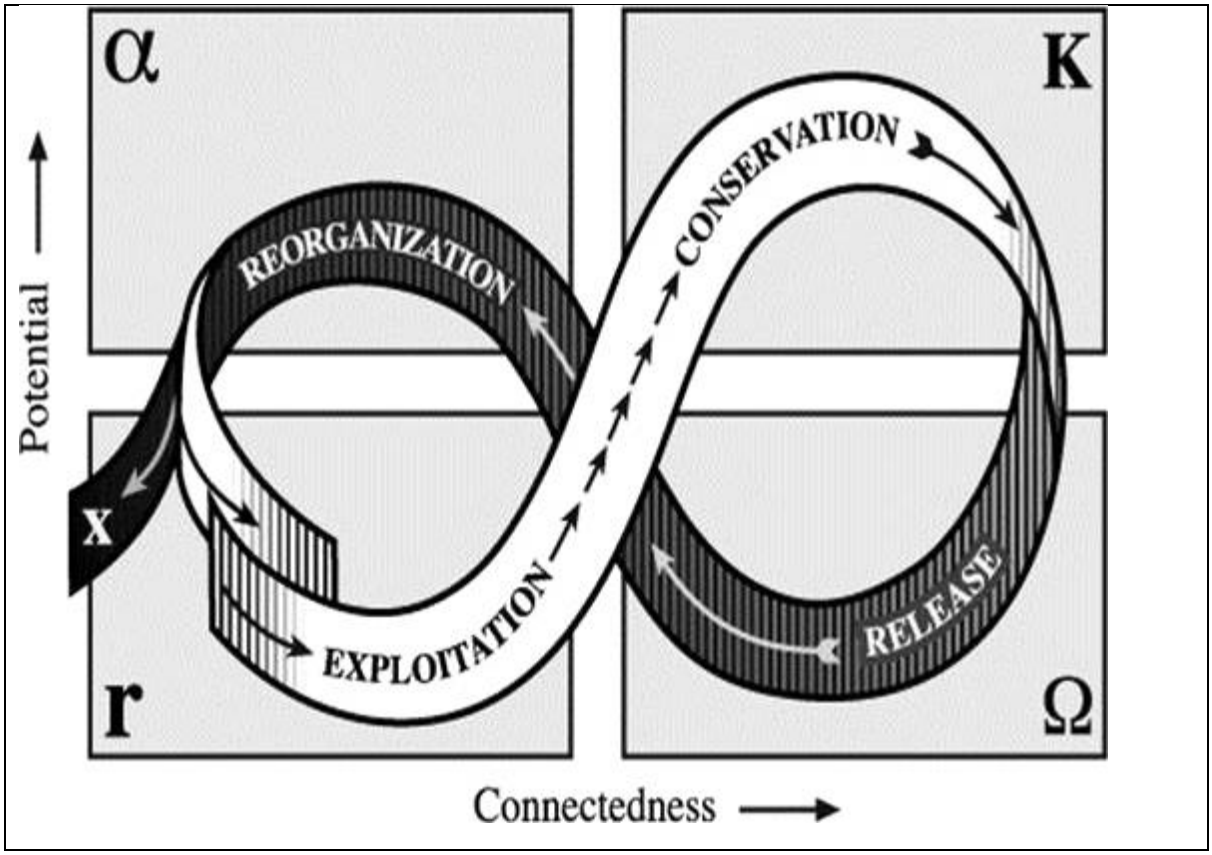


Figure 2: The two controlling variables of the adaptive cycle: Capital (Potential) and Connectedness (Adapted from Fath et al., 2015)

When a system is in conservation phase it functions with relative stability and predictability. However, a system's controlling variables may become rigid and trigger a collapse in the functioning of that system, in which the accumulated potential is released (Rawluck and Curtis, 2016; Gunderson and Holling, 2002). This emergent phase is sometimes called the release or collapse phase. The names are used interchangeably, but they depict the state of a system in collapse. After collapsing, the system begins to gain capital from the loosely held collapsed capital to restart the adaptive cycle and enter into the reorganisation phase. These latter two phases, from collapse to reorganisation, are called the back-loop of the adaptive cycle (Chaffin and Gunderson, 2016). The four phases of the adaptive cycle metaphor are used as a representation of a functional system phase. A system may be in any of the four adaptive cycle phases or may have completed the four phases, although it is rare to find such a system that has completed the four phases of the adaptive cycle (Baral et al., 2010).

There are three main dimensions of change in the adaptive cycle that are used to explore change in a system, namely the capital or potential demission, connectedness and resilience dimensions (Gunderson and Holling, 2002). Scholars use any of the three variables depending on the dimension of change being studied (Kizos et al., 2014; Vang Rasmussen and Reenberge, 2012; Baral et al., 2010; Abel et al., 2006; Nkhata et al., 2009, 2008). Other concepts that scholars use to understand dynamic change in SESs include transformability, adaptability, as well as parnachy (Walker, et al., 2004; Chaffin and Gunderson, 2016; Gunderson and Holling, 2002). In the adaptive cycle, the potential or capital dimension is defined as the potential that drives the trajectory of a system and sets the limits on what is possible in a given system (Holling, 2001). System connectedness is defined as the internal connections of a system which mediate and regulate influences between inside processes and the outside world of a system, which is essentially the degree of control of internal process from the variability of external process (Nkhatat et al., 2008a; Gunderson and Holling, 2002; Holling, 2001). These two dimensions are assessed with respect to the four phases of an adaptive cycle as the levels of each of these dimensions increases and decreases through the adaptive cycle. As these variables change the resilience of a system contracts and expands, depending on the levels of the capital and

connectedness (Gunderson and Holling, 2002). The third dimension is used for resilience assessments. The adaptive cycle assumes that a system grows and assumes a steady phase in which structure and function is relatively stable and the system functions with certainty. However, a system in this phase may lose its resilience due to external uncertainty and shocks, and if not resilient enough the system may collapse, adapt and transform into a fundamentally new system (Walker et al., 2004; Gunderson and Holling, 2002; Holling, 2001). Resilience is defined as the ability of a system to undergo unpredictable change, yet still maintain its function and structure – it is a measure of a system's vulnerability (Walker et al., 2004; Gunderson and Holling, 2002).

Although the adaptive cycle was originally developed to interpret ecological change, it has been used to interpret change in social systems and in linked systems consisting of human and ecological subsystems as well (Rasmussen and Reeberg, 2012; Nkhata et al., 2009). These linked social and ecological entities are considered as one system with two main subsystems together referred to as social-ecological systems (Anderies et al., 2004). In SESs, scholars have used the adaptive cycle as a heuristic to organise and interpret phases of change in a number of SESs such as wildlife conservation areas (Baral et al., 2010) in which dynamics in the governance system are organised in phases of adaptive change, as was found in Nepal. The adaptive cycle was used in a study of fisheries resources management systems (Nkhata et al., 2009), where phases of change in governance of an artisanal fishery from a common pool resource system to an open access resource system were analysed in the Rovuma fishery in Mozambique. In studying an agro-pastoral system in Burkina Faso, Rasmussen and Reeberg, 2012 use the adaptive cycle to explore the function and direction of change in land use systems.

2.8 Capital as a variable of adaptive change in Social –Ecological Systems (SES).

One advantage of the adaptive cycle is that it is hardly a theory as such; rather it is a model for depicting and interpreting dynamic adaptive change in a system (Gunderson and Holling, 2002; Holling, 2001). Because of this attribute, the adaptive cycle enables a dynamic system to be

characterised based on the system's specific variables that are characterised as the capital or potential of a dynamic system. This makes it an appropriate heuristic for interpreting a dynamic system's adaptive change, provided a given system variable can be described in dynamic terms and is able to move into multiple phases (Nkhata et al., 2009; Holling, 2001). In a sense this very characteristic of an adaptive cycle as a heuristic has contributed to the various characterisations of adaptive cycle variables of capital and connectedness. It also makes it possible to integrate social theories to complement the adaptive cycle heuristic to explain change in SESs (Rawluck and Curtis, 2016; Abel et al., 2006). Capital as a core dimension of a change in a system has been used in a number of SES empirical cases. However, characterisation of capital in these studies has shown a variation from one empirical case study to another. In a general sense, capital has been characterised in terms of quantitative indicators of how a community preserved capital such as an increase in livestock or percentages showing changes in social capital (Vang Rasmussen and Reenberg, 2012; Baral et al., 2010). Qualitative attributes are also used in studies such as those conducted by Kizos et al., (2014) and Nkhata et al., (2009, 2008). In these two studies, qualitative indicators were used to characterise a SES's capital as social capital. For example, changes in property rights were used as an indicator of social capital in the governance of a fishery SES in the Rovuma Artisanal Fishery in Mozambique. Kizos et al., (2014) related the forms of social capital to changes in the landscape use in an agro-pastoral SES in southern Greece.

In some studies, scholars have used both quantitative and qualitative indicators for characterising a system's capital, for example in Baral et al., (2010). Among the forms of capital that are commonly used are: financial, human, social and natural capital (Kizos et al., 2014). In some cases, manufactured capital that is structures such as wildlife fences, are also used alongside these forms of systems capital (Abel et al., 2006). Abel et al., (2006) for instance used all these above forms of capital to explore the back-loop (collapse and reorganisation phases) of adaptive cycles of range land SES transformation in Zimbabwe and New South Wales, Australia. In most cases when social capital is used as a form of SES capital it is used in conjunction with other forms of capital such as financial capital and human

capital (Baral et al., 2010). Attributes of social capital include network formation, rules and norms, trust and property rights (Nkhata et al., 2009; Abel et al., 2006). For example, social capital is characterised as including social networks, as well as formal and informal norms and rules that mediate interactions in an SES (Baral et al., 2010). Some scholars have tended to investigate and describe the forms of social capital such as bonding capital- that link similar individuals, and the bridging capital that connects unlike groups are also used (Abel et al., 2006). Njuki et al., (2008) include linking social capital that connects unlike groups across scales of interactions that include those that are aimed at new partnerships – for example a local group resource user group's connection with an external group like a government department (Kizos et al., 2014).

In the study that was conducted by Kizos et al., (2014), they measured social capital in terms of wider social trust among groups, networks and institutional arrangements constraining interactions. They distinguished social capital into three types, namely: bonding social capital, bridging social capital and linking social capital. Bonding social capital is the social relationships that exist and which bond actors of the same social status, for example village kinship groups and those linked through marital relationships. Bridging social capital refers to relations among different social groups. This form of social capital is useful for engaging into intergroup collaborations. The other form of social capital identified is linking social capital, which refers to relations among individuals and groups that occupy different positions in social hierarchies (Larsen et al., 2004). Based on these distinctions, it was found that social capital was a contributor to land use system transformations in the Asteroussia agro-pastoral SES. Strong social ties that existed among the various kinships, similarities in the villages from which individuals came from as well as links through marital connections bonded individuals together in the SES. These strong ties prevented the formation of linking social capital which hindered the possibility of forming any collective activities aimed at improving land use systems in the area. The low levels or the loss of bridging social capital in the area among the various social groups in Greece's Asteroussia Agro-pastoral SES contributed to land degradations in the area. Lack of bridging social capital was found to hamper the development of collaborative activities that could

facilitate adaptation to conditions in prevailing land use or transform the SES. Kizos et al., (2014) furthermore added that the introduction of subsides in the area to help pastoral farmers added to the erosion of linking social capital as subsidies were sometimes unequally shared among the various groups in the SES. This significantly added to the loss of trust between individuals and between groups and formal institutions.

Vang Rasmussen and Reenberg (2012) investigated two dimensions of change in the adaptive cycle (capital and connectedness) of an African agro-pastoral SES in Burkina Faso. In their study, they measured changes in the adaptive cycle of the land use system through the phases of an adaptive cycle. This was based on the general theoretical assumption of the adaptive cycle that capital and connectedness in each phase is either low or high. For example, in the growth phase the tow variables are characterised as low so they adopt the same reasoning for the other phases in the SES case they present. Their unit of analysis is of the household level throughout the entire village. Of interest is how they characterise capital: they broadly take capital to imply the wealth of a system and extend it to the household level in the community. Members of the community at household level are the ones that choose what they deem as wealth. In this Sahelian agro-pastoral SES, capital was found to include wealth such livestock and migration routes that can bring wealth during the dry periods of the year. In measuring changes in capital, they characterise the levels of capital in each phase to the number of livestock or wealth accumulated or lost in each time phase. For example, in the release phase, capital is generally low, so in the Vang Rasmussen and Reenberg (2012) study the number of livestock during this phase was lowered due to reduction in fodder for the animals and droughts that swept through the agro-pastoral SES. The finding was that the SES had actually gone through four and half phases of the adaptive cycle: collapse, recovery, exploitation and a possible conservation phase. This is possible in the sense that the SES did not enter the late conservation phase before it collapsed and revered again. They contended that some systems may not necessary experience a long conservation phase in which the late conservation phase leads to loss of system resilience and collapses, but that the system may collapse even in the early phase of conservation, as in their case. This finding is in

tandem with the proposition that an adaptive system may not necessary follow sequential changes in system phase, but may collapse or reorganise at any given phase of the system's life cycle (Walker et al., 2004). In their findings, Vang Rasmussen and Reenberg (2012) learnt that recovery of the Sahelian agro-pastoral SES was aided by external support through the introduction of subsidies to the community members. This is similar to what Abel et al., (2006) found in the Zimbabwean and Australian cases, where recovery of the land use systems was also facilitated by external support such as government support and other international linkages as in the case of the Aboriginal community. Although these studies highlight how the concept of social capital has been used, the distinction is largely in how the concept is measured. In this study social capital is seen as being mediated by trust and commitments. In the next section, a conceptual framework for social capital is given.

2.9 Conceptualising social capital as trust and commitments

While in this study I do recognise the various ways in which social capital has been conceptualised and characterised as a social resource that can lead to both positive and negative outcomes (Fisher 2013; Njuki et al., 2008; Lansen et al., 2004; Putnam, 1995), the conceptualisation of social capital as trust, norms and networks of interactions that actors engage into in pursuit of a collective good broadly captures the most components that characterise social capital (Anthony and Campbell, 2011; Pretty, 2003; Putnam, 1995). In this study, I am of the view that most scholars do recognise the place and function of trust and commitment in the established view of social capital that enables the facilitation of collaboration (Fisher, 2013; Nkhata et al., 2008; Iness et al., 2007; Cullen et al., 2000; Cousin et al., 2002; Grey and Wood, 1991). Where social capital is characterised in terms of the three forms that have been identified above, trust and commitment are key determinants of social capital (Lansen et al., 2004; Pretty, 2003). For example, Nkhata et al., (2008) conceptualises relational capital as characterised mainly by the levels of trust and commitment that actors show towards a social relationship. In this study, I adopt Nkhata et al.'s (2008) conceptualisation of relational capital and apply it to social capital. Therefore, trust is defined as the belief that actors adopt that their counterparty in a social relationship will not act against their interest (Nkhata et al., 2008; Luo, 2002).

It entails that an actor assumes that their partners will be capable of delivering on their expectations (Cullen et al., 2000). Cousin (2002), in the framework for collaborative alliances, argues that trust should be accompanied by a degree of commitment for the collaboration to work out. It is also argued especially in business marketing, and particularly relationship marketing, that commitments are an essential component that should be intertwined with trust if alliances are to sustain relationships beyond the mere existence of collaborative agreements (Luo, 2002; Cullen et al., 2000). Commitment is defined here as the investments and resources that actors put into a social relationship, it evinces the degree to which actors in a collaborative relationship are willing to see the relationship succeed (Nkhata et al.., 2008; Luo, 2002). Commitment as an attribute of social capital is important in sustaining and facilitating collaborative relationships in the management of collaborative water security initiatives. Petersen-Perlman et al., (2012) posit that due to lack of commitments in the flood management activities between the USA and Canada, the Canadian government was not willing to engage in collaborative activities on flood management unless the USA government showed commitments towards the collaboration. Kiss (1990), as quoted in Nkhata et al., (2008), argues that during the early stages of community-based natural resource management (CBNRM) programs in most Southern African countries, following the previous unimpressive relationships between colonial governments and the community in the management of natural resources, collaboration was challenging to establish. Community members were initially sceptical to accept the proposed collaborative management of natural resources by governments and non-government organisations (NGOs) until investments into the collaboration were made in form of financial capital to demonstrate the commitments of government and NGOs to engage communities in the CBNRM programs.

Thus, as trust and commitment in a social relationship increase, the change in social capital of a collaborative SES is able to attract actors to take advantage of the available opportunities for collaboration (Nkhata et al., 2008). In this regard, the growth phase in an adaptive cycle is largely an opportunistic phase (Gunderson and Holling, 2002).

2.10 Conclusion

In this chapter I have introduced the main concepts that form the core of this study. In the first section I have presented how water is a linking resource that connects coupled systems such as SESs. The water security concept is introduced to illustrate the growing need for societies to secure water resources by harnessing hydrology so as to manage both the destructive potential and productive potential of water resources through collaborative initiatives among various competing interests. Approaches such as collaboration and the way social capital influences collaborative activities are also highlighted and form the core arguments of this chapter. Furthermore, a review of how the dimension of capital in the adaptive cycle heuristic has been used is illustrated. In the last section of the chapter, the conceptual framework for social capital and its measurements as used in this study was presented.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The purpose of this study was to explore and describe the growth phase of the Kaleya Smallholders Company Limited (KASCOL) as a collaborative irrigation scheme to describe and interpret how social capital over time influenced growth and the collaboration between KASCOL management and smallholder farmers. In this chapter, I present the methodologies used to achieve the objective stated above. In the next section below, I introduce and discuss the research paradigm adopted for this study.

3.2 Research Paradigm

In every research study, it is of particular importance to specify a particular frame of reference through which the particular theoretical issue being pursued will be observed and interpreted. Babbie (2013) calls this frame of reference or model through which observations and reasoning are organised a paradigm. Essentially, paradigms are about ways through which knowledge is sought and used by researchers (Thomas, 2013). In addition, paradigms are a guide that researchers follow when crafting the kind of questions to be asked and the procedures to be followed in answering such questions during the research process (Du Plooy-Cilliers, 2014). However, there are a number of paradigms (for example see Du Plooy-Cilliers et al., 2014). Therefore, specific paradigms are suited for answering specific questions and help provide useful frameworks for thinking about the course of inquiry and its outcomes (Thomas, 2013). In this study, I adopted an interpretivist research paradigm. In the section below, I offer a description of this paradigm through five main positions or beliefs that go along with the paradigm.

3.3. Interpretivist Paradigm

The interpretivist paradigm is a research tradition that seeks to describe ways in which human beings make sense of their subjective reality and attach meaning to it (Pope and Mays, 2006; Thomas, 2013). This understanding is based on the assumption that in social science research people change all the time and their behaviours are also influenced by the environment in which they are found (Du Plooy-

Cilliers, 2014). An interpretivist therefore emphasises providing a rich description of meaningful social actions, in order to gain an in-depth understanding of multiple realities (Du Plooy-Cilliers 2014). In this sense, an interpretivist's paradigm is therefore the main paradigm that underlies qualitative research (Pope and May, 2006; Thomas, 2013). In the sections that follow I consider the five positions or beliefs that shape any given paradigm.

3.3.1 Epistemological position

Epistemology deals with questions that interrogate the nature of knowledge, ways of making sense of that knowledge and the limits of that knowledge. An interpretivist views knowledge in a subjective way and as context dependent, unlike in the positivist paradigm in which knowledge is only interpreted in an objective way – a typical characterisation of quantitative research (Du Plooy-Cilliers, 2014). Thus, in this research, issues of context were given much-needed attention, for example the historical setting in which the social system was established.

3.3.2 Ontological position

Under this position or belief, the basic issue pursued here relates to questions about what is reality, and how one can tell that something is real. In the interpretivist paradigm, reality is viewed as a social construct. It is dependent on the meanings that individuals attach to their own experiences and interactions with others. It is mainly based on people's perceptions of what is actually real. Therefore, reality is bound to change as people's perceptions change (Du Plooy- Cilliers, 2014). Given this, understanding the changing nature of social actions, using the adaptive cycle, was of interest to this study in order to trace and describe changes in the KASCOL scheme over time.

3.3.3 Meta-theoretical position

Babbie (2013) defines a theory as a systematic set of interrelated statements that are aimed at explaining an observation, and thus it answers the 'why?' question. Therefore, metatheoretical position deals with the kind of theoretical lens being used in a given research study and its underlying assumptions and implications. Du Plooy-Cilliers (2014) argues that interpretivists view theoretical

issues in a descriptive way rather than in an explanatory manner. For example, in quantititative studies where a positivist paradigm is dominantly used, statistical data is used as evidence to explain relationships between variables. A qualitative or interpretivist approach will depend on direct quotations from participants in a study to give evidence of a phenomenon being investigated (Du Plooy-Cilliers, 2014). Equally, this study relied on key participants' description, as well as documentary sources written about the scheme as main sources of evidence to inform the dynamics of the scheme through collaboration and the adaptive cycle theories.

3.3.4 Methodological position

Methodological position is about the methodology guiding a given research study. However, is not the same as methods, even though it includes the actual appropriate methods for collecting and analysing data for a given study (Du Plooy-Cilliers, 2014). It essentially entails the methodology to be used such as qualitative, quantitative or mixed methodology. Given that interpretivists aim at gaining an in-depth description of a particular research question rather than quantification, researchers adopting this paradigm make use of qualitative methods (Babbie, 2013). In terms of the actual methods, interpretivists make use of methods that are sensitive to context and which will help them gain an in-depth understanding of the phenomenon under consideration (Thomas, 2013). These methods include participant observation, focus groups and in-depth interview with a focus on participants' feelings, ideas, thoughts, and actions (Thomas, 2013; Du Plooy-Cilliers, 2014). Just as described above, the study employed a qualitative research methodology throughout the entire research process as described in the methods section.

3.3.5 Axiological position

Axiological position refers to the study of values and value judgements. It gives insights into what is valued within a particular paradigm or tradition. Interpretivists discuss values that shape their research, including a researcher's own interpretation (Du Plooy- Cilliers, 2014). In this study issues relating to trustworthiness, transferability and credibility of the study were considered. They are

particularly presented later in this chapter. Given the above descriptions of the research paradigm used in this study, the subsequent sections that are presented in this chapter discuss the actual research methods that were employed in conducting the study, as well as trustworthiness and research ethical considerations.

3.4 Research Methods

3.4.1 Qualitative field research

Field research is a research method used chiefly in qualitative research; however it also has its usefulness in quantitative-type research (Barbie, 2013). This method entails collecting data in the natural setting of the phenomenon being investigated (Strydom and Bezuidenhout, 2014). It is useful in qualitative research or in inquiry in which observations are not easily reduced to numbers and where such observations appear to defy simple quantifications (Strydom and Bezuidenhout, 2014; Babbie, 2013). Babbie (2013) argues that one of the strengths of field research is that it enables researchers to gain a comprehensive perspective of the subject under investigation by doing direct observations of the aspects of the phenomenon being investigated. In that way, it enables a researcher to recognise nuances of attitudes and behaviours exhibited by participants that might otherwise be difficult to recognise using other methods (Strydom and Bezuidenhout, 2014; Babbie, 2013). In a sense, this method is most suited in examining attitudes and behaviours that are best understood in their natural settings. In a more general way, field research is well suited to the study of social processes over time (Babbie, 2013). Given that in the aim of this study was to gain insight into the social dynamics underlying the KASCOL collaborative water user scheme, qualitative field research was adopted. Under qualitative field research a case study approach was used. This approach is described in the following section.

3.4.2 Case study approach

There are a number of different approaches that go along with field research. Among them is the case study approach (Babbie, 2013). A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009). It aims at describing a given phenomenon within the specific circumstances and contexts (Strydom and Bezuidenhout, 2014). Babbie (2013) adds that the essential characteristic of a case study approach is its limitation to the particular context of a subject under investigation. In a similar way, there are different contexts in which social systems exist and operate in the management of natural resources. In this case, the area of interest is an outgrower scheme, in particular the Kaleya Smallholders Company Limited (KASCOL) – a sugar cane farming collaborative scheme in Zambia. One of the reasons for selecting the KASCOL sugar cane scheme is that this scheme is largely dependent on irrigation systems and is one of the oldest and most successful collaborative systems in Zambia (Mujenja and Wonani, 2012; Mungandi et al., 2012; Bangwe and Van Koppen, 2012; Njobvu, 1990). In the next section I present the research design adopted in this study.

3.4.3 Sampling methods

Sampling refers to how the population for the research is selected. Population is used here to mean the group of people or individuals from whom research information is to be obtained and conclusions made (Babbie, 2013). There are two commonly used approaches in the sampling of a research population, namely probabilistic and non-probability sampling methods (Pascoe, 2014: 137). In addition, a non-probabilistic sampling approach is useful when access to the entire population earmarked for research is difficult to access. Non-probability sampling has been adopted because key participants in the study involved include those who initially participated in the early stages of the scheme formation. These include smallholders as well as KASCOL management, for which it is difficult to get hold of all the key participants. Some may no longer be working at the scheme and

have relocated to other parts of the country, in which case it may be difficult to track their whereabouts at the time of the study. Given that in this study only the growth phase of the scheme's adaptive cycle was explored, some participants did not have a lived experience of the growth of the scheme as they were inheritors of the rights to collaborate with KASCOL Management. This was made possible through the Cane Farmers Agreement (CFA) which was renewable.

Purposive sampling was used as a non-probability sampling technique in this study. In purposive sampling, the population to be included in the research is purposively selected based on a list of characteristics that relate to the population and research questions (Pascoe, 2014; Babbie, 2013). Thus, given that participants are to be selected based on their knowledge of the scheme from inception to its current status, a purposeful sampling technique was used. In addition, it is argued that the advantage of purposive sampling approach is that all respondents selected fit within the population parameter of the study (Pascoe, 2014). In the sections that follow, data collection methods used during the study are discussed.

3.5 Data Collection Methods

3.5.1: In-depth interviews

In-depth interviews are a data collection technique which allow questioning respondents in order to learn about their views, opinions, and beliefs about a specific topic (Strydom and Bezuidenhout, 2014; Babbie, 2013). This technique makes use of open-ended guidelines of a topic to be investigated as a basis to discuss it with the participants in the form of a conversation, leading to answers on a specific topic of interest (Babbie, 2013). In-depth interviews afford respondents a chance to clarify their meaning and provide more details if needed (Strydom and Bezuidenhout, 2014). Accordingly, a standardised open-ended in-depth interview was used (Appendix I). Key informants were selected from among KASCOL management and smallholder farmers.

The participants were purposefully selected (Pascoe, 2014) based on their knowledge of the KASCOL scheme, and especially those who were initially present when the scheme was established and who

are still working either as employees or smallholders at KASCOL collaborative irrigation scheme. In total, 18 key informants were interviewed during data collection for this study. Ten (10) were smallholder farmers, three (3) members of Kaleya Smallholders Farmers Association (KASFA) and five (5) KASCOL management staff. It was envisaged that data saturation would be reached from the number of respondents selected and serve as a guide for deciding whether to sample more key informants. This was the case in this study as all the participants narrated the same story of how the scheme evolved or referred to those who had a lived experience of the scheme's growth phase. Each interview lasted for at least 45 minutes, within which aspects of the research were covered such has how the scheme developed and what the key factors that facilitated growth of the collaborative scheme were.

Prior to engaging with respondents, a request to conduct research with KASCOL was sent and permission was given. In addition, KASCOL management helped in identifying key informants who I later scheduled an informal meeting with to establish their availability to participate in the study and subsequently set a date for when the interview could be done. This process in a way helped in establishing a rapport with these key informants. In some instances, participants were willing to do an interview on the very day of meeting them – for example, the two KASCOL management staff. All interviews were conducted either in English or Nyanja. Nyanja is a local language commonly spoken in Mazabuka. The entire interview process was recorded on an audio recorder with the consent of all participants. The other sources of data were from the documents that have been written about KASCOL in relation to the topic under investigation. Presented below is a description of the procedure employed using the documentary data source.

3.5.2 Documentary analysis

The other form of data collection in qualitative research deals with documentation: documents that have been written on a particular subject of research interest. Documentary data collection is a systematic technique, and it involves collecting, reviewing and evaluating documents – soft and hard

copy – in order to construct meaning (Bowen, 2009). Documentary sources may include meeting minutes, letters, official documents and newspaper articles (Blanche et al., 2006). Documentary sources are useful for: providing the context in which research participants operate through historical insight; providing a means of refining interview questions based on new insight into the phenomenon; and providing a way of tracking change and development (Bowen, 2009; Blanche et al.,2006). Documentary materials such the Cane Farmers' Agreement and past research studies on KASCOL were collected.

3.6 Data Analysis

In qualitative research, data analysis involves reducing the volume of raw information, sifting significance from trivia, identifying significant patterns and constructing a framework for communicating the essence of what the data reveals (De Vos et al., 2011; Bezuidenhout and Cronje, 2014). In addition, analysis of qualitative data is a nonnumeric examination and interpretation of observations to determine underlying patterns and meaning out of the mass of data collected (Babbie, 2013). Despite different methods used for analysing qualitative data, the common denominators of qualitative data analysis methods are reduction, organization, interpretation and substantiation of data (Bezuidenhout and Cronje, 2014). The data analysis method used in this study was qualitative content analysis: a nonnumeric method. The details about this method are presented below.

3.6.1 Qualitative content analysis

Qualitative content analysis is used to explore and identify obvious and concealed themes and patterns embedded in a particular text (Bezuidenhout and Cronje, 2014). The essence of qualitative content analysis is to ''group data together into chunks and then assign them to broader categories of related meaning'' (Babbie, 2013 pg. 390). The first step in analysing data was to prepare audio recorded data into text by transcribing and translating it into English for the interviews which were conducted in Nyanja (Bezuidenhout and Cronje, 2014). After this process was done, codes were created. Coding is the process involving categorising data sets into retrievable sets based on the themes that are to be

looked for in to the data (Babbie, 2013, pg. 36). In this case, data was organised based on three main coding units: the growth phases of an adaptive cycle, social capital and collaboration.

3.6.2 Coding process

The next stage that followed after transcription was coding the data after the main themes identified from the conceptual framework of this study (Bezuidenhout and Cronje, 2014). It is basically the process of classifying or organising data into the conceptual frame being used to explain a phenomenon (Babbie, 2013.pg, 369). The 'conceptual framework' of this study is based on the concept of the adaptive cycle – a heuristic model for characterising and interpreting change in adaptive systems as social-ecological systems (SESs). A description below (Table 3) shows the conceptual codes and their definitions used in this study.

Table 3: The main coding units used in the analysis of data.

Coding Unit	Code Description
Adaptive Cycle Growth Phase	The state of a collaborative SES described as an opportunistic phase in that actors compete for available social capital for collaboration.
Social Capital	The social resource embedded in social relationships which influences the trajectory of collaboration. It is defined by Trust (belief that a partner will not work against them) and Commitments (energies and resources invested to see the success of a collaborative relationship).
Collaboration	Actors working together to achieve a collective goal, which in unilateral settings is difficult to achieve. (Measured in terms of joint activities between Smallholder farmers and KASCOL Management towards water management goals).

In this study, following on Babbie (2013) and Bezuidenhout and Cronje (2014), three main coding schemes were employed, namely: open coding, axial coding and selective coding. Open coding was the initial method that was used to categorise in-depth interviews into general themes relating to social capital, collaboration and the growth phase of the adaptive cycle. The second process involved axial coding. During this process of regrouping data into central concepts and measurements of the social capital and collaboration. In the last process of selective coding the concepts were centrally organised into the growth phase of the adaptive cycle conceptual framework. Selective coding is done in order to identify the central concepts that organise the other concepts together (Bezuidenhout and Cronje, 2014; Babbie, 2013) – in these cases the adaptive cycle's growth phase. After this process, conclusions about the dynamics of social capital and collaboration in the KASCOL collaborative scheme were drawn and represented as characterising the growth phase of KASCOL's adaptive cycle.

3.6.3 Study Limitations

Limitations are constraints of the study that are out of control to a researcher (Enslin, 2014). There are two aspects of this study that may be considered a limitation. Firstly, the historical nature of the data required to interpret change in the KASCOL Collaborative Scheme. Participants relied on memory to describe how collaboration in the scheme has been changing over time. As a result, some aspects of the social experience may have been missed out. However, comparing these narratives across all interview participants as well as documentary sources in a way helped minimise this limitation. The other limitation is the number of participants that were involved in the study. A total number of 18 participants were interviewed. However, given that qualitative research is about in-depth description rather than statistic frequencies, there is usually a point during data collection when data saturation is reached. This is the point when no new information emerges from the people that are being interviewed (Strydom and Bezuidenhout, 2014). This insight was also helpful in addressing some of the difficulties which might arise when interpreting the findings.

3.7 Trustworthiness

The research process and findings should be valid and reliable (Babbie, 2013). The principal term used for validity and reliability in qualitative research is 'trustworthiness'. In qualitative research trustworthiness aims to ensure the quality of the research, as is the case in quantitative research, which aims for validity and reliability (Wahyuni, 2012; Krefting, 1990). However, it is achieved or determined differently in qualitative research when compared to quantitative (see Koonin, 2014). Trustworthiness is assessed in terms of: credibility, transferability, dependability and confirmability (Wahyuni, 2012; Krefting, 1990).

3.7.1 Credibility

Credibility is about the accuracy in interpretation of data that has been collected (Wahyuni, 2012). Following Koonin (2014), credibility of the research was considered in the following ways: a considerable amount of time was spent in the field with participants discussing the changes in the KASCOL Collaborative Scheme through in-depth interviews, each lasting about 45 minutes. In some instances, participants were asked to elaborate further on points that seemed not to be clearly described. In addition, triangulation in methods for data collection added to the credibility of this research in that the study employed two approaches of collecting data, namely in-depth and documentary source analysis. These two methods ensured that themes emerging from the interviews are cross-checked with documentation about KASCOL that addresses changes in the scheme over time. Also credibility of the study was ensured by allowing themes emerging from data analysis to be guided by the conceptual framework of the study.

3.7.2 Transferability

Transferability is another aspect of assessing the trustworthiness of a research project. It is about the ability of the findings to be applied to a similar situation and produce similar results. It entails the degree to which the finding can useful beyond a specific research project (Koonin, 2014; Wahyuni, 2012). Krefting (1990) posits that transferability is accounted for through a rich and detailed

description of the case being studied so as to provide enough details for comparative purposes. Thus, a detailed description of the KASCOL Collaborative Scheme is provided in the chapter that follows. In here the only the context of participants is given to address transferability. I selected participants that were present when KASCOL was just established. In particular, most of those interviewed from KASCOL management begun working for KASCOL from the inception of the scheme. From the smallholder farmers group of participants there was a mixture of those who joined the scheme from inception, as well as those who joined in the later years but who have the knowledge and the experience of the changes that have taken place overtime.

3.7.3 Dependability

Dependability refers to the quality of integration that takes place between data collection methods, analysis and interpretation (Koonin, 2014; Wahyuni, 2012). Dependability was achieved by a consistent description of the data collection and analysis methods given in the earlier sections of this chapter. When interpreting the findings, the claims of the conceptual framework (adaptive cycle) and the characterisation of each attribute were interpreted in accordance to the themes arising from the participant's narrative about KASCOL. In addition, the research process was peer-reviewed particularly by the researcher's supervisors from Monash South Africa Water Research Node in order to check for consistency with theories underpinning social change and the adaptive cycle and interpretation.

3.7.4 Confirmability

Confirmability refers to how well the data collected supports the findings and interpretations of the researcher (Koonin, 2014; Wahyuni, 2012). It entails how well the research process is described in order for others to be able to scrutinise the research design (Koonin, 2014; Krefting, 1990). Using triangulation as a way to improve confirmability, interviews were cross-checked with documentary sources. The approach in collecting and analysing data was conducted by following the research methods described above.

3.8 Ethical Considerations

Ethics in research are a matter of integrity. They set standards of behaviour in a research process that affect all potential stakeholders (Louw, 2014). Below are ethical considerations that were applied in this study.

Monash University has ethical considerations provided by the Monash University Human Research Ethics Committee (MUHREC). Data collection only commenced after an ethical clearance had been obtained from MUHREC (see Appendix II). This is to ensure that all standards and procedures deemed ethical by the University Research Ethics Committee are followed and well understood.

Organisational consent from KASCOL was obtained verbally from KASCOL management through the human resources department upon submitting an explanatory form (Appendix IV), which gave brief insights on the kind of research to be conducted at the organisation. Additionally, a confidentiality clause was added to the consent form (Appendix III) to assure participants of a proper data management and to gain their trust. Participants were asked to sign the consent form before starting an interview as a way of providing their consent to participate in the study.

3.9 Conclusion

In this chapter, I have described the research tradition that was used in the study through five main paradigm positions in the interpretivist research tradition. The chapter also has described how qualitative field research was used and the appropriate data collection and analysis tools that were used. The chapter has also addressed limitations of the study, and its trustworthiness through credibility, dependability and confirmability measures used in the study. The chapter has also described ethical procedures that were undertaken during the study.

CHAPTER FOUR: STUDY AREA

4.1 Introduction

The purpose of this chapter is to contextualise KASCOL irrigation collaborative scheme as a SES on the Kafue Flats of the Kafue River Basin in Zambia. The chapter is grouped into seven main sections. The first section deals with the description of the Kafue Basin and the Kafue Flats. In the second section, the focus is on topography of the basin. A description of hydrology and drainage of the basin is presented in the third section, while the fourth and fifth sections focus on the vegetation type characterising the Kafue River Basin as well as the climatic influence on the basin. Following this section is the social economic outlook of the basin and the Kafue Flats. A description of the governance system of the KASCOL collaborative SES ends the presentation of this chapter.

4.2 The Kafue River Basin and the Kafue Flats

The Kafue River Basin is the most utilised river basin in Zambia. The basin hosts most of the socio-economic activities in Zambia (Haller, 2008). The Kafue River Basin covers five provinces in Zambia. The basin starts from North-Western Province in Zambia and stretches' through Copperbelt, Central, Southern and Lusaka Provinces (Leonard, 2005). Figure 4 below shows the geographical distribution of the Kafue River Basin. The basin is also considered as a sub-basin of the Zambezi River Basin when described at a regional scale (Petersen-Perlman et al., 2012). The main socio-economic activities in the basin include mining activities on the Copperbelt, fisheries activities on the Lukanga swamps in Central Province and irrigation and hydro-power production in lower part of the basin in Southern Province (Chomba and Nkhata, 2016).

Figure 4.1: Distribution of the Kafue River Basin. Adopted from Chomba and Nkhata, 2016.

The Kafue River Basin is divided into three sub-catchments, namely the upper Kafue, which covers the North-Western and Copperbelt areas, the middle Kafue catchment, covering the entire Lukanga swamps in Central Province, and the lower Kafue catchment, which covers a large position of Southern Province (COWI, 2009; Leonard, 2005). The Kafue Flats are located in the lower catchment of the Kafue River Basin. The Kafue Flats are one of the largest floodplains in Southern Africa, and the wetland ecosystem is formed by the Kafue River as it flows from the upper catchment downwards to the lower catchment, making the Kafue River the main river channel of the Kafue River basin (Chomba and Nkhata, 2016; Haller, 2008). The Kafue Flats is also a Ramsar-designated site for conservation of wetland-dependent animal species. Some of the notable species are the endemic Kafue lechwe (*Kobus leche Kafuensis*), and large population of water birds such as cranes, ducks and migratory bird species (Leonard, 2005). Landscape use on the Kafue Flats includes hydro-power production, fisheries activities, cattle grazing and tourism activities in the Lochinvar and Blue Lagoon National Parks and surrounding game management areas (GMAs) (Haller, 2008; Leonard, 2005).

4.3 Topography of the Kafue Basin

The Kafue River is one of the Zambezi River's major tributaries. It has a total length of 1300 km from the source up on the Copperbelt down to the confluence with the Zambezi River, covering an area of 156995 Km2 (Ulendahl et al., 2010). This entire land scape is located within Zambia. When the area the basin covers is compared to the country area, the basin covers about 20% of country's total land area (APFM, 2007; COWI, 2009; Ulendahl et al., 2010). The basin is characterised by low topographic relief, which influences the regional hydrology within the catchment (APFM, 2007). The basin is described in terms of its sub-catchments, which are divided into three sub catchments, namely the upper, middle and lower catchments (Chomba and Nkhata, 2016). Topographically, the upper catchment has a slope ratio of 1: 1,000, mainly consisting of a plateau landscape. The middle catchment is characterised by a slope ratio of 1:20,000, which is partly a plateau and plains (APFM, 2007). In addition, the lower catchment is characterised by a slope ratio of 1: 20,000 (flats) and 1:100 (gorge), and the large part of the lower catchment after the river flows down through the Kafue National park is a floodplain known as the Kafue Flats (APFM, 2007; Leonard, 2005).

4.4 Hydrology and Drainage of the Kafue River Basin

The hydrology and drainage system of the Kafue Catchment varies as the river goes south of the basin. The density of tributaries is high in the northern parts of the basin, and becomes lower in the southern part of the basin (APFM, 2007). Extensive dambos, the Lukanga Swamps and the Kafue Flats are the main features of the Kafue Basin and are known to be prone to seasonal flooding. At peak flows the Kafue River's riverine flooding pattern is quite extensive in some areas such as in the Lukanga swamps and the Kafue Flats (WWF, 2005; Leonard, 2005). In the lower catchment of the basin, there are two national parks: Blue Lagoon and Lonchinvar National Parks, and at the north-eastern end of Lochinvar National Park runs a geological fault and a hot spring is created in the park (Leonard, 2005).

The hydrological response to rainfall in the Kafue River Basin accounts for the distribution of the available surface and groundwater resources in the basin (Chomba and Nkhata, 2016). The Kafue Basin's water resource availability is influenced by the geological and geomorphological evolution of the basin. The geological configuration of the basin has results in high open water evapotranspiration and seepage losses from areas of impeded drainage and good permeability associated with saprolite and karstic types of aquifers (APFM, 2007). The geomorphological configuration is known to subsequently lead to low base flow contribution to the Kafue River flows (APFM, 2007; COWI, 2009).

4.5 Vegetation type on the Kafue Basin

The Kafue Basin consists of different vegetation types, especially along the Kafue River. The Basin consists mainly of savanna grasslands and predominant miombo woodlands. Industrial plantations of eucalyptus and pines in the upper catchment of the basin have replaced some indigenous woodlands along the Kafue River (APFM, 2007). The middle catchment, which comprises the Lukanga swamps, is characterized by miombo and mixed woodlands, thickets and swamps (Leonard, 2005). In the lower catchment, the Kafue River is bordered by levees, lagoons and smaller channels which support a number of aquatic plant species such as water lilies and reeds, and other plant species which are spread throughout the flood-plain grasslands include miombo woodland vegetation and a mixture of termitaria acacia species and munga woodlands in some areas. Other vegetation species include the invasive water hyacinth and *mimosa pigra* (Leonard, 2005; APFM, 2007).

4.6 Climatic description of the Kafue Basin

The Kafue river basin is influenced climatically by the Inter-Tropical Convergence Zone (ITCZ) and the El Niño/La Niña Southern Oscillation (GRZ, 2010, Chundama and Maseka, 2015). During summer months, the ITCZ influences the north of the country and gradually moves south in the rainy season, bringing with it large amounts of rain covering the basin (Chomba and Nkhata, 2016). Rainfall over the Kafue Basin is derived mainly from a low-pressure system caused by the

convergence of the trade winds of the ITCZ. The annual rainfall varies from 1,300mm in the north to 800mm in the south of the basin (Leonard, 2005). Natural variations in rainfall are more significant in the southern areas where the frequency and duration of dry spells is greater. This is caused by the inter-annual changes in the southern extent of the ITCZ. The mean annual rainfall over the catchment is 1,060 mm and is subject to distinctive temporal and spatial variations (COWI, 2009; Leonard, 2005).

4.7 Socio-economic Characteristics of the Kafue Basin

The waters of the Kafue River Basin support most of the economic activities in Zambia. They support a host of mining activities in the Copperbelt Province, as well as industrial and agricultural activities in the Southern Province (Ulendahl et al., 2010; Schelle and Pittock, 2005). In the middle catchment of the Kafue Basin, the main activity is fishing, which supplies markets on the Copperbelt, Central and Lusaka Provinces. The Zambia Central Statistics report indicates that the Kafue Flats alone is home to about 1.2 million people, representing 9% of Zambia's total population (Zambia Central Statistics Office, 2013). The lower catchment of the Kafue River Basin, which consists mainly of the Kafue Flats provides a number of water-related services to the local economies as the Kafue River flows into this section of the Kafue Basin (Leonard, 2005). Some water-related services and activities include domestic water supply to Mazabuka municipality; livestock, particularly cattle herding in Namwala; fishing activities among the fishing communities; commercial irrigated sugar cane agricultural farming by Zambia Sugar and outgrower schemes; hunting; and tourism (Chomba and Nkhata, 2016; Haller, 2008; Njobvu, 1990).

The Kafue Flats irrigation agricultural activities are concentrated in Mazabuka district of Southern Province, with sugar cane being the main crop being grown in the area. Zambia Sugar Company is the oldest sugar cane company in the area. Figure 4.2 below shows the map of the lower Kafue Basin, particularly the Kafue Flats, and the location of some of the main activities on the flats. Mazabuka district is famous in Zambia for the commercial farming of irrigated agriculture. Sugar cane farming

is a main socio-economic activity of the district (Mujenja and Wonani, 20012). Zambia Sugar processes all the sugar cane that it grows at its Nakambala milling plant and all that its outgrower schemes produce, including private commercial sugar cane farmers such as Nanga farmers, KASCOL and other cane growers (Mungandi et al., 2012; Bangwe and Van Koppen, 2012).

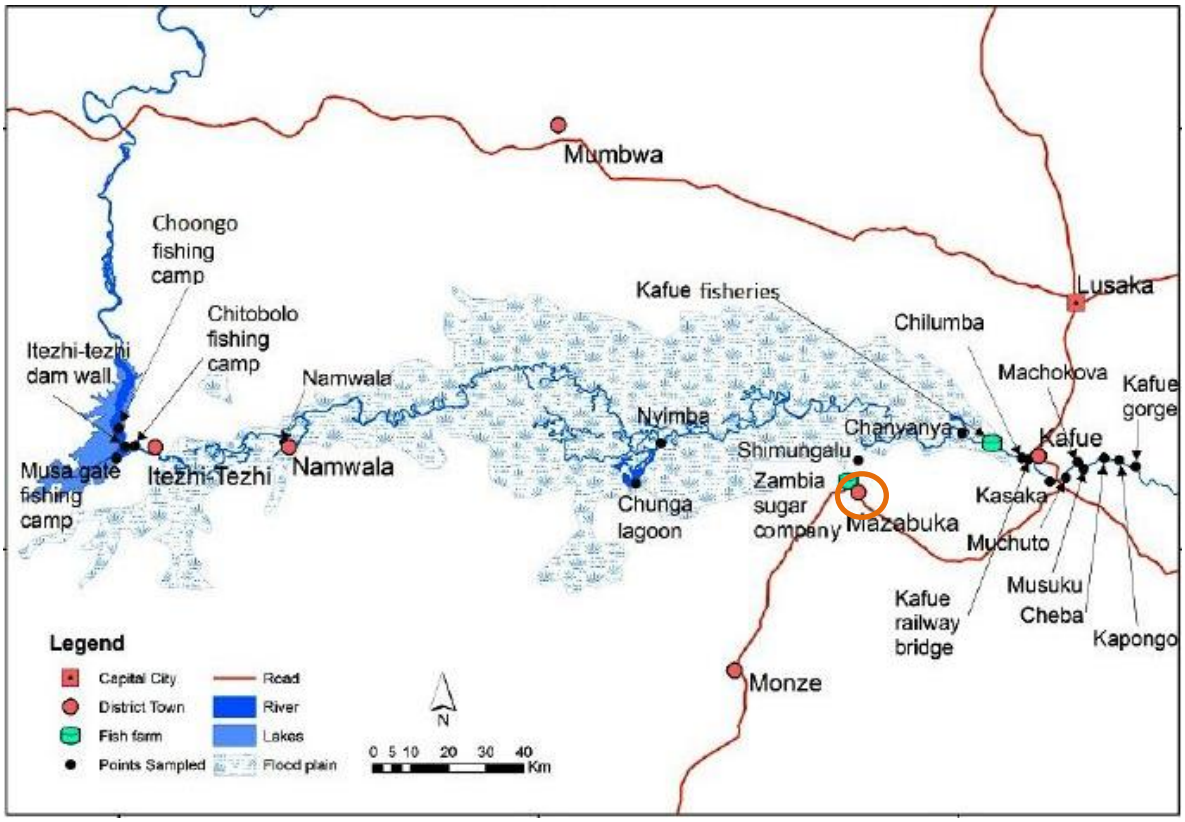


Figure 4.2: Location of the Kafue Flats, Zambia Sugar Company, Mazabuka District, fishing communities (Adapted from Bbole et al., 2014)

Although there are a number of sugar cane farming groups, such as KASCOL, the Zambia Sugar Company's Nakambala Estate, Manyonyo Smallholder Scheme, Nanga Farms and Chilala Farms, just to mention a few (Bangwe and Van Koppen, 2012), the focus of this study is on the KASCOL sugar cane farming scheme. In the following section, a description of the sugar cane scheme in terms of its governance system is presented.

4.8 Governance structure in the KASCOL SES

A social-ecological system (SES) is broadly understood to be a complex system comprising social and ecological subsystems and their interactions at various scales (Gunderson et al., 2017, Chaffin and Gunderson, 2016, Vang Rasmussen and Reenberg, 2012, Abel et al., 2006). The ecological

subsystem has varies across various natural resources such as water, forest, wildlife, and agro-pastoral systems interacting with the social subsystem (Baral et al., 2010, NKhata et al., 2009, Abel et al., 2006). Therefore, KASCOL as a collaborative SES is defined as a complex system of the water and people (Gunderson et al., 2017). It is a SES nested within the larger Kafue River Basin SES and its sub-systems in the lower Kafue Catchment of the Kafue flats.

Governance entail's the systems and processes through which management decisions are implemented. It gives guidance on how management operations will be implemented (Chaffin and Gunderson, 2016, Nkhata et al., 2009). It is measured in terms of the structures or institutions (rules and norms) that describe how management activities will be implemented. In the KASCOL SES, the governance structures that oversee the implementation of the rules outlined in the CFA involve KASCOL Management and individual smallholder farmers who are represented by the Kaleya Smallholder Farmers Association (KASFA). Individually, the smallholder farmer can also represent him/herself to management as the CFA is signed individually. For example in the following quotations smallholder KL5 who is also a former KASCOL Management employee and the Agronomist KL4 the officer in charge of smallholders narrated how governance systems works through their structures and institutions respectively.

''*KASFA was brought in both by the management and the famers, in fact the management wanted famers to take responsibility on some of these issues that is why they were made to form this KASFA, so that some of the decisions they can be making on their own. And so some of the decisions were found to be ok. So KASFA had to select some committee members who were representatives, those representatives had to sit together with management when there is some problems. Then that executive had to meet with management they discuss over that and whatever solutions they arrive at then it is brought back to the farmers that ok the solution is this and that. Even any complaint or suggestion that comes from the farmer it is through KASFA to the management''. KL 5*

''This KASFA has been in existence for some time now, I think from 1984 KASFA was there, so I think there was some involvement. Smallholders talk through KASFA and KASFA to Management, so that is how the thing is, but you know KASFA has little to do with the cane farmer's agreement

because the cane farmers agreement is a document signed between a smallholder and KASCOL''. KL 4.

In a way, governance in the KASCOL SES can be summarised as comprising structures such as KASFA and KASCOL Management which help implement institutions that are outlined in the CFA.

4.9 Conclusion

In this chapter, I have presented a description of the Kafue Basin, in terms of its topographics, climate and vegetation, as well as how the basin is demarcated in to three sub-catchments, namely the upper, middle and lower Kafue Basin. In addition a general description on of the KASCOL SES and its governance system has also been presented. The chapter that will follow, will be based on the findings of how the KASCOL collaborative scheme evolved, with particular attention on the growth phase of the collaborative scheme.

CHAPTER FIVE: RESULTS

5.1 Introduction

The purpose of this chapter is to present results of this study, the study's objective was to explore growth phase of a collaborative irrigation scheme called the Kaleya Smallholders Company Limited (KASCOL). The study used the adaptive cycle as a heuristic model for exploring and interpreting change in the KASCOL collaborative irrigation scheme. It employs the concept of social capital as a core dimension of change to explore how KASCOL collaborative irrigation scheme evolved. According to the adaptive cycle theory, capital is defined as the potential available that determines the range of options and sets the limits on what is possible in a system (Gunderson and Holling, 2002).

In the KASCOL collaborative irrigation scheme, change was described in terms of social capital as a main dimension of SES change in the growth phase. On the other hand, social capital was defined as a resource that is embedded in social relationships that influence collaboration and is measured in terms of trust and commitment as key attributes (Anthony and Campbell, 2011; York and Schoon, 2011; Nkhata et al., 2008). Collaboration was defined as actors working together in pursuit of a desired collective goal, in which such pursuit is difficult to achieve in unilateral settings. (Anthony and Campbell, 2011; Nkhata et al., 2008).

The chapter begins by exploring the historical context of KASCOL to provide a premise for interpreting the nature and substance of change that the collaborative scheme had to undergo. Thereafter, a description of the dynamics of social capital and its influence on the collaborative irrigation scheme is presented. In the sections that follow, an exploration of the beginnings of the KASCOL as a sugar cane farming scheme is presented.

5.2 Historical Context of KASCOL

5.2.1 The beginnings

The Kaleya Smallholders Company Limited (KASCOL) is an outgrower sugar cane farming scheme that depends on irrigated water from the Kafue Flats floodplain to function. The collaborative scheme consists of a private company called KASCOL and 160 smallholder farmers growing sugar cane. The kind of irrigation system used by the scheme is mainly furrow irrigation, with a few estate fields being run on a mechanised centre pivot irrigation system (Mujenja and Wonani, 2012). KASCOL and the smallholder farmers are the main partners that collectively make up the KASCOL Collaborative Irrigation Scheme (Njobvu, 1990). The company has employed a skilled management team that has been given the responsibility to run the affairs of the collaborative scheme as a whole. KASCOL's management team is responsible for cultivating sugar cane on the company fields – called the estate fields – and is also responsible for overseeing sugar cane farming as well as all the other irrigation activities on the smallholder farmers' cane fields. Each of the smallholder farmers also grows their own sugar cane on their allocated sugar cane fields. The quotation below from the irrigation system manager explains how the KASCOL collaborative scheme is organised and run in terms of irrigation water supply.

"There are two areas forming the company, the estate portion and the smallholder portion – these two when put together form what is called Kaleya Smallholders Company Limited (KASCOL). Now smallholders are managed by the company itself; us, we are employed by Kaleya Smallholders to manage both the estate and the smallholders. So when it comes to water supply we try our best to supply water both to the smallholder and the estate fields on equal basis" (KL3).

The idea of establishing a collaborative irrigation scheme was in response to changes in policy by the Zambian government (Northern Rhodesia before independence) to diversify the country's economy from solely depending on copper mining to start investing in irrigated agriculture (Njobvu, 1990). The Kafue Flats were selected as a suitable area for irrigated agriculture, and a number of large

commercial sugar cane farms were established there, such as the Nakambala Estate run by Zambia Sugar Company. Other farms were run by private European commercial farmers.

By the year 1968, the production of processed sugar had begun at Zambia Sugar Company's Nakambala processing plant (Njobvu, 1990). After Zambia's independence in 1964, the demand for sugar both locally and internationally increased, triggering a need for Zambia Sugar Company to seek ways of meeting the increasing demand. While commercial farmers at that time responded by way of increasing cane production, reliance on a small group of European farmers was not politically expedient, as the Zambian government also wanted to address rural unemployment as well as the raising poverty levels in rural communities (Mungandi et al., 2012). It was agreed that Zambia Sugar Company should expand the total cultivated area by establishing an outgrower scheme so that they could meet the demand for sugar and involve Zambians in farming sugar cane (Njobvu, 1990). By the year 1980, the plans had advanced, with the scheme being established and run by a private company, KASCOL, which was essentially separate from Zambia Sugar Company (Mujenja and Wonani, 2012; Mujenja and Wonani, 2012).

The idea of involving Zambians in sugar cane farming resonated well with the Zambian government. As a result, the government got involved in the acquisition of land on which to establish an outgrower scheme. A large tract of land was identified as convenient for establishing the scheme, based on its close proximity to the main sugar cane processing plant at Nakambala and as well as access to irrigation water supply from the Kafue River (Mungandi et al., 2012). The Zambian government facilitated the acquisition of land by negotiating with the farmowners who occupied the land for them to sell off their farmland and facilitate the establishment of the scheme. This narrative is captured in Box 5.1 on the next page, containing quotations from the Kaleya Smallholder Farmers' Association (KASFA) chairperson and the KASCOL agronomist (KL4) who is also in charge of the smallholders' affairs.

Box 5.1: Selected quotations on the objectives of forming KASCOL Collaborative Scheme

"Back in the 1980s Kaleya Smallholders Company Limited (KASCOL) was actually formed to incorporate locals in sugar cane growing back in those days. Because the principal idea was, we should have the locals participate in the sugar cane industry – it should not only be multi-nationals that is why the smallholder scheme was to be thought of and that is how Kaleya smallholders come into existence" - KASFA chairperson.

"In 1980 Kaleya Smallholders Company Limited (KASCOL) was formed with two main objectives; to provide sugar cane to the newly expanded Zambia Sugar factory at Nakambala Sugar Mill. Zambia Sugar came up with a proposal to come up with an outgrower scheme to supplement the cane needed for their newly expanded sugar mill about (200,000 tonnes of cane) which they needed on top of their cane they produce. They then identified an area to establish the outgrower scheme. Just on this land where the scheme is today there were about 3-4 farmers who occupied this land and were growing other crops like maize, beans and keeping animals, but they did not grow sugar cane. They owned this land; they were commercial farmers. Among these was a game ranch called Zambezi Ranching. The other objective was to involve Zambian small-scale farmers into cane growing, as cane growing was mainly for commercial farmers. Government was enticed by the idea of involving small-scale farmers into sugar cane farming, then government facilitated in convincing the farmers who owned land to sell off their land so that KASCOL can be established." KL4

By the year 1980, the scheme was well established. It operated for two years as a private scheme, and later in the year 1982 a collaborative scheme was advertised through a public invitation so that community members in Mazabuka district could apply to join (Mungandi et al., 2012). The intention was for KASCOL to start integrating small-scale farmers in the collaborative scheme as smallholder farmers (Njobvu, 1990).

5.2.2 Composition and selection of initial shareholders of KASCOL

KASCOL consisted of a team of stakeholders who put their resources together to start the sugar cane irrigation project. After the government of Zambia had facilitated acquisition of the land on which the collaborative scheme was to be established, there were four shareholders who started operating

KASCOL in the year 1980. These shareholders included the Commonwealth Development Corporation (CDC), which spearheaded the management of the scheme based on their experiences with similar projects in other African countries. The Development Bank of Zambia (DBZ) represented the Zambian government and Barclays Bank International (BBI). These two were mainly responsible for financing the project (Njobvu, 1990). The fourth shareholder was Zambia Sugar Company (ZSC). Each of these four initial shareholders held 25% shares in the KASCOL irrigation scheme (Mungandi et al., 2012; Mujenja and Wonani, 2012). These shareholders wanted to continue supplying sugar cane to Nakambala Estate and to integrate local people into KASCOL so as to establish a collaborative scheme. When the scheme was established it was run for the first two years as private scheme, and when more cane fields had been developed, KASCOL management started planning on how to integrate the smallholder farmers. As the agronomist narrated:

"...then they formed shareholders to initiate the growing of sugar cane on the newly established outgrower scheme. There were four shareholders: Zambia Sugar Company (ZSC) 25%, Barclays Bank 25% and Development Bank of Zambia (DBZ) 25% these formed the initial shareholders and started growing sugar cane from 1981-1983 for the two main objectives: to supply sugar cane to Zambia Sugar, and lastly to integrate smallholders to participate in cane-growing business. So when they had enough fields to settle smallholders they started selecting the smallholders." KL4

The preparation for smallholder farmer integration into KASCOL was arranged in such a way that it comprised the traditional leadership in the area as well as other key stakeholders such as the district commissioner. The representation from these shareholders formed the selection committee to help in selecting the potential smallholder farmers. The type of individuals they targeted were described as those who had the ability to farm and had a family but could not manage all the farming inputs needed for successful agricultural activities. Most of these could be described as subsistence farmers at the time. They also needed those who were retirees so that involving them in sugar cane farming would be a form of empowerment through which rural poverty could be reduced (Mujenja and Wonani, 20012; Njobvu, 1990). Generally, they needed those who were regarded as vulnerable and poor. This

narrative was captured in interviews with the agronomist and the irrigation system manager as indicated in Box 5.2 below.

Box 5.2: Selected quotations highlighting smallholder selection process.

"They involved four chiefs in Mazabuka to be part of the selecting committee. These chiefs were Chief Hanjalika, Chief Mwanachingwala, Chief Naluwama and Chief Mweenda, [and] the ministry of agriculture, the cooperatives as well as KASCOL management were all part of the selecting committee. The selecting criteria was that one needed to be a Zambian with a reasonable family size (5-9) because the land size could not accommodate a huge family. Interested Zambians where told to apply to be considered into the outgrower scheme." KL4

"Ok this project was initiated by Commonwealth Development Bank cooperation so the idea was to help those who could not [be] able to sustain themselves. Those who had no land to do the tilling, those who had no farm implements to use at the farm. in fact, I should just say they were loiterers. Those who were vulnerable. So when the project was introduced the idea was then to help those who were unable to help themselves, the retirees, who had nothing to do" KL3

The selection criteria were used to guide the selection of potential smallholders to join KASCOL so that the collaborative scheme could be established. Generally, preference was given to low-income, middle-aged, married men who had some farming experience but who did not have ownership of land and faced difficulties in securing farming implements (Njobvu, 1990).

5.3. Growth Phase of KASCOL (1982-1987)

Based on the adaptive cycle model, the growth phase of a collaborative scheme can be described as the opportunistic phase that involves the exploitation of available system resources or social capital (Nkhata et al., 2008; Gunderson and Holling, 2002). Social capital during this phase is expected to grow, and actors are described as engaging in a contest in which opportunities are actively explored and engaged, and in doing so the system is driven into growth (Nkhata et al., 2008; Gunderson and Holling, 2002). I consider in the next section changes in social capital, particularly focusing on trust

and commitment as attributes of social capital. I further explore how social capital influenced collaboration in the growth phase of the KASCOL collaborative irrigation scheme.

5.3.1: Early stages of the growth phase of the KASCOL collaborative scheme

In this study, it was found that the early stages of the KASCOL growth phase were characterised by low levels of social capital. There was lack of trust among the community members towards the proposed collaboration between members of the community and KASCOL management. In this context, trust is defined as a socio-psychological attribute in which an actor in a relationship adopts a belief that their counterpart will not act against their interest (Luo, 2002). Trust develops from an actor's past, current interactions and expectations (Cullen et al, 2000; Luo, 2002).

As indicated previously, KASCOL was established in 1980 as a private scheme for the management of irrigation water and growing of sugar cane. Two years later, KASCOL started preparing to integrate smallholder farmers into the irrigation scheme by way of a public invitation for interested Zambians to apply and join a collaborative scheme. When this public invitation was first made, no one from the community applied to be considered for the collaborative scheme. The community members were generally sceptical about how the collaboration in the scheme would evolve. The KASCOL irrigation system manager, a key informant in this study who was working for KASCOL at the time the public invitation was made, narrated the following:

"Interested Zambians were told to apply to be considered into the outgrower scheme. They wanted those who could not help themselves: the poor, the loiterers and retirees – these were mainly small-scale farmers. So in the year 1982, the first announcement was made to start recruiting smallholders, but then NO one applied for this as people were not sure about this outgrower scheme." KL3

The low levels of trust influenced the growth phase of the collaborative scheme. Mungandi et al., (2012) report that it was difficult for people to believe that KASCOL management genuinely intended to work in collaboration with farmers in growing sugar cane and the management of the irrigation scheme. The low levels of social capital (particularly trust) led to the failure to establish the collaborative scheme during the first public invitation. This failure was partially attributed to the

historical context of agricultural crops in Mazabuka district. In the early 1980s, community members in Mazabuka did not grow sugar cane. The traditional crop grown in the area was maize, while sugar cane was mainly a crop grown on a commercial scale by European farmers (Njobvu, 1990). This historical context in a way contributed to the sceptical attitudes that were exhibited in the early growth phase of the collaborative scheme. The quotation below from the KASCOL agronomist illustrates this claim.

"Community members were unsure about the idea of irrigation, because you know in those days sugar cane growing was mainly for commercial farmers. It was not common for small-scale farmers to grow sugar cane; sugar cane farming was just for commercial farmers, just commercial, big commercial farmers." KL4

Additionally, the low levels of social capital were also caused by the local people doubting KASCOL's commitment and intentions towards the collaborative scheme. KASCOL promised to offer residence areas and the cane fields to smallholder farmers almost for free. The smallholder farmers were only required to pay a cob of maize every year as rent. The quotation below from the Cane Farmers Agreement (CFA) illustrates this point.

"*KASCOL hereby agrees to sublet to the smallholder the cane field and the dwelling area for the growing of cane and residence respectively at the rent of one maize cob per annum (if demanded) and subject to the terms and conditions set out in the Agreement."* (CFA, 1982: Section 2).

This offer was largely doubted by community members, as such gestures were not common among them. This made them doubt that KASCOL would offer free resettlement land and cane fields to smallholders farmers upon joining the collaborative scheme. The low levels of social capital led KASCOL management to shift its attention from the community members and try their own employees as pioneers in collaborating with KASCOL management in managing irrigation water as well as growing sugar cane crops. Mujenja and Wonani (2012) reported that one of the officers at KASCOL explained why the motive and intentions of KASCOL were largely doubted (see quotation below):

"Because of the general disbelief that a company can offer resettlement land for free, the initial response was very poor as many people were sceptical of the underlying motive and intention of KASCOL to give land and settle smallholder farmers with all the infrastructure for free. However, to demonstrate the seriousness of the project, KASCOL management entered into negotiations with its selected employees to serve as pioneers of the scheme" (In Mujenja and Wonani, 2012).

KASCOL management went about asking among its employees if they would be willing to join the collaborative scheme. However, even employees were also initially sceptical about starting a collaborative scheme with KASCOL management. Two reasons emerged as contributing factors to this scepticism. Firstly, the general unwillingness from the community to join the scheme influenced KASCOL employees' unwillingness to join the collaborative scheme. KASCOL employees wondered why community members did not want to join the collaborative scheme, which made them also hesitant to join the collaboration. Secondly, KASCOL employees were uncertain about their future in the event that the collaborative scheme did not work according to their expectations after joining. They felt that joining the collaborative scheme would result in them losing their jobs at KASCOL. This is confirmed in the narrative given by a key informant who worked as a KASCOL smallholder training officer at the time of the scheme's inception, but who is now operating as a smallholder himself:

"First of all, I think we had to pick people from the villages, and what happened was that people were not happy at first to join KASCOL – they did not know how it will work. We tried our level best with the management. I was part of the management also, but we could not just make it – people were not sure about the irrigation scheme and the promised outcome. When the community refused to apply, then we said maybe let us try our own capitals (employees). Maybe others may see what we mean and start joining. But even capitals were not happy, they said 'No, no, no. How come people are refusing?' Even ourselves, if we joined this it means we will be out of employment if we fail." KL5

This perception was also confirmed by the KASCOL agronomist:

"When the community refused, then the idea was sold to the employees of KASCOL. But even them, they refused at first; they said, 'Look, how come our friends from the community do not want to join? Even us it is difficult to join."- KL4.

From the above, it is clear that the early stage of the KASCOL collaborative irrigation scheme was largely characterised by low levels of social capital.

5.3.2 Later stages of the growth phase (1985-1987)

The next phase of growth was initiated by the steady increase in social capital when only eight among the hesitant KASCOL employees agreed to join the collaborative scheme. KASCOL management managed to gain the trust of a few of their employees by promising to give them back their employment positions in the event that they did not like the outcome of the collaboration. The former KASCOL smallholder training officer (KL5) and the agronomist (KL4) respectively narrated this episode:

"…. We (KASCOL management) said 'no, if you fail we shall take you back in employment, but we just want you to see what will be the outcome', so that is how they accepted" (KL5).

"… But later when we told them 'We just want to see how it will work, if it doesn't work well, you will still come back, you will not lose your job', and only eight agreed and resigned from their positions as employees of KASCOL. These were given already planted cane fields and proceeds from the harvested cane on the smallholder field was given to the smallholders."KL4

The year 1983 brought an increase in social capital when the eight employees resigned from their employment at KASCOL and joined the collaborative scheme. In the first year of the collaborative scheme, the eight pioneer smallholder farmers worked for one farming season and the scheme was re-advertised again through another public invitation for the community members to join the collaboration.

Given that trust is influenced by actors' experiences and expectations, when expectations are met (Cullen et al., 2000; Cousin, 2002), the experiences of the eight employees were able to motivate other actors to exhibit cooperative behaviour towards the collaborative scheme. The increase in trust among collaborating actors increased social capital in the KASCOL collaborative scheme, which in turn influenced the nature of collaboration in the growth phase of the scheme. The first eight smallholder farmers opted to continue in the collaborative scheme with KASCOL management after

they were satisfied with the expectations from the collaboration during the first sugar cane farming season. There was an increase in trust from both the community and the pioneer smallholder farmers towards the KASCOL collaborative scheme when the scheme was re-advertised. The eight smallholders were very willing to continue collaborating with KASCOL management after the first year. This was because of the huge financial benefits for smallholders during the first year of collaboration. The KASCOL irrigation system manager and the agronomist stated the following in the quotations below:

"After it went well with the first eight smallholders then KASCOL management advertised again through the government media houses and radio stations for interested people to come and join as smallholders. KASCOL had to put up a selecting committee consisting of the chiefs, government officials from the ministry of agriculture and the district commissioner to help select individuals. Those who applied, I was their interpreter because most of them could not speak English."KL3

"When they sold the cane, the monies they got from the sale of sugar cane was so huge that it became an eye-opener to others." KL4

The increase in social capital became more evident in the year 1985 when there was willingness from the community members to also join the collaborative scheme. In that year, there was an increase in the number of people who applied to be considered for membership in the KASCOL collaborative scheme, probably a manifestation of the increase in the level of trust from the community members in Mazabuka. When the collaborative scheme was re-advertised, over a thousand applications were received by KASCOL management from people around Mazabuka who wished to be considered for the scheme. A former KASCOL smallholder training officer (KL5) narrated how this transpired:

Box 5.3: Selected quotations from a key informant on how pioneer smallholders re-joined as well as the community members joining the collaborative scheme

"So the first year (1983) the eight farmers worked with us; we gave them the plots – four hectares' sugar cane field each. So at the end of the season, we sold the sugar cane and gave them the money; you know, during that time money had power. Ah! I think the first farmer his money if not mistaken was about three point something million kwacha, which even we the workers were not, you know, we were not reaching such amounts. One of the farmers received you know, he received three point something million kwacha, so there we said, 'Now, what do you think? 'Now you know!' He said, 'No, no, no. I will continue as a smallholder.'" KL5.

"Because the income was so high, even the managers, everybody become interested and they applied about 1,500 applicants. But we could not pick all of them – it became a problem. Now what we did was that we suspended the process in 1987 and the number of applications that year increased to1,500. But we could not pick anyone, but people still continued applying but we could not do anything because recruitment had come to the end." KL5

Money received from the sale of cane was a factor that facilitated increase in the levels of trust towards the newly established collaborative scheme (Mungandi et al., 2012; Mujenja and Wonani, 2012). Increase in social capital was also observed through the signing of a Cane Farmers Agreement (CFA) by both KASCOL management and smallholder farmers. In addition, the CFA outlined the responsibilities and duties of each collaborating partner in the scheme. For example, in terms of irrigation water management, KASCOL management was responsible for delivering irrigation water to the edge of the smallholder farmer's cane field and the farmer would then take the responsibility for that water (Njobvu, 1990). This in a way was a manifestation of mutual trust to foster collaboration. This increase in social capital influenced collaboration in the scheme as smallholder farmers and KASCOL management begun collaborating to manage irrigation water as well as managing the growing of sugar cane upon joining the scheme. The following quotes exemplify this increase in social capital:

Box 5.4: Selected quotations on roles and responsibilities in the KASCOL collaborative scheme

"The Cane Farmers Agreement started around 1985 when we had smallholders now joining, because you know every organisation you cannot just run it, you need some conditions to guide how things are to be done, so management had to put in some conditions that farmers should follow so that the irrigation system and the cane fields are managed accordingly." KL5

"KASCOL shall deliver water to the boundary of each cane field by means of a tertiary canal. Deliveries shall normally be made in 11 hour periods during daylight hours at intervals sufficient to provide proper irrigation of the cane fields as decided by KASCOL taking into account rainfall, evaporation rates and other factors" (CFA, 1982: Sec. 6.1).

"*Smallholders shall irrigate their cane fields properly as advised by KASCOL and must avoid unnecessary waste of water" (CFA, 1982: Sec 6.4).*

Therefore, in terms of trust, the dynamics in social capital illustrated above are attributable to variations in the degree of trust among stakeholders. As elaborated above, expressions of lack of trust in the proposed collaborative scheme by both community members as well as KASCOL employees during the first public invitation indicated that there were low levels of trust in the early stages of the scheme, which affected collaboration. In a way, the joining of the eight farmers as well as those who applied later demonstrated that social capital changed in terms of trust and increased in the last stage of the growth phase in the scheme. In the next section, I consider how the other variable of social capital, commitment, influenced changes in social capital in the KASCOL collaborative scheme.

5.3.3 Commitment: Increase of social capital

Social capital is also influenced by the degree of commitment that actors put into the collaboration. Commitment as an attribute of social capital is defined as resources and energies that actors invest into a social relationship in order to secure a long-term relationship (Nkhata et al., 2008). Such commitments depict the extent to which an actor believes that a relationship is worth expending energies and resources on (Luo, 2002; Cullen et al., 2000). Given that commitments are investments

that are put into a relationship to influence social capital, in the KASCOL collaborative irrigation scheme, even though there was an enormous increase in the number of individuals willing to join the scheme, those who applied to join the collaborative scheme had no knowledge of both irrigation water management and sugar cane management. As a result, KASCOL management had to invest in resources to provide practical skills training to the newly recruited smallholder farmers. KASCOL had to put these farmers on a six-month practical training period to ensure they all gained the appropriate skills for managing irrigation water as well as sugar cane so that the collaborative scheme could be enhanced. The former KASCOL smallholder training officer (KL5) narrated how KASCOL implemented training for the newly recruited smallholder farmers.

"We had to put them on training for six months. Training was practical. Most of them where illiterate, a mixture of men and women, and had no knowledge of how to manage irrigation water and the cane itself. I was their trainer as well as an officer for KASCOL. After six months' training we now ended up with some of the farmers who could not do well during training and started leaving. Some did not like the conditions, a few left on their own, those who become stubborn were removed from the scheme just to teach them a lesson so that the situation did not continue, so we remained with 160 smallholders including the first eight, which is the total we still have even now." KL5

Furthermore, commitment was shown by KASCOL management by putting all the trainee smallholder farmers on a monthly salary during the six-month training period. The salary was equivalent to that of a temporal (seasonal) employee working at KASCOL at that time (Mujenja and Wonani, 2012). Additionally, KASCOL management provided smallholder farmers with interest-free inputs: soft loans such as fertilisers and other pest control chemicals for cane management. Such loans were only required to be paid back by the farmer to KASCOL management after sugar cane had been harvested and sold to Zambia Sugar (Mujenja and Wonani, 2012; Njobvu, 1990). Besides the training, salaries and interest free input loans that KASCOL management provided, they also gave out the cane fields and dwelling areas to all the smallholder farmers that completed the training course and joined the collaborative scheme. See the following quotation from the KASCOL agronomist.

"Farmers were given dwelling land and cane fields upon signing the Cane Farmers Agreement. The Cane Farmers Agreement was done by KASCOL management to guide how irrigation water was to be managed and shared; also it gives conditions of what should be done in the dwelling area. Then it was supposed to be read by the smallholders and agreed to by signing so that all things should be done according to that agreement." KL4

Social capital increased in a sense through commitments that were put into the collaboration by KASCOL management. The training of smallholder farmers in irrigation and sugar cane management, the monthly salary given to the farmers, interest-free farming input loans and the provision of both dwelling and cane fields was a manifestation of commitment, which in a way ensured that growth in social capital was increased, leading to the growth phase of the adaptive cycle being navigated at the end of the smallholder recruiting period. In a sense, smallholder farmers also showed commitment through their dedication to undergo training and acceptance to resettling under new conditions in the CFA. Therefore, the period from 1982-1987 represented the growth phase of the KASCOL collaborative irrigation scheme. Such investments of resources and energies in terms of commitments contributed to the growth of the collaborative scheme's social capital enabled collaboration between KASCOL management and smallholder farmers to be achieved.

5.4. Collaboration on water management during growth phase of KASCOL' adaptive cycle.

Collaboration was defined in terms of joint activities between smallholders and KASCOL Management towards collective management of water resources in the scheme. Previously KASCOL as a private scheme managed water resources in collaboration with Zambia Sugar (ZS) from the Kafue River to KASCOL through ZS' water infrastructure (Njobvu, 1990). Even though all water users in the sugar cane agricultural system have their own water permits those in partnership with ZS they are charged on the cost of transporting bulk water by ZS. For example the estate manager in the quotation below described how collaboration is done at broader scale of outgrowers using ZS water infrastructure system.

"Every outgrower has a permit for water abstraction and pumps water within the required/ specified amounts of water. So for example if Zambia Sugar have 10 outgrowers depending on water from

Zambia Sugar, so what Zambia Sugar will do is to add all the amount of water each outgrower needs plus them what they need and pump the total amount. Now within these are cooperation's – sometime within May and July the temperatures are low; the crop does not need much water, so you may have to pump less or more depending on the situation, but at the end of the day you are required to abstract within the limits required." KL6.

At the scale of KASCOL which is the focus of the study, smallholders collaborate with KASCOL Management. According to the adaptive cycle, during growth phase it is expected that a system will be characterised with rapid accumulation of opportunities or potential for collaboration between KASCOL Management and Smallholders towards irrigation water management as social capital increases. For example, as social capital begun to increase in the scheme by way of more people joining the scheme, KASCOL ensured that training of smallholders on how to manage water resources was done. This was a manifestation of commitments to prepare for collaborating towards water management. For example when a smallholder signs a CFA it meant that a smallholder was able to collaborate with KASCOL Management in the management of water resources within the scheme. One of the Key informant the irrigation manager highlighted how water management in the scheme is collaboratively managed, from when it is received and stored to scheduling of fields and harvesting periods.

"KASCOL buys water from Zambia Sugar. However, a farmer is charged based on the number of irrigation done in their cane field. KASCOL will bring water into the storage dams and then a schedule for irrigation is made. After cane has been harvested a field will be put on [an] irrigation schedule. Harvesting schedules parallel irrigation schedules''. KL3

With the above collaborative system in place in the KASCOL Scheme, there arose a dissatisfaction among smallholders in the way water resources where (then) managed such that smallholders were able to call upon the increasing social capital to transform water management from one that was established initially to one that involves the trust and commitment or social capital of both smallholders and KASCOL Management. The section below presents this transition in collaboration on water management.

5.4.1 Evolution of collaborative water management strategy from volume to cycle.

As collaboration on water management in the scheme evolved, the system of managing water payments in the scheme was revised and changed by smallholders in collaboration with KASCOL Management. Smallholders through their Association, presented their case to KASCOL Management and they collaboratively changed the system from volume to cycle as a new way of determining water usage and pricing in the scheme. This is arguably the manifestation of the increasing levels of social capital in the scheme during its growth phase between KASCOL and KASFA in that both actors were able to committee their time and energies to the transformation of volume system to that of a cycle system. For example, the quotations in box 5.4 below, key informants described how Smallholders through KASFA and Management engaged each other to address water management strategies from the volume to a cycle system of water usage determination. This change subsequently affected how water charges are calculated by removing administration charges that were charged on water.

Box 5.5 Selected quotations on the evolution of a collaborative water management strategy from a volume to a cycle.

''Now there was an agreement that was looked at with smallholders, through the association that you may have heard about already KASFA to say no they find this system of paying for irrigation water through the volume to them was too expensive. So what was happing was that when you open an irrigation gate from the dam for the smallholder to irrigate we were counting the number of hours that a smallholder has been irrigating. The number of hours we knew the take-off rate for irrigation water then we worked out the volume used. So we take the charge for example from Zambia Sugar, we then work out in reverse how much each farmer should pay for irrigation water after an administration fee is removed. But later this was changed'' KL3.

''As at now the administration fees have been reduced they are not covering water usage, so what is happening now is that farmers are now charged based on irrigation cycles'' KL4

''*KASFA in the water management system, quiet well it is a little bit away from the primary objective of forming an association, but we have had situations where KASFA should come in because the farmers are affected. I think 12-13 years back the farmers had a concern on their water charges, to they are paying too much for their water and it was brought in through the normal channel through the association and it was presented to management and during the cane split*

price negotiations it was incorporated and the structure was changed on how the famers will pay for their irrigation water. We now pay per cycle rather than the volume''. (KASFA Chairperson).

The transition in collaboration- working together to achieve a collective good in the management of water resources during growth phase was facilitated by the increasing levels of social capital in the growth phase of the of the KASCOL Scheme adaptive cycle.

5.4. Conclusion

In this chapter, an exploration of the growth phase of the KASCOL collaborative irrigation scheme adaptive cycle has been presented. This historical narrative of the growth phase of the KASCOL collaborative irrigation scheme, which has been described in this chapter based on the theory of the adaptive cycle, provides insights on how social capital influenced the dynamics in collaboration in the growth phase of the collaborative scheme. The chapter has also demonstrated that dynamics in the collaborative scheme's social capital were influenced by trust and commitment. Low levels in social capital affected generally collaboration- in terms of smallholders working together to establish the scheme- in the early stages of the collaborative scheme's growth phase. In the later stage of the schemes growth phase, the increase in social capital enabled collaboration in the management of irrigation water, which lead to the emergence of the KASCOL collaborative irrigation scheme and transformations in the management of water resources in the scheme.

CHAPTER SIX: DISCUSSION

6.1 Introduction

The purpose of this study was to explore and describe the growth phase of the Kaleya Smallholders Company Limited (KASCOL) collaborative irrigation scheme. Social capital was used as a core variable of change in the adaptive cycle of KASCOL. In this chapter, I further discuss the results of this study and their implications. The discussion begins with highlighting the adaptive cycle itself and how it was useful in the analysis and presentation of results. Following the adaptive cycle section is a discussion of the main findings on social capital and how it influenced collaboration in the KASCOL collaborative irrigation scheme. In the last section of this chapter, the interplay between social capital and collaboration are then discussed in terms of their implications for collaborative water security initiatives in a general sense.

6.2 The Adaptive Cycle

In this study, the adaptive cycle was used as a heuristic to explore growth and characterise social capital as a dimension of change in the KASCOL collaborative irrigation scheme. From the findings of this study, the adaptive cycle provided a useful framework for exploring and describing the growth phase of the KASCOL collaborative irrigation scheme in terms of the levels of social capital and the evolving nature of collaboration in the management of water resources as social capital increased during the growth phase of the scheme. The capital dimension of the adaptive cycle enabled the study to explore the dynamics of social capital as a variable of change in the KASCOL collaborative irrigation scheme SES and enabled the linking of influence of the increasing social capital on collaboration in the scheme. Such a finding contributes to similar works done by other scholars such as Able et al., (2006), Nkhata et al., (2009) and Vang Rasmussen and Reenberge (2012). These scholars found the adaptive cycle to be useful for interpreting change using the dimension of capital. The adaptive cycle also made it possible for the collaborative scheme to be placed or organised into distinct functional phases. In addition, by describing and characterising social capital in the adaptive cycle of KASCOL collaborative irrigation scheme, the adaptive cycle model made it possible to able

to link the dynamics in social capital to those of collaboration in the scheme. For example, growth phase is one in which every opportunity for collaboration is taken advantage of through the investments to build social capital and enhance collaboration in the management of a system (Nkhata et al., 2008; Gunderson and Holling, 2002; Holling, 2001). Similarly in the KASCOL scheme as the levels of social capital began to increase through investments in commitments and developing of trust between smallholders and KASCOL lead to the evolution of collaboration in the management of water resources. Collaboration in the KASCOL scheme evolved from initial water management quantity and price determination which employed a volume system of collaborative water management to a cycle system of water management and pricing strategy. Although this finding is consisted with other case studies in which qualitative data has been used to characterise adaptive cycles of SES such as those presented by these scholars (Vag Rasmussen and Reenberge, 2012; Baral et al., 2010; Nkhata et al., 2009). There are however cases where the adaptive cycle of a SES reveals contradictory narratives of change. This has been due to differences in perceptions of change influenced by the benefits stakeholders derive from the SES see (Rawluck and Curtis, 2016). In such a case scholars used the adaptive cycle as a tool to help in data triangulation of the different versions of change with other published literature. This enabled a much more holistic description of change useful for the management of SES (Rawluck and Curtis, 2016). I content that the significance of incorporating scale and system definition in terms of system identity can help reduce discrepancies in measurement of change in SES for management purposes. Parnarchy as a theory of cross-scale interactions of adaptive complex systems of nature and people can be helpful in describing change based on scale and trace the evolution of the system measured in terms of its identity or resilience (Chaffin and Gunderson, 2016; Abel et al., 2006; Cumming and Cullier, 2005; Gunderson and Holling, 2002). Lastly, I posit that defining scale and system identity or bounding the system can contribute to sustainable management of SES, as a SES navigates the phases of an adaptive cycle (Walker et al., 2006, Gunderson and Hollining, 2002).

6.3 Changes in Social Capital and the Adaptive Cycle

The adaptive cycle theory suggests that the growth phase is the rapid accumulation of capital, and this is likened to a contest for pioneering actors in a system (Gunderson and Holling, 2002). It was found in this study that during the early stages of growth there was low social capital in which actors were sceptical and hesitant to join the collaboration. In particular, trust was found to affect growth in social capital, which hampered collaboration and resulted in the scheme failing to start during the first public invitation for community members to join. This finding is in a sense very consistent with the general assumption of the adaptive cycle that the growth phase is generally characterised by low levels of capital in a system that is gaining strength and that increases later to lead into the conservation phase (Nkhata et al., 2008; Holling, 2001).

Interestingly, a sceptical attitude driven by low levels of social capital, and trust in particular, was also observed in KASCOL employees when they were offered an opportunity to join the collaborative scheme as pioneer smallholder farmers. Despite the relationship that KASCOL management had with the employees, the majority showed low levels of trust in the collaboration, resulting in low levels of social capital in the collaborative scheme. The employees were very hesitant to start collaborating with KASCOL in growing sugar cane and management of irrigation water at first. This finding suggests that it is possible that in the growth phase, there may be low levels of social capital that may precede the increase in social capital, which characterise the growth phase as an opportunistic phase in a collaborative scheme's adaptive cycle (Nkhata et al., 2008). Growth in the social capital of the collaborative scheme that can be described as opportunistic, in which actors took every opportunity available, was eventually noticed in the second public invitation with the eight employees at KASCOL trusting management with the condition that they would be returned to employment if they wished to be employees rather than smallholder farmers at the end of the first cane farming season in collaboration with KASCOL management. In a sense, the first eight pioneer smallholder farmers triggered the beginning of an increase in social capital in the growth phase of the KASCOL collaborative scheme.

In accordance with the adaptive cycle theory of a collaborative scheme, which suggests a rapid increase in social capital as the growth phase continues (Nkhata et al., 2008), the later part of the growth phase of the KASCOL collaborative scheme showed an increase in the level of social capital resulting from the increase in trust and commitment. It was an opportunistic period and a contest period in which individuals from the community around Mazabuka competed to join the scheme through the applications that were sent to KASCOL for consideration (Nkhata et al., 2008; Gunderson and Holling, 2002; Holling, 2001). The experiences and expectations of the pioneers in the collaborative scheme led to the increase in trust and commitment towards the collaborative scheme. This led to an increase in social capital and collaborative behaviour within the KASCOL collaborative scheme. Such a finding indicates that the opportunistic state in the growth phase may be influenced by achieving an expectation (Cullen et al., 2000). When expectations are clearly known, there is likelihood that the growth phase in the adaptive cycle will proceed rapidly in the collaborative scheme.

6.4 Dynamics in Social Capital and Collaboration

Luo (2002) argues that trust and commitments can aid in facilitating collaboration in collaborative alliances, particularly in their growth phase. The findings in this study agree with Luo (2002) in that trust and commitment as attributes of social capital influenced the dynamics in social capital and collaboration in the KASCOL collaborative scheme. This was observed in the KASCOL collaborative scheme. As social capital increased there was also an increase in collaboration as more smallholder farmers joined KASCOL and started collaborating with KASCOL management during the later part of the growth phase in the KASCOL adaptive cycle. Kizo et al., (2014) found that strong social capital that bonded individuals and groups in Greece's Crete region in an agro-pastoral SES was enabled within group collaboration. In a way, this finding highlights that building commitments, in terms of developing human capacity and trust towards the goals of a collaboration, is a key factor in driving collaboration in the management of natural resources such as water resources. Baral et al., (2010) also found that in the growth phase of Nepal's national parks and wildlife conservation scheme,

collaboration with community members was successful because there was an initial investment in human capital through training. Stakeholders were also found to have developed trust among themselves and between other partners in the conservation programs in Nepal.

Other factors that influenced social capital in the KASCOL collaborative scheme are largely contextual, in the sense that they are particular to the KASCOL collaborative scheme situation. For instance, the historical agricultural crop that local people grew was not what the scheme was proposing to engage smallholder farmers in during the collaboration. This difference had a significant influence on trust formation by the community members towards KASCOL management and the entire collaborative scheme plan. It was found that it was uncommon for the local people to grow sugar cane in the early 1980's. This incongruence in the agricultural activities of the local people and the proposed activities in the scheme had influenced social capital formation and collaboration in the KASCOL collaborative scheme. This result is in support of Mungandi et al., (2012), who found that incongruence in agricultural activities affected the collaboration in and the emergence of the KASCOL collaborative scheme. This contextual arrangement influenced levels of social capital as expressed through low trust between the community members and KASCOL management, affecting the establishment of collaboration.

In addition, findings of this study showed that low levels of social capital such as trust were also linked to the promises that KASCOL management made, including that of relocating individuals from their places of residence to an established resettlement at KASCOL. Furthermore, KASCOL management was to provide all the resettled smallholder farmers with an established cane field on which to grow sugar cane (Mungandi et al., 2012). In a sense, such expectations seemed unrealistic, which resulted in community members being sceptical about the true intention of the collaboration, as the gesture that KASCOL promised was not common. This finding is similar to that of Kiss (1990), as reported in Nkhata et al., (2008), where in most Southern African countries during the early years of governments and NGOs establishing community-based natural resources management (CBNRM) schemes, local people were sceptical about the government and NGO's intentions. This hindered

community members' trust in the intentions of the government and conservation NGO groups. In the CBNRM case financial resources were invested to show commitment and the intentions of government and NGOs. In the KASCOL collaborative scheme, KASCOL management shifted the attention for a while to their own employees to demonstrate what the collaborative scheme was all about, with the hope that others may learn from them.

Interestingly, even although most employees did not accept KASCOL's proposal to begin the collaboration, a few accepted. This is in contrast to the local community. The first eight pioneer smallholder farmers who accepted trusted KASCOL management when they were promised secure jobs in the event that their expectations in the collaborative scheme were not met. This finding is suggestive of a relationship between trust formation and prior interactions, in which it is easier to trust partners who have some form of existing social relationship than those actors with whom there is no previous interaction. Smallholders found it easy to trust KASCOL due to the established relationship that the eight former employees had with KASCOL management from their time working together. This finding agrees with the findings of other authors who have written about the KASCOL collaborative scheme (Mungandi et al., 2012; Mujenja and Wonani, 2012). The finding also confirms in a way that trust formation is influenced by past and present interactions and expectations (Cullen et al., 2000). Elsewhere, Kizos et al., (2014) found that it was difficult for community members in Crete, Greece, to trust other community members with whom they had no direct relationship. This affected social capital and lead to the degradation of the landscape.

Furthermore, in the KASCOL case it was found that financial income farmers received from the selling of sugar cane was strongly linked to the increase in social capital in the collaborative scheme. Similarly, Mungandi et al., (2012) and Mujenja and Wonani (2012) also found that financial income obtained from the sale of sugar significantly influenced the number of people who wished to join the collaborative scheme. Similarly, in the Sahelian agro-pastoral SES, Rasmussen and Reeberge (2012) found that the creation of a seed bank from which community members could get farming implements

on credit increased social capital. In sense, this result suggests that when an expectation is sure and significant, social capital is more likely to increase, as noticed in the KASCOL collaborative scheme.

6.5 SESs, Collaboration and Social Capital

In terms of SESs that are formed by water resources, broadly the results from this study suggest that social capital facilitated collaboration in the establishment of the KASCOL collaborative scheme, as well as in the management of irrigation water to ensure its availability for sugar cane growing and the overall resilience of the SES. For example we find that as Social Capital was increase in the growth phase it was able to influence the evolution of collaboration in the management of irrigation water resources in the scheme. This was demonstrated in scheme in that smallholders were able to sign a Cane Farmers Agreement in which irrigation water management roles and responsibilities were outlined for each collaborating partner in the SES. The transformation in collaborative water management strategy in the KASCOL demonstrates how social capital can possibly influence collaboration in the management of water resources specifically and natural resources broadly. Additionally, each actor in the KASCOL collaboration scheme was paying for the volume of water supplied to the edge of their cane field (Njobvu, 1990). This increase in social capital in a way ensured that KASCOL management and smallholder farmers collaborated towards achieving irrigation water security in the KASCOL SES.

In other cases, similar results were found that suggest that increased social capital facilitates collaborative management of contested water resources. For example, informal collaborative arrangements in the Sacramento–San Joaquin Delta and the San Francisco Bay Estuary were found to facilitate collaborative management of watersheds in the USA (Innes et al., 2007). Innes (2007) found that in cases were social capital was developed, informal collaborative strategies facilitated the management of water resources in the Delta and Bay Estuary in the USA. Scott et al., (2013), found that social capital influenced collaborative strategies to manage water security-related challenges in the Colorado River Basin. In that example, it was found that a collaborative arrangement involving

policymakers, scientists and various environmental stakeholders achieved a number of goals as a result of improved social capital, such as securing ecological flows vital for sustaining critical wetlands and species habitats. In a case study focusing on the transformation of information into usable knowledge, Fisher (2013) found that in the absence of trust, which consisted of commitments, productive social capital was difficult to achieve as farmers did not cooperate with government officials by adopting bovine tuberculosis control information the officials provided. They preferred their own private established network of private veterinary doctors as trusted and committed partners. Although Fisher's (2013) case does not refer to water resources, it illustrates the crucial effect that social capital has in facilitating dynamic change and its influence on enabling collaboration. In the case studies on water security that Petersen-Perlman et al., (2012) examined, they found that lack of commitment affected collaboration in a water security project between the Canadian government and the US government. This project involved flood control management plans between the two governments. The Canadian government was only willing to collaborate on this project when their counterpart showed some level of commitment (Petersen-Perlman et al., 2012).

In a sense, incorporating social capital as a key variable in efforts aimed at ensuring water security would prove to be useful in driving collaborative efforts that seek to address complex SESs. In collective action problems, a characteristic in which some stakeholders lack an incentive to engage in the collective good is common. Securing collaboration among various stakeholders will also largely depend on the social capital development among stakeholders of a problem domain. As noticed in this study and other studies, social capital has a huge influence on the collaboration of multiple actors. Although in this study it was found that there was a direct relationship where low levels of social capital resulted in non-collaborative behaviours, studies by Kizos et al., (2014), Njuki et al., (2008) and Anthony and Campbell (2011) indicate that increased social capital can also be problematic in achieving certain goals that involve bridging different social groups. In such instances, it was found that increased social capital hampered collaboration – such cases occurred in situations where new ideas or plans were being introduced to stakeholders with a high level of internal (group)

social capital, which influenced collaboration with other groups and the adoption of agricultural technology negatively (Anthony and Campbell, 2011; Njuki et al., 2008).

6.6 Conclusion

This chapter has discussed the adaptive cycle and changes in social capital, demonstrating that changes in social capital generally influence the dynamics in collaboration. In the case of the KASCOL collaborative scheme's growth phase, low social capital hindered collaboration. However, as social capital increased, collaboration in the scheme was facilitated, particularly in the growth phase of the KASCOL collaborative scheme's adaptive cycle. In addition, this chapter has also demonstrated that such dynamics in social capital and collaboration have implications on water security of SES. Variables such as social capital can significantly affect collaboration in ways that can either promote or prevent achieving water security. This is demonstrated by the examples given in Innes et al.'s (2007) study of informal collaborative schemes in the USA which helped to facilitate water security-related management. The KASCOL collaborative scheme is one other example that can be cited in which increased social capital facilitated collaboration towards water security. When social capital increased in the KASCOL collaborative scheme, smallholder farmers begun collaborating on irrigation water management arrangements with KASCOL management.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

In this chapter, I draw the conclusions of the study based on the objectives that were set in the introductory chapter, as well as the findings and discussions presented in the two preceding chapters. The chapter begins by presenting a summary of the key findings, and then later highlights the implications of these findings for collaborative natural resources management generally and specifically for water resource management and security. In the last section, I offer recommendations for policy as well as for further studies.

7.2 Conclusion of the Study.

The study purpose was to use the adaptive cycle as a heuristic model to assess the growth phase in the Kaleya Smallholders Company Limited (KASCOL), a sugar cane collaborative irrigation scheme in Mazabuka on the Kafue Flats in Zambia. The study considered the adaptive cycle's capital as a core variable of change in the collaborative social-ecological system. It is based on the rationale that social capital – a social resource embedded in social relationships that affects the nature of collaboration among actors – is influenced by trust and commitments as key attributes directing the dynamics of actors in a collaboration (Anthony and Campbell, 2011; Nkhata et al., 2008). The concept of collaboration was taken to mean actors in a social relationship working together to achieve a desired collective goal where such collective goals are difficult to achieve in unilateral settings (Nkhata et al., 2008).

Findings of this study showed that social capital was a key variable that influenced the trajectory of collaboration in the KASCOL collaborative irrigation scheme. The scheme failed to establish itself as collaborative sugar cane farming irrigation scheme between individuals drawn from the community and the KASCOL management during the first public invitation that KASCOL made, as no one was willing to start collaborating with KASCOL. This indicated low levels of social capital.

The low levels in social capital increased later as eight employees of KASCOL showed some degree of trust in KASCOL management and accepted a proposal to join the scheme as pioneer smallholder farmers. This increase in social capital was exhibited through trust and commitment that KASCOL invested into the collaborative scheme by providing skills training to the newly recruited farmers who joined in the second public invitation in which social capital showed a steady increase and drove the collaborative scheme into the last part of the growth phase, which was characterised by the suspension of smallholder recruitment in the year 1987.

The adaptive cycle continues to be a useful heuristic in that it enabled the organisation and interpretation of growth phase and the dynamic changes in social capital that influenced collaboration in the KASCOL collaborative scheme. It allowed the characterisation of the KASCOL scheme as being in growth phase by adapting Nkhata et al., (2008) conceptual framework. Based on particular levels of relational capital, collaborative social relationships can be conceptualised as adaptive cycles (Nkhata et al., 2008). Although in the KASCOL scheme only growth phase of the adaptive cycle, the scheme was explored, from this finding it can therefore be concluded that designing collaborative strategies will need to consider the potential influence that social capital, 'trust and commitment' has, as it contributes to shaping the trajectories in the adaptive cycle of a collaborative scheme in the governance and management of natural resources such as water resources. SES that have strong social ties have been seen to have significant influences in the way actors relate with each other. In this study it was found that weak social ties influenced negatively the formation of a collaborative scheme and that only stronger social capital facilitated the emergence and growth of the KASCOL collaborative scheme. Some studies show that strong bonding social capital also has the potential to hamper the formation of linking and bridging social capital with other groups that may require collaborating with the KASCOL collaborative scheme in the advancement of water resource management (Kizos et al., 2014; Njuki et al., 2008).

7.3 Policy Recommendations

Water resources being a key linking natural resource between the social system and the ecological system is of significant importance in the functioning of coupled systems such as collaborative irrigation schemes SESs. Policies that target collaborative governance and management of water SESs with a goal to achieving water security or IWRM should consider social capital variables in the design and implementation of collaborative initiatives for the governance and management of natural resources in general, and specifically for water resource systems.

Policies should be designed in such a way as to allow the inclusion of the adaptive nature of SESs. Going by the adaptive cycle theory, a system may actually not go through the sequential four-phase trajectory. A system may actually skip the next sequential phase to another phase, either backwards or forwards in the adaptive cycle. As a result, policies should be flexible enough so that adaptive SESs are managed with the understanding that social systems are largely the influencer of the dynamics of an SES.

7.4 Recommendation for Further Studies.

In order to better understand the evolution of the KASCOL collaborative SES, there is a need to explore the adaptive cycle of the scheme using other forms of capital, as well as using the other dimensions of change such as connectedness to evaluate the degree to which actors are connected – for example through the resources tie dimension. I suggest investigation of the resource tie dimension to consider how actors are connected through water resources. This is because every actor in the KASCOL collaborative scheme is dependent on irrigation water used in the cane fields. Furthermore, the adaptive cycle can also be used to understand the functionality of the KASCOL collaborative scheme in the conservation phase, which comes after the completion of the growth phase, as suggested by the adaptive cycle model. Finally, it could also be interesting to investigate the potential resilience of the collaborative scheme from external and internal shocks, especially those that may

have huge implications on the security of irrigation water resources, a key input resource in the functioning of the KASCOL collaborative irrigation scheme.

7.5 Conclusion

The chapter has provided the conclusions drawn from this study and their implications on collaborative strategies and the management of water resources. I have emphasised that social capital variables should be taken into consideration in the designing of collaborative strategies for the management of water resources.

REFERENCES

Abel, N., Cumming, D. H. M. and Anderies, J. M. 2006. Collapse and reorganization in social-ecological systems: questions, some ideas, and policy implications. *Ecology and Society* 11(1): 17. URL: http://www.ecologyandsociety.org/vol11/iss1/art17/

Anderies, J.M., Janssen, M.A. and Ostrom, E., 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society* 9(1): 18. URL: http://www.ecologyandsociety.org/vol9/iss1/art18/

Anthony, D.L and Campbell, J.L. 2011. States, social capital and cooperation: looking back on governing the commons. *International Journal of the Commons*. 5(2). pp. 284–302.

APFM. 2007. Strategy for Flood Management for Kafue River Basin, Zambia. Available online on: www.floodmanagement.info/projects/pilot/africa/Pilot_National_Strategy_for_Zambia

Accessed on: 04/04/2017

Bangwe. L and Van Koppen B. 2012. AgWater Solutions Project Case Study; *Smallholder Outgrowers in Irrigated Agriculture in Zambia.*

Babbie. E. 2013. *The Practice of social research*. Wadsworth, Cengage Learning, Canada.

Baral, N., Stern, M. J. and Heinen, J. T. 2010. Growth, collapse, and reorganization of the Annapurna Conservation Area, Nepal: an analysis of institutional resilience. *Ecology and Society* 15(3): 10. URL: http://www.ecologyandsociety.org/vol15/iss3/art10/

Bbole, I., Katongo, C., Deines, A. M., Shumba, O., and Lodge, D. M. 2014. Hybridization between non-indigenous Oreochromis niloticus and native Oreochromis species in the lower Kafue River and its potential impacts on fishery. *Journal of Ecology and The Natural Environment*, 6(6). pp. 215–225.

Bezuidenhout, R. and Cronje. F. 2014. *Qualitative data analysis*. In: Du Plooy-Cilliers. F, Davis. C, Bezuidenhout, R. (eds.), *Research Matters*. Juta and Company Ltd, Cape Town, South Africa.

Biggs, E.M., Duncan, J.M.A., Atkinson, P.M. and Dash J. 2013. Plenty of water, not enough strategy: How inadequate accessibility, poor governance and a volatile government can tip the balance against ensuring water security: The case of Nepal. *Environmental Science and Policy*. 33 (2013). pp. 388 – 394.

Bowen, G. A. 2009. Document analysis as a qualitative research method. *Qualitative Research Journal*, 9. pp. 27–40.

Chaffin, B.C and Gunderson, L.H. 2016. Emergence, institutionalization and renewal: Rhythms of adaptive governance in complex social-ecological systems *Journal of Environmental Management*, 165 (2016): 8187.

Chomba, M.J. and Nkhata, B.A. 2016. *Water Security on the Kafue Flats of Zambia*. Technical Report of the International Water Security Network, Water Research Node, Monash South Africa, Johannesburg.

Chundama, M. and Maseka, C. 2015. *Scoping Study for the Kafue Water Program*. Lusaka: The Nature Conservancy.

Coleman, J.S. 1988. Social Capital in the Creation of Human Capital: *American Journal of Sociology*, Vol. 94, Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure (1988). pp. S95-S120

Cook, C and Bakker, K. 2012. Water security: Debating an emerging paradigm. *Global Environmental Change*, 22 (2012). pp. 94–102.

Cousins, P. D. 2002. A conceptual model for managing long-term inter-organizational relationships. *European Journal of Purchasing and Supply Management*, 8. pp. 71–82.

COWI. 2009. *Availability of water resources for sugar cane production expansion in Zambia in the context of competing hydropower and other users*. Denmark: Ministry of Energy and Water Development, European Union.

Cullen, J. B., Johnson, J. L. and Sakano, T. 2000. Success through commitment and trust: the soft side of strategic alliance management. *Journal of World Business* 35(3). pp. 223–240.

Cumming, G. S. and J. Collier. 2005. Change and identity in complex systems.

Ecology and Society 10(1):29.

Du Plooy-Cilliers F. 2014. *Research paradigms and traditions*. In Du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R. (eds). 2014: *Research Matters*. Juta and Company Ltd, Cape Town, South Africa.

Fath, B. D., Dean C.A. and Katzmair, H. 2015. Navigating the adaptive cycle: an approach to managing the resilience of social systems. *Ecology and Society*, 20(2): 24. URL:http://dx.doi.org/10.5751/ES-07467-200224.

Fisher. R. 2013. 'A gentleman's handshake': The role of social capital and trust in transforming Information into usable knowledge. *Journal of Rural Studies, 31 (2013) 13e22.*

Gerring J. 2007. *Case study research: Principles and practice,* Cambridge, Massachusetts, Cambridge University Press.

Grey, D. and Sadoff, W. 2007. Sink or Swim? Water Security for growth and development. *Water Policy*, 9**.** pp. 545-571.

GRZ. 2010. *National Climate Change Response Strategy*. Lusaka, Zambia: Ministry of Tourism, Environment and Natural Resources.

Gunderson, L. H., and Holling, C. S. (eds.). 2002. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington, D.C., USA.

Gunderson, L. H., Carpenter, S. R., Folke, C. Olsson, P. and Peterson, G. D. 2006. Water RATs (resilience, adaptability, and transformability) in lake and wetland social-ecological systems. *Ecology and Society* 11(1): 16. URL: http://www.ecologyandsociety.org/vol11/iss1/art16/

Gunderson, L., B. A. Cosens, B. C. Chaffin, C. A. (T.) Arnold, A. K. Fremier, A. S. Garmestani, R. K. Craig, H. Gosnell, H. E. Birge, C. R. Allen, M. H. Benson, R. R. Morrison, M. C. Stone, J. A. Hamm, K. Nemec, E. Schlager, and D. Llewellyn. 2017. Regime shifts and panarchies in regional scale social-ecological water systems. *Ecology and Society* 22(1):31. https://doi.org/10.5751/ES-08879-220131.

Haller, T., and Merten, S. 2008. We are Zambians – Don't tell us how to fish! Institutional Change, Power Relations and Conflicts in the Kafue Flats Fisheries in Zambia. *Human Ecology*, 36 (5). pp. 699–715.

Hepworth, N and Orr, S. 2013. Corporate water stewardship: exploring private sector engagement in water security. In Lankford, B, Bakker, K, Zeitoun, M and Conway, D. (eds.) 2013. Water security principles, perspectives and practices, pp. 221-235. Routledge.

Holling, C. S. 1987. Simplifying the complex: the paradigms of ecological function and structure. *European Journal of Operational Research*, 30. pp. 139-146.

Holling, C. S**.** 2001. Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, 4. pp.390-405.

Imperial, M. T. 2005. Using collaboration as a governance strategy: lessons from six watersheds. *Journal of Management*, 28(5). pp. 669–694.

Innes, J.E, Sarah Connick, S and Booher, D. 2007. Informality as a Planning Strategy. *Journal of the American Planning Association*, 73(2). pp. 195-210. http://dx.doi.org/10.1080/01944360708976153

Kiss, A. (ed.) 1990. *Living with wildlife: wildlife resource management with local participation in Africa.* Technical Paper 130. Africa Technical Department series. World Bank, Washington, D.C., USA. In: Nkhata, A. B., Breen, C. M. and Freimund, W. A. 2008. Resilient social relationships and collaboration in the management of social–ecological systems. *Ecology and Society* 13(1): 2. URL: http://www.ecologyandsociety.org/vol13/iss1/art2/

Kizos, T. V, Detsis, T, Iosifides, and M. Metaxakis. 2014. Social capital and social-ecological resilience in the Asteroussia Mountains, southern Crete, Greece. *Ecology and Society* 19(1): 40. http://dx.doi.org/10.5751/ES-06208-190140.

Koonin M. 2014. Validity and Reliability. In Du Plooy-Cilliers F., Davis, C., and Bezuidenhout, R. (eds.). 2014: *Research Matters*. Juta and Company Ltd, Cape Town, South Africa.

Krefting L. 1991. Rigor in Qualitative Research: The Assessment of Trustworthiness. *The American Journal of Occupational Therapy*. 45(3).

Lankford, B., Bakker, K., Zeitoun, M. and Conway, D. (eds.). 2013. Water security principles, perspectives and practices. Routledge.

Larsen, L., Harlan, S. L., Bolin, B., Hackett, E., Hope, D., Kirby, A., Nelson, A., Rex, T. R., and Wolf, S. 2004. Bonding and bridging: understanding the relationship between social capital and civic action. URL:http://www.asu.edu/clas/oldshesc/faculty/pdf/JPERBondingandBridging.pdf

Leonard, P. 2005. *Important Bird Areas in Zambia. Priority sites for conservation*. Zambia Ornithological Society, Lusaka Zambia.

Louw M. 2014. Ethics in research. In Du Plooy-Cilliers F., Davis, C., and Bezuidenhout, R. (eds.). 2014. *Research Matters*. Juta and Company Ltd, Cape Town, South Africa.

Luo, Y. 2002. Building trust in cross-cultural collaborations: towards a contingency perspective. management programs. *Administration and Society. 37(3). pp. 281–320.*

Meinzen-Dick, R., 2014. Property rights and sustainable irrigation: A developing country perspective. *Agricultural Water Management*. (2014). http://dx.doi.org/10.1016/j.agwat.2014.03.017

Mungandia S, Conforteb, D and Shadbolt, N.M. 2012. Integration of Smallholders in Modern Agri-food Chains: Lessons from the KASCOL Model in Zambia. *International Food and Agribusiness Management Review Volume 15, Issue 3, 2012*.

Njobvu, S.L., 1990. The problems of running an efficient irrigation system on a small holder Project. *Agricultural Water Management. Vol. 17, pg. 319-321*.

Njuki, J. M., M. T. Mapila, S. Zingore, and R. Delve. 2008. The dynamics of social capital in influencing use of soil management options in the Chinyanja Triangle of southern Africa. *Ecology and Society* 13(2): 9. URL: http://www.ecologyandsociety.org/vol13/iss2/art9/

Nkhata, A. B., Breen, C. M. and Freimund, W. A. 2008. Resilient social relationships and collaboration in the management of social–ecological systems. *Ecology and Society* 13(1): 2. URL: http://www.ecologyandsociety.org/vol13/iss1/art2/

Nkhata, A. B., Breen, C. M. and Abacar, A. 2009. Social capital, community based governance and resilience in an African artisanal river fishery. *Water SA (Online)* 35(1). pp. 45–53. Website: http://www.wrc.org.za .

Ostrom, E. 1990. *Governing the Commons*. Cambridge University Press, New York.

Pahl-Wostl, C., Jeffrey P. and Isendahl, N. 2011. Maturing the New Water Management Paradigm: Progressing from Aspiration to Practice. *Water Resources Management*, 25. pp. 837-856.

Pascoe, G. 2014. Sampling. In Du Plooy-Cilliers F., Davis, C., and Bezuidenhout, R. (eds.). 2014. *Research Matters*. Juta and Company Ltd, Cape Town, South Africa

Petersen-Perlman, J.D, Veilleux, C.J, Zentner, M. and Wolf, A.T. 2012. Case Studies on Water Security: Analysis of System Complexity and the Role of Institutions. Universities Council on Water resources. *Journal of Contemporary Water Research & Education*, 149. pp 4-12.

Pope, C., and Mays, N. 2006. *Qualitative Methods in Health Research, in Qualitative Research in Health Care* (3rd edition). Blackwell Publishing Ltd, Oxford, UK.

Pretty, J. 2003. Social capital and the collective management of resources. *Science* 32. pp. 1912-1914.

Putnam, R.D. 1995. Bowling Alone: America's Declining Social Capital *Journal of Democracy*, January 1995. pp. 65-78.

Rawluk, A., and A. Curtis. 2016. Reconciling contradictory narratives of landscape change using the adaptive cycle: a case study from south eastern Australia. *Ecology and Society* 21(1):17. http://dx.doi.org/10.5751/ES-08245-210117

Sanginga, P. C., Kamugisha, R. N. and Martin, A. M. 2007. The dynamics of social capital and conflict management in multiple resource regimes: a case of the southwestern highlands of Uganda. *Ecology and Society* 12(1): 6. URL:http://www.ecologyandsociety.org/vol12/iss1/art6/

Scott, C.A., Meza F.J., Varady, R.G., Tiessen H., McEvoy, J., Garfin, G.M., Wilder, M., Luis, M. F., Pablos, N.P. and Montana, E. 2013. Water Security and Adaptive Management in the Arid Americas. *Annals of the Association of American Geographers*, 103:2. pp. 280-289, DOI: 10.1080/00045608.2013.754660.

Strydom, A. and Bezuidenhout, R. 2014. Qualitative data collection. In Du Plooy-Cilliers F., Davis, C., and Bezuidenhout, R. (eds.). 2014. *Research Matters*. Juta and Company Ltd, Cape Town, South Africa.

UN-Water. 2013. Water Security. URL: http://www.unwater.org/topics/water-security/en/

Accessed on: 26/03/2017

Uphoff, N., and Mijayaratna, C. M.. 2000. Demonstrated benefits of social capital: The productivity of farmers' organizations in Gal Oya, Sri Lanka. *World Development* 28(11). pp. 1875-1840.

Vang Rasmussen, L., and A. Reenberg. 2012. Collapse and recovery in Sahelian agro-pastoral systems: rethinking trajectories of change. *Ecology and Society* 17(1): 14. http://dx.doi.org/10.5751/ES-04614-170114

Wahyuni. D. 2012. The Research Design Maze: Understanding Paradigms, Cases, Methods and Methodologies. *JAMAR*, 10(1).

Walker, B., Holling, C. S., Carpenter, S. R., and Kinzig, A. 2004. Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society* 9(2): 5.

Wood, D.J and Gray, B. 1991. Toward a Comprehensive Theory of Collaboration. *Journal of Applied Behavioral Science.* 1991 27: 139. DOI: 10.1177/0021886391272001. http://jab.sagepub.com/content/27/2/139.

Yin, R. K. 2009. *Case Study Research: Design and methods* (4th edition). Sage Publications, Thousand Oaks, CA.

York and Schoon. 2011. Collective action on the western range: coping with external and internal threats. *International Journal of the Commons.* 5(2). pp. 388–409.

Zambia Central Statistical Office. 2013. *Zambia 2010 census atlas*. Lusaka: Central Statistical Office.

APPENDICES:

Appendix I: **Interview Guide for data collection.**

List of tentative questions

1. When was Kaleya Smallholders Company Limited (KASCOL) established?
2. What was the main purpose of establishing KASCOL?
3. What was the composition of KASCOL in terms ownership when it first started?
4. How did KASCOL develop into a collaborative (Private –Public Partnership)?
5. How was the selection of smallholder farmers into KASCOL conducted?
6. How does KASCOL obtain its irrigation water resources?
7. How does KASCOL share its irrigation water within the collaborative scheme?

Appendix II: Human Ethics Certificate of Approval.

MONASH University
Monash University Human Research Ethics Committee (MUHREC)
Research Office

Human Ethics Certificate of Approval

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and has granted approval.

Project Number:	CF16/285 - 2016000129	
Project Title:	Adaptive governance and water security on the Kafue flats: A case of the sugar cane farming industry, Mazabuka, Zambia	
Chief Investigator:	Assoc Prof Bimo Nkhata	
Approved:	From: 25 February 2016	To: 25 February 2021

Terms of approval - Failure to comply with the terms below is in breach of your approval and the Australian Code for the Responsible Conduct of Research.

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must include your project number.
6. **Amendments to the approved project (including changes in personnel):** Require the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.
7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.
8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.
10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

[redacted]

Professor Nip Thomson
Chair, MUHREC

cc: Mr Victor Siingwa

Monash University, Room 111, Chancellery Building E
24 Sports Walk, Clayton Campus, Wellington Rd
Clayton VIC 3800, Australia
Telephone: +61 3 9905 5490 Facsimile: +61 3 9905 3831
Email: muhrec@monash.edu http://intranet.monash.edu.au/researchadmin/human/index.php
ABN 12 377 614 012 CRICOS Provider #00008C

Appendix III: Consent Form

MONASH University

CONSENT FORM

(Relevant Participant Group)

Project: 'Title as it appears on your MUHREC application form'
Exploring growth phase in the adaptive cycle of a collaborative irrigation scheme. A case of Kaleya Smallholders Company Limited (KASCOL) in Zambia.

Chief Investigator:

A/Prof. Bimo Nkhata, Prof. Peter Nyasulu

I have been asked to take part in the Monash University research project specified above. I have read and understood the Explanatory Statement and I hereby consent to participate in this project.

I consent to the following:	Yes	No
• Audio recording during the interview / focus group	☐	☐
• Taking part in a focus group of up to 10 members	☐	☐
The data that I provide during this research may be used by University/researcher in future research projects	☐	☐
•	☐	☐
	☐	☐
	☐	☐

Name of Participant _____

Participant Signature _____ Date _____

Appendix IV: Explanatory Statement

MONASH University

EXPLANATORY STATEMENT
(Relevant Participant Group)

Project Title: "Exploring growth phase in the adaptive cycle of a collaborative irrigation scheme. A case of Kaleya Smallhlders Company Limited (KASCOL) in Zambia

Project Number: (This number will be provided by MUHREC upon receipt of the application)

Chief Investigator's name

A/Prof. Bimo Nkhata

Department of Social Science / Director
Monash South Africa Water Research Node_____
Phone
email: bimo.nkhata@monash.edu

Student's name

Victor Siingwa

[redacted]

Prof. Peter Nyasulu

School of health science,

Monash South Africa.

Peter.nyasulu@monash.edu

You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed above.

What does the research involve?

This study seeks to explore how the Kaleya Smallholders Company Limited (KASCOL) as a collaborative scheme emerged and navigated the growth phase of its adaptive cycle. It explores this by focusing on social capital as core concept. The dynamic and adaptive nature of social capital which underlie collaboration in collaborative schemes is characterised as a social resource embedded in social relationships measured by the degree of trust and commitment in a social relationship.

Why were you chosen for this research?

Given that KASCOL is one of the oldest collaborative irrigation scheme in the sugar cane industry on the Kafue Flats in Zambia. The sustainability of the sugar cane farming activities at KASCOL largely depends on water resources to irrigate the cane fields. Thus, this collaborative irrigation scheme qualifies as case study in which to exploring how social capital influences the dynamics of a collaborative in the management of Social –Ecological System in growth phase that are dependent on water resources.

Consenting to participate in the project and withdrawing from the research
Explain: (i) the consent process involves (e.g. signing and returning the consent form),

Participants will be asked to sign the consent forms prior to their participation in the research.

(ii) the participants' right to withdraw from further participation at any stage, along with any implications of withdrawal.

Participants are free to withdraw from the study if the reasons are beyond the control of both the researcher and the participants.

(iv) the alternatives available to those who have chosen not to participate.

The participants will be requested to nominate a relevant participant in the case of them declining to participate in the study.

Confidentiality

Describe (i) how you will manage the confidentiality or anonymity of the data you have collected,

This study will not require any form of identification of participants. However, participants' particulars will be coded in a non- decodable format.

(ii) how you will manage the information when published and (iii) how you will publish or report your data e.g. at a conference, as a thesis etc. If applicable, mention use of pseudonyms/codes etc.

The information obtained and relevant to the study will be kept by Monash University library as a thesis. And all the quotes used will be assigned codes that distinguishes one code from the other.

Storage of data

Explain what constitutes data in the context of this project (e.g. survey responses, biospecimens, interview transcripts, video recordings, etc.).

Data will be in the form of interview transcripts and documents that speak to the purpose of the study.

Describe where and how this data will be stored and who will have access to the data.

The data will be stored by the researcher and the university library. Access to data is only limited to the research and the supervisor.

Indicate when the data will be destroyed if it is no longer required.

In accordance with the university regulations.
Results
Include a statement to explain where and when the results will be made available, and how the participants can access the findings.

The results will be available upon completion of the researcher's study in 2017 in form a thesis and policy briefs. The policy brief will be made available to the participants.

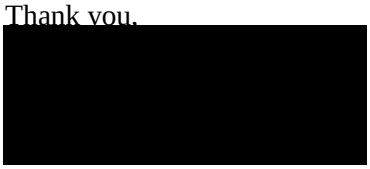
Complaints

Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
Room 111, Building 3e
Research Office
Monash University VIC 3800

Tel: +61 3 9905 2052 Email: muhrec@monash.edu Fax: +61 3 9905 3831

Thank you.



(insert Chief Investigator's signature)

Chief Investigator's name

Bimo Nkhata.

Appendix V: Cane Farmers Agreement

KALEYA SMALLHOLDERS COMPANY LIMITED.

1982

CANE FARMERS AGREEMENT

Described above; "Regulations" means the smallholders' and any reasonable modifications or additions that may be made to them from time to time by Kascol under 5 relating to all aspects of cultivation, irrigation and replanting of cane ,the control of the dwelling area and other related, referred to in this agreement.

1. "Cane price Agreement" means the Agreement dated the -------
day of ---------- and made between Zambia Sugar Company Limited and the Cane Growers Association of Mazabuka and any variation or renewal thereof.

2. SUBLETTING OF CANE FIELD AND DWELLING AREA
Kascol hereby agrees to sublet to the smallholder the cane field and the dwelling area for the growing of cane and residence respectively at the rent of one maize cob per annum (if demanded) and subject to the terms and conditions set out in the Agreement. ?

3. OBLIGATION OF THE SMALLHOLDER
During the term of this Agreement the smallholder shall:-

reside in the dwelling area and construct thereon a (presentable) residence for himself and his immediate family only.

(ii) pay Kascol expenses incurred by it for:

(a) supplying of fertilizers and other chemicals ;
(b) hiring of tractors, implements and operators;
(c) any other goods and services supplied and operators;

(iii) deliver to or allow Kascol to harvest and transport all the cane produced in the cane area;
(iv) not assign, sublet or part with share possession of the cane field or residential area or part thereof without the prior written consent of Kascol:

(V) Except for the residence referred to in clause 3(I).not carry out any earthworks on the cane field or dwelling area of any part of the project area without prior written consent of Kascol;
(VI) Not do or suffer to be done any thing which may be or become a nuisance or annoyance to Kascol or the owners or occupiers of land adjacent to the dwelling area and cane field;
(VII) Comply with all the terms of any Regulations made under the Agreement;
(VIII) Permit Kascol and it's agents to enter the cane and the dwelling area to view their condition and for the purpose of carrying out such operations as may consider necessary to compliance with the conditions of the Agreement;
(IX) Grant Kascol, it's agents and other participants in the scheme:-

(a) all rights of way as are used and enjoyed by Kascol across the cane field and the dwelling area to and from other parts of the project area;
(b) rights to all springs and other sources of water on the cane field and dwelling area;
(c) access to and use of drains, water pipes ,channels, cables and wires or any thing used in connection with irrigation systems (other than such items) shall be exclusively in connection with the cane field and dwelling area constructed or installed by Kascol.

4. SMALLHOLDERS RIGHTS

The smallholder may, subject to Regulations under this Agreement cultivate crops, keep poultry and other acceptable animals as long as these animals are enclosed and neighbors and management have been consulted and have accepted .

5. OBLIGATIONS OF KASCOL

(i) allow the smallholder peaceable occupancy of the dwelling area and peaceable use of the cane field subject to the terms and conditions of this Agreement;

(ii) supply and deliver irrigation water to the cane area and repair and maintain irrigation equipment;

(iii) make and publish the smallholder Regulations as set out in the second schedule and any reasonable modifications or additions to them relating to all aspects of cultivation, irrigation and replanting of cane ,the control of the dwelling area and any other matters connected to or incidental to the foregoing;

(iv) plough the cane field, plant the cane and provide all the necessary inputs and services necessary for proper growing of cane, unless the smallholder decides to carry out any of these operations himself or herself with the consent of Kascol.

(v) harvest and deliver cane produced in the cane field to Nakambala Sugar Estate Mill of Zambia Sugar;

(vi) the smallholder's cane price will be 40% of the cane as per cane price Agreement entered between Zambia Sugar and Kascol time to time and is payable in Zambian Kwacha;

(vii) in the event of delay in payment for more than 21 days of receipt from ZSC or a delay by ZSC itself, Kascol will pay interest to smallholders for the delayed period on the basis ZSC has paid interest to Kascol;

(viii) the cane price as calculated in 6 (v) above includes the price of molasses, therefore no separate payment is due for molasses.

6. CHARGES

Kascol shall deduct any charges due and payable by the smallholder from any monies due and payable to the smallholders under the Agreement, including, but without limitation on the following charges:-

1. Fertilizers
2. Chemicals and Ripeners
3. Seed Cane
4. Cane testing fee
5. Crop Insurance
6. Cane cutting and harvesting
7. Any other charges due as per cane price agreement or other charges as may be indicated on stop orders from the smallholders.

7. SUCCESSION TO AGREEMENT

The smallholder shall nominate a suitably qualified member of his immediate family (spouse or own child) as successor to this Agreement on his or her death and subject to the approval of Kascol such nominee on the death of the smallholder shall assume the rights and obligations of the smallholder for the remaining period that the lease has to run. In case the nominee has no cane experience, he/she shall be subjected to the normal 6 months training.

However, in the event of the nominee failing to manage the farm, for whatever reason, Kascol shall not substitute the successor but repossess the farm .

8. DURATION AND RENEWAL

(i) This Agreement shall take effect from _____and shall continue in full force for the renewing period of one (1) year and then shall be renewable, subject to the provisions of section 8,for further similar periods, as long as Kascol shall remain lease of both the cane and dwelling areas.

(ii) Renewal of this Agreement will be automatic if the following conditions satisfying at the date of termination of Agreement;-

(a). The Smallholder shall remain solvent;
(b). Kascol shall remain solvent;
(c). The Smallholder shall have proved himself to Kascol's satisfaction to be a good and diligent smallholder and shall not have contravened the terms of this Agreement;

9. DISPUTES AND ARBITRATION

Any disputes arising out of this Agreement shall be referred to the Disciplinary Committee composed of four members of the Smallholders Executive (Chairman, Secretary, Treasurer and one Committee member) and three members nominated by Management at any given time. This Disciplinary Committee shall choose a Chairman and a Secretary.
This Committee will develop a system of resolving disputes and imposing sanctions. Matters which will not be resolved at this level shall then be dealt with by an independent arbitration .
In the event that in Kascol's opinion the Smallholder has not been able to satisfy the conditions in clauses (ii) (a) or(c) above or if the Smallholder after two (2) warnings in writing fails to comply with the Regulations, or any lawful instructions given by Kascol, or generally shows himself to be unable to maintain standards of cane cultivation acceptable to Kascol and in the opinion of Kascol is an unsuitable Smallholder, then Kascol may terminate this Agreement by giving three (3) months' notice in writing before or at the expiry of the 14-year period.

10. TERMINATION OF AGREEMENT

This Agreement shall terminate immediately;-

(a) if the Smallholder is proved or otherwise declared bankrupt;
(b) on the death of the Smallholder where no person has been nominated to succee the smallholder or a person's nomination has not been approved by Kascol ;
(c) in accordance with the attached Disciplinary code
(d) the Smallholder decides to resign from the project
(e) the nominated successor fails to manage the farm properly.

11. COMPENSATION

Upon the termination of this Agreement Kascol shall compensate the Smallholder, in accordance with the advice of an independent evaluator for;-

(a) the estimated value of any permanent buildings on the dwelling area at the time of termination;
(b) any crops cultivated in accordance with the terms and conditions of this Agreement and regulations;
(c) any standing cane in the field
(d) any other improvement made by the Smallholder with the approval of Kascol;
(e) if the Smallholder decides to resign on his own as per clause (9d) above, the compensation payable shall be restricted only to standing cane in the field as per clause (C) above and any acceptable permanent dwelling house as per clause (a) above.

12. KASCOL MAY DEDUCT FROM ANY COMPENSATION PAYABLE UNDER CLAUSE 10

(a) any monies owing by the Smallholder to Kascol;
(b) any loss or damage to any part of the dwelling area or cane field or to any part of the project area caused by the Smallholder or as a result of the Smallholder's negligence.

IN WITNESS HEREOF KASCOL

Has caused it's common seal to be affixed here and the smallholder set his hand and seal on----------200---

THE COMMON SEAL OF KALEYA SMALLHOLDERS COMPANY LIMITED was affixed in the presence of:

_____

ESTATE MANAGER

_____

COMPANY SECRETARY

SIGNED, SEALED AND DELIVERED BY THE SAID
in the presence of

WITNESS: ----------)

NAME: ----------)

ADDRESS: ----------)

----------)

----------)

OCCUPATION: ----------)

FIRST SCHEDULE

(clause 1)

1. DESCRIPTION OF THE CANE FIELD

The field is related to tertiary canal no…… and shall commence at row number one for the first smallholders in the block ……..and end at a demarcated spare row where the next farm shall begins row…… inclusive, these rows being as numbered along tertiary canal, and will approximate an area of …… hectares, shown for the purpose of identification but not delineation on the sketch plan annexed hereto and thereon coloured green and situated on……However, this will depend on the new set up of lines every after each replanting .*

2. DESCRIPTION OF DWELLING AREA

The dwelling area is the area Kascol has allocated for the use by the Smallholder and his family shown for the purpose of identification but not delineation on the sketch plan annexed hereto and there on colored red and situated on…….

SECOND SCHEDULE

(Clause 1)

SMALLHOLDERS' REGULATIONS

These Regulations are issued to ensure the proper operations of the Kascol Scheme so that all Smallholders receive long-term benefits from their participation. They are issued by the Board of Directors of Kaleya Smallholders Company Limited and compliance with these Regulations is required under the terms of the Kascol Smallholders' agreement of which this Scheme forms a part. Amendments to these Regulations may be made by Kascol.

1. CULTIVATION OF CANE.

The Smallholders shall maintain the cane on the field to the standard required by Kascol and to this end Smallholders shall;-

(a) follow the fertilizer programme recommended by Kascol and in respect of methods, rates and types of fertilizer and also be responsible for the charges relating to that programme;

(b) maintain their cane fields in a weed-free condition either by hand labour or by the use of herbicides;

(c) use only such herbicides at such rates and by such methods as may be recommended by Kascol from time to time;

(d) notify Kascol of the occurrence of any disease listed in Appendix 1 to these Regulations

(e) take all steps to eliminate diseased cane by such methods as are directed by Kascol;

(f) apply only such pest control measures as Kascol may recommend;

(g) notify Kascol of the occurrence of any pests listed in Appendix 1 to these Regulations;

(h) apply only such cane ripeners or any other chemicals to the cane as are recommended by Kascol;

(i) ensure that the areas outside the cane field are maintained weed-free with a cover of short grasses. The Smallholders' responsibility for this extends to the outside of the field road for the collection of their cane. For those Smallholders adjacent to secondary canals or drains this responsibility extends to the top of the secondary canal bank and the top of the secondary drain adjacent to the field;

(j) maintain the tertiary drain taking drainage from their cane field with a cover of short grass and in proper shape and condition as directed by Kascol.

1.1 kascol may under the terms of the Agreement enter the cane field and take any action as it may deem necessary for the control of weeds, pests and disease. The cost of any such control measure shall be settled by the Smallholder. This action however, shall be at Kascol's discretion.

2. HARVESTING OF CANE

2.1 Smallholders shall utilize any harvesting facilities made available by Kascol and allow Kascol employees or their agents to burn and harvest their whole area of cane (or such part as Kascol may decide) at one time in accordance with the harvesting programme notwithstanding that the actual date of harvest may differ to some extent from the initial programme published.

2.2 Smallholders shall be personally present on their cane field during the burning and harvesting operations, but Kascol may carry out the burning, harvesting and hauling of cane in the absence of a Smallholder .*

2.3 Cane supplied to Nakambala Sugar Estate Mill of Zambia Sugar Company shall meet certain quality requirements to be classified as "Standard Cane" Smallholders shall be responsible for ensuring that these quality Requirements are met (in as far as they are able). These quality requirements are set out in Appendix II to the Regulations and the Smallholders accept these requirement as part of their acceptance of the Farmer's Agreement.

2.4 Smallholders shall be personally responsible for carrying out all field Operations subsequent to harvesting and commencing with trash clearance.

3. REPLANTING OF CANE

3.1 To ensure long-term sustained yields of cane it shall be ploughed out and be destroyed at such times as Kascol may direct and in accordance with replanting programme laid down by Kascol having regard to disease control, pest control, drainage requirements, yield decline or other reasons. Kascol shall provide a replanting service to Smallholders.

3.2 pesticides or treatments to the seed cane or soil shall be applied as Kascol

may recommend.

3.3 Fertilizer or other treatments to the seed cane or soil shall be applied as Kascol may recommend.

3.4 Only approved varieties of sugar cane as listed in Appendix 1 to these Regulations may be planted and Kascol will stipulate the varieties for particular cane fields with Smallholders' participation.

3.5 Only seed cane from a source approved by Kascol may be used

3.6 Seed cane shall be planted at rates recommended by Kascol

3.7 Smallholders shall maintain their plots even at times when those plots are being planted

4 DWELLING AREAS

4.1 Smallholders shall in their dwelling areas:-

(a) control their live stock and ensure that all their animals are under proper control and not causing a nuisance;

(b) refrain from growing any crops prohibited by Appendix I these Regulations;

(c) refrain from keeping any animals prohibited by Appendix I to these Regulations

(d) maintain their dwelling area and buildings thereon to a proper standard;

(e) practice only good soil conservation practices to prevent soil erosion and their dwelling area;

(f) make proper provisions for the disposal of rubbish by composting, burning or such other method as Kascol may recommend;

(g) erect and maintain a suitable toilet and ensure that this is properly used and maintained to a proper hygienic standard.

(h) provide proper water taps and ensure that water is properly used. Connections of pipes from the main lines will only be done with permission from Kascol.

5. MAINTENANCE OF CANE AND DWELLING AREAS

5.1 Smallholders shall take all steps necessary to preserve soil erosion at all times and shall observe any advice and instructions given to them by Kascol for that purpose. They shall in particular:

(a) use or hire for use only that machinery of which Kascol approves in the manner that Kascol recommends in order to avoid damaging the structure of the soil;

(b) adopt such soil conservation and erosion prevention measures as Kascol directs;

(c) refrain from any excavations of the soil or removal of soil;

(d) refrain from applying to the soil any soil from any area, any organic fertilizer or any soil ameliorant except under the direction of Kascol;

(e) carry out such drainage or soil ameliorant work as Kascol may direct;

5.2 Smallholders shall ensure that any boundary beacons demarcating their Cane fields and dwelling areas are maintained in their places and are at all times kept visible;

5.3 Smallholders shall remove at their own expense all stones and obstacles such as steel pipes, fencing materials, etc., on their cane fields and dwelling areas which may damage machinery engaged in cultivation, harvesting or other operations, and shall reimburse the cost of repair of any damage to machinery caused by their negligent failure to do so. Such disposal is to be in a manner approved by Kascol.

6. IRRIGATION

6.1 Kascol shall deliver water to the boundary of each cane field by means of a tertiary canal. Deliveries shall normally be made in 11 hour periods during daylight hours at intervals sufficient to provide proper irrigation of the cane fields as decided by Kascol taking into account rainfall, evaporation rates and other factors.

6.2 Kascol shall notify Smallholders in advance of the days on which water will be delivered to them and Smallholders must accept water on those days;

6.3 Extraction of water from tertiary canal shall only be done by using the set of syphons supplied by Kascol for that canal. These are to be shared among all Smallholders obtaining water from that canal who shall be jointly responsible for loss or damage to the syphons.

6.4 Smallholders shall irrigate their cane fields properly as advised by Kascol and must avoid unnecessary waste of water.

6.5 Water supply gates may only be opened, closed or adjusted by Kascol's Employees or it's agents.

6.6 Smallholders shall not damage or interfere with any part of the canal System, irrigation equipment or drainage system.

6.7 Smallholders shall, when domestic water is drawn from canals, use clean containers and shall not contaminate canal water with toxic chemicals, refuse or sewage.

6.8 Smallholders shall not plant anything except grass within 1.5 meters from

the edge of any canal.

6.9 No Smallholder shall build a bridge over a canal except under the Supervision of Kascol.

6.10 Smallholders shall maintain drainage at the end of in-field irrigation lines to direct surplus water into drainage system.

6.11 All canals and dams are out of bounds to children; the smallholders shall make sure that children are kept away from these premises.

7. RESIDENCE ON AND ABSENCE FROM THE PROJECT AREA

7.1 All Smallholders shall occupy the residence on their dwelling areas as their primary and usual place of abode, and shall normally be present at the cane field during normal working hours and to ensure maintenance of high standard of husbandry.

7.2 If a Smallholder intends to be absent from the project area for more than seven (7) consecutive days, he shall ensure that a competent adult person is present on the project area for the period during which the Smallholder is absent, who shall act on behalf of the Smallholder. The Smallholder shall register such a person with Kascol. Any such person shall be deemed to have the Smallholder's full authority to request and sign for goods and services provided by Kascol, and shall observe all instruction given to the Smallholder by Kascol.

7.3 If a Smallholder is absent from the project area for more than seven (7) days for whatever reason, and if no competent substitute is present, then Kascol may do all such acts, at the expense of the Smallholder, which it shall reasonably consider necessary to ensure the proper cultivation and maintenance of the cane field and Kascol shall not be liable for any damage caused by Kascol's employees.

7.4 If a Smallholder is absent from the project area for a period of more than one month without having agreed with Kascol's acceptable arrangements for the management of his/her plot, the Smallholder automatically forfeits the right to the continuance of his lease which will be terminated by Kascol.

8. PROJECT AREA

8.1 Kascol intends to manage the parts of the project area not allocated to individual Smallholders to ensure the best long term benefit for the project, Smallholders have no right over these areas without the prior written permission of Kascol.

8.2 Firewood may be taken from the project area on designated areas and only with the specific permission of Kascol.

8.3 No trees on the project area shall be cut without the prior approval of Kascol.

9 PAYMENTS

9.1 Whenever a payment is due from Kascol to a Smallholder , Kascol will Endeavour to make prompt payment.

9.2 Whenever a payment is due from a Smallholder to Kascol, the amount will be deducted from the next payment due or the Smallholder may opt to pay cash.

9.3 Kascol shall charge interest at the current Barclays Bank of Zambia Limited's prime overdraft rate, if the Smallholder does not effect payment at the agreed time.

APPENDIX I

APPROVED CROPS:

Cane area:	Sugarcane varieties approved by management from time to time.

PROHIBITED CROPS:

Cane area:	All crops other than cane.
Dwelling area:	Marijuana.

NOTIFIABLE PESTS:

Cane area and Dwelling area:	Heteronychus beetle, thrips, Locusts, Army worms.

NOTIFIABLE DISEASES:

Cane area:	Smut, Rust, Leafscald, YLS, RSD
Dwelling area:	Smut, Rabies.

PROHIBITED ANIMALS:

Cane area and Dwelling area:	Cattle, sheep, Donkeys, and Goats

APPENDIX II

1. All cane delivered to Nakambala Mill will be subjected to direct cane analysis (DAC) to determine the quality.

2. All cane delivered shall also be inspected for extraneous materials which are Generally divided into two groups:

   (a) Extraneous Materials of a General Nature e.g rocks. Sand, metals or anything that is likely to damage machinery in the mill.

   (b) Extraneous Vegetable Matter i.e any vegetable matter other than just cane stalks that is likely to lower the purity standards of the sugar.

3. Minimum cane quality accepted for milling shall be POL% cane 10.7; Brix 13.4 and purity of 80%.

4. Cane found with excess extraneous materials and/not meeting the minimum standards shall be:

   (a) recommended for outright rejection or,
   (b) penalised as recommended by the ERC Committee. The cost of disposal of such rejected cane shall be borne by the smallholder.

APPENDIX III

SMALLHOLDER'S DISCIPLINARY CODE

INTRODUCTION:

The Kascol Management and Smallholders must recognise that in any society, Orderly conduct within the frame work of rules and regulations laid out is Essential for well-being of society at large and for the successful achievements of endeavors. At Kascol, it is the function of both Management and the Smallholders' Association Executive to maintain law and order, discipline and efficiency. Individual Smallholders who fail to maintain the required peaceful habitation on the project area should be dealt with appropriately.

The code of conduct will help maintain the necessary law and order. It should not be seen as a restriction or threat, but an effort to ensure the success of the Smallholders project which is only possible if all abide by law of the land. The rules and regulations set out in the Cane Farmer's Agreement, of which this forms part, are rules that a good farmer should follow. Some rules and regulations must, of necessity, be enforced in the interest of peace, progress and maintained productivity. These vital regulations are highlighted hereunder. Those who fail to observe these vital regulations will be dealt with in any one of the following ways;-

CODE OF CONDUCT

Legend

(1) Verbal warning
(2) Written warning
(3) Final warning (appearance before a Committee of Management and Smallholders Executive) i.e the Disciplinary Committee.
(4) Appearance before the Disciplinary Committee who alone can recommend a dismissal.

S/NO	OFFENCE	PUNISHMENT
		1st 2nd 3rd 4th
A	Any absence from the of 30 days or more	
	Without having agreed with Kascol's acceptable	
	Arrangements for the Management of his/her	
	Plot.	4
B	Insulting publicly or shouting at any time Without proper reason	3 4
C	Assaulting or fighting, showing threatening Behavior or using abusive language to any Company employee or any Smallholder	3 4
D	Willfully damaging any company property	3 4
E	Bribery of a company employee or any other Persons to the detriment of the company	3 4
F	Inciting a strike or "sit down" or any form of Riotous behavior	4 -
G	Any other form or type of bad behavior which is against the general interests of the company And is likely to jeopardize it's well being or Reputation	3 4
H	Lack of serious, conscientious and sustained Application or implementation of the Recommended sugarcane growing field Management practices	1 2 3 4
I	Failure to observe laid down channels in	

	Resolving disputes.	2 3 4
J	Failure to take over irrigation in time and/or failure to follow the recommended irrigation Schedule	1 2 3 4
K	Forgery or fraud	3 4
L	Theft of any description, including misdirection of fertilizers and chemicals meant for cane	3 4
M	Disclosing confidential company information to any outsider which may have detrimental effect on the company	3 4
N	Found at an awkward place, at an awkward time and condition which may jeopardize the safety of others	4 -
O	Failing to turn up to fight fire by a smallholder and their dependants when called to do so (it is the duty of everyone in the project area to fight fire).	3 4
P	Refusing to obey company instructions or carry out a field operation or dwelling area operation as recommended by management.	3 4
Q	Insubordination or blank disrespect to any other Smallholder or company employee	3 4
R	Publishing false information which would jeopardize the safety of the company	3 4

Where a Smalholder has been given verbal warning or written for any offence, this warning will stand for a period of one (1) year. In case of a final warning , the warning will stand for two (2) years. Should the individual not commit any offence of similar nature within this period, then the warning will be deemed as having lapsed.